

PRACTICAL PROGRAMS IN INDUSTRIAL ARTS & RELATED ACTIVITIES

Experimental Edition

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Vocational Education Section
EDUCATION DIVISION
Northern Administration Branch
Department of Northern Affairs
and National Resources
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THE CHANGING NORTH



FOREWORD

This draft proposal which augments the unique industrial arts programs of the Northwest Territories marks another step forward in the development of distinctive courses of studies for northern schools. It is designed to meet the special needs of pupils and teachers. The programs outlined herein are predicated upon the conviction that the courses of studies which comprise a curriculum should have their origins deep set in activities common to the area where learning takes place. To validate in this respect the Industrial Arts programs, every effort is made to build course material and units of work around the everyday activities of the people.

From the pupils' points of view the purpose of these programs is to inculcate that knowledge, to develop those attitudes, and those skills which will aid pupils to appreciate the backgrounds upon which their lives are built and to offer a deeper insight into the activities in their own communities. In this way pupils will become not only more knowledgeable and more productive members of their own communities but will be better able to adapt to change.

It is hoped that these new programs will aid teachers in developing pupil interest, in furthering curriculum integration and in adding broader dimensions to learning. In this way it is believed that pupils will develop skills and formulate positive attitudes toward the kinds of human activities which serve to sustain life in the areas where they live.

Because a major problem in curriculum building in the north relates to difficulty in communication over vast distances, and because in the building of a program such as this, authenticity must be rigidly respected, every effort has been made to involve competent people who have first-hand knowledge and experience in northern settings.

The programs outlined here are experimental. They will be used on this basis during the school year 1964-65. A preliminary evaluation of the programs is planned for the end of this period and a major evaluation and revision one year later. Only through the co-operation of superintendents, teachers, parents and other interested persons can the success of this undertaking be adequately evaluated.



B. Thorsteinsson,
Chief, Education Division

PREFACE

This draft booklet contains suggested programs which represent the first hesitant steps towards an integrated program for pupils who, through no fault of their own, have become age-grade retarded. The program is intended to meet a wide spectrum of needs ranging from those of pupils who will engage in wage employment to those who will return to the traditional life on the land.

During the past two years, the Industrial Arts and Home Economics Supervisors have been visiting and conferring with teachers, parents, projects officers and other interested people, and have been collecting material and ideas for inclusion in an integrated program. During the past year, the effort to integrate this material and to authenticate the work has been intensified. Several meetings with community councils have been held to try to ascertain the wishes of the native people and to take these wishes into account in the building of curriculum. One such fruitful experience occurred in Rankin Inlet where the Eskimo Council was extremely co-operative and gave their frank opinion of the type of courses they wished the children of their community to receive. Very evident was the peoples' wish that children be taught to benefit from the new way of life. They also expressed concern over the loss by the children of their traditional skills some of which, they felt, might effect their survival in the north country. Consequently, it was agreed that the school should budget time suitably, and an Eskimo man should come to the school to teach the children to build an igloo (see frontispiece). A similar arrangement was made with one of the ladies who is an excellent bead-worker. She came to the school and, with the class under the supervision of the home economics teacher, she taught the girls her traditional skills.

It is hoped that this collection of programs will stimulate the staffs of our schools to experiment and try to implement the philosophy which advocates the involvement of persons who possess the skills and talents necessary in the teaching and learning. In this way, the teacher may make use of the human resources available anywhere for the benefit of his pupils.

It is earnestly hoped that wherever any program of this nature is offered, whether it be included in this booklet or not, the people involved will share their experiences with other educators in this vast area of responsibility. Surely the most efficient way to accomplish this sense of unity of purpose, is to help the supervisors co-ordinate effort by reporting on all activities, evaluating and making recommendations for revision. Please bear in mind that this is a draft outline which has been prepared in the hope that it will promote discussion, experimentation and implementation. It should in no way be regarded as a final curriculum or course of studies. Only after further discussion and trial periods with the participation of as many interested persons as practicable can the completed course be produced.

ACKNOWLEDGEMENTS

This course was developed under the direction and guidance of:

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who wishes to acknowledge the assistance of Mr. G.J. Rancier, Head of the Vocational Education Section, Education Division, who proof read this work and made many valuable suggestions, and of members of the staff who contributed time and ideas in the form of drawings of projects.

The work of individuals and other government agencies is acknowledged in the text.

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INTRODUCTION

This collection of programs is intended to assist:

1. Industrial Arts teachers.
2. Teachers who feel capable of teaching or supervising this form of "Industrial Arts" in schools in small settlements. Wherever possible teachers should endeavour to utilize anyone with particular talent or skill that may be available in the community. Such people may offer courses outlined herein or any other course that the Superintendent of Schools may approve.

Selection of Students

Selection of students should be at the discretion of the principal or teacher. Note that the grade of the student should not be considered as a major criterion. Academic level requirements will vary according to which program is followed.

Accommodation

Programs can be carried out in:

1. Schools which have shops.
2. Schools which have access to any form of shop or building which can be utilized for the purpose of this type of instruction. Many schools have janitors' rooms, or other rooms which can be utilized for this purpose. Some schools may carry on part of a program in the classroom. Two teachers may co-operate, one teaching the girls, the other the boys. Experimentation should be encouraged. Some processes involved in Industrial Arts may profitably be taught to girls. This will be left to the discretion of the teachers who will take into account the strength of tradition in the community and the women's role in the society. Some of the programs could best be introduced

as co-curricular activities, for example, the course on care and use of firearms can be taught through the medium of a rifle club.

Objectives

1. To develop group identity while maintaining a sense of individual worth.
2. To develop a pride in workmanship which leads to self-confidence and an appreciation of aesthetic values.
3. To introduce the pupils to simple tool operation as they apply in his environment.
4. To develop skill in the use of tools and materials commonly found in the north.
5. To develop lasting respect for tools and to improve skills in sharpening and maintenance.
6. To develop familiarity with good maintenance techniques.
7. To teach the concomitant and developmental skills of planning, reading, writing, drawing and calculating.
8. To develop the perseverance required to carry long and difficult projects through to completion (note, long and difficult are relative words which in this case apply in terms of the development of the child).
9. To assist the pupils to bridge the gap from the traditional ways of doing things to more modern methods.
10. To develop the ability to work with a minimum of direction and supervision and to encourage initiative and creativity.

Class Size

No definite maximum size of class can be prescribed in any but regular industrial arts or vocational shops. The size of class must be determined by such factors as safety, accommodation, equipment, materials and the skill, energy and ingenuity of the teacher.

Teachers are cautioned against overcrowding classes. It would be better to try to organize two small groups than have one group so large that the learning situation deteriorates and the risk of accidents increases.

Programs Offered

The programs offered in schools which do not have recognized industrial arts programs will depend almost entirely on the talents and skills brought to the job by the teacher and the resource people available in the community, and will be related to the equipment and supplies available.

Time Allotment

The principal should check the time allotment for a program of this nature with the Superintendent of Schools. Sufficient time should be provided to see projects and programs completed. Care should be taken not to use the programs as a replacement for important class subjects but rather as a means of making regular courses more meaningful.

Equipment

Most of the projects suggested in this guide can be made with simple hand tools. Care should be taken to define the objectives well before embarking on any course. Use of power tools even when they are available should be limited to the teacher and to anyone to whom he

especially grants permission. Only where a qualified instructor is available should class instruction in power tools be carried on. Equipment should be requisitioned with the regular school requisitions and the purpose clearly stated.

Supplies

Present regulations allow \$100.00 per classroom to be spent on supplies for home economics and industrial arts. The percentage of this sum of money allotted to each subject may be decided locally. Materials should be ordered with the regular school requisitions and a clear and detailed explanation should be given of the purpose of the supplies.

Note: Supplies and equipment may be supplemented by local purchase with the authority of the local administrator. Any special equipment or supplies should be requested through the Superintendent of Vocational Education.

TRAPPING AND FUR PREPARATION

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FUR PREPARATION

Introduction

This outline is intended merely as a guide for the teacher. Traditionally the economy of northern residents has centered on the fur trade. There is no doubt that a course of trapping and fur preparation is directly applicable to the lives of the young people in the schools of the north. Ideally pupils should learn the fur trade from their parents as they work the trap line together. However, in some cases, this is no longer practicable. If this knowledge and the accompanying skills are to be preserved, the school will be involved. In recent years the tendency has been for native trappers to receive low prices for their pelts. It is believed that this is partly the result of poor preparation of the pelts for market.

Every effort should be made to keep this course practical in nature and related to the local situation. While much of the information in this course is fairly universally applicable, the teacher should ensure that traditional methods used in the community are recognized in the instruction. It is emphasized that the skill and knowledge of local trappers and of game officers should be fully utilized in this program. No program of instruction should be undertaken without first providing for consultation with local trappers and game officers.

Objectives

1. To integrate the geographical and historical aspects of the fur trade in Canada with the day to day activity in the school and community.
2. To instil an understanding of the importance of game regulations to the conservation of natural resources.
3. To encourage diligence and reliability in tending traps regularly and carefully.
4. To improve the trapping technique of the pupils.
5. To encourage co-operative effort and group skills through working together on the trap line and through discussions of co-operative marketing techniques.
6. To endeavour to improve the quality of fur pelts and so increase their value.
7. To broaden the knowledge of the process of fur marketing from animal to garment.

Class Organization

This course should be taught to both boys and girls. The principal in consultation with the Superintendent of Schools should decide upon the selection of pupils.

Equipment

Since this course requires only equipment which can be found in the local community, it may be carried on in any school in the north.

COURSE OUTLINE

- A. Skins and Furs
 - 1. Identification
 - 2. Classification of Quality
 - 3. Skinning
 - 4. Fleshing and Cleaning
 - 5. Drying
- B. Game Laws of Northwest Territories
 - 1. Local Regulations
 - 2. Permissible Methods of Trapping
- C. Trapping
 - 1. Organization of Project
 - 2. Resource Material
- D. Geographical Distribution of Furs
 - 1. Local
 - 2. Canada
 - 3. Other Services
- E. Historical Significance of the Fur Trade in Canada
 - 1. Local
 - 2. Hudson's Bay Company
 - 3. Montreal Merchants
 - 4. Explorers, Voyageurs, etc.
- F. Fur Garment Industry
- G. Marketing
 - 1. Outlets
 - 2. Packing and Shipping



Geographic Locations of Furs as Designated by the Hudson's Bay Company

GEOGRAPHICAL DISTRIBUTION OF FURS

The Hudson's Bay Company has designated the fur sections of Canada as shown on the accompanying map.

Note to teacher: Teachers will wish to introduce this outline by a look at the local setting - by such an introduction the rest will become more meaningful.

<u>Abbreviation</u>	<u>Section</u>	<u>Samples of Fur-Bearing Animals</u>
YUKON	Yukon	Lynx, Ermine, Fisher
NW	North West	Badger, Grizzly Bear, Beaver
WA	Western Arctic	Polar Bear, Fox
MKR	Mackenzie River	Beaver
YF & MKR	York Fort and Mackenzie River	Fox, Lynx Fox, Mink
YF	York Fort	Badger, Beaver, Ermine, Lynx, Fisher
YF C&S	York Fort - Central and Southern	
EA	Eastern Arctic	Polar Bear, Fox
	Moose River West	
LS	Lake Superior	Beaver, Ermine, Fox, Lynx
EM & FG	East Main and Fort George	Beaver, Ermine, Fox
MRW	Moose River West)	
MRE	Moose River East)	Beaver, Ermine, Fox, Lynx
EB	Eskimo Bay	Beaver, Ermine, Fox, Lynx
EB & MR	Eskimo Bay and Moose River	
CANA	Canada	Beaver, Ermine, Fox
NF	Newfoundland	Beaver, Ermine
NS	Nova Scotia	Beaver
YUKON	Yukon	Lynx, Marten
NW	North West	Badger, Grizzly Bear, Beaver, Ermine, Fisher, Marten, Muskrat, Otter, Prairie Wolf (Coyote) Raccoon, Squirrel, Timber Wolf, Wolverine
WA	Western Arctic	Polar Bear, Fox, Marten, Muskrat, Seal
MKR	Mackenzie River	Beaver, Marten
YF & MKR	York Fort. & Mackenzie River	Fox, Lynx, Muskrat

YF	York Fort	Beaver, Badger, Ermine, Fisher, Fox, Mink, Skunk, Squirrel, Timber Wolf, Wolverine, Lynx, Muskrat, Otter, Prairie Wolf (Coyote), Raccoon
YF C&S	York Fort - Central and Southern	
EA	Eastern Arctic	Polar Bear, Fox, Seal
LS	Lake Superior	Beaver, Ermine, Fox, Lynx, Marten, Otter
EM & FG	East Main and Fort George	Beaver, Ermine, Fox, Marten, Muskrat, Otter
MRW	Moose River West)	Beaver; Ermine, Fox, Lynx, Marten, Muskrat, Otter
MRE	Moose River East)	
EB	Eskimo Bay	Beaver, Ermine, Fox, Lynx, Marten,
Cana	Canada	Beaver, Ermine, Fox, Marten, Muskrat, Otter, Raccoon, Skunk
NF	Newfoundland	Beaver, Ermine, Muskrat Otter
NS	Nova Scotia	Beaver, Muskrat

GAME LAWS, NORTHWEST TERRITORIES

Reference: Game Laws, Northwest Territories, Canada.
Office Consolidation, January 1, 1963.
Queen's Printer, Ottawa.

This booklet can be obtained from the Game Officer or
Regional Administrator of the community.

Emphasis should be placed on the following:

The Game Ordinance

1. Interpretation
2. General Prohibitions
3. Issue of Licences
4. Records and Reports
5. Trapping Areas
6. Game Preserves and Sanctuaries
7. Schedules

The Game Regulations

1. Game Management Zones
2. Open Seasons and Bag Limits
3. Outfitters
4. Schedules

The Fur Export Ordinance

The Game Export Act

Furs Found In Some Other Countries



TRAPPING

Equipment

In planning a course of this nature, requisitions for special equipment should be sent to the Superintendent of Vocational Education together with a detailed outline of the proposed program including such information as the age and number of students involved and the area in which the traps will be set. Again remember to consult the Game Officer and local trappers.

Course Organization

As a guide, reference is made to the following report on a muskrat trapping project conducted by students of the Peter Warren Dease School in Fort McPherson during the years 1960-61, 1961-62, 1962-63. This report was submitted by Mr. Tucker, Principal of the school during this time, and his frank appraisal of the course and recommendations and suggestions for improvements should be studied by everyone considering a similar program.

FORT MCPHERSON TRAPPING PROJECT

This project was started with the aim in mind of providing useful learning experience for the senior students. A selection of from six to twelve students (male and female) was made, based on need, age and likelihood of continuing as trappers after they had finished school. The Game Branch (N.A. & N.R.) supervised the skinning, stretching, and care of the pelts. The hostel supervisors and teachers supervised the students as they tended their traps each evening after school.

Last year the project petered out largely because of the following reasons:

1. It appeared to me that most pupils interested were not acquiring any new experiences. The most that could be said for it is that they might be taught greater care in preparing the pelts.
2. Teachers and hostel supervisors do not know as much as the students in setting and caring for the traps. It was more of a new experience for the teachers and supervisors than for the pupils.
3. The selection of students posed a problem. Who amongst students needed the profits most? Most students really would continue as trappers; therefore, most of the students in grades six, seven and eight should be selected.
4. At times it was difficult for the teachers and hostel supervisors to go to the trap lines. If the traps were not attended every day, there was a danger of other children getting to the traps and stealing the rats or doing damage to the traps.

5. There was some question regarding whether the lakes near town should be reserved for widows and old ladies rather than for children, some of whose parents were already doing well in trapping.

Recommendations if the project is to be revived:

1. One or two local men or women should be employed as supervisors and instructors;
2. The Game Branch should be contacted to have clarified the areas that pupils might use.
3. It should be organized as a co-operative effort. This would provide a useful experience in the principle of the co-op enterprise, which has lately been organized in Fort McPherson.
4. Only students in grades seven and eight should be allowed to participate, so that in time all students of the school pass through the project.

The basic aims to be kept in mind are -

- (a) Care and protection of furs .
- (b) Proper use of traps.
- (c) Marketing principles along co-operative lines.

The basis of selection according to need should not be considered. It is difficult to be objective in this kind of selection.

I had intended to revive the project again this year, but our game warden has been transferred and no replacement has been made.

Signed,

Ft. McPherson
April 21/64

O.G. Tucker
Principal

General Trapping Tips

The following trapping information is to be found in the Trapper's Guide issued by Conservation Information Service, Regina, Saskatchewan.

1. Do not rush the season. Pelts taken before the season opens are not prime and are of little value.
2. Check the trapping area carefully. Look for the signs of fur animals. Learn their habits, where they live, and where and when they travel.
3. Always boil traps to remove manufacturer's oil prior to setting the traps.
4. Check traps before setting out. Be sure they are in good working order.
5. Do not set traps haphazardly or carelessly. Make set as natural as possible in a location where the animals travel. Mink like to go under or through something. Foxes usually do not like to approach a set in heavy cover.
6. Use gloves to keep sets free of human scent.
7. Do not set the pan too hard, necessitating extra weight to set it off. Set the pan even with the jaws for a level set rather than a bulge over the pan.
8. Check sets regularly.
9. Remember, clean pelts mean more money.

MUSKRAT

Trapping Suggestions

Look over the muskrat trapping area early in the fall and before the snow comes. Close observation should be made of the muskrat populations and the locations where it is planned to set traps. If the population is high, some muskrats should be taken in the fall to ensure enough winter food for those left.

Areas with water less than 26 inches deep should be salvage-trapped in the fall. If left, the muskrats will be killed anyway by freeze-out.

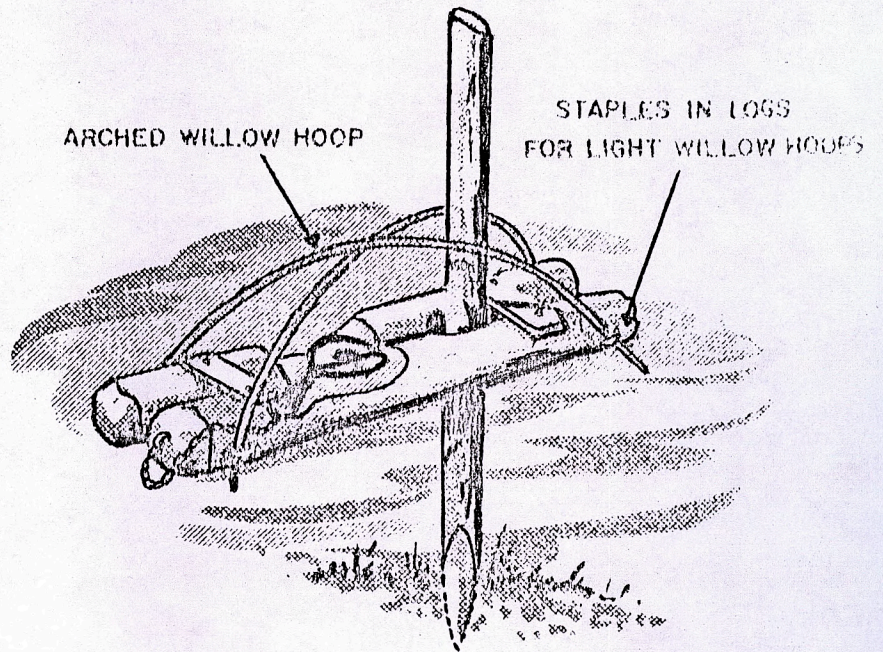
If muskrats are allowed to overpopulate an area, the feed supply will be greatly depleted and the marsh will be damaged. Several years will pass before the feed grows back.

Use numbers 1, 1 1/2, or number 1 "stop-loss" traps for taking muskrats.

Muskrats should be skinned, fleshed, stretched and dried as soon as possible after trapping.

To construct a muskrat float set (see figure on next page) fasten together two 4-inch logs by nailing two blocks of wood across the top. Scoop out the logs to hold the trap, and cut out a hole so that the vertical pole will allow the platform to move freely up, down and around. Staple light willow poles across the top to prevent ducks from being caught. Set the pole in the lake or stream bottom deep enough to prevent trap from drifting away or working loose.

Muskrat Float Set



BEAVER

Trapping Tips

The following trapping information is to be found in the Trapper's Guide issued by Conservation Information Service, Regina, Saskatchewan.

Beavers taken under the ice bring better prices.

Tooth marks on beaver skins indicate a lack of food and too high a population. Increase the harvest.

Shot or damaged pelts lose much of their value.

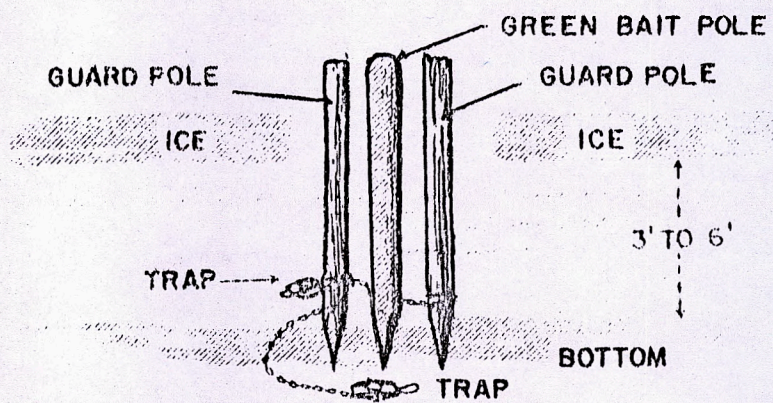
Overscraping exposes the roots of the fur on the skin.

Overstretching spoils the skin and gives it a paper-like appearance.

Large beaver pelts are worth more than small ones. Leave the small ones to grow up.

The simple set shown in the figure on the following page has been found quite effective in deeper water. Locate the set ten to 25 feet from a beaver lodge. Cut a hole in the ice. Cut two 4-inch diameter dry poles (guard poles) and one 4-inch diameter green pole (bait pole) long enough to reach lake bottom. Shove one of the dry poles into the bottom of the lake to see how far it goes into the mud. Pull it out and fasten a number 4 trap to each of the guard poles near the top of the mud line. Then set the poles and traps back into the lake bottom. Set the green bait pole firmly into the lake bottom between the guard poles. Move the traps into correct positions with long sticks.

BEAVER STAKE SET



Centre pole is for bait.

Locate the set shown in Figure 1 about ten to 25 feet from a beaver house. The depth of water should be about 16 inches from the bottom to the underside of the ice. Cut two dry poles about three inches in diameter and five feet long. Shove one pole into the bottom to see how far it goes into the mud. Fasten a number 4 trap to each dry pole at the top of the mud line. Fasten a number 4 trap to each dry pole at the top of the mud line. Nail a foot long green bait stick across the dry poles about one foot above the mud line. Shove the poles and bait stick into the mud bottom. Place two dry poles about six feet long in the mud about one foot on either side of the trap poles. Cross these brace poles and tie all poles together at ice level. Carefully position the two traps between the upright poles and the brace poles.

The Conibear trap is one of the best traps on the market today for the humane taking of beavers (Figure 2). Other useful sets are shown in Figures 3 and 4.

Figure 1 - CONIBEAR TRAP STAKE SET. Bait Stick is Nailed Across Guard Poles

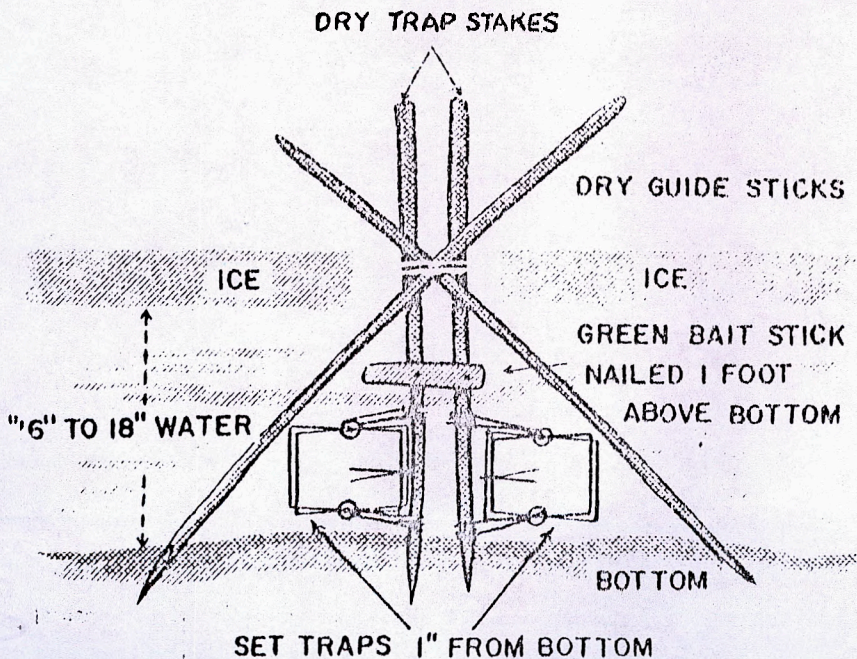


Figure 2 - CONIBEAR TRAP. Developed by a Professional Trapper, this practical, humane trap offers new opportunities to increase your fur yield.

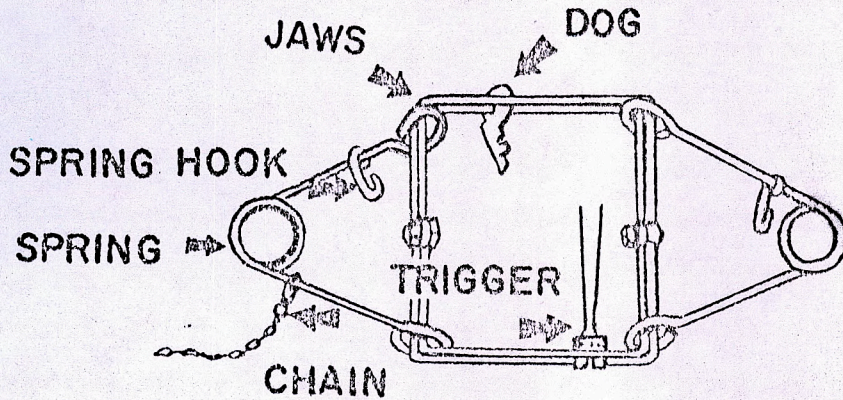


Figure 3 - BEAVER LODGE ENTRANCE SET WITH CONIBEAR TRAP

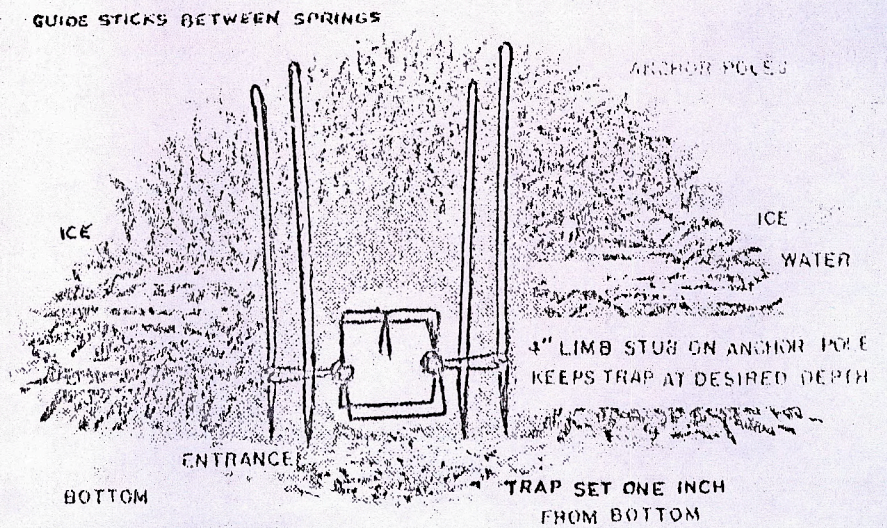
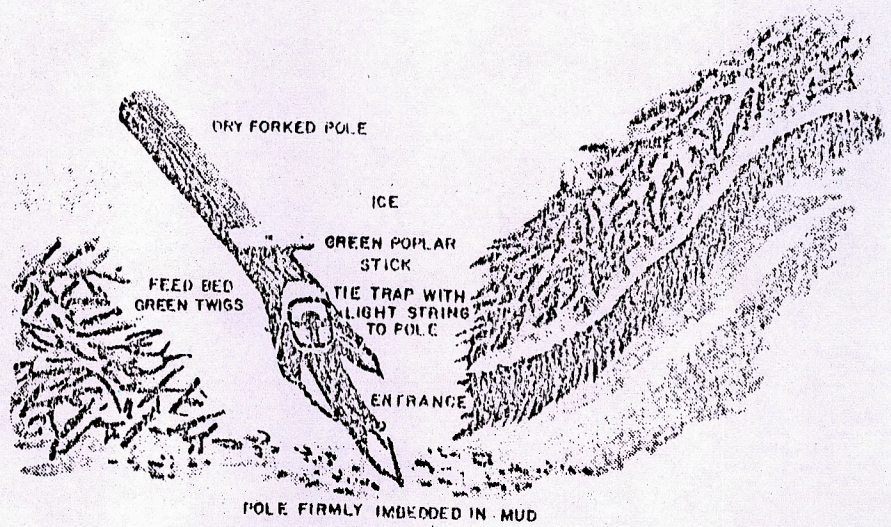


Figure 4 - BEAVER LODGE ENTRANCE POLE SET. Bait stick used is green poplar.



MINK

Trapping Suggestions

These fine, little furbearers are seldom found very far from water. Their favorite haunts are the banks of creeks where there is good cover. They travel through the woods only when crossing from one body of water to another. Mink den in the ground in old muskrat burrows, rock piles, bluffs, and sometimes in hollow logs, but never far from water.

The mink is strictly carnivorous in its feeding habits. Its diet consists of fish, crayfish, frogs, mice, muskrats, rabbits and other small animals and birds. The young are born in April or May, and the average litter is five or six.

Mink are great travellers, following the banks of streams and lakes for long distances in the night. Like most other wild animals, they follow the same route at periodic intervals, unless disturbed in this routine. The female mink usually covers her regular hunting route every other night. The male is apt to make longer trips and may not cover the same route more than once a week.

In these travels, they invariably visit certain spots on each trip. These favorite places may be a deserted muskrat den, a ground-hog hole, a pile of driftwood, a hollow log or tree, a rock pile, a bluff or the bottom of a narrow stream bed. The trapper will acquaint himself with the location of these places and make his trap sets in or near to them. When there is snow on the ground, these spots are quite easy to find.

Another characteristic of mink is that they enter and leave the water at the same place. By careful observation, even when there is no snow on the ground, these places can be located by signs. They make excellent places for trap sets.

Methods of trapping the mink vary as the trapping season progresses. Best results are obtained from early fall trapping, as soon as the pelts are prime. The second week in November usually shows a good pelt.

Do not set traps on the ground or on snow. Place a few dry twigs as a foundation for the trap. This prevents the jaws of the trap from freezing down. Camouflage the trap with feathers, dry leaves, dry grass or material such as a deserted squirrel nest. This material should be scattered lightly over and around the trap.

Another good location for a trap is in a narrow stream below a beaver dam, about four inches below the surface of the running water. If the water is too deep, a platform of sticks placed in the mud may be made.

Traps set in a ground-hog hole should be at least 14 inches down the hole. The entrance should be very lightly plugged with a handful of grass.

Fall Trapping

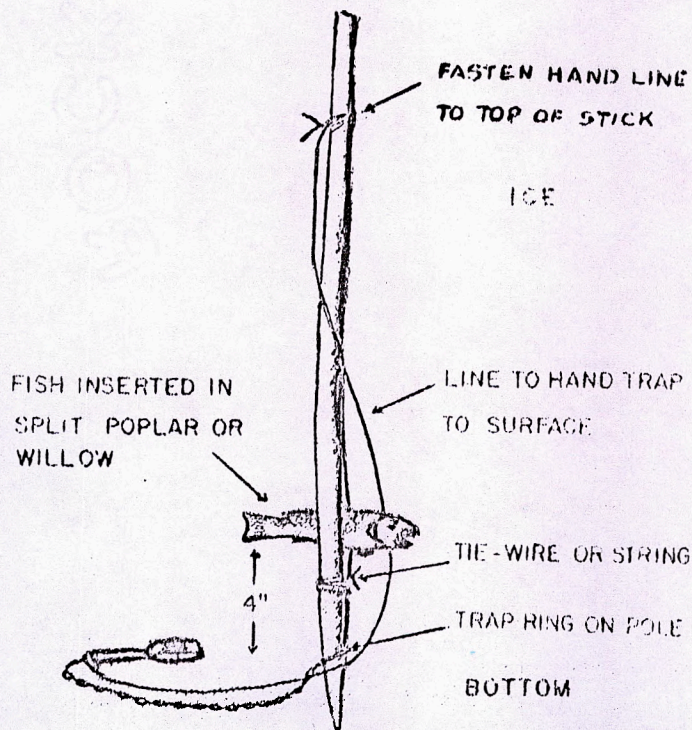
Mink travel more in early fall when there is less snow. They will take bait quite readily and do not spend much time under the ice. If possible, fall sets should be made at beaver dams, preferably just below the dam in a natural cave or cubby. A cubby may consist of a few sticks or logs placed in such a fashion as to make a box about two feet square. It should have only one entrance, and should not be wider or higher than is necessary to allow the trap to close properly. The cubby should be covered with grass, moss or spruce branches to protect the trap and bait from ravens, jays or magpies. The bait may consist of almost any fresh meat, or the scent glands of a previously caught mink, if available. Offal, available from any mink ranch, also makes excellent bait.

Winter Trapping

Once the very cold weather sets in, the water levels of beaver ponds and the midstream ice usually drop, creating additional travel surroundings for minks. Near the shore, the ice frozen onto the banks cannot drop and the space created under the ice makes a runway for minks, and an excellent trapping place. At this time, traps should be set in old runways leading to abandoned beaver houses. No bait is necessary, but the trap should be camouflaged and set on a dry twig foundation.

Another winter set, using a fish as the lure, is described in Figure 5.

Figure 5 - MINK FISH BOTTOM SET



WEASELS

Trapping Suggestions

Number 1 traps are the most practical size for weasels. Sets should be covered with brush or placed in cubbies to avoid catching scavenging birds, and also to prevent the traps from being snowed-in. A properly constructed cubby will also prevent loss of trapped animals to owls and hawks.

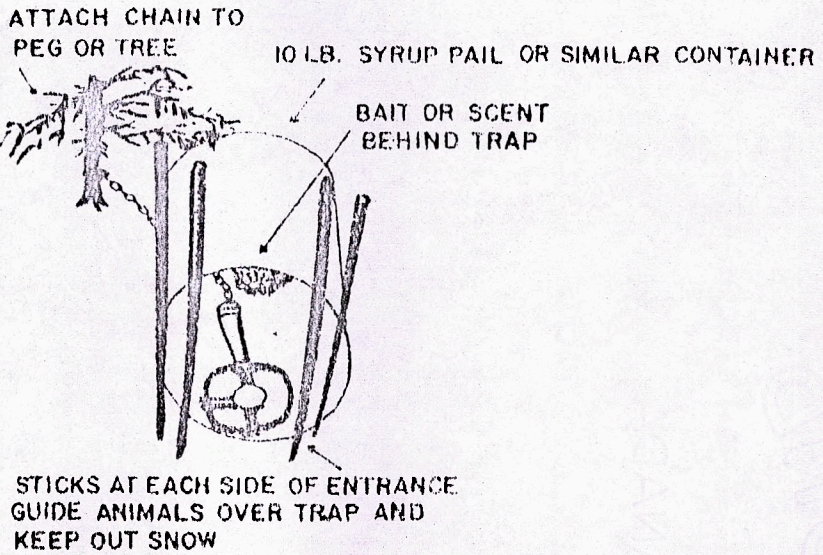
The best locations for weasel traps are where mice are commonly found. Locate sets in rock piles and small brush patches.

Weasels will take bait most readily during November, with some tapering off during the mid-winter months. Fresh meat or blood are excellent baits. Rabbits, muskrats, fish or any waste parts from slaughtered animals can be used with success. Well-blooded meat is most desirable.

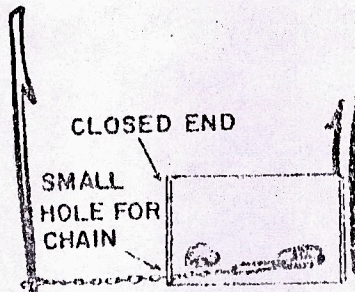
Weasel sets should be checked frequently for damage by mice or shrews. If mice are abundant, re-bait sets frequently.

Do not thaw out frozen weasels too near a stove. Hands should be washed before skinning, and rinsed again before stretching pelts. Clean weasel pelts bring far greater returns in money to the trapper and dealers.

WEASEL OR MINK SET



WEASEL OR MINK SET (SIDE VIEW)



PREPARATION OF SKINS AND FURS

The following description of some common fur bearing animals has been prepared by Wm. M. Ritchie, Chief, Fur Inspection and Grading Services and the Livestock Division, Fur Section, Canada Department of Agriculture, Ottawa.

BADGER - BLAIREAU

"The badger differs from the other members of the weasel family in that forest life holds no inducement comparable to the wide expanse of dry, semi-desert and prairie lands, wherever the soil is dry and light enough to make burrowing easy. Its immediate home is a burrow two or three feet below the surface with runways extending in different directions. Very numerous in earlier days, its numbers, with the settlement of the prairies in more recent years, have been greatly reduced. In appearance it is a low thick-set animal. The body is broad and flat, the ear short, tail short, and legs very short and powerful. The general colour of the prairie badger is silvery grey, but skins with a reddish or yellowish tinge are typical of the British Columbia sub-species. The cheeks and the chin are white and a white stripe runs from the tip of the nose back over the head.

"The animal is slow moving, speed apparently having been sacrificed for strength. It is the only member of the weasel family that hibernates during the colder months of the winter. Even at other seasons though, it is seldom seen abroad during the daytime unless occasionally basking in the sun at the mouth of the burrow.. When alarmed, it will immediately make for its burrow but if that is impossible, it may play possum and endeavour to lie quietly hidden on the ground. If concerned, however, it can be a ferocious fighter and particular care has to be taken of its long hooked claws and powerful jaws and teeth at close quarters. It was the dogged courage of this animal, when at bay, that made badger-baiting such a popular sport in earlier days. Clumsy and ungainly as it was the badger invariably gave a good account of itself against the most ferocious dogs.

"The badger is mainly carnivorous, its food consisting largely of gophers, prairie dogs, mice, ground squirrels, snakes and frogs, birds and their eggs, grasshoppers, and other insects are also included in its diet when they are available.

"There seems to be a great deal of doubt as to the domestic life of the Canadian badger. The British badger mates in the autumn, but there are some who maintain that the Canadian animal mates in early spring like most of the other Canadian fur-bearing animals. The evidence is not conclusive either way and the period of gestation is therefore still a matter of doubt. The young are born late in the spring and are usually three in number, although litters of four and five have been known."

BEAR - OURS

"Bears occur widely throughout Canada. There are several species but the black bear is the most common, being found throughout most of the forested areas from coast to coast. This animal is omnivorous and its range of food is indeed extensive. Although it lives largely on nuts and berries when these are available, it will also spend hours fishing patiently, or turning over stones and old logs to lick up the ants and other insects underneath. Everything is game for it and it will rob a bee's hive or a trapper's food cache with equal relish.

Black bears breed only every second year. Mating occurs in June or July and the twin cubs are born approximately 210 days later, while the mother is denning up for the winter in a state of semi-hibernation. The cubs are hairless at birth and weigh less than one pound each. They will remain with the mother for two years before striking out on their own.

The grizzly bear is a larger and much more formidable animal than the black bear. It is one of the world's largest land carnivores and has the reputation of, often, attacking man on sight. Like the black bear, the grizzly will eat almost anything. Its range extends from the eastern slopes of the Rocky Mountains through to the west coast and it may be found in valleys throughout this area, fishing the streams and feeding on berries. The grizzly dens up for three or four months of the winter and the cubs, averaging two, are born in this period. The female breeds every second year.

The polar bear is found only in the Arctic regions, its range extending throughout the Arctic Islands, along the coast of the Arctic Ocean and down into Hudson's Bay. This carnivore is about the equal in size of the grizzly bear but is peculiar for its long, slender neck and rather pointed head. It feeds chiefly on seals and fish, however, it can subsist on lemmings, and even on moss and berries when other foods are not available.

This bear is white in colour (sometimes with a yellowish cast) throughout the year and the soles of its feet are covered with close set hairs that enable it to grip and walk securely on the ice. It is a very powerful swimmer and spends much of its time on drift ice and in the water, sometimes being seen at sea miles from the nearest shore. The polar bear has few natural enemies in his home range, although, when he is in the water, he generally steers clear of the male walrus whose strong tusks make him a formidable adversary.

The male polar bear is active throughout the year, but in late fall the female chooses a sheltered spot in the icefields and fashions a makeshift den. During the winter months the two cubs are born there, remaining in the den until Spring when they are old enough to accompany their mother on foraging expeditions."

BEAVER - CASTOR

An amphibious animal and the largest of the rodent family, the average adult beaver weighs around 40 pounds, although occasionally heavier specimens are found. Like most aquatic animals they have webbed feet and, in addition, have valves in their ears and nostrils that close when they swim under water. The range of the beaver in Canada is across the forested parts, north to the timberline, and they are generally found in lakes and along streams where birch, willow and aspen abound.

Beaver are monogamous and when they choose a mate in February or early March, they remain mated for life. The young are born late in May or early in June and generally number three or four. The beaver live in colonies of eight to twelve animals, including the adults, the kits, and the young from the previous year. In their third year the young leave the colony and set out to found homes of their own.

Beaver are well known for their engineering feats of building lodges and dams. The lodges are very stoutly constructed from sticks, mud and stones, and may be 20 feet in diameter, extending from the water bed to several feet above water level. There are one or more under-water entrances leading to the inner living space. In time, the exterior of the lodge becomes hard and strong enough to afford complete protection against other marauding wildlife. Since fluctuating water levels would render the lodge untenable, the beaver construct a dam to ensure the necessary constant level. A typical dam may be 4 or 5 feet high and up to several hundred feet in length, depending on the terrain. All hands, adults and young, pitch in on the project, the dam being constructed from the same types of material as the lodge.

The beaver's food consists largely of the bark of birch, willow and aspen trees, the young bark and twigs of many other hardwoods and, in summer, many kinds of vegetation and berries. Before freezeup, food supplies must be provided to last through the winter months and the beaver takes care of this by storing smaller tree trunks and branches on the water bed close by the lodge. The pieces are held in place by being pushed part way into the mud. During the winter they are taken one at a time into the lodge, the tasty bark is stripped off, and the bare pole is then discarded.

Prior to the institution of conservation measures, uncontrolled trapping had practically eliminated beaver throughout large areas, occasioning considerable hardship to the native population which depended largely for its livelihood on fur trapping. Enlightened game management techniques, including restocking the depleted areas with beaver from other parts of the country, were effective in assisting the animal to stage a comeback. Also, in many fur-producing areas a system of registered traplines has been instituted, whereby trappers are allotted a specific trapping area for their sole use. This system puts the responsibility on the trapper for the conservation of beaver and other fur bearers in his area, and encourages him to trap less intensively any species which show signs of becoming scarce. As a result of these and other conservation measures the beaver population has been enabled to build up rapidly and, in 1960, throughout the country it was estimated that this hardy rodent was again as numerous as it had ever been since the early days of settlement.

Economically, the beaver has been and still is the most important fur bearer to the trapper. Beaver is the staple of the Canadian fur industry and the rich, dark brown underfur of the sheared and plucked skins has achieved popularity in fur salons throughout the world.

RED FOX - RENARD ROUGE

"Foxes are the smallest members of the dog family, which includes wolves, coyotes and domestic dogs. They are found in all areas of Canada, from coast to coast and north to the timberline. The cross fox and the silver fox are colour phases of the red fox and red fox litters often include one or more cross or silver pups.

The red fox is the most common of these coloured foxes. Averaging about ten pounds in weight, its colour varies from dark red to light yellow, shading to white on the belly. In common with the cross and the silver, the tail (or brush) of the red fox is very bushy, with a white tip.

Cross foxes vary greatly in colour, ranging from a pale yellow or orange tone to dark red, inter-mixed with black and white hairs. Its chief characteristic, however, is the cross on its back from which this fox derives its name. The cross is formed by bands of black hairs running down the centre of the back and across the shoulders.

The colour of the silver fox varies from entirely black to full silver. This is actually a black fox which achieves its "silvery" effect through white hairs sprinkled on the back and sides. Most of the silver fox pelts on the market today are raised on fur farms.

Foxes mate in February or March and the young are born in April or early May, following a gestation period of approximately 60 days. During the whelping season the foxes occupy dens among rocks, or holes which they dig for themselves. These usually have two or three exits running in opposite directions. The litters contain from two to nine young and both the male and the female assist in looking after the offspring.

In addition to inhabiting the forested areas of the north, the red fox has adjusted successfully to life in the settled areas, frequenting bushland and meadows neighbouring on farms, where mice are plentiful. Foxes eat practically anything. Their main foods are mice, rabbits and birds but they will also eat insects and berries and, in the settled areas, they are not averse to raiding a chicken coop.

Although the demand for fox furs increases or falls off in accordance with the dictates of fashion, the fox pelt at all times remains a thing of beauty. The striking colour contrasts and the long, glossy guard hairs overlaying the deep pile of the underfur produce a luxurious effect that embodies all the magic contained in the word fur."

MUSKRAT

The muskrat is an aquatic rodent, about 20 inches in length including a tail of about 9 inches. It is well adapted to its form of life, having a dense, waterproof underfur and a protecting coat of long, glistening guard hairs. Its ears are almost concealed in the fur and the eyes are small. The hind feet are large and partly webbed and the tail is long and scaly. Because of its appearance and the presence of glands which emit a musky odour, it has been appropriately named a muskrat.

The muskrat may be found practically everywhere in Canada, north to the timberline, and in some areas right up to the Arctic Ocean. The habits of the beaver and the muskrat are similar in many respects. They are both amphibious rodents which choose for their habitat marshy ponds and lakes and the banks of slow running streams. Muskrats may live in bank burrows or in lodges built largely of twigs and mud. When a new home is to be constructed, vegetation and mud are brought to the spot and a little island is gradually built up. When this is well above water, the muskrat digs a tunnel into the structure under the water level, and keeps excavating until it has a living chamber with, generally, two entrances under water to facilitate escape in case of attack.

Muskrats living along streams and creeks where the banks are steep and the water deep, usually burrow into the bank underneath the surface of the water and excavate until they arrive above the water level, where the tunnel is widened into a large room for living quarters. These burrows sometimes extend 40 or 50 feet and the entrances are always in deep water where there will be little danger of them freezing up.

The muskrat is very prolific, producing two or three litters per year with, generally, from 5 to 7 kits in each litter. The gestation period is about 30 days. The young muskrats are able to fend for themselves when they are about 4 weeks old, and muskrats born in the spring will breed in the fall. This high reproduction rate would soon lead to an overabundant population, however, the muskrat has many enemies, the chief of which are mink, otter, foxes, wolves and the larger owls. The worst of these is probably the mink since it frequents the same areas and, being aquatic, can follow the muskrat right into its home. In addition to the depredations of these marauders, disease, drought and flooding also serve to keep the muskrat population in check.

The food of the muskrat consists principally of aquatic vegetation but they will also eat clams, frogs, fish and even young birds when these can be obtained. When an area becomes overpopulated, the resulting shortage of foodstuffs forces many to leave the area and journey, often overland, to find new homes.

The fur of this mammal is nearly as fine and dense as that of the beaver and through the years muskrat has contributed a great deal to the fur industry. In addition to the annual catch made by Northern trappers, muskrats are still taken in good numbers in the central portion of the country, even in many of the settled areas, and returns from the sale of the pelts provides supplementary income for many part-time trappers.

At the manufacturing level, following dressing, some of the finest quality pelts are "sealed", that is to say the guard hairs are removed and the underfur sheared, then dyed black to produce "Hudson Seal" muskrat coats. Other pelts are used for natural coloured garments. The majority however are dyed various shades of brown, then striped and grooved so that the finished garment resembles, to a degree, mink.

LYNX, LYNX CAT AND BOBCAT

"The lynx is a member of the cat family. It has a large head with a rather flat face and the ears are quite prominent, with tufts of black hair projecting from the tips. The feet are large and heavily furred, and the tail is not more than a stub, grey on top and white below, with a black tip. The rather shaggy fur is silvery, mottled with brown, on the back and sides, shading off to white beneath. The characteristic stance of this animal is with the hindquarters higher than the shoulders.

The lynx is primarily a wilderness creature, its range extending throughout the more remote forested areas where it is seldom seen even in periods of comparative abundance. Although the adult lynx weighs up to 40 pounds, its large paws enable it to walk easily in soft snow where other animals would flounder helplessly, and the lynx makes good use of this advantage when hunting.

The chief food of this animal is the rabbit and the fluctuations or 'cycles' in the abundance of lynx correspond closely to the increase and decline in the numbers of rabbits. The lynx also preys on mice, birds and any other small game that may come its way.

Lynx mate during February or March and the gestation period is approximately 60 days. The litters containing from two to five young are born in dens under windfalls or in crevices among rocks. The young are suckled for about 3 months and appear to follow the mother for the greater part of a year. Although the male is seldom seen with the family after they leave the den, the indications are that he stays in close proximity to them during the greater part of the year, giving rise to the belief that the lynx is monogamous.

The lynx cat and the bobcat, or wild cat, are sub-species of the lynx that are found in forested areas, usually further south than the range of the true lynx. In Canada they occur mainly in central and southern British Columbia, and in some parts of the eastern provinces.

They are smaller than the lynx and, although similar in appearance, the fur of the lynx cat and the bobcat is usually reddish-brown, with dark spots on the flanks and underside. Also, the tail has several dark bars on top and the tip is black on top only, whereas the lynx has a full black tip.

Like the lynx, the lynx cat and the bobcat are shy animals and are seldom seen by hunters, probably due to the fact that they are nocturnal, remaining in their dens during the daylight hours. Their diet consists almost entirely of small animals, game birds and their eggs. Infrequently they attack livestock.

The deep silky fur of the lynx is prized by the fur industry, being used mainly as trimming on a wide variety of cloth garments. The pelts of the lynx cat and the bobcat are also used for this purpose but generally realize prices considerably below that of the true lynx."

OTTER - LOUTRE

"The northern otter is to be found throughout the forested area in Canada, along the larger streams and lakes. It belongs to the weasel family, like mink and ermine, and its chief characteristics are a long body, very short legs, webbed feet and a long, tapering tail which, at the butt, is almost as thick as its body. The colour ranges from medium brown to glossy black.

The most playful and sociable of the weasel family, the otter, in company with its kind, is very fond of sliding or tobogganing down the steep banks of a stream or lake into the water. These animals may be seen climbing and sliding and thoroughly enjoying themselves for hours on end. They appear also to enjoy playing their own watery versions of tag and hide-and-seek.

The otter spends practically all of its time in and around water, frequenting, especially, the larger lakes and rivers where there is clear water and plenty of fish. In winter it is often found around areas of open water near falls or rapids. The diet consists principally of fish, supplemented by waterfowl, frogs, muskrats and other small animals. Although rather awkward on land, otter will travel long distances overland from one body of water to another, progressing with a peculiar bounding and sliding gait.

In the latter part of April the young (from one to four) are born, in dens under overhanging rocks or among the roots of an old tree. Sometimes the otter will burrow into the bank of a lake or river, making the entrance to the den under water. Both parents assist in caring for the young, which are able to fend for themselves at around three months of age.

The finest otter come from Northern Quebec, pelts from this area possessing a silky texture and a density of fur unequalled in the otter from other areas. At the processing level, otter pelts are treated much the same as beaver, the long guard hairs being removed and the top of the underfur sheared. The underfur that is left is very dense, more so even than that of the beaver.

More recently the practice has been perfected of bleaching otter pelts then dyeing them in pastel colours. The resulting garment is very attractive and, in addition, this treatment serves to camouflage a fault found with otter - the very light colour of the lower underfur which, in a natural coloured garment, has a disturbing tendency to reveal itself with the movement of the garment when worn."

RED SQUIRREL - ECUREUIL

" The red squirrel is a member of the rodent family. Its range extends throughout the forested areas, from coast to coast and north to the timberline. This noisy creature is undoubtedly the most familiar of all Canadian mammals and throughout the year its chattering and scolding can be heard in almost every section of evergreen woodland.

The diet of the squirrel consists mainly of nuts, seeds and berries. During the fall period it harvests large quantities of these items and stores them for use in winter. A deserted woodpecker hole or a small hollow in a tree serves as a nest and the young, generally four to seven, are born here in April or May.

Squirrel are taken in many parts of Canada and although the value of the individual pelt is low, trapping returns are distributed throughout countless central and northern villages, providing a welcome source of additional revenue for many part-time trappers as well as for the professionals.

The province of Alberta accounts for approximately half of Canada's squirrel production, the bulk of the pelts coming from the Peace River and Grande Prairie sections. The largest and finest quality Canadian squirrel come from the Yukon Territory, followed closely, from point of view of quality, by squirrel from northern Alberta and northern Saskatchewan."

WEASEL OR ERMINE -- BELETTE OU HERMINE

^a The range of the weasel extends throughout Canada from coast to coast and north to the Arctic Islands. There are three sub-species, the long-tailed weasel which is usually found in the more open sections of western Canada, the short-tailed weasel or ermine which frequents forested areas from coast to coast and the "least" weasel which occurs in all areas. The long-tailed weasel is by far the largest of this family. When fully prime its fur is pure white while the winter coat of the smaller short-tailed ermine is white with, usually, a slightly yellow cast. In summer the coats of both these animals change to reddish-brown, the tip of the tail remaining black in all seasons. The least weasel averaging about 5 inches, is of no commercial value.

This animal frequents thickets and stoney places, as well as tree roots and the deserted burrows of moles and other ground creatures. Slender and wiry in body, with short legs and small feet, the weasel is a wanton killer and does not hesitate to tackle animals much larger than itself. It lives mainly on mice but will also kill rabbits and birds. Its depredations in chicken houses are well known to farmers for it will often kill twenty to thirty birds in a single night. Often the weasel will simply suck the blood, leaving the rest of the carcass untouched.

Mating takes place during March and the young, usually numbering six to twelve, are born in April or May. Both parents appear to assist in rearing the young.

Throughout history ermine has been associated with majesty and at one time the wearing of this fur was restricted to royalty. It is still used for state robes, the station of the wearer being indicated by the presence, absence or disposition of the black tail tips."

TIMBER WOLF - LOUP DE BOIS

"The timber, or grey wolf as it is frequently called, is much larger and much more heavily built than the prairie wolf or coyote. Formerly found nearly all over Canada, it has now been largely restricted to the more remote areas of timber-land and the barren lands of the sub-arctic.

It varies greatly in colour and size according to the areas in which it ranges. On the northern barrens it is almost white except for a few black markings down the back. Further south in the timber areas, the colour varies from a yellowish to blue grey along the back and sides fading to white underneath while the black markings on the back are much more pronounced.

The timber wolf is, apparently, more social in its instincts than its smaller cousin, the coyote, for small packs, usually family parties, up to seven or nine in number, will frequently be found hunting together. This may be occasioned by necessity, however, rather than any special hankering for the company of its kind. Since the wolf has to depend on the successful hunting of moose, deer, muskox and the other larger animals for the main part of its food and as these animals are well able to defend themselves in a fair fight the advantages of hunting in packs must soon have become evident to an animal as cunning and resourceful as the timber wolf.

Like the coyote, the timber wolf mates during February and the young are brought forth in a rough den about April, the number in a litter varying from five to ten or even more. The young continue with the parents until late Autumn when they separate apparently for good.

What has been said regarding the difficulties of trapping coyote applies even more emphatically to the timber wolf. It has all the cunning and wariness of the coyote and, in addition, is a much heavier and stronger animal."

WOLVERINE -- GLOUTON

"The range of the wolverine extends throughout the northern forested areas in Canada, this animal being found most frequently in northern British Columbia and the Yukon and Northwest Territories. It is the largest and most formidable member of the weasel family, having a squat, heavy body, broad head, heavy limbs with long, powerful claws and a short bushy tail.

Its colour ranges from yellowish-brown to dark brown. Pale bands which vary in colour from light brown to near-white extend across the forehead and along both sides of the body, to the tail. Like the other members of the weasel family it has glands at the base of the tail that produce a musky odour. The adult wolverine weighs up to 40 pounds.

Its food consists largely of mice and other rodents but it will successfully attack larger animals including moose, deer and caribou that may have become weakened or bogged down in deep snow.

Trappers claim that the wolverine will follow a line of traps, eating the bait, destroying any animals caught, and even pulling up the traps and burying them. It is said to be expert at breaking into food caches, destroying or spoiling whatever it is unable to eat.

The little information that is available concerning this animal indicates that the wolverine mates in February or March and the young are born late in April and May. Usually the young number two or three and it seems likely that they remain with the parents until fall."

FISHER -- PEKAN

"The fisher is one of the larger members of the weasel family. About the size of a large domestic cat, its fur is dark brown to greyish-brown, generally lighter in colour, and often somewhat grizzled, towards the head. The fisher's head is short and broad, the ears are quite short and the tail is long and rather bushy. It is probably the most agile of all the arboreal animals, being faster in the trees than either the squirrel or the marten, while on the ground it can run down a hare in open chase. Despite its name, the fisher does not fish and, as a matter of fact, has not much inclination towards water.

"At one time fisher roamed throughout the forested areas of Canada but they are quite scarce now, being found mainly in isolated northern regions. Their principal foods are rabbits, porcupines, squirrels, mice and birds, but they are fearless and savage marauders and will successfully tackle larger animals.

"The fisher generally makes its den in the hollow of a tree, high off the ground, although it may sometimes be found under a windfall or in a crevice in the rocks. Mating takes place in March or April and the young (an average of three) are born after a gestation period of approximately 350 days. Judging by observations made on fur farms, fisher are polygamous and the males do not play any part in raising the young. In fact they maintain a safe distance from the litter and keep a fearful and wary eye on the female."

FOX, ARCTIC

"The Arctic or white fox inhabits the Arctic and sub-Arctic regions. In winter pelage its colour varies from a clear, dazzling white to white with a slightly creamy tinge. In the summer months it is greyish-brown, with a lighter belly. The white fox is smaller in size than the red fox and the bushy tail is shorter than that of the red.

"The blue fox is a colour phase of the white fox and blue pups may occur in white litters, although production of the blue phase does not generally exceed about one percent of the total production of white foxes. The colour of the "blue" fox varies from a slate blue to a rather drab brown.

Lemmings form the principal food of this fox which feeds also on birds, bird's eggs and the leavings of the larger carnivora. The white fox is subject to marked fluctuations in numbers from year to year and these fluctuations or 'cycles' notably affect the number of pelts taken annually. The cycle of white foxes coincides with a similar cycle in lemmings and is perhaps caused by it.

"White fox furs are the staple of the Eskimo trapper. At the retail level this fur is perennially popular for evening wear, in capes, stoles and collars. The finest quality pelts come from Western Arctic sections, clear white pelts being the most valuable. Due to the feeding habits of the animal, and also arising out of improper pelt handling methods, many of the pelts that reach the market are badly stained by grease, with a consequent reduction in the value of the pelt."

MARTEN - MARTRE

"The marten, sometimes called the Canadian Sable, is a member of the weasel family and has the reputation of being the most unsociable of that unsociable family." Originally it was found throughout the forested areas in Canada but many years of trapping has now reduced its range to the more isolated areas. "Its lair is usually in a hollow high up in some old tree, although, sometimes, it may be found in burrows or in crevices among the rocks.

"Since it will live only in the densest forest and underbrush, much less is known about its habits than about those of most other animals. It is smaller in size than an ordinary house cat, with rather short legs, small feet and a fairly thick bushy tail. Very shy of man, it is seldom or never seen near a habitation of any kind. It is most agile in the trees and will climb and jump from tree to tree with tireless energy.

"The value of the marten lies in its rich silky fur which is often of a very rich dark brown colour shading into almost black at the tail, with a large irregular patch of pale buff or orange at the throat.

"It will eat practically anything. Its main food consists, however, of rabbits, squirrels, mice, birds and their eggs, nuts and many kinds of wild fruits and berries and particularly rowan berries. Unlike the ermine, it does not appear to kill wantonly. What it cannot eat, it caches away for future use.

"The same unusual circumstances apply to the breeding habits of marten as to fisher. The young are apparently born about April, but it is contended that the gestation period extends over about eight and a half months so that mating under these circumstances would take place

about July or August. Litters usually run from four to seven and the young continue with the mother probably until winter sets in, after which they take up their individual solitary existence. Except for the brief period of mating, marten usually show a consistent cold-blooded ferocity to each other, regardless of sex or relationship."

PRAIRIE WOLF - LOUP DE PRAIRIE

"This branch of the wolf family is found all over Western Canada on the prairies and in the sparsely wooded sections bordering on them. Smaller and more slenderly built than the timber wolves, they are just as rapacious and predatory in their habits. Ordinarily they may be found hunting in couples. The bands that are reported as having been seen from time to time are most likely family parties, as it is known that the young continue with the parents until well on in the autumn. The efforts that have been made by governments and individuals to exterminate these animals in certain localities have been singularly unsuccessful. This has been due largely to the cunning of the coyote which it has shown in eluding man's efforts to capture and destroy it.

"There is reason to believe that the coyote is monogamous. Mating takes place about February and the young are born about April, in a burrow dug on a hillside by the female, or in a natural den in broken rocky country. Litters may contain as many as ten or twelve. During this time, while the female is tending the young, the male provides for the family and will desperately protect it against intrusion. The young are able to move around when about four or five weeks old and keep company with their parents until about the end of October when, apparently, the family breaks up.

"In colour, the coyote is yellowish grey, relieved on the back with a sprinkling of black hairs. The head is long and pointed as also are the ears. The tail is black tipped and bushy.

"When the buffalo were numerous over the plains of Western Canada, they were followed by bands of coyotes. With the disappearance of the buffalo the coyotes had to look elsewhere for their prey and consequently turned their attention to the cattle and sheep of the farmer, as well as

extending their range in the mountain districts of the west. So numerous are they in certain districts that they have become a real menace to the farmer and nothing that he can do seems to lessen their numbers in any material way."

RACCOON - CHAT SAUVAGE

"This animal is like the bear in many respects, it hibernates during the cold months and it is omnivorous, yet it cannot be classed as a bear, for it uses its flexible front paws while feeding in a manner quite different from that of the bear, and its way of breeding and caring for its young is different also.

"It is a thickly built animal about the size of a badger, with a shaggy coat of rather coarse, greyish-brown fur interspersed with yellowish and black hairs. The underfur is dark and dense. The short club-shaped tail, with alternate black and yellowish rings, makes the animal readily recognizable. The nose and ears are rather pointed and there is a distinct black mask across the yellowish white face. The toes, particularly of the forefeet, are long and well separated and are used much as a monkey uses its hands.

"The coon, as it is commonly called, is found mostly in Western British Columbia and Ontario, Quebec, and the Maritime Provinces, living usually on the edges of hardwood forests near water or marshy ground. It is an excellent climber and also swims well. Nocturnal in its habits, it does practically all its hunting and travelling at night. The ideal den is a hollow branch high up in a tree well exposed to the sun, but although arboreal in its nesting habits, it hunts and obtains most of its food on the ground. It will eat practically anything and when near water it has the peculiar habit of washing its food before eating it. Among its principal items of food, frogs, cray-fish, crabs, birds, eggs, berries and nuts might be mentioned. It is also inordinately fond of green corn and if there is a cornfield around, that is where the coon will be found most

nights. The raccoon is a night prowler at all times and has a great amount of curiosity that gets it into no end of trouble. Any bright object like metal will cause it to stop and investigate, and persons engaged in hunting it make good use of the habit.

"Being a hibernating animal, there is some doubt whether the coon mates in the fall or in the spring. The weight of opinion, however, favours the spring. In any case, the young born late in April or early in May and may number from three to six in a litter. The male and female both assist in bringing up the young and the family continues to live together well through the following year. The coon is very sociable and it is but rarely it is found alone. There are usually a pair or a family together."

TERMS USED BY FUR TRADE INDICATE QUALITY

It is important to know the meaning of the common terms used by the trade in classifying skins according to quality. The following definitions of trade classifications will give some idea of the essential points that determine the class into which a pelt is placed.

- FIRSTS (I) - Pelts of best quality. Generally speaking these are faultless skins, being fully furred, prime pelts, free of blemishes.
- NUMBER TWOS (No. 2) - These are essentially FIRSTS with slight blemishes which do not materially affect the use of the fur. Pelts in this class may be slightly unprime, or have a very slight amount of damage or a slight weakness in the fur.
- SECONDS (II) - This grade covers a wide range of qualities and is often divided into two sections, i.e. "good" seconds and "common" seconds. SECONDS may be unprime or blue pelted, with short underfur and guard hair. They may be badly handled, singed or of coarse texture. Also, SECONDS may be badly faded or off-colour.
- THIRDS (III) - These are skins that have decided defects. The leather may be blue all over, the fur short and thin, or the skin may be long past its prime and shedding badly.
- FOURTHS (IV) - Low grade skins with little or no top hair.
- DAMAGED - Damaged skins, including shot skins, are graded and valued according to their merits and the extent of the damage.

PREPARATION OF PELTS FOR THE MARKET

Source: Livestock Division, Canada Dept. of Agriculture, Ottawa.

Trapping calls for skill and patience and often exposes the trapper to hardship. Catching the animals is, however, only part of the battle. The skinning and the preparation of the pelts for the market still remain to be done. These are important operations, for upon the skill and care devoted to them depends to a great extent the value of the pelts in the fur market. There is no doubt but that clean, well-handled skins will always realize better prices than skins of similar quality which have been poorly fleshed or improperly stretched.

SKINNING - Two methods are used "open" and "cased". Animals customarily skinned "open" are, beaver, badger and bear. Beaver is of course the most important of these three and this animal is always skinned "open". Raccoon and wolverine may be either "open" or "cased", but all other animals are "cased".

If the animal is to be skinned "open", the skin should be cut from the point of the lower lip along the centre of the chest and belly to the vent. The pelt is then worked off to the legs which are pulled through after they have been cut off at the first joint. It is then quite easy to finish taking the pelt off.

If the skin is to be "cased" the skin should be slit on the inside of the hind legs from the paws to the vent, the hind legs, the rump and the tail, skinned out and the animal hung up by tying the hind feet together over a hook or the limb of a tree. It will then be found easy to work the skin off, inside out, with very little use of the knife. When the forelegs are reached, they should be pushed back and worked out of the skin until the paws are completely skinned out. Particular care should be taken when skinning around the eyes and the lips. The tails of most animals should be split and the bone removed.

The tails and paws of the beaver and muskrat are of no value and should be cut off where the fur ends.

If an animal is frozen when taken from the trap, it should be thawed out very slowly and never put in too warm a place.

FLESHING - After the skin has been taken off, remove all fat and flesh with the dull edge of a knife or similar tool, care being taken to avoid over-scraping or cutting the pelt. Opinions vary on the direction of scraping, but it is usual to start with the head, working towards the tail. Work so as to keep the fur free from grease to the greatest possible extent. Following fleshing, lukewarm water with mild soap will remove most of the fresh blood and grease from the fur. Never use hot water - this will burn the leather and completely spoil it.

STRETCHING - No matter how good a skin might be, it will lose in value if it is not properly stretched. All "open" skins should be tacked on to a flat surface with the flesh side up, or laced in a frame made by bending and tying green willow into an oval-shaped hoop. For "cased" skins, use a wedge-shaped stretcher made of soft wood, 1/4" to 3/4" thick. The edges of the stretcher should be rounded off and made perfectly smooth. If a solid board is used, a center wedge should be inserted on the belly side, to permit easy removal of the pelt after drying.

DRYING - Always dry in a cool place, away from the direct rays of the sun or the heat from a stove. "Open" skins, and all "cased" skins of types which are normally sold with the leather side out, should remain until dry. Those "cased" skins which are normally sold with the fur side out, should first be placed on the stretcher pelt side out, then removed after they have dried sufficiently to hold their shape. To turn the skin, start by folding in the nose and work the pelt inwards little by little. Replace the turned skin on the stretcher until it is thoroughly dry.

PACKING - All furs should be thoroughly dry before shipping. It is best not to fold fur skins if it is possible to avoid doing so, and beaver skins especially should never be folded. Lay them fur to fur and skin to skin, and pack them flat or, if only a few skins are available, they can be rolled and shipped in this manner.

Following are the approximate sizes for stretching boards, for use on the undernoted fur-bearers.

- ERMINE (WEASEL) Length 18 inches, width at shoulders 1" to 1 1/2" (for large skin) width at base 1 3/4" to 2 1/2". Ermine should always be "cased", with the fur in.
- FISHER Length 36 inches, width at shoulders 4 1/2", width at base 6". Fisher skins should be "cased" with the fur side out.
- FOX Length 45 inches, width at shoulders 6", width at base 8". Fox skins should be "cased" with the fur side out.
- LYNX Length 60 inches, width at shoulders 7", width at base 9". Lynx should be "cased", with the fur side out.
- MARTEN Length 25 inches, width at shoulders 3 1/2", width at base 4 1/2". Marten should be "cased" with the fur out.
- MINK Length 30 inches, width at shoulders 3", width at base 4". Mink should be "cased" with the pelt, or leather side out.
- MUSKRAT For a large skin, length 20 inches, width at shoulders 5", width at base 6 1/2". Muskrats should be "cased", with the pelt side out.
- OTTER Length 60 inches, width at shoulders 6", width at base 8". Otter should be "cased" and shipped pelt side out.
- WOLF Length 60 inches, width at shoulders 8", width at base 11". They should be "cased", with the fur out.
- SQUIRREL Squirrel should be "cased", with the fur out.

PREPARATION OF FOX PELTS FOR MARKET

Source: J. Malfair, Churchill, Manitoba.

After a fox has been caught there are still several operations necessary to make the skin ready for marketing. These are very important and the following suggestions and information may be helpful.

SKINNING

In skinning the fox, great care should be taken not to cut and damage the skin. Using a sharp pointed knife, begin with the front legs and slit the skin from the centre of the paw down the underside to the elbow of each foreleg. The legs are skinned out to the toes. The toes are taken out to the last joint, then severed with a small pair of snips or sharp knife, the toe nails being left intact in the pelt. With the hind legs, commence at the foot pad and cut directly to the hock joint, and from that joint down the back of the leg in a nearly straight line to the vent. The greater part of the work of removing the pelt from the legs is done with the fingers. Like all other pelting operations, it requires some practice to acquire the proper skill to make an incision of the proper depth and to develop speed in the performance of the whole operation.

After skinning the legs the pelt is removed from the abdominal region and, in so doing, care should be taken that it is not torn. By using a notched stick, which is inserted between the cords of the hind legs, the fox should now be hung up. The underside of the tail should be split about two inches from the base, and working around the tail from this slit, free the skin from the tail bone so that there is sufficient space to get a good hold of the bone with one hand, then holding the base of the tail with the other pull the bone out.

The body of the pelt is then removed as far as the head. This step is largely accomplished by applying a downward pressure on the pelt, and, at the same time, loosening it from the body with the fingers. Care should be taken to exert only a slight pressure as otherwise there is danger of overstretching the pelt. Very little use should be made of the knife until the base of the neck is reached, after which it will be needed to remove the pelt from the head. Care should be taken to avoid cutting the arteries of the neck and head. If these are damaged, a considerable quantity of blood escapes, which hinders the removal of the pelt. When they are reached, the entire ears should be severed from the body, leaving them attached to the pelt. The gristle is removed from inside the ear after the pelt is off. The next point of importance is the eye, which is left in the carcass, but the eyelids and eye lashes are removed with the pelt, and in doing this, great care should be exercised for if it is not skillfully done an unsightly gap will result. The skinning of the head is then continued, until the operation is completed, the lips and nose being removed with the pelt.

SPLITTING THE TAIL

The pelt is now entirely free from the carcass, the next operation is to slit the tail from end to end. It is important that this slit be made straight down the middle of the tail on the underside.

FLESHING

The next step is the removal of the flesh and fat from the pelt. This can be accomplished best by placing the pelt fur side in on a fleshing board. Before this is undertaken, it is a good plan to allow the pelt to cool and the fat to solidify. It is a tedious and disagreeable task to attempt this procedure while the fat is still warm and liquid. While it is desirable that all the fat and flesh should be cleanly removed, the process can be overdone and the pelt scraped so closely that the roots of the hair will be exposed.

STRETCHING

After the fleshing, with the fur inside, draw the pelt gently over the stretching board. A frequent error is to over-stretch the pelt. If this is done, the guard fur on the neck and shoulders is made to appear thin and scanty, which detracts from its appearance and lowers the value of the pelt. Be careful to place the pelt squarely on the board so that the centre of the pelt will coincide with the centre of the board. Beginning at the nose the pelt is fastened to the end of the board by a small nail, then work gently back until the sides are even. On the under, or belly, side of the pelt about one inch in front of the foreleg, grasp the skin with each hand and draw towards the nose about one inch and here tack with two nails. This gives the pelt a chance to thicken at the neck and shoulders where many pelts are weak in fur. Tack a narrow strip of wood across the back of the pelt about 2 inches behind the forelegs. This strip prevents the stretching of the neck and shoulders when the backs and butts of the pelts are being placed on the boards. Without stretching, adjust the pelt so as to have it fit snugly, draw the skin of the butts which is near to and on each side of the tail towards the centre where the tail joins the main part of the pelt, and tack with three or four nails to hold in place.

The tail is then brought down the centre of the stretcher, but before tacking, take the tail about 4 to 5 inches from the butt and push it back towards the pelt about 2 inches, enough to allow the skin, as it contracts in drying, to close in the space that in many pelts makes them appear so disjointed or thinly connected. Spread out the tail and fasten it along the board with slats tacked to the boards. On either side of the tail, tack the hind legs so that they will be in line with the butts.

The front legs are spread open, stretched and tacked on two slats about one quarter inch thick and tapered from one and one quarter inch to three inches wide, the full length of the forelegs. Care should be taken to see that the paws are split to the point of each toe and the bone removed. No matter how good a skin may be it will lose in value if it is not properly stretched. Therefore, it is most important that stretching be carefully and correctly done.

CLEANING AND FINAL PREPARATION

Never expose the skins, when drying, to the direct rays of the sun or to the heat of a stove. Allow it to dry slowly in a cool shaded place. After two days all excess fat should be carefully scraped off the skin as it will "burn" as if it had been exposed to excessive heat. After the scraping, rub the pelt with a piece of coarse sacking. When the pelt is 90% dry take it off the stretching board and turn the pelt, fur side out. To do this, start by folding in the nose and then work the pelt slowly inwards, a small piece at a time, to avoid cracking or tearing. The pelt is then replaced on the stretcher board fur side out. For this no tacking is required. The pelt is then left in a cool place until ready to be sold.

PREPARATION OF HAIR SEALSKINS

Source: Industrial Division,
Department of Northern Affairs
and National Resources,
Ottawa.

1. To eliminate the most common defects of discolouration and stain on hair sealskins, it is imperative that the skins be rendered absolutely free of fat, oil and blood in the process of "Native Tanning" immediately after being removed from the carcass.
2. When grease is left on the skin, oxidation quickly develops that burns irremovable stains into the hair that no known treatment can remove.
3. It is also advisable to take similar precautions against contamination when it is found necessary for unskinned seals to be kept in storage caches.
4. Discolouration and stain are directly attributable to improper handling during the initial stages of cleaning and drying. Since it is impossible to supervise every individual effort there seems only one alternative; that is to instigate selective purchasing, emphasizing the importance and value of cleanly handled pelts.
5. The following instructions are laid down as an easy and convenient method to ensure top quality skins. These simple rules of procedure are adaptable to facilities found almost everywhere.
 - (a) After removing the pelts, all fat should be scraped off and the skins washed with warm (not hot) water and soft green soap (Fels Naphtha) until every indication of grease disappears. Then, in turn, make certain that no trace of soap remains by two rinsings in clear warm water.
 - (b) Prepare the skins for the drying frames by drawing together the flipper holes and puncturing the edge of the skins for lacing into the frames.
 - (c) Mix a salt solution using approximately one pound of salt to five gallons of water, and soak the skins in this for twelve to fifteen hours. This will brighten the sheen of the hair, neutralize any particles of grease that may remain, and tend to leatherize the pelt. It also imparts a sort of a set condition to the fabric of the skin, thereby toughening it appreciably for further processing. For this reason it is advisable to prepare as in (b) before immersing in the solution. The solution may be used once over again providing the salinity is not seriously reduced. However, for best possible results mix a fresh supply for every batch of pelts. Let excess water drain off from original washing before pickling. Pure, fine grain rock salt should be used.

- (d) Rinse again thoroughly after taking out of pickle, in at least two waters. Clean, fresh warm water to be used.
- (e) Lace in frame without over-stretching. Just enough strain to take up all slackness is sufficient.
- (f) Best results are obtained by frost drying in the open air during the coldest part of the winter. Place frames outside in leaning position with fur side uppermost. The drifting snow and wind will beat and drum the hides to perfection.
- (g) Never expose to the direct rays of the sun with outside atmosphere above freezing temperature.
- (h) During adverse weather conditions there is no other resource but drying the skins inside buildings. When this is done the frames should be placed away from direct heat.
- (i) The skins should never be scraped (softened) after they are dry. Some people are inclined to penetrate too far and oftentimes cause "slippage" by rupturing the roots of the hair.
- (j) Keep in storage bulk by laying skins flat - alternately hair to hair and pelt to pelt. Never fold at anytime after drying. Folding will create a crease where the thin pellicle of skin on the fur side will eventually crack open and the hair on the crease line will become misshapen and broken. Skins may be rolled for convenient transportation.
- (k) If in storage for any length of time, the skins should be aired outdoors at least every two months.
- (l) Always keep in cool place or under refrigeration if possible.
- (m) **IMPORTANT!** Spring "jars" taken on ice with indication of sunburn (curling hair) should not be tanned.

THE PREPARATION OF BEAVER SKINS FOR THE MARKET

Source: Livestock Division, Department of
Agriculture, Ottawa.

Hudson's Bay Company,
Northern Stores Department,
Winnipeg, Manitoba.

Beaver which are of a bluish colour in the leather have been too early trapped, probably before freeze-up, and they lack the depth of underfur to be found in an animal trapped later in the winter. The latter will be clear pelted. Beaver trapped too late in the spring, usually after break-up, are of poorer colour and quality. Discolouration appears on the leather side, the fur is open and weak and often rubbed around the flanks. In addition, the fur is loose and usually sheds. Late caught beaver, also, contain a very high percentage of damages. While neither of these beaver is desirable on the market, the late caught pelt is discounted the most.

On being taken from the trap, beaver should be cleaned of any blood, sand, mud, etc., either with water or by brushing in the snow. If possible, the fur should be dried and brushed on the carcass before skinning. Place the animal on a clean spot on its back. The feet are cut off where the fur ends, and with a sharp-pointed knife make one cut from the chin to the tail. Work out from this cut with short strokes, separating the skin from the flesh. Pull legs through the skin, but make sure not to enlarge the holes previously made by cutting off the feet. Skin carefully around the eyes and cut the ears close to the skull. When skinning, leave as much fat and flesh on the carcass as possible. This will save extra fleshing work later. Sponge off all blood marks with water and toilet soap.

Two acceptable methods of stretching and drying are in common use. They are as follows:

1. The Hoop Method

Make a willow frame from willows about 1 1/2" in diameter; the frame to exceed the size of the beaver pelt by 8" on all sides. A large needle and twine are used to sew the skin to the frame. The skin is pierced at the edges about every inch and the twine taken around the willow and back through the skin. Do not have the twine too tight at first - just keep the skin taut.

Next, scrape the skin before it dries. Some dull instrument must be used (a bone, spoon, or specially shaped dull piece of metal). Every bit of fat must be removed before the skin dries to any noticeable extent, otherwise an undesirable, scraped appearance will result. Sew up the holes, both leg holes or damages with fine twine. Now tighten the twine between frame and pelt to get the desired shape but be careful not to overstretch. Try to get as near as possible to a rectangular shape. Some trappers cut off about 3/8" of skin around the nose and tail in order to achieve the rectangular shape.

2. Board Method

Beaver, if real care is taken, can be well handled on stretchers made from boards or on a suitable wall, if one can be found.

Grasp the pelt by the nose, shake out and hold hanging in a natural position. That should be the length of the pelt on the stretcher. Nail on boards at that length at top and bottom.

Approximately $\frac{2}{3}$ of the length is usually a desirable width. The rest of the pelt can then be nailed to the board by following a pattern similar to that shown in the sketch or by eye if the trapper is sufficiently skilful. The nailing of the pelt should be worked from both ends on both sides at the same time, i.e., from the ends towards the middle of the pelt. Fine nails should be used and spaced not more than 1" apart. The nails should be of sufficient length and strength however, to allow you to raise the pelt up on the nails and away from the board. This will allow good circulation and the drying of the fur side of the pelt as well as the leather. Damp fur, if not dried with the pelt, will cause discolouration of the leather as well as matting of the fur.

After the pelt has been nailed on the boards, scraping and sewing, as outlined in Method 1, should be carried out, then the pelt raised on the nails and left to dry.

The material required to make a board stretcher for beaver is as follows:

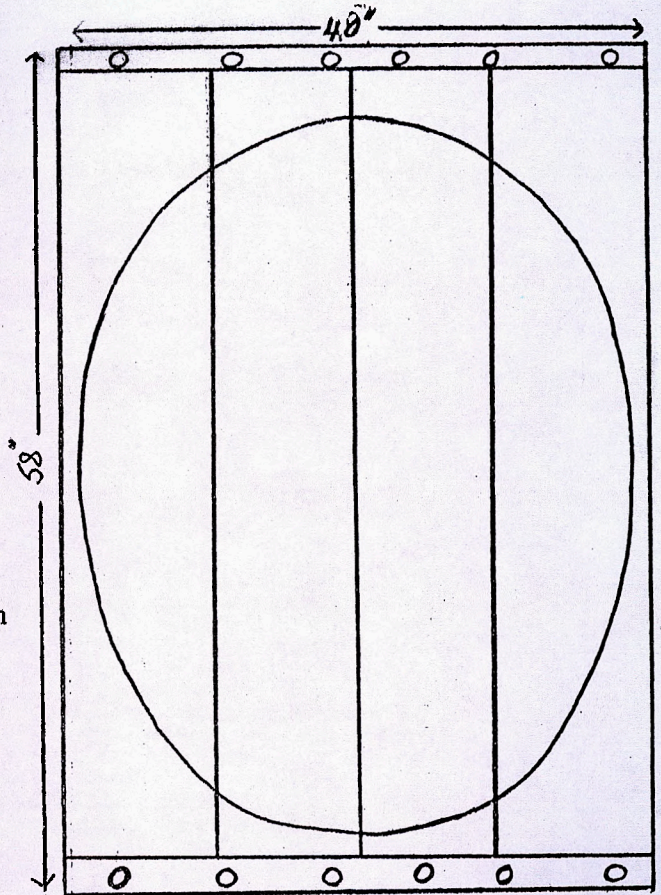
4 boards	10" wide	58" long	$\frac{3}{4}$ " thick
2 strips	2" wide	40" long	$\frac{1}{2}$ " thick

This stretcher will allow you to handle two beaver on one board at the same time.

General

Beaver should be dried in a dry place, not too warm. They must not be placed to dry in the sun or near a stove.

Do not fold beaver after they have been dried. They should be transported flat, if possible, or rolled if this is not practical.



After your beaver are thoroughly dry, they can be removed from the stretchers. If you have used boards and did not dry the fur before skinning, check now for dampness on the fur side. If the fur is at all damp, the pelt should be hung up, independently, until free of moisture.

You can now add immeasurably to the appearance and value of your pelts by thoroughly brushing or combing them. A curry comb is handy in this regard, or a wire brush. Clean the fur free of all sand, mud, and mats, and keep shaking the pelt to rid it of freed particles of dirt. The fur will become glossier and more attractive and will be silkier to the touch than when it contained dirt, sand, etc.

THE FROST DRYING METHOD OF PREPARING BEAVER PELTS

Source: Frank C. Racicot
Regional Fur Supervisor Northern
Ontario Region,
Indian Affairs Branch

The skill and care exercised in skinning and preparing a pelt for market are very important for they have a decided bearing on its ultimate value. Clean, well-handled pelts will command more money than those which are mutilated, dirty or badly handled.

The method outlined herein is widely used by Indian trappers - or rather their wives - and the art has reached a high degree of perfection amongst the Crees in the East Coast district of James Bay. The method is used for all species of fur except the muskrat but as the heading indicates this submission will deal only with the preparation of beaver pelts.

Skinning

Beaver are skinned 'open', that is the pelt has been slit down the belly in skinning instead of removing the pelt intact as in 'cased' pelts where the pelt is slit only down the inside of the hind legs to the vent. In skinning beaver the natives lay the animal on its back and, using a very sharp knife, slit the pelt starting at the lower lip and cutting in a straight line down the chest and belly to the vent.

They then cut off the legs at the first joint and pull them through leaving four round holes in the pelt. The tail is cut off where it meets the fur. Particular care is taken in skinning around the eyes and lips to prevent mutilation, but in general beaver pelts are not skinned quite as cleanly as fine fur pelts for reasons which will become apparent later in this paper.

Fleshing

After skinning the pelt is laid fur side down on a flat surface and tepid water is rubbed on the flesh side of the pelt with the palm of the hand. This removes any blood that has been smeared on the pelt during the skinning process and removes the red corpuscles from any flesh still adhering to the pelt. Similarly, a piece of beef washed in water will have a pale and whitish appearance. If the blood is not removed the pelt sometimes becomes permanently blood stained with an understandable reduction in its market value.

Stretching

When the pelt has been thoroughly cleaned as outlined above, the natives stretch it by lacing it on a hoop type stretcher which, because it permits the free circulation of air around the pelt, is preferable to the widely used practice of tacking the pelt on a flat board or table type stretcher. The hoop is formed by taking two trimmed saplings - usually spruce, willow or birch and lashing the top of one end and the butt of the other securely together with an overlap of about twenty inches, after which the saplings can be laid on the ground and by standing on them, bend the other two ends

together and lash with a corresponding overlap. The hoop can be properly formed by pressing over your knee. The result is an oblong hoop slightly larger than the pelt to be stretched and strong enough to hold its shape. This is assured by selecting saplings about 1 $\frac{1}{2}$ " at the butt.

The pelt is now laid within the hoop, and using a large seilmaker's needle and number five baling twine is laced to the hoop, starting at the mouth and continuing outwards until a point opposite the front leg holes is reached. Next this process is repeated at the other end, starting at the centre and continuing until opposite the holes left by the removal of the hind legs. These two steps give the pelt its length and width is accomplished by stitching in the sides of the pelt again starting at the centre and working both ways to join the previous stitching.

The great care exercised by the James Bay Indians in this stage of preparing their beaver pelts does much toward the pleasing appearance of the finished product. The stitches are uniformly placed and not more than one inch apart and, while avoiding overstretching, they pull the pelt evenly, taking out all wrinkles with the result that they turn out a pelt not subject to any deduction in measuring since, in the case of the Old Factory natives they are almost square, and in the case of the Nottaway natives, they are oblong with only the corners rounded. They always avoid turning out any of the distorted fishtail and diamond shaped pelts too prevalent on the market.

Scraping

After stretching, the pelt is placed outside to freeze and is generally hung by the hoop either from a rack or from the lower branches of an evergreen where it is shaded from the direct rays of the sun. In a day or so at below freezing temperatures the pelt is ready for the first scraping which is done outside while it is still in the frozen state. To do this the pelt, still laced to the hoop, is stood on end against a support and scraped from top to bottom using long continuous strokes with a scraper grasped in both hands. The scraper is made in the shape of the capital 'L' and has a bevelled cutting edge like an adze to which it bears in miniature more than a superficial resemblance. The handle is from ten to twelve inches long and the blade about 1 $\frac{1}{2}$ inches wide, bevelled very slightly towards the outer corners which are rounded to prevent nicking or scratching the hide. With each stroke of the scraper a ribbon-like strip of fat or flesh is removed and scraping is continued until the leather itself makes its appearance. Great care is taken in the final stages lest the pelt be damaged by scraping too thin. However, the leather may be readily distinguished from the material that should be removed since it shows a more definite grain and is much more resistant to the scraper.

Cleaning

Only when the scraping has been completed is the pelt taken inside and allowed to thaw out gradually and always away from the direct source of heat. When the pelt has thawed out fully it is quite damp and using

only this moisture toilet soap is rubbed into the leather working up a slight lather. Laundry soap is never used since it gives the hide a yellowish tinge. The last vestige of this lather and moisture is then scraped out of the hide using a dull half-moon shaped scraper - often made from the shoulder blade of caribou - since the use of a bone scraper lessens the danger of cutting at this stage of the process.

This is possibly the most important in the whole procedure and any lack of care will spoil the appearance of the pelt. Many of the pelts turned out by newcomers to this process are graded as stale simply because either laundry soap was used or final scraping was not persisted in long enough to completely remove the soap film or residue from the lather.

Scraping and cleaning tends to loosen the pelt so it is next tightened into final form - again avoiding overstretching - and the leg holes are sewn closed after which it is once more placed outside to freeze where the frost will remove the remaining molecules of moisture. This takes about two days after which the pelt, still on the stretcher, is brought into the tent or camp and allowed to thaw out away from the heat. In thawing out a very light film of moisture forms on the leather and as soon as this dampness has dried the pelt is removed from the stretcher and the process is complete.

Even though a first grade pelt has been produced it can still be spoiled by such lack of care as storing in a warm place which can cause taint or hair slip, by folding, which can cause cracking during the tanning process or by leaving the pelt exposed to vermin and mice. Along the East Coast beaver pelts are always rolled and generally placed in bags and left outside in the food cache where they are protected from the elements and safe from mice or birds.

Considerable time has been taken in setting out details of the process but the main points can be summarized quite briefly:

1. Skin clean but not too closely. The more flesh removed in skinning the less the pelt will have to be scraped.
2. Immediately after skinning wash the pelt to remove blood, using lukewarm water.
3. Use care in stretching pelt to symmetrical lines and natural oblong oval shape.
4. Use sharp scraper in fleshing, taking off all fat and flesh but exercising care to not scrape away any of the leather.
5. Wash using only fine toilet soap and scrape removing all traces of lather and moisture.

6. Tighten and sew up leg holes - avoid stretching.
7. Never at any time expose the pelt to direct heat or sunlight.
8. Roll pelts and store in a cold, dry place away from rodents and pests.

The main principle to be remembered is to use care and more care all the way through the various stages of the process so that the final product will be a clean leathered, lustrous furred skin of symmetrical shape commanding a premium price on the market which will amply repay the trapper for the time and energy required to turn it out.

TANNING

Source: EXTENSION LEAFLET E-62 ALASKA

"The skins and hides from smaller animals - rabbits, muskrats, squirrels, and foxes - may be tanned by home methods with little work. Even larger skins may be treated at home to produce leather or fur, although chemicals, equipment, and considerable herd work go into the process of softening the hide and making the skins pliable. Even in the tanning factories much of the work is still done by hand as no machine can be devised to duplicate hand manipulation.

In the simplest method the raw hides are soaked in water and hung over poles and worked with blunt-edged tools as they dry. Soap and cod oil dissolved in water help to soften the skin.

Simple Indian Tan for Reindeer, Caribou, and Deer Hides (Dry or Salted)

Soak in fresh water and scrape off flesh with a blunt-edged tool.

Hang hides in warm room until hair slips off easily, scrape off the hair.

Put the wet skins into the following tanning solution:

1 pound white soap
1 pound cod or seal oil
5 gallons water.

Boil the soap in water enough to dissolve it, add oil and rest of water. Cool it.

Soak skins in this emulsion 24 hours.

Dry them over poles out of doors. When dry, soak them in fresh water and work them over a beam.

Put the skins back in the soap solution and repeat the process. The oftener it is repeated, the softer the skins.

Commercial methods require the use of chemicals (generally poisonous that must be handled with care). Staking or softening is done with shoulder stakes or with the bare knee, stretching the leather over posts about knee high. The finishing is done by hand with a blunt-edged instrument.

Tanning Furs with the Hair On

To remove flesh:

Soak the hide in water several hours, depending upon thickness of the skin.

Spread softened skin on flat surface and scrape away all flesh. Soak it again if necessary until hard spots are gone.

To set the hair soak it 2 to 6 hours according to weight in following solution:

4 gallons cold soft water
 $\frac{1}{2}$ ounce borax dissolved in water
 $\frac{1}{2}$ pint salt dissolved in water
1 ounce sulphuric acid (Poisonous - handle with care)
Pour it slowly into the cold water.

To soften the hide in tanning solution soak the hides 48 hours or until solution penetrates through the skin. Test by cutting through the hide and noting if there are light spots.

Tanning solution:

2 gallons soft cold water
 $\frac{1}{2}$ pound pulverized oxalic acid (poisonous)
1 quart salt.

When skin is soaked through, wring it out, hang it in the shade to dry over a smooth pole. As it dries, stretch it and work it to keep it soft. This solution protects fur against moths.

Tanning Leather with Hair Removed

To remove flesh soak skin in cold water until flesh side is soft. Scrape it with a dull knife.

Liming process (sufficient for 2 or 3 caribou hides):

Mix 8 pounds lime in a half barrel of water. Soak skins overnight.
Repeat this process every day for 8 days or until hair slips easily.
Scrape off all the hair and flesh.

To remove the lime with bran:

Sprinkle 2 handfuls of bran in bottom of barrel.
Put one skin in the barrel; sprinkle it with bran.
When all the skins are in, add water to cover and soak 24 hours.

They are then ready for the tanning solution. To prepare the tanning solution - white napa or alum tan:

Boil 3 pounds alum and 5 pounds salt in 2 gallons water. Add enough water to make 10 gallons in all. Be sure all the chemicals are dissolved and the solution cooled to lukewarm

Add the skins and stir well. Soak skins for 24 hours. Remove skins and add a paste made of:

6 pounds of flour
1 quart neatsfoot oil
a little of the alum mixture.

Add this to the barrel and stir well. Put in the skins and stir well $\frac{1}{2}$ hour. Keep the skins in the solution 24 hours. Cut through the skin to see if solution has penetrated.

To finish off in natural color:

Rinse the skin as it comes from the tanning solution in clean cold water and lay it in the sun flesh side up until half dry.

Rub in the following dressing: Dissolve 1 bar neutral white soap in $\frac{1}{2}$ gallon boiling water. Add 4 ounces borax and 1 quart neatsfoot oil. Cool for 5 minutes. Stir well. Cool the solution and apply it to both sides of the skin. Allow it to dry thoroughly. Then soften with a dull knife on the flesh side. This can be accomplished by laying the skin on a cushion or carpet and pressing with a curved dull-edged tool."

University of Alaska Extension Service and U.S. Department of Agriculture, Cooperating. Allan H. Mick, Director, College, Alaska. Published in furtherance of the Acts of May 8, and June 30, 1914..... March 1949, re-issued February 1956.

FUR MARKETING

1. Possible markets for the trader's pelts:

- independent traders
- Hudson's Bay Company
- direct dealing with outside fur buyer

2. Packing and shipping

- See preparation of pelts.

3. Fur garment industry in the Northwest Territories

At present fur is imported to a fur garment factory run by a co-operative in Aklavik in the Mackenzie Delta. Garments from this factory are made from furs such as muskrat, seal, fox, marten, beaver, lynx, wolf and wolverine and are sold all across Canada. Another fur garment project at Tuktoyaktuk is being introduced and if successful, it is hoped that a small tannery may be developed in the Delta. This will serve both small industries and allow all steps, from trapping to the finished garment, to be carried on by local people in a local setting.

VOCATIONAL OPPORTUNITIES IN THE FUR INDUSTRY

Assistant Fur Buyer	Glazer
Blender	Gresser
Chemist	Matcher
Clerical Worker	Model
Cutter	Nailer
Designer	Operator
Driver	Sales Person
Drum and Kicking Machine Operator	Salesman (Dressing and Dyeing)
Dye Worker	Salesman (Manufacturing and Wholesaling)
Finisher (Manufacturing and Wholesaling)	Secretary
Finisher (Retailing)	Shearing and Unhairing Machine Operator
Flesher	Shipping Clerk (Dressing and Dyeing)
Fur Buyer	Shipping Clerk (Manufacturing and Wholesaling)
Fur Repairman	Stock Clerk
	Trader
	Trapper

BIBLIOGRAPHY

Canada, Department of Agriculture,
Preparation of Fur Pelts
Free on request from the Information Division.

Canada, Department of Agriculture,
Canadian Fur Industry
Free on request from the Information Division.

Links, J.G.
The Book of Fur
James Barrie
\$6.00

Madson, John and Ed Kozicky,
For the Young Hunter
Olin Mathieson Chemical Corporation, East Alton, Ill.,
Free on request.

Madson, John and Ed Kozicky,
Principles of Game Management
Olin Mathieson Chemical Corporation, East Alton, Ill.,
Single copies free on request.

Northwest Territories, Laws, statutes, etc.
Game Laws, Northwest Territories, Canada
Office Consolidation, 1963,
Queen's Printer.

Saskatchewan, Department of Natural Resources,
Wildlife Branch,
Trapper's Guide
Queen's Printer, Regina.

Taylor, Russel R.
The Fur Industry
Bellman Pub. Co.
\$1.50.

Whittam, Geoffrey,
Fur Farming and Fur Hunting
Oxford
\$.45.

CARE AND USE OF FIREARMS

Introduction

It is generally accepted that a course of studies in the care and use of firearms would be of benefit to any young person and of particular value to the peoples of northern Canada. This course can effectively teach the importance and necessity of the game laws and help familiarize the pupils with the services of game wardens and project officers. Good marksmanship is an important part of a conservation program, since wounded animals that escape only to die later create a drain on the game population without benefit to the hunter. The life and accuracy of any rifle can be greatly extended by careful maintenance and this must be an important part of this program.

Organization

This course can probably best be timetabled as a co-curricular activity and perhaps part-time as an aspect of the industrial arts program. Details of timetabling should be worked out between the principal and the teacher concerned and have the concurrence of the Superintendent of Schools.

Supplies and Equipment

Follow the general instructions in the introductory section of this guide when ordering supplies and equipment. As a guide for initiating a course the following is a suggested list of supplies and equipment:

For single classroom school - Two .22 calibre rifles

For schools having more than one room - 1 rifle per six riflemen
400 rounds of ammunition per rifleman. (Note: This will be sufficient for instructional purposes only.)

Rifle slings may also be purchased

Firing mats can usually be improvised from existing school equipment but failing this may be requisitioned

Rifle cleaning equipment

Instruction booklets for each pupil

Note: Many pupils will have or will be able to borrow a .22 rifle to supplement the above equipment.

Building a Firing Range

(See National Rifle Association and Canadian Industries Limited publications.)

Each settlement will have to solve this problem using the resources available. The school gymnasium, where available, is a likely location (see the report from Fort Simpson).

To duplicate the excellent materials already readily available in this field would be costly and unnecessary. Therefore, only a report of a successful rifle group carried out in Fort Simpson, N.W.T. and a list of sources from which to obtain instructional booklets and information publications are given for guidance in developing a school rifle club. To expedite the ordering of this written material it is suggested that a letter outlining the plans and requirements of the program to be offered be sent to the Supervisor of Industrial Arts, Vocational Education Section, Department of Northern Affairs and National Resources, Kent Building, Ottawa. A kit containing the required materials will be mailed direct immediately and the Superintendent of Vocational Education informed of the proposal.

THOMAS SIMPSON SCHOOL RIFLE CLUB

A Short Report in Two Parts

- A. Club organization and Principles
- B. The rifle range i.e. the Backstop

A. Club Organization and Principles

The purpose of the club was:

1. To introduce the .22 calibre rifle to beginners,
2. To improve the shooting skill of "old-timers",
3. To allow "experts" to qualify for awards. To effect the latter, the club was affiliated with "Dominion Junior Marksmen".

The age limit is followed for Dominion Marksmen Awards but the basic criteria for membership or shooting is the ability to cock the rifle, a single shot, and handle it safely. A certain strength of the wrists is a basic requirement for the former.

First rifle practice starts closer than 20 yards from the targets but at a safe distance. All shots must be on the target. Firing distance is increased as ability improves. Demonstration, coaching and firing discipline are continuous. Beginners first observe the "old-timers" go through the routine. In most cases, beginners will be firing during the first shooting practice. Lecturing is kept to a minimum. Practice, with coaching, is the basic idea. "Nothing succeeds like success" and you cannot learn to shoot without firing the rifle. This can be followed because of high interest and there being no real "beginners" -- the .22 rifle is known to practically all students. The use of automatic and

tubular repeaters should be discouraged. They are dangerous when fired on an indoor range, with young people under instruction. Even for rifles with magazines, all shots should be single loaded.

DOMINION MARKSMAN (C.I.L.) provides free targets, organization literature, and awards. The standards are Canada-wide so the awards are of special value. Also, the award program is elaborate and continuous. For further information see Section C, References.

The only ammunition used is .22 long. It is much easier to handle and much easier to load single shot.

B. The Rifle Range and the Backstop

The school gym is the rifle range with gym mats used at the firing point. Targets are arranged in pairs on the three target "bays" so that six rifles can be used simultaneously. The target bays or backstops are conveniently stored under the stage, (similar to auditorium chairs), placed on a dolly that is easily rolled out.

Particular attention must be paid to the design, construction and quality of the backstops. These are an extremely important safety feature.

RIFLE ASSOCIATIONS

Rifle Associations

- A. Canadian Civilian Association
of Marksmen Inc.,
P.O. Box 635,
Station B,
Montreal, P.Q.
- B. Dominion of Canada Rifle Association,
200 $\frac{1}{2}$ Bank Street,
Ottawa, Ontario.
(for military cadets only)
- C. Dominion Marksman,
P.O. Box 10,
Montreal, P.Q.
- D. National Rifle Association,
1600 Rhode Island Ave., N.W.,
Washington 6, D.C.

How to Organize a Rifle Club

Why?

1. Boys and girls like shooting.
2. Encourage everyone to take an active part in the sport (within the club).
3. To develop muscular co-ordination, perseverance, self-control and sportsmanship.
4. To maintain and contribute towards good safety practices.
5. To learn the fundamentals of good marksmanship and how to produce accurate results.
6. To teach and put into practice, conservation of animal life.

7. To teach the need for game laws and to show why they must be respected.

Where?

A club requires at least 10 boys or girls and one or more interested adults, one of whom will become the Rifle Club Instructor. When organized, the club may be affiliated with the Canadian Civilian Association of Marksmen Inc. All affiliated clubs receive free announcements on .22 Target Rifle, .22 Sporting Rifle and Handgun activities. Annual membership, if desired is \$2.50 per year per member. Members' Crests are available at \$1.25 each and Members' Lapel Pins are available at \$0.25 each. Club affiliation is \$6.00 per year.

THE CANADIAN CIVILIAN ASSOCIATION OF MARKSMEN:

1. Is the acknowledged governing body of Match Rifle, Sporting Rifle and Handgun (Pistol and Revolver) shooting in Canada.
2. Is Canada's Official Representative, as regards ALL civilian shooting, to:
 - (a) The Canadian Olympic Association.
 - (b) The International Shooting Union (which regulates all international shooting activities.)
 - (c) The Pan-American Sports Organization.
 - (d) The Canadian Sports Advisory Council.

3. Is the official distributor for:

- (a) THE CANADIAN RIFLE CLUBS' ASSOCIATION and all other rifle clubs in Canada, and the National Rifle Association of Canada.

3. Prints, stocks, distributes and extends special prices to members and affiliated organizations (in keeping with operating and transportation costs) all items such as official targets for most types of shooting, centre patches, stickers, score and aggregate cards, official rule books and various other literature on the subject of shooting. Supplies, too, free of charge, literature on the establishment and organization of shooting clubs, the building of safe ranges, etc.
4. Has adopted the rules of the National Rifle Association of America and the International Shooting Union for Small-bore Rifle, Free Rifle, Pistol, Free Pistol, and International Rapid Fire (Silhouette) and applies and interprets these for special Canadian conditions.

Ranges

A range is a necessity whether it be indoors or out. Complete plans are given in the booklet How to Build a Rifle or Revolver Range - obtainable from Dominion Marksman - P.O. Box 10, Montreal, Quebec. It is advisable to build a seventy-five foot range whenever possible for .22 calibre rifle instruction because most championship matches are fired at 20 and 25 yards range.

Minimum Requirement per Group of Ten Pupils

1. Rifles - preferably 11 - one for instructor. Each rifle to be supplied with carrying case or box, cleaning equipment and sling.
2. Mats - at least eight feet in length, 10 in number.

Depending upon range facilities, these items can be reduced to one-half if necessary. However, if insufficient rifles are purchased, they will have to be reset each instructional period for individual eyes.

3. Ammunition - .22 rim fire Long Rifle grease lubricated target ammo.

Requirements - 6,000 rounds per group of 10. This allows for 10 rounds per pupil per week on a 40-week course with an additional 2,000 rounds for instructional purposes. If competition firing is entered by the group, additional ammunition will be necessary.

4. Instructors - Keep on hand additional supplies of:
 - a. .22 rifle cleaning patches
 - b. Gun oil - e.g. Hoppes Gun Oil
 - c. Gun Solvent Cleaner - Hoppes Gun Solvent
 - d. B.S.A. Saftipaste.

These items are absolutely necessary for the efficient operation and maintenance of your rifles.

Types of Rifles Available (7 lbs. or less)

The single shot bolt action "sporting" rifle put out by such companies as Winchester, Remington and Mossbert are usually production-made, less accurate, lighter and considerably less expensive than "target" sights and will weigh as much as 12 pounds.

The sporting rifle is ideal for the beginner and for those desiring target shooting at low cost. Automatic and

tubular repeaters should not be purchased because of the danger of cartridges being left in the chamber. For safety, a single shot or a repeater with a cartridge clip is more advisable.

Others, both sporting and target, may be purchased from such companies as:

- | | |
|---------------|------------------------------|
| 1. Winchester | 5. Stevens and Springfield |
| 2. Remington | 6. Harrington and Richardson |
| 3. Marlin | 7. Iver Johnson |
| 4. Savage | 8. Cooney (Canadian) |

Note: Any inexpensive single-action .22 will suffice for the beginner. These cost from \$11.00 to \$25.00.

Suggested Targets

Sporting Rifle

- 15 yards - 5-bull with x ring
- 20 yards - single bull
- 20 yards - 5-bull with x ring

When two or more competitors have a tie score, then x ring target will aid in determining who is the best shot.

Target Rifle

- 20 yards - 5 bull
- 25 yards - 5 bull with x ring
- 50 yards - 2 bull with x ring

50 metre - single bull with x ring

100 yards - single bull with x ring

Targets may be obtained from:

1. Dominion Marksman - free to registered club only
2. Canadian Civilian Association of Marksmen

Code Number	Description	Weight Per 1000	Price Per 1000	
			Members	Non-Members
SR-50 Ft.	Sporting Rifle, 50-Foot, 11 Bull	25 lbs.	\$ 14.00	\$ 16.00
SR-20	Sporting Rifle, 20-Yard, 11 Bull	32 lbs.	15.00	17.00
SR-50	Sporting Rifle, 50-Yard, 1 Bull	25 lbs.	14.00	16.00
SR-100	Sporting Rifle, 100-Yard, 1 Bull	32 lbs.	15.00	17.00
R-50 Ft.	Match Rifle, 50-Foot, 11 Bull	25 lbs.	14.00	16.00
R-20	Match Rifle, 20-Yard, 11 Bull	32 lbs.	15.00	17.00
R-25	Match Rifle, 25-Yard, 11 Bull	25 lbs.	14.00	16.00
R-50	Match Rifle, 50-Yard, 2 Bull	32 lbs.	15.00	17.00
R-50 Metre (2)	Match Rifle, 50-Metre, 2 Bull	32 lbs.	15.00	17.00
R-50 Metre (5)	Match Rifle, 50-Metre, 5 Bull	65 lbs.	33.00	37.00
R-100	Match Rifle, 100-Yard, 1 Bull	32 lbs.	15.00	17.00
X-100	100-Yard Sighting-In Target, 1 Bull	32 lbs.	15.00	17.00
HS-50 Ft.	Handgun, 50-Foot, Slow Fire	23 lbs.	12.00	14.00
HT-50 Ft.	Handgun, 50-Foot, T & R Fire	23 lbs.	12.00	14.00
HS-20	Handgun, 20-Yard, Slow Fire	23 lbs.	12.00	14.00
HT-20	Handgun, 20-Yard, T & R Fire	23 lbs.	12.00	14.00
HFP-20	Handgun, 20-Yard, Free Pistol Shirtfront Handgun Target	23 lbs.	14.00	16.00
HS-25	Handgun, 25 Yard, Slow Fire	23 lbs.	12.00	14.00
HT-25	Handgun, 25-Yard, T & R Fire	62 lbs.	38.00	45.00
HS-50 Yd.	Handgun, 50-Yard, Slow Fire	62 lbs.	38.00	45.00
HFP-50 Metre	Handgun, 50-Metre, Free Pistol	62 lbs.	45.00	52.00
CP-25	Handgun, 25-Yard, T & R Centres	14 lbs.	16.50	18.50
CP-50	Handgun, 50-Yard, Slow Centres	14 lbs.	16.50	18.50
CFP-50 Metre	Handgun, 50-Metre, Free Pistol Centres	14 lbs.	19.50	21.50
GSW	Gummed Stickers White - 500 per roll		1.00	1.50
GSB	Gummed Stickers Black - 500 per roll		1.00	1.50

Marking Devices

Each club should have more than one of these devices - preferably one to every two and no more than four pupils. Pupils usually work in pairs, one acting as "pupil" and one as "instructor". Obtainable from N.R.A. at \$1.00 each.

Resource Material

Canadian Civilian
Association of Marksmen

1. Aim - Official C.C.A.M. publication -
issued free to each member and to the
secretary of each affiliated club Free
2. American Rifleman - Canadian Resident
Members only \$ 5.50 - 1 yr.
10.25 - 2 yrs.
14.50 - 3 yrs.
3. The Rifleman - The Journal of the
National Small-bore Association,
London, England, Published Quarterly 2.00 - per yr.
4. Basic Rifle Marksmanship .25 - per copy
5. Basic Instruction on Small-bore Rifle
Shooting .15 - per copy
6. Basic Pistol Marksmanship .25 - per copy
7. Basic Pistol Marksmanship Instructors
Guide .25 - per copy

Dominion Marksman

1. How to Build a Rifle or Revolver Range

National Rifle Association

1. Rifle Instructor's Manual
2. Junior Club Guide
3. Basic Rifle Instruction
4. Hunter Safety Course
5. Hunter Safety Handbook
6. How to Organize an N.R.A. Junior
Rifle Club
7. Hunter Safety Handbook
8. Hunter Safety Course
9. Rifle Instruction Wall Charts \$ 1.00 set
Six charts 19 x 25 inches showing
safety rules, positions, sight
pictures, etc.
10. Rifle Instructor's Manual .50 each
11. Basic Rifle Instruction Manual .50 each
12. Faige Sighting Device 1.00 each
13. Rifle Marksmanship School Student
Registration card - one per pupil .02 each
14. Rifle Instructor's Report Card -
one per pupil .02 each
15. Rifle Marksmanship Progress Cards -
one needed for every 38 pupils .10 each
16. Rifle Marksmanship Student's Examination
Written at end of course - one per pupil .02 each
17. Safety Posters - 5 full-colour posters
14 x 22 inches illustrating firearms
safety principles 1.00 set
18. Small-bore rifle rule book .25 each
5/95 \$1.00

BIBLIOGRAPHY

How to Build a Rifle or Revolver Range
How to Build a Sporting and Bench Rifle Range
How to Organize a Shooting Club
Canadian Industries Limited,
Post Office Box 10,
Montreal, P.Q.
Free on request

Ellacott, S.E.

Guns
Methuen
\$2.00

Janes, E.C.
A Boy and His Gun
A.S. Narnes
\$5.50

Madson, John and Ed Kosicky
For the Young Hunter
Olin Mathieson Chemical Corporation
East Alton, Illinois
Free on request

N.R.A. Hunter Safety Instructor's Guide

\$0.25

Bow Hunting Supplement

\$0.10

N.R.A. Basic Rifle Marksmanship

\$2.25

N.R.A. Basic Shotgun Instruction

\$0.25

N.R.A. Hunter Safety Handbook

\$0.10

Shooting the .22 Rifle

\$0.75

Basic Pistol Marksmanship

\$0.25

Rifle Shotgun Instruction Charts

\$2.00

National Rifle Association of America,
1600 Rhode Island Avenue, N.W.,
Washington 6, D.C.

The Guidebook to Rifle Marksmanship

O.F. Mossberg and Sons,
New Haven 5, Conn.

Shoot-to-Live

King's Printer, 1945
Out of print, available only on loan

OUTBOARD MOTORS

Introduction

The widespread use of the outboard motor in the north makes this study of special interest to pupils in our schools. It seems evident to everyone that a course in the operation and maintenance of outboard motors should be part of the school program, however, a note of caution should be sounded here. Only persons who are competent in this area should attempt to teach this unit. It is possible that a teacher or principal may consider someone in the community to have the necessary skill to carry out this course. Advantage should be taken of any talent of this kind with the teachers and the students working and learning together.

Objectives

1. To introduce the student to an acceptable standard nomenclature.
2. To give instruction in correct operation of outboard motors.
3. To indicate the importance of adequate maintenance in extending the life and efficiency of any engine.
4. To make it apparent to the pupils that certain minor repairs can be done simply and to make it equally clear that major repairs should not be attempted unless adequate facilities and trained people are available.

In most communities there are old or unservicable engines and spare parts available for demonstration purposes and it may be quite possible to obtain a live engine. (Excellent visual aids can be made from unservicable parts, see the illustration)

Equipment

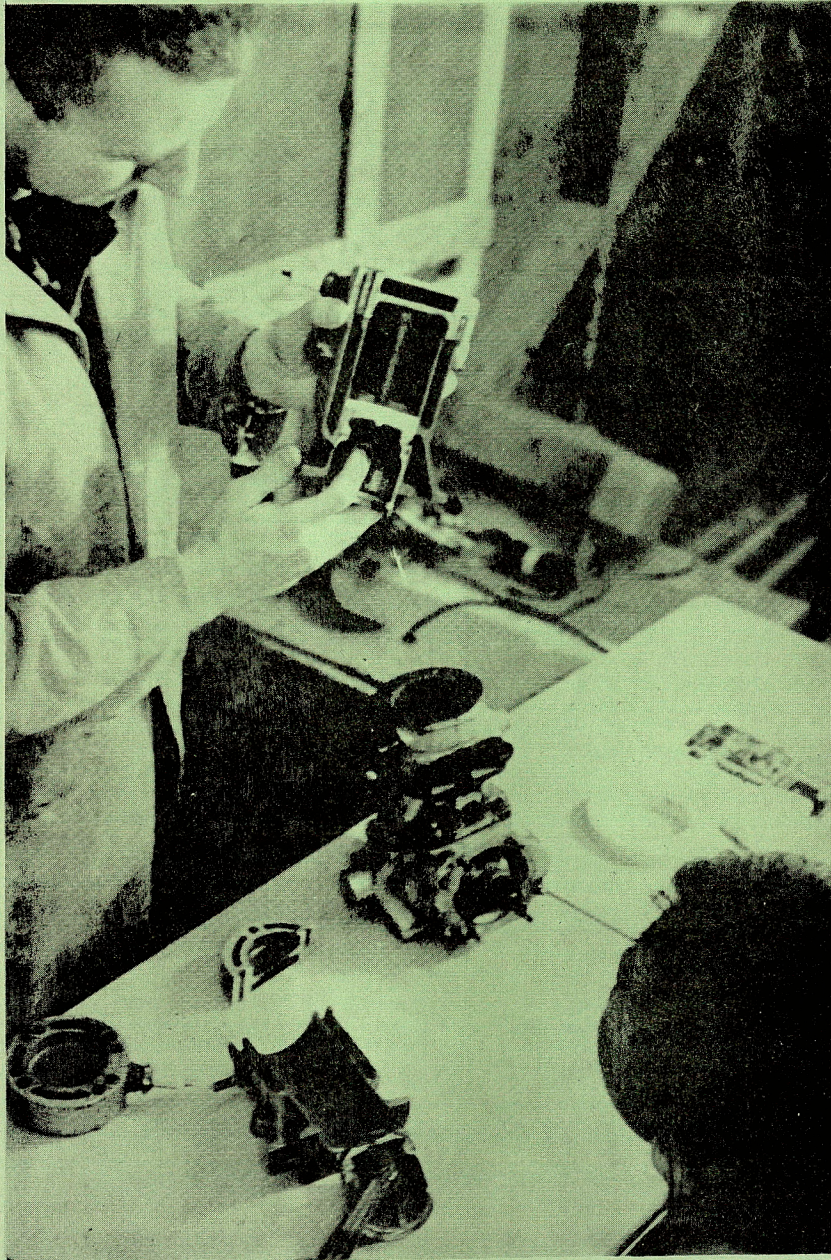
Certain equipment may be requisitioned in the usual way, for example, motors, tool kits and special tools. The cost of this equipment will be beyond the regular \$100.00 allotment and each requisition should be supported by an outline of the proposed program. A course outline should accompany every requisition of this nature. Each requisition will be processed by the District Superintendent of Vocational Education.

Excellent free or low-cost literature of an instructional nature is published by various manufacturers of outboards (see bibliography).

Note: It is hoped to extend this program into the future to include care and use of light oversnow equipment such as the Skidoo and Autoboggan.

Classes

The criteria outlined in the introduction of this guide should be applied in this case. However, to get maximum benefit from a course of this nature, the pupils should be able to read well enough to understand manuals and/or instruction sheets prepared by the instructor. A decision on this matter should be made at the local community level because certain aspects of the course, particularly those relating to operation can be carried on without high reading proficiency.



Two pages are reproduced from "Prescription for Better Small Engine Overhauls" published by the Perfect Circle Corporation, Hagerstown, Indiana, U.S.A. and available on request. The same company produces the Trouble Shooting material also included in this booklet. Outboard Marine of Peterborough, Canada also has many publications available on request.

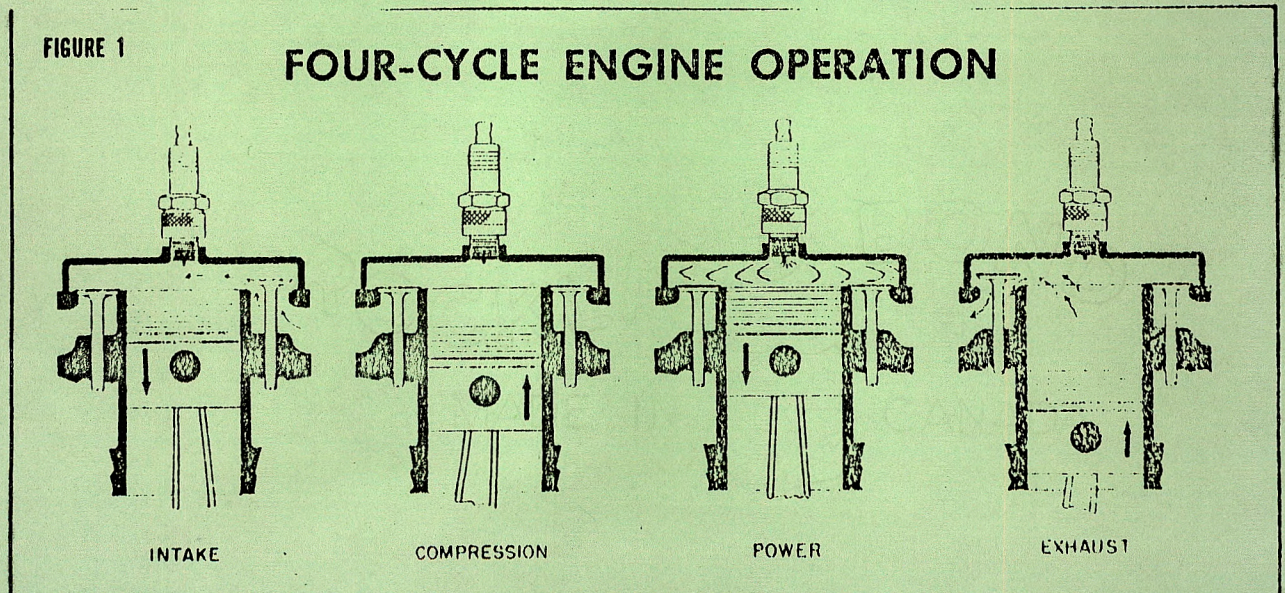
Prescription for Better Small Engine Overhauls

Powering a wide variety of labor-saving and recreational equipment, small engines are found almost everywhere.

Although most owners realize the importance of periodic oil level checks, oil changes, spark plug inspections and other PREVENTIVE MAINTENANCE measures for their car engines, many apparently are not so careful with their small engines. Service requirements, however, are quite similar, and a scheduled PREVENTIVE MAINTENANCE program is just as necessary to assure efficient operation and long engine life. Proper overhaul procedures are equally important.

Four-Cycle Engine Operation

Before discussing service and overhaul procedures, the operation of 2 and 4-cycle gasoline engines will be reviewed. This is how a 4-cycle engine, the type used in automobiles, works: See Figure 1.

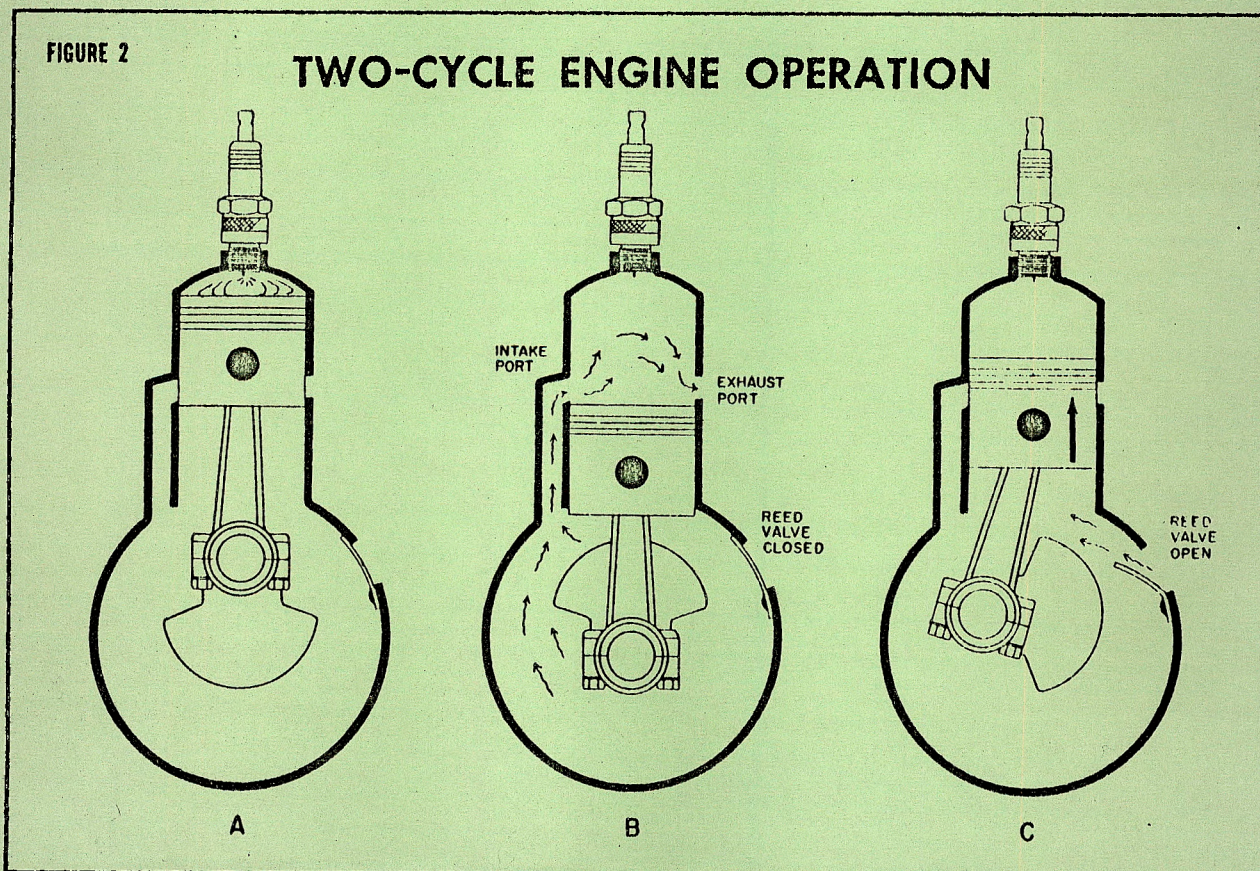


1. INTAKE - As the piston moves downward or toward the crankcase, the intake valve opens and a partial vacuum is created in the cylinder. A mixture of vaporized fuel and air is then forced into the cylinder by atmospheric pressure.
2. COMPRESSION - Next, the intake valve closes. As the crankshaft rotates, the piston moves upward and compresses the fuel-air mixture.
3. POWER - Just before the piston reaches the top of its travel, the ignition system fires the spark plug to ignite the fuel vapor. The expanding gases, resulting from the burning, force the piston downward to turn the crankshaft.
4. EXHAUST - After the fuel charge is burned, the exhaust valve opens. Burned gases are forced out of the cylinder when the piston moves upward again.

Then this series of events, called a cycle, is repeated. Since the piston makes four strokes, two up and two down, the complete name of the operation is 4 stroke cycle. The engine fires on every fourth stroke. A cycle involves two turns of the crankshaft.

Two-Cycle Engine Operation

Two-cycle engines - many outboards, for example - combine the functions of a 4-cycle engine in two strokes. Each time the piston reaches the top of its stroke the spark plug fires. Thus, power is delivered to the crankshaft on every downward stroke. Gases enter and leave the combustion chamber through holes, or ports, in the cylinder wall. And, instead of oil in the crankcase, there is a vaporized mixture of fuel present that enters through a reed, poppet or rotary valve. This fuel vapor contains suspended droplets of oil that lubricate the surfaces of moving parts. A 2-cycle engine works like this: See Figure 2.



1. DOWNSTROKES - After being ignited (A), the burning fuel vapor expands, driving the piston downward to deliver power to the crankshaft. In its downward travel the piston first uncovers the exhaust port, then the intake. As it moves downward, the piston also compresses the fuel mixture in the crankcase slightly by reducing the crankcase volume. The resulting pressure closes the fuel inlet valve and forces the fuel mixture through the intake port into the combustion chamber (B). There the fuel charge helps force exhaust gases out the exhaust port.
2. UPSTROKE - As the piston moves upward, it covers the intake and exhaust ports and compresses the fuel mixture in the combustion chamber (C). At the same time, the pump-like action of the piston moving up from the crankcase creates a vacuum in the crankcase. The fuel inlet valve opens due to low pressure in the crankcase and allows fuel vapor to enter from the carburetor. The cylinder fires near the top of the upstroke, then the process is repeated.

Servicing a Small Engine

Servicing a small engine (less than 45 cubic inch displacement) is much like servicing any other engine. Most causes of poor engine performance - need for adjustment and tuneup, dirt accumulation around vital parts, and worn parts - are common to all engines.

Therefore, simple but thorough PREVENTIVE MAINTENANCE checks before storage and while the engine is in service are necessary for trouble-free operation.

Regular checks should cover the ignition, fuel and lubricating systems.

COURSE OUTLINE

Principles of the Two Stroke and Four Stroke Cycle

(a) Parts recognition

1. Cylinder block
2. Crankcase
3. Crankshaft
4. Piston and connecting rod assembly
5. Piston rings
6. Cylinder Head
7. Connecting rods (aluminum and steel)
8. Bearings
9. Compression ratio
10. Inlet and exhaust ports and/or valves
11. Valve operation

(b) Variations in the Two Stroke Principle

1. By means of ports - 3 port
2. By means of ports and the spring loaded poppet valve - 2 port
3. Ports and valve in centre journal of crankshaft - 2 port (rotary)
4. By means of ports and an automatically operated reed valve arrangement - 2 port (see illustration)

(c) Lubrication (see illustration page 89)

1. Oil mixed with gasoline
2. Circulatory system

(d) Carburetion

1. Development of the modern carburetor from the simple mixing valve to the float feed multi-jet carburetor with bleeding orifices currently in use.
2. Combustion
3. Methods of vaporization to achieve combustion
4. Fuel induction to crankcase
5. Methods of fuel feed to carburetor
 - (a) gravity
 - (b) pressure
6. The crankcase bleeder system
 - (a) To relieve the crankcase of condensed fuel vapor settling during slow and intermediate motor speeds

(e) Ignition

As much electricity and electronic theory as the class is capable of utilizing.

1. Fundamental theory of electricity
2. Current Flow
3. Magnetism
4. The ignition coil
 - (a) the core
 - (b) primary winding
 - (c) secondary winding
 - (d) the use of the condenser and breaker points
5. Magneto assembly as applied to the outboard motor (flywheel type)
6. Spark plugs
 - (a) heat range
 - (b) proper installation
 - (c) cleaning and setting

(d) trouble shooting

(f) The Lower Unit

1. Gear Train

(a) forward, neutral and reverse

(b) Where students are far enough advanced, a set of gear ratio.

2. Bearings

3. Lubrication

(a) type of lubricant

(b) oil seals

4. Cooling

(a) circulation - waterpump

5. Underwater exhaust

(a) relief for starting and slow speed running

6. Propellers

(a) Types

- Two blade

- Three blade

- Four blade

- Material

- Brass or aluminum

- Sizes

- Where students are capable, theory on pitch and diameter

- Shock absorbers and shear pins

(g) Boats

1. Basic design for outboard motor installation (see illustrations)
2. Construction
3. Power recommendation
 - (a) Type of boat
 - (b) Shape of the hull
 - (c) Behaviour
 - (d) Characteristics
 - (e) Size and weight
 - (f) How to load
 - (g) Performance expected
 - (h) Suitable Propeller
4. Attaching motor to stern of boat
 - (a) Stern height
 - (b) Stern angle
 - (c) Turbulence (see illustration)
5. Maintenance Procedures
 - (a) Spring tune-up
 - (b) How to treat a new motor
 - (c) Winter storage
 - (d) What to do if the motor is submerged

FUEL AND OIL FOR THE OUTBOARD . . . *The importance of*

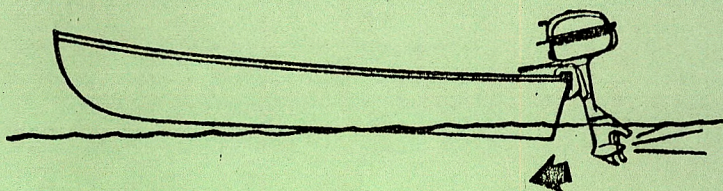
using the proper mixtures of gasoline and lubricating oil to secure the best results from your motor.
(Reproduced from the Evinrude Service Manual)

YOUR OUTBOARD MOTOR—PART TWO

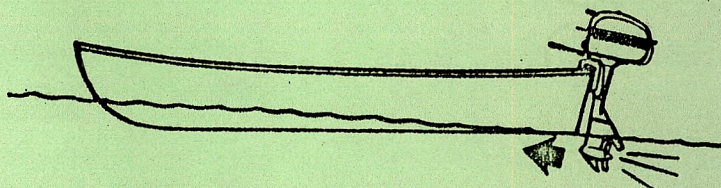
WE are all accustomed to the lubrication methods used in automobiles and in larger boats, where anywhere from one to two or more gallons of lubricating oil are carried in the base of the engine. This oil is constantly pumped through the oil circulating system of the engine and is used over and over again. It will naturally pick up particles of metal, carbon, condensed moisture and harmful products of combustion which all tend to reduce its lubricating properties. Manufacturers of these large engines all stress the need for completely renewing the supply of oil at regular intervals in order to protect the engine against these contaminants.

In an effort to protect engines against the neglect of forgetful operators we find an accessory known as oil filters used quite generally. As the name implies its prime purpose is the filtering out of metal and carbon particles and it does a good job of prolonging the useful life of the lubricant and protecting the engine itself against unnecessary wear. The oil refiners have helped also by supplying their best grades of oils with chemical detergents which are designed to dissolve and keep in solution many of the harmful solids which normally would be more injurious to the engine.

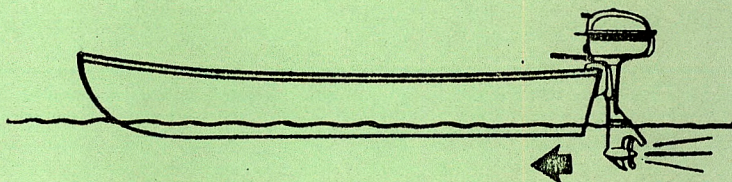
Another chemical addition to the automotive grades of gasoline is tetraethyl lead. The compression ratio of many of the newer automotive engines is now so high, in the effort to squeeze the last bit of power out of the fuel, that a controlled rate of combustion is necessary to prevent knocking. This is due to pre-ignition of the charge by any of several causes. There may be glowing particles of carbon in the combustion chamber which are capable of igniting the compressed charge before the time at which the spark-plug would do so. Again, the heat created by the high compression ratio may serve to ignite the charge before time in a manner similar to that which is found in the diesel engine. This premature detonation of the charge is checked.



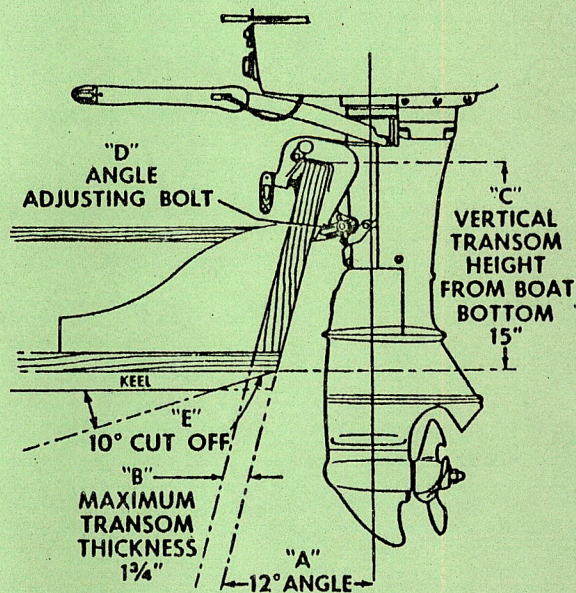
When the propeller is tilted away from the stern, it will cause the boat to squat. Incorrect.



When the propeller is tilted toward the stern, it will cause the boat to plow. Incorrect.



The correct mounting with the propeller line-of-drive parallel to boat travel gives maximum performance.



The correct way in which to mount an outboard motor on the transom of a boat.

TROUBLE SHOOTING AND TESTING

START ALL MAJOR DIAGNOSIS WITH A COMPRESSION TEST, AND TEST WHEEL RPM CHECK

Taken from the Service Promotion Dept. Outboard Marine Corporation of Canada Limited.

A. ENGINE REACTION

B. CHECK POINTS

1. Manual starter ropes pulls out, but pawls do not engage.
 - a. Friction spring bent or burred.
 - b. Excess grease on pawls or spring.
 - c. Pawls bent or burred.

2. Starter rope does not return.
 - a. Recoil spring broken or binding.
 - b. Starter housing bent.
 - c. Loose or missing parts.

3. Clattering manual starter.
 - a. Friction spring bent or burred.
 - b. Starter housing bent.
 - c. Excess grease on pawls or spring.
 - d. Dry starter spindle.

4. Electric starter inoperative.
 - a. Loose or corroded connections.
 - b. Micro or mercury switch open, or out of adjustment.
 - c. Weak battery. (corroded battery terminals)
 - d. Faulty starter solenoid.
 - e. Moisture in electric starter motor.
 - f. Broken or worn brushes in starter motor.
 - g. Faulty fields.
 - h. Faulty armature.
 - i. Broken wire in harness or connector.
 - j. Faulty starter key or push button switch.
 - k. Worn or frayed insulation.

5. Electric starter does not engage but solenoid clicks.
 - a. Loose or corroded connections.
 - b. Weak battery.
 - c. Faulty starter solenoid.
 - d. Broken wire in electric harness.
 - e. Loose or stripped post on starter motor.
 - f. See steps in number 4.

6. Hard to start or won't start.
 - a. Empty gas tank.
 - b. Gas tank air vent not open.
 - c. Fuel lines kinked or severely pinched.
 - d. Water or dirt in fuel system.
 - e. Clogged fuel filter or screens.
 - f. Motor not being choked to start.
 - g. Engine not primed -- pump up hose.
 - h. Carburetor adjustments too lean (not allowing enough fuel to start engine).

-continued-

A. ENGINE REACTION

7. Low speed miss or motor won't idle smoothly and slowly.

8. High speed miss or intermittent spark.

B. CHECK POINTS

- i. Timing and synchronizing out of adjustment.
 - j. Manual choke linkage bent -- auto choke out of adjustment.
 - k. Spark plugs improperly gapped, dirty or broken.
 - l. Fuel tank primer inoperative (pressurized system).
 - m. Ignition points improperly gapped, burned or dirty.
 - n. Loose, broken wire or frayed insulation in electrical system.
 - o. Reed valves not seating or preloaded shut.
 - p. Weak coil or condenser.
 - q. Faulty gaskets.
 - r. Cracked distributor cap or rotor.
 - s. Loose fuel connector.
-
- a. Too much oil - too little oil.
 - b. Timing and synchronizing out of adjustment.
 - c. Carburetor idle adjustment -- mixture lean or rich.
 - d. Ignition points improper -- gap, worn or fouled.
 - e. Weak coil or condenser.
 - f. Loose or broken ignition wires.
 - g. Loose or worn magneto plate.
 - h. Spark plugs -- improper gap or dirty.
 - i. Head gasket, reed plate gasket, blown or leaking.
 - j. Reed valve standing open or preloaded shut.
 - k. Plugged crankcase bleeder, check valves, or lines.
 - l. Leaking crankcase halves.
 - m. Leaking crankcase seals, top or bottom.
 - n. Exhaust gases returning thru intake manifold.
-
- a. Spark plugs improperly gapped or dirty.
 - b. Loose, leaking or broken ignition wires.
 - c. Breaker points improper -- gap or dirty.
 - d. Weak coil or condenser.
 - e. Water in fuel.
 - f. Leaking head gasket or exhaust cover gasket.
 - g. Spark plug heat range incorrect.
 - h. Engine improperly timed.
 - i. Carbon or fouled combustion chambers.
 - j. Mag. or distributor poorly grounded.
 - k. Oiler wick bad.

A. ENGINE REACTION

9. Coughs, spits, slows.

10. Vibrates excessively or runs rough and smokes.

11. Runs well, idles well for a short period, then slows down and stops.

12. Won't start, kicks back, backfires into lower unit.

13. No acceleration, low top RPM.

B. CHECK POINTS

- a. Idle or high speed needles set too lean.
 - b. Carburetor not synchronized.
 - c. Leaking gaskets in induction system.
 - d. Obstructed fuel passages.
 - e. Float level set too low.
 - f. Improperly seated or broken reeds.
 - g. Fuel pump pressure line ruptured.
 - h. Fuel pump - punctured diaphragm, check valves stuck open or closed, fuel lines leak.
 - i. Poor fuel tank pressure (pressurized system)
-
- a. Idle or high speed needles set too rich.
 - b. Too much oil mixed with gas.
 - c. Carburetor not synchronized.
 - d. Choke not opening properly.
 - e. Float level too high.
 - f. Air passage to carburetor obstructed.
 - g. Bleeder valves or passages plugged.
 - h. Transom bracket clamps loose on transom.
 - i. Prop out of balance.
 - j. Broken motor mount.
 - k. Exhaust gases getting inside motor cover.
 - l. Poor ignition -- see steps in number 8.
-
- a. Weeds or other debris on lower unit or prop.
 - b. Insufficient cooling water.
 - c. Carburetor, fuel pump, filter or screens dirty.
 - d. Bleeder valves or passages plugged.
 - e. Lower unit bind due to lack of lubrication.
 - f. Gas tank air vent not open.
 - g. Not enough oil in gas.
 - h. Combustion chambers and spark plugs fouled, causing preignition.
 - i. Spark plug heat range too high or too low.
 - j. Wrong propeller (preignition).
 - k. Slow speed adjustment too rich or too lean.
-
- a. Spark plug wires reversed.
 - b. Flywheel key sheared.
 - c. Belt timing off.
 - d. Timing and synchronizing.
 - e. Reed valves not seating or broken.
-
- a. Improper carburetor adjustments.
 - b. Improper timing and synchronization.
 - c. Spark plugs -- improper gap or dirty.

A. ENGINE REACTION

14. No acceleration, idles good, but when put to full power dies down.

15. Engine runs at high speed only by using hand primer.

16. No power under heavy load.

B. CHECK POINTS

- d. Ignition points -- improper gap or faulty.
 - e. Faulty coil or condenser.
 - f. Loose, leaking or broken ignition wires.
 - g. Reed valve not properly seated or broken.
 - h. Blown head or exhaust cover gasket.
 - i. Weeds on lower unit or prop.
 - j. Incorrect prop.
 - k. Insufficient oil in gas.
 - l. Insufficient oil in lower unit.
 - m. Fuel restrictions.
 - n. Scored cylinder, stuck rings.
 - o. Marine growth, hooks, rockers or change in load of boat.
 - p. Sticky magneto plate.
-
- a. High or low speed needle set too lean.
 - b. Dirt or packing behind needles and seats.
 - c. High speed nozzle obstructed.
 - d. Float level too low.
 - e. Choke partly closed.
 - f. Improper timing and synchronization.
 - g. Fuel lines or passages obstructed.
 - h. Fuel filter obstructed, fuel pump not supplying enough fuel.
 - i. Not enough oil in gas.
 - j. Breaker points improperly gapped or dirty.
 - k. Bent gearcase or exhaust tube.
-
- a. Carburetor adjustments.
 - b. Dirt or packing behind needles and seat.
 - c. Fuel lines or passages obstructed.
 - d. Fuel line leaks.
 - e. Fuel pump not supplying enough fuel.
 - f. Float level too low.
 - g. Fuel tank or connector at fault.
 - h. Fuel filter obstructed.
-
- a. Wrong propeller.
 - b. Weeds or other debris on lower unit or prop.
 - c. Breaker points improperly gapped or dirty.
 - d. Stator plate loose.
 - e. Ignition timing over advanced or late.
 - f. Faulty carburetion and/or faulty ignition.
 - g. Prop hub slips.
 - h. Scored cylinders or rings stuck.

A. ENGINE REACTION

17. Cranks over extremely easy on one or more cylinders.

18. Engine won't crank over.

19. Motor overheats.

20. Motor stops suddenly, freezes up.

21. Motor knocks excessively.

B. CHECK POINTS

- a. Low compression.
 - 1. Worn rings.
 - 2. Scored cylinder or pistons.
 - 3. Blown head gasket.
 - 4. Loose spark plugs.
 - 5. Loose head bolts.
 - 6. Crankcase halves improperly sealed.

- a. Manual start lock improperly adjusted.
- b. Pistons rusted to cylinder wall.
- c. Lower unit gears, prop shaft rusted or broken.
- d. Broken connecting rod, crankshaft or driveshaft.
- e. Coil heels binding on flywheel.
- f. Engine improperly assembled after repair.

- a. Motor not deep enough in water.
- b. Not enough oil in gas or improperly mixed.
- c. Faulty water pump parts.
- d. Seals, gaskets or castings -- burned, cracked or broke, allowing exhaust gases to enter cooling system.
- e. Impeller key not in place or broken.
- f. Plugged water inlet, outlet or cavity.
- g. Obstruction in water passages.
- h. Broken, pinched or leaking water lines.
- i. Advanced ignition timing.
- j. Motor not assembled properly during repair.
- k. Shorted heat light wiring.
- l. Bad impeller, plate or housing.

"DO NOT TEST MOTOR OUT OF WATER"

- a. No oil in gas, or no gas.
- b. Insufficient cooling water.
- c. No lubricant in gearcase.
- d. Rusted cylinder or crankshaft.
- e. Bent or broken rod, crankshaft, driveshaft, prop shaft, stuck piston.
- f. Gas tank air vent not open.
- g. Bad water pump or plugged water passages.
- h. Bad fuel connector.

- a. Too much or not enough oil in gas.
- b. Worn or loose bearings, pistons, rods or wrist pins.
- c. Advanced ignition timing.

A. ENGINE REACTION

22. D. C. Generator will not charge.

23. A. C. Generator will not charge.

24. Excess fuel consumption.

25. Shifter dog jumps.

26. Electramatic slips.

B. CHECK POINTS

- d. Carbon in combustion chambers and exhaust ports.
- e. Manual starter not centred.
- f. Flywheel nut loose.
- g. Bent shift rod (vibrating against exhaust tube).
- h. Flywheel hitting coil heels.
- i. Loose assemblies, bolts or screws.

- a. Battery condition.
- b. Connections loose.
- c. Connections dirty.
- d. Faulty regulator.
- e. Field fuse blown.
- f. Generator not polarized.
- g. Faulty generator.

- a. Battery condition.
- b. Connections loose.
- c. Connections dirty.
- d. 60 amp fuse blown.
- e. Faulty regulator.
- f. Faulty rectifier diodes.
- g. Faulty generator.

- a. Hole in fuel pump diaphragm.
- b. Deteriorated carburetor gaskets.
- c. Altered or wrong fixed jets.
- d. Jets improperly adjusted.
- e. Carburetor casting porous.
- f. Float level too high.

- a. Worm shifter dog or worm gear dogs.
- b. Worm linkage.
- c. Remote control adjustment.
- d. Gearcase loose.
- e. Exhaust housing bent.
- f. Gearcase bent.

- a. Improper remote control installation.
- b. Faulty coils.
- c. Faulty springs.
- d. Faulty clutch and gear.
- e. Faulty bearings.
- f. Wrong lubricant.
- g. Loose gearcase.
- h. Shorted wiring.
- i. Sprung gearcase.

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WOODWORK

Introduction

Woodwork is probably the subject most often taught in schools which offer shop programs. There are many reasons for this choice. They include the utility of the material, its relative softness which results in ease of working, the fact that most teachers have had some training or familiarity in woodworking and the availability of suitable tools in most communities. The following projects have been collected from teachers and other sources throughout the north and are arranged roughly in order of difficulty.

Equipment and Supplies

Procedure for requisitioning is outlined in the first section of this booklet, however in certain cases special supplies and equipment beyond the regular dollar allotment may be requisitioned. Such requisitions will be reviewed by the Superintendent of Vocational Education and should be accompanied by a detailed account of the use to which the equipment or supplies will be put.

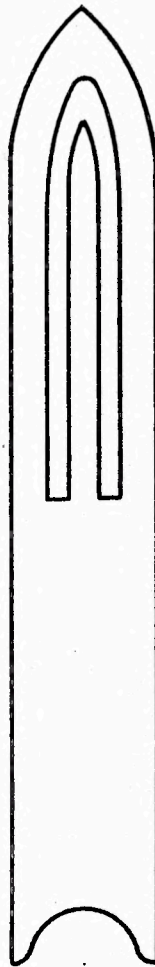
Course Outline

If the teacher or instructor feels that a formal course outline might help him to arrange more meaningful learning experiences for the pupils, he should refer to the course outline prepared for use in junior high schools in the Northwest Territories and select suitable sections of it for use in his local setting.

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NETTING NEEDLES

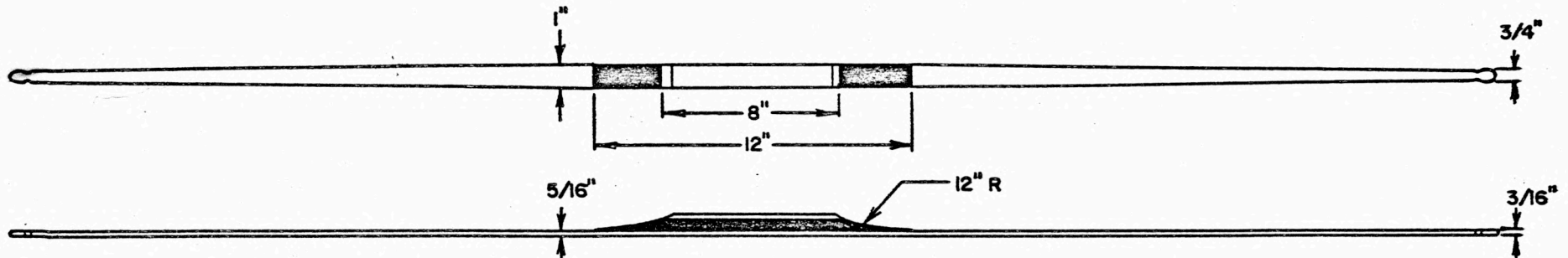


SIZES

- SMALL - 5½"
- MEDIUM - 6½"
- LARGE - 8"
- GIANT - 10"

MATERIAL : HARDWOOD

TARGET BOW



Stock Required

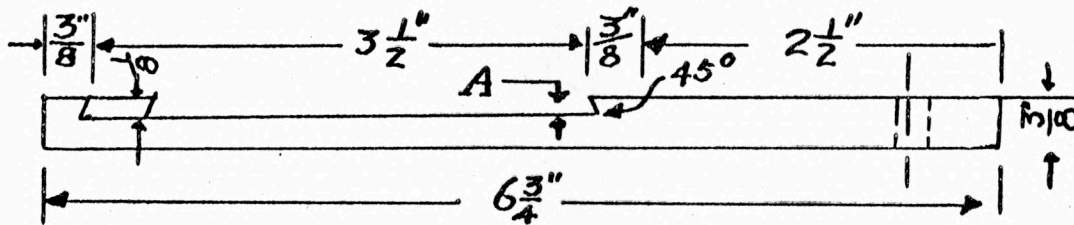
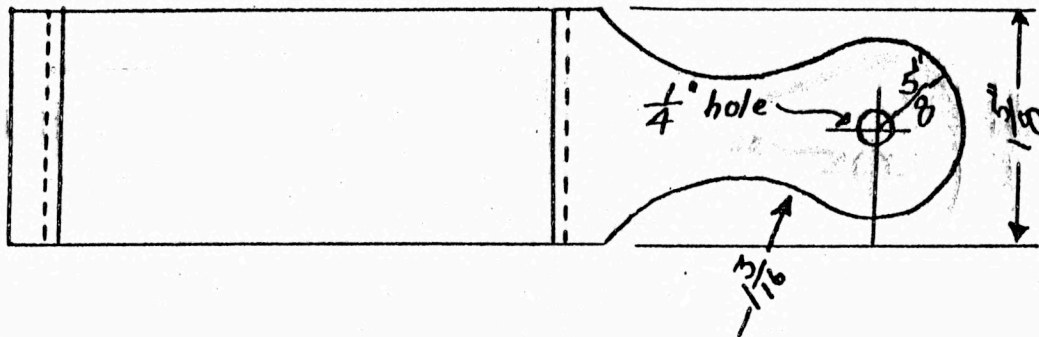
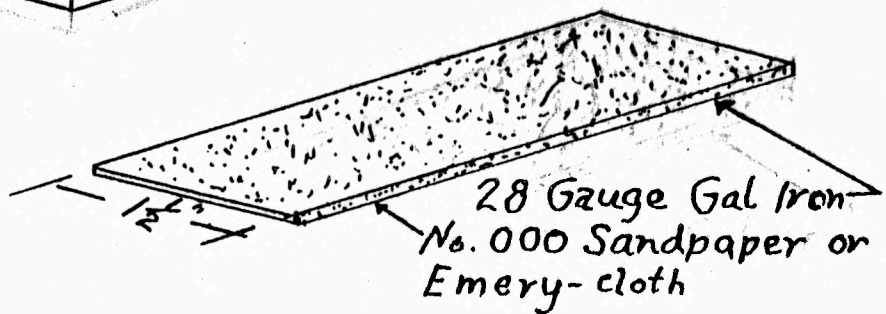
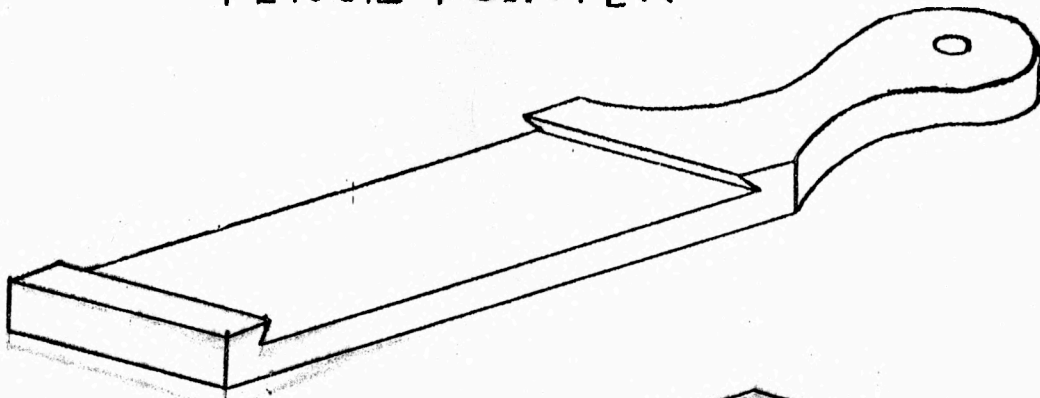
1 pc. Oak or Hickory	1" x 5/16" x 48" (old hockey stick)
1 pc. Walnut	1" x 3/8" x 12"
1 Birch	1" x 3/8" x 8"

1. Find one-half the length of each piece and using a try square and pencil, draw a pencil line around each piece.
2. Lay out and plane the taper on the long piece.
3. Glue and clamp the three pieces of wood together, being sure to get the pencil lines on each piece of wood lined up with each other. Make sure you have your clamps and glue ready before you start to work.
4. After the glue has dried, layout the curve on the handle. To do this, draw the arc of a circle 12" in diameter on a piece of cardboard and use this as a templet.

5. Saw carefully along the lines.
6. Using a block plane, half round file, spokeshave, curve the edges of the bow.
7. Sand smooth.
8. Soak in hot water until pliable enough to bend.
9. Using string, draw the bow into shape and allow to dry.
10. After the bow is dry, sand clean and finish with three coats of varnish.

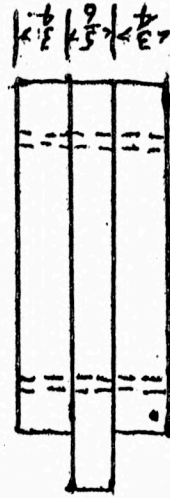
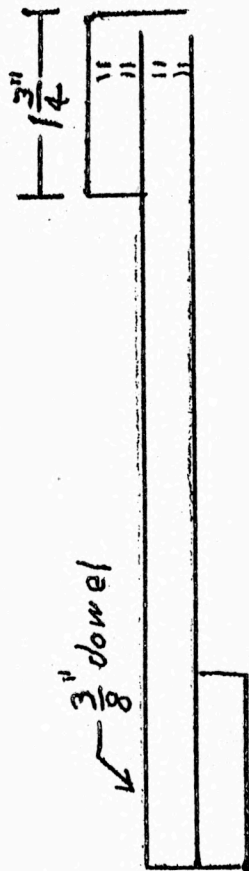
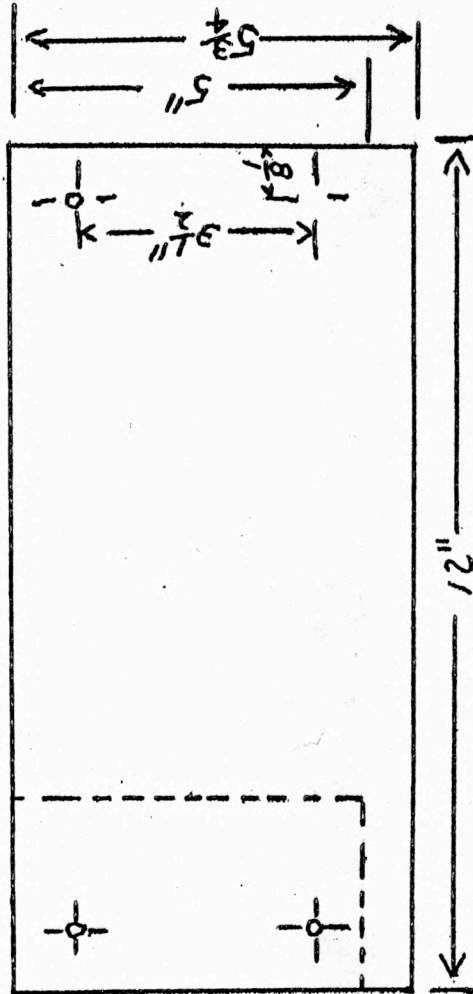
Note: You may make arrow shafts by planing and sanding 3/8" square sticks to a round shape. Plane the four corners at a 45 degree angle first and then sand round with a coarse piece of sandpaper.

PENCIL POINTER



A = Width of saw cut

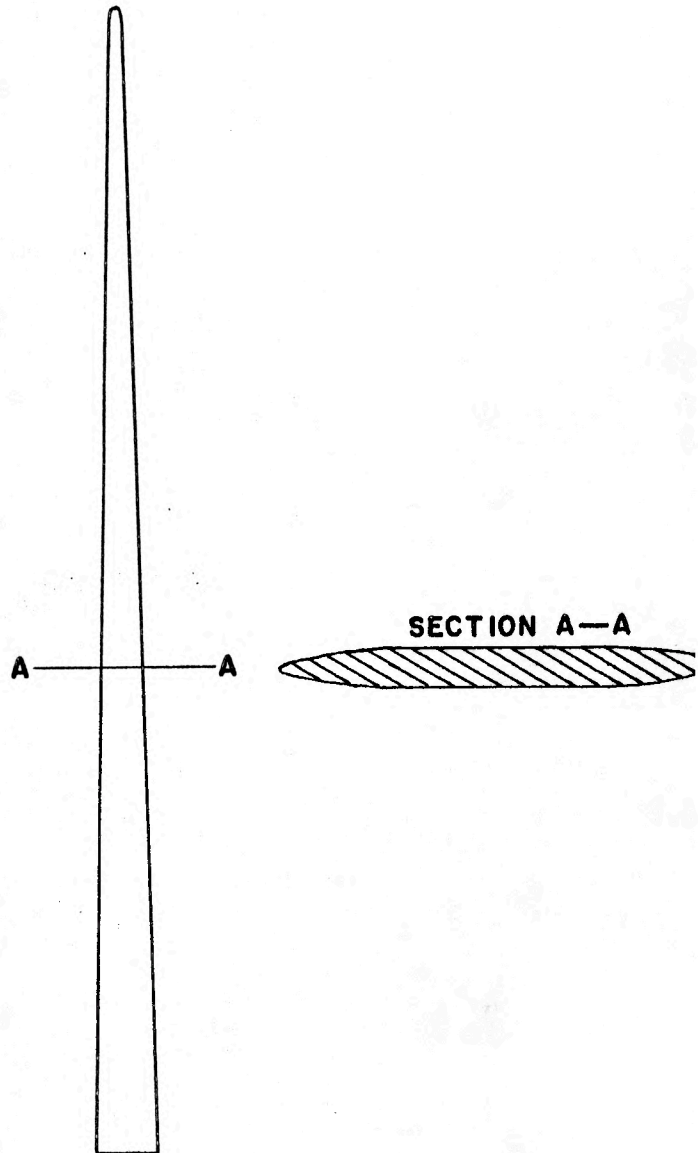
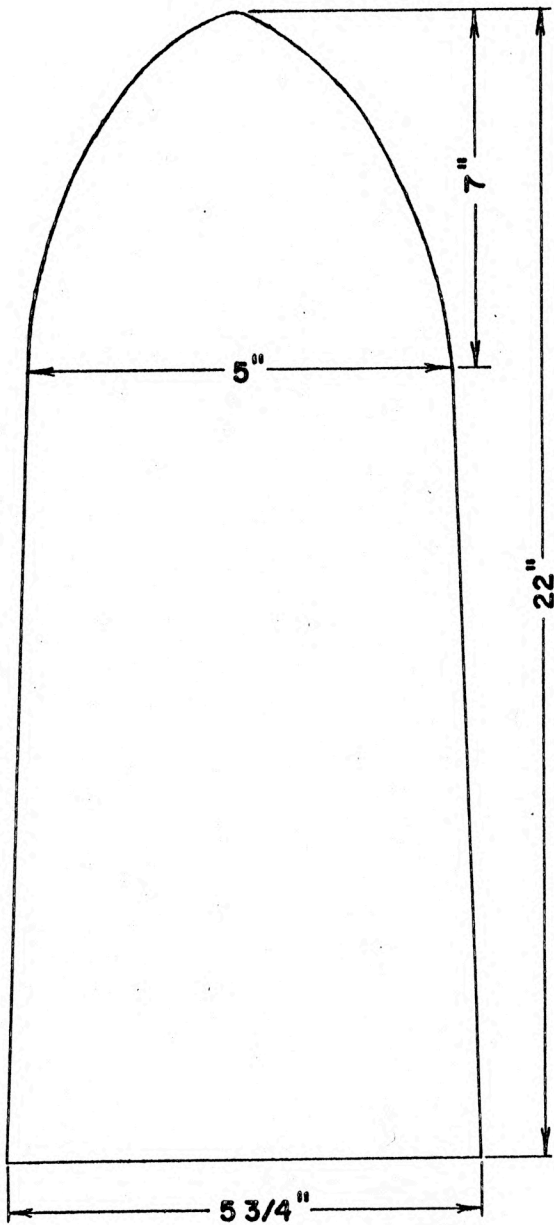
BENCH HOOK



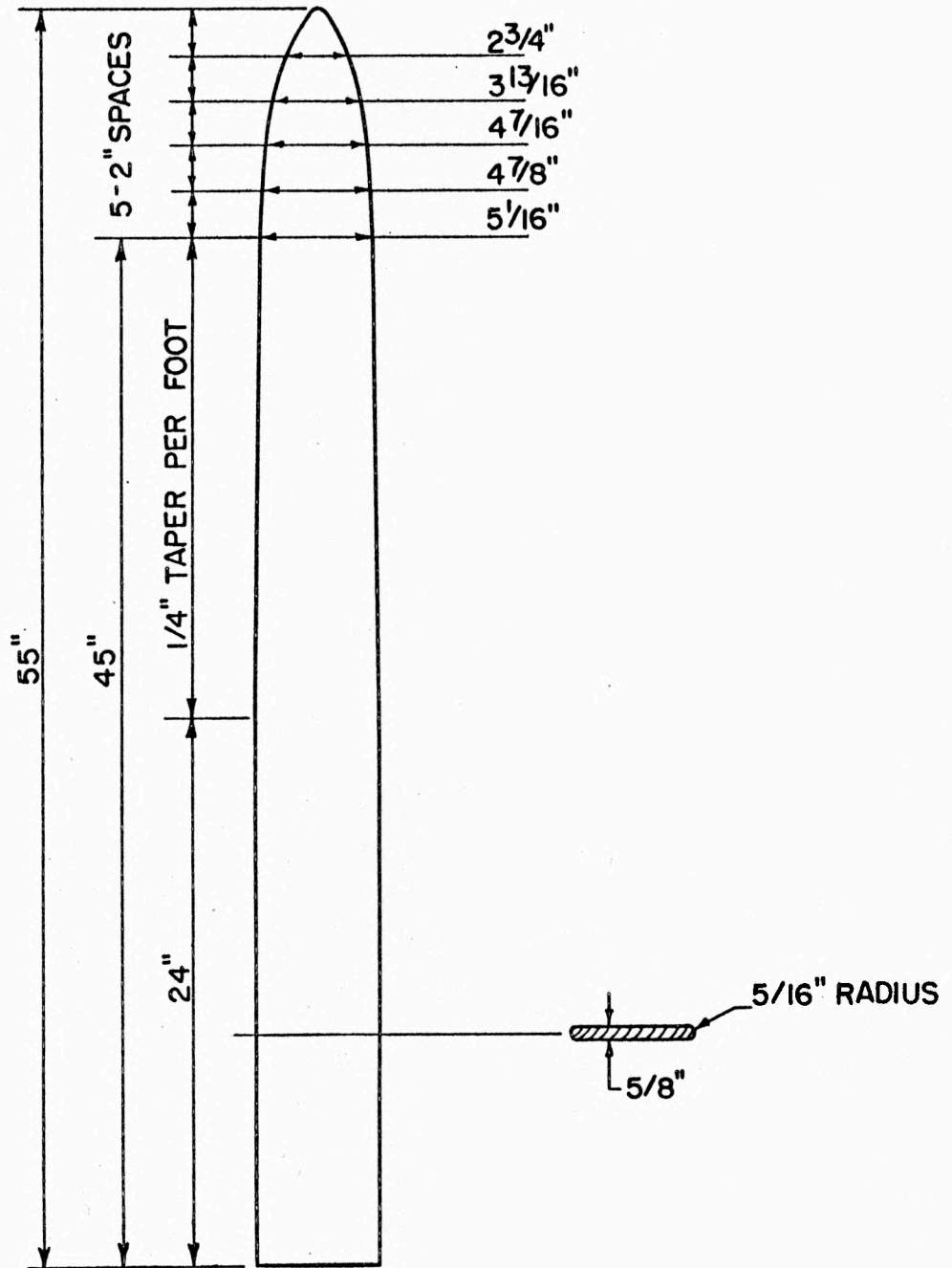
One of the most important facets of trapping is the preparation of the furs. It is extremely important that the furs be stretched uniformly and symmetrically on a standard size skin stretcher. If this is well done, furs will sell for a maximum price. If the stretcher is misshapen, the furs are automatically reduced in value.

In many communities trappers do not take sufficient time to make accurate skin stretchers. Here then is a project eminently suitable for construction in the school shops. The attached drawings show stretchers for fox and different sizes of muskrat - materials $5/8$ inch plywood. It is not necessary to finish the project but a coat of shellac will help to preserve it.

FORT McPHERSON SHOP-1962 MUSKRAT STRETCHERS

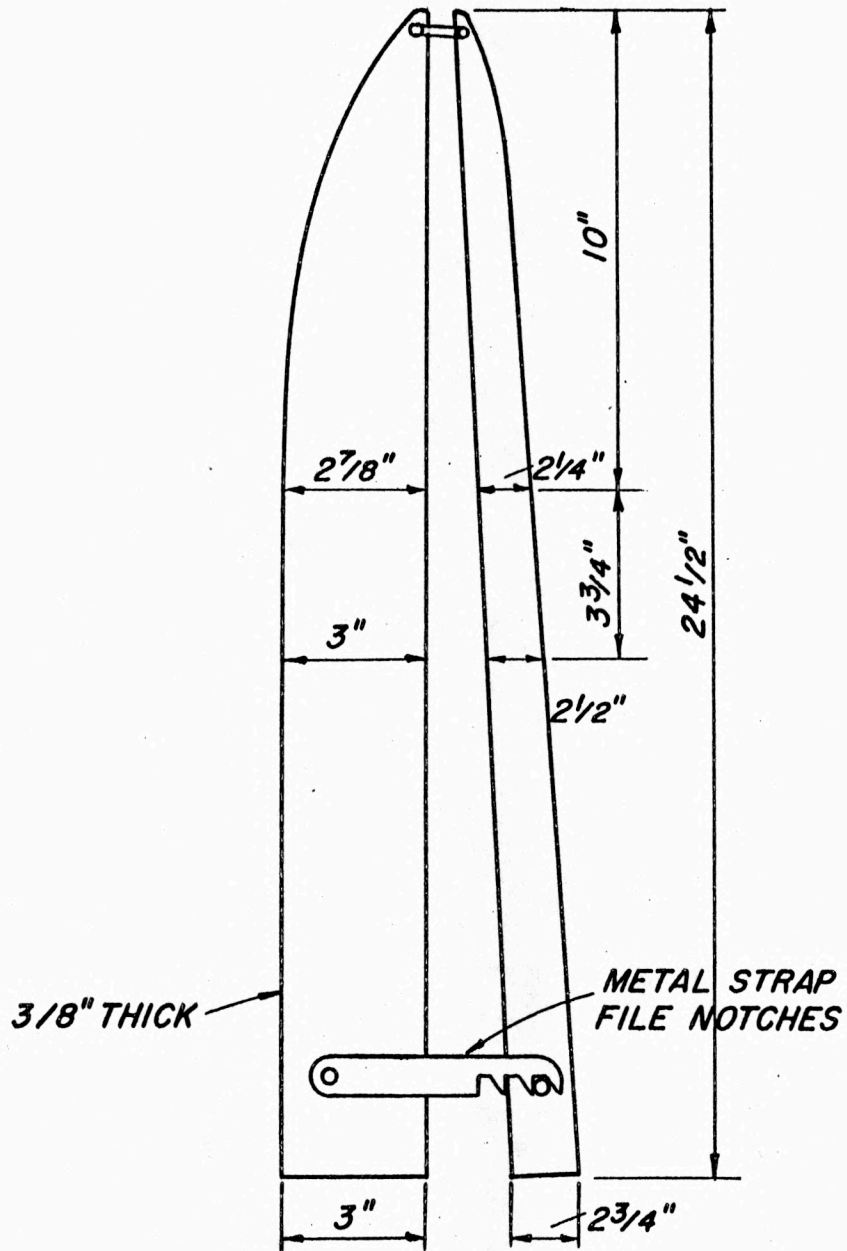


FOX STRETCHER



SCALE: 1 1/2" = 1'-0"

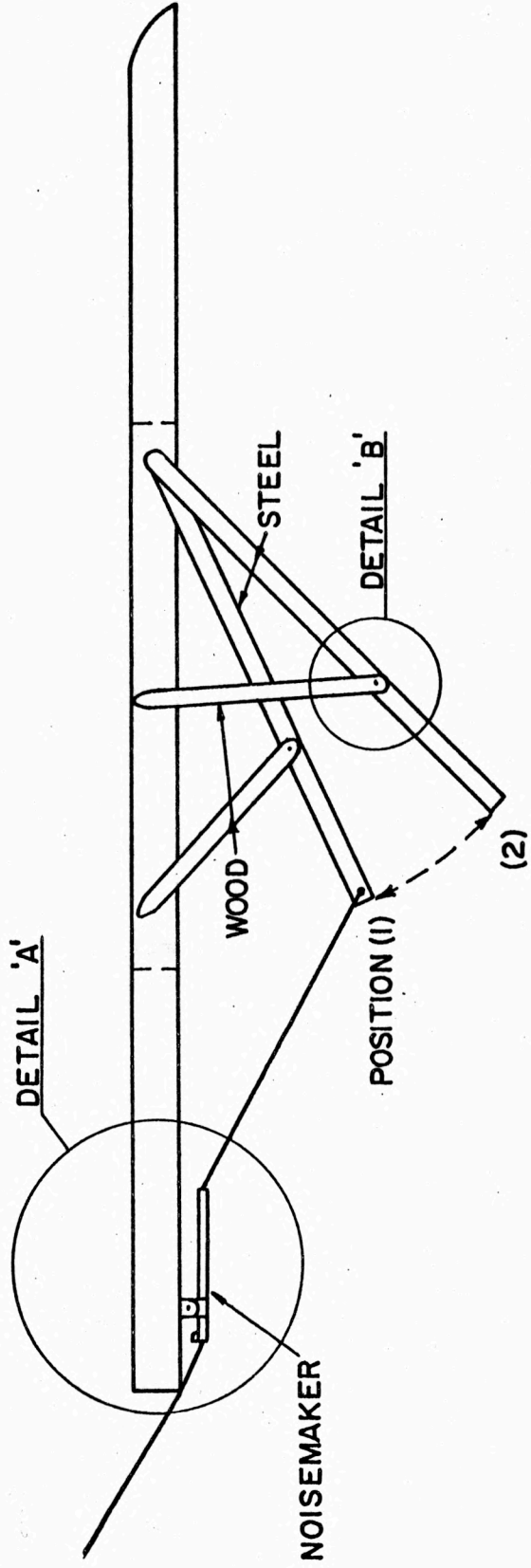
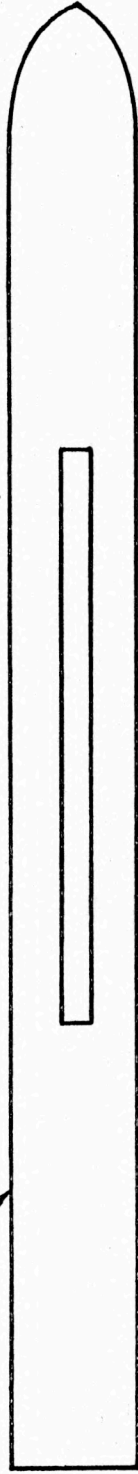
STRETCHER



In communities where fishing is part of the economy, an ice jigger makes a very useful and challenging project. While materials suggested are suitable, others may be substituted. It should always be the teachers aim to use material which is available in the community even if adaptations in the basic design are required. The jigger shown in the drawing can be made in three different sizes. It can be used to introduce the students to a variety of different tools and techniques if this is the objective of the teacher or it can be made with very simple tools.

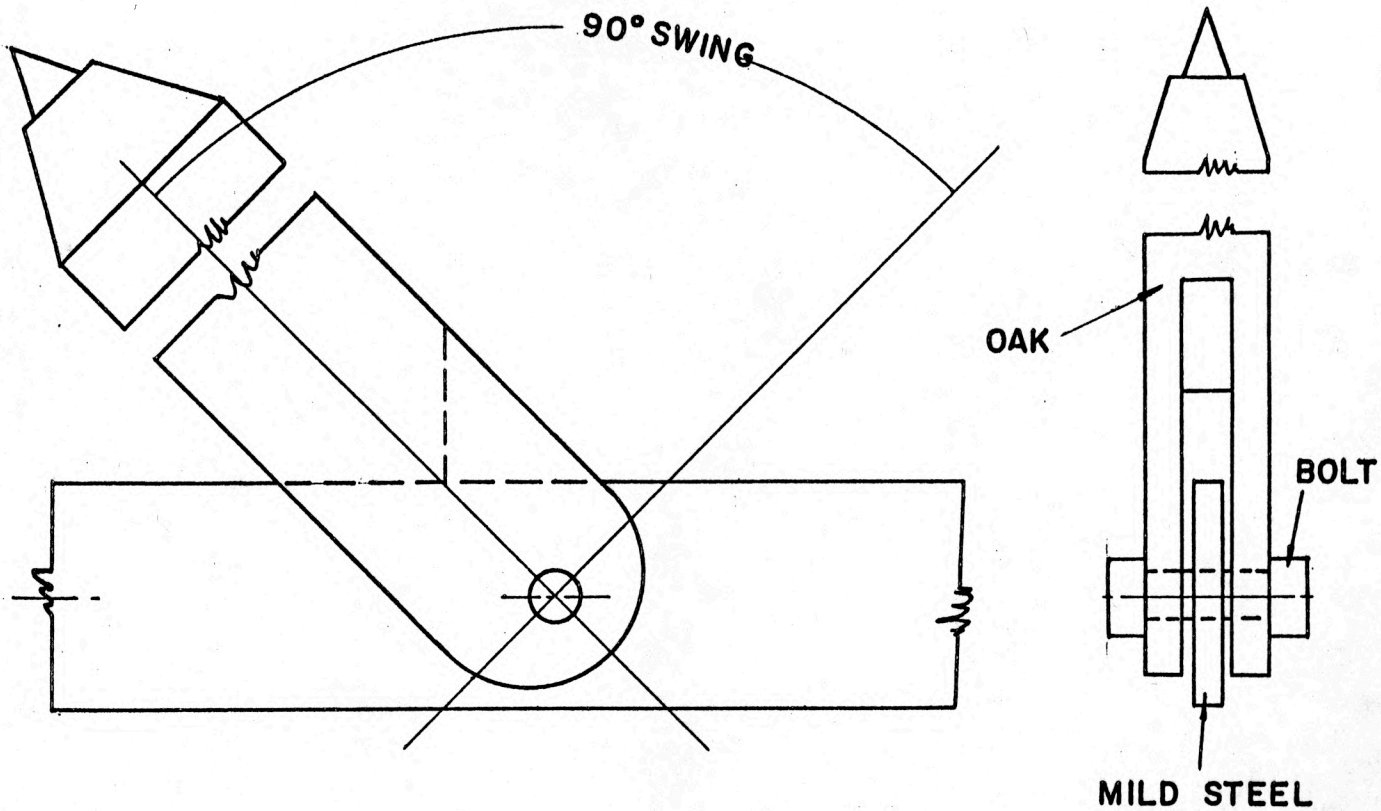
ICE JIGGER

MATERIAL: CEDAR

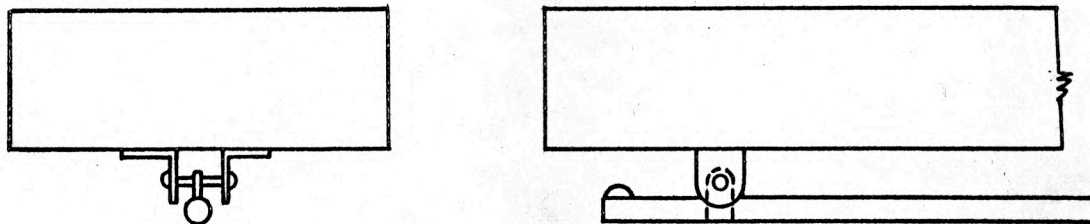


ICE JIGGER

DETAILS

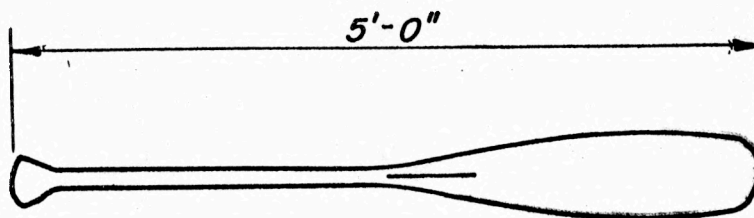
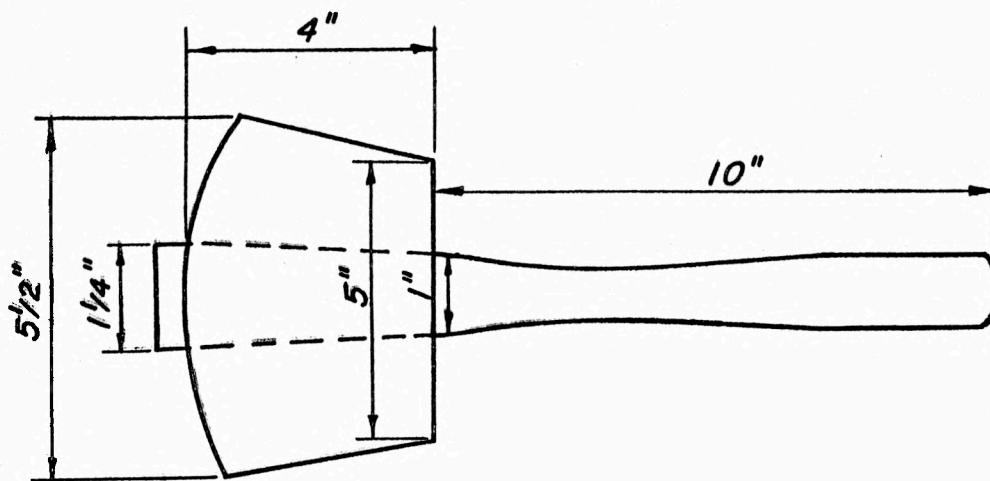


DETAIL 'B'
SCALE FULL SIZE



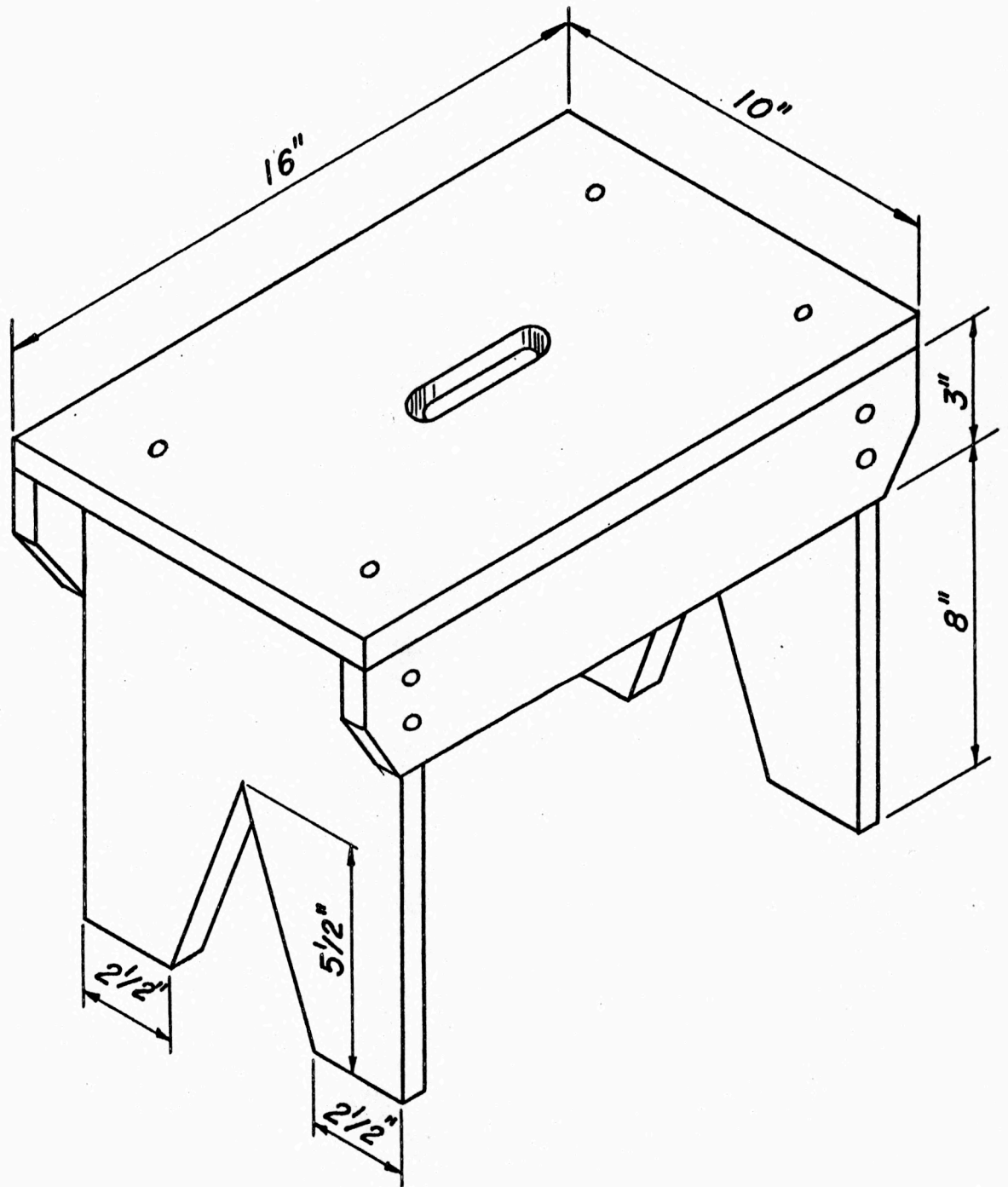
DETAIL 'A'
SCALE: 1/4" = 1"

MALLET

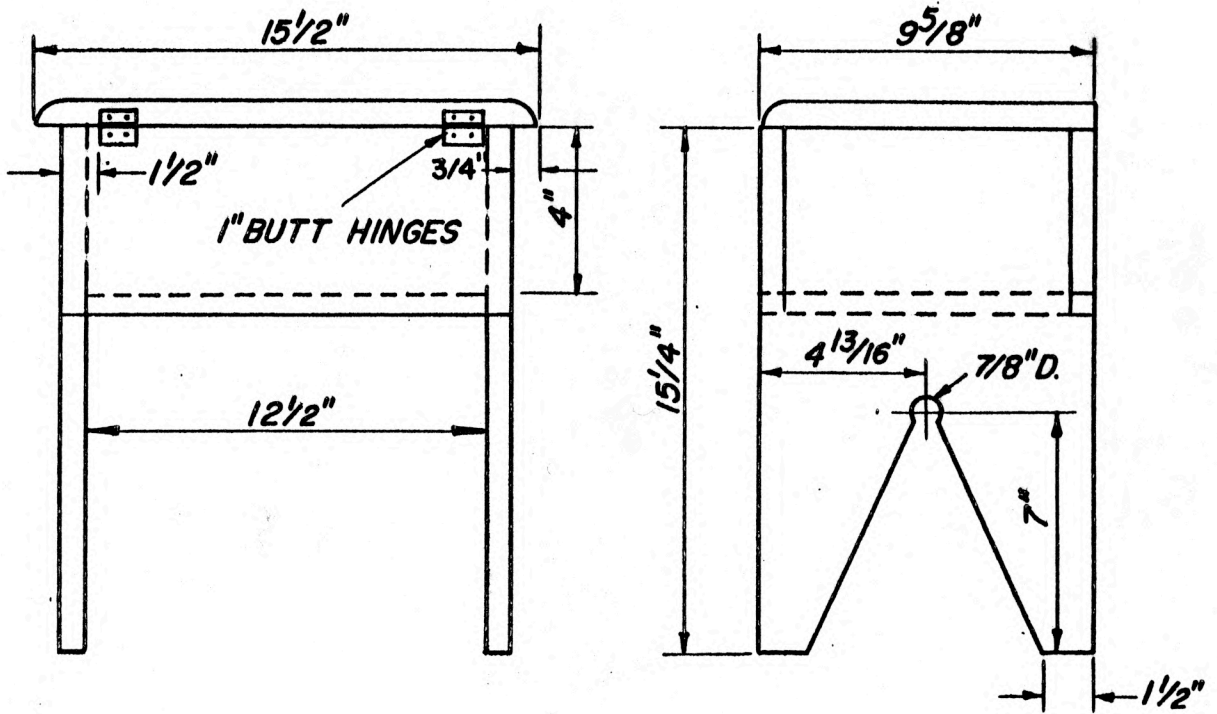


WOOD PADDLE

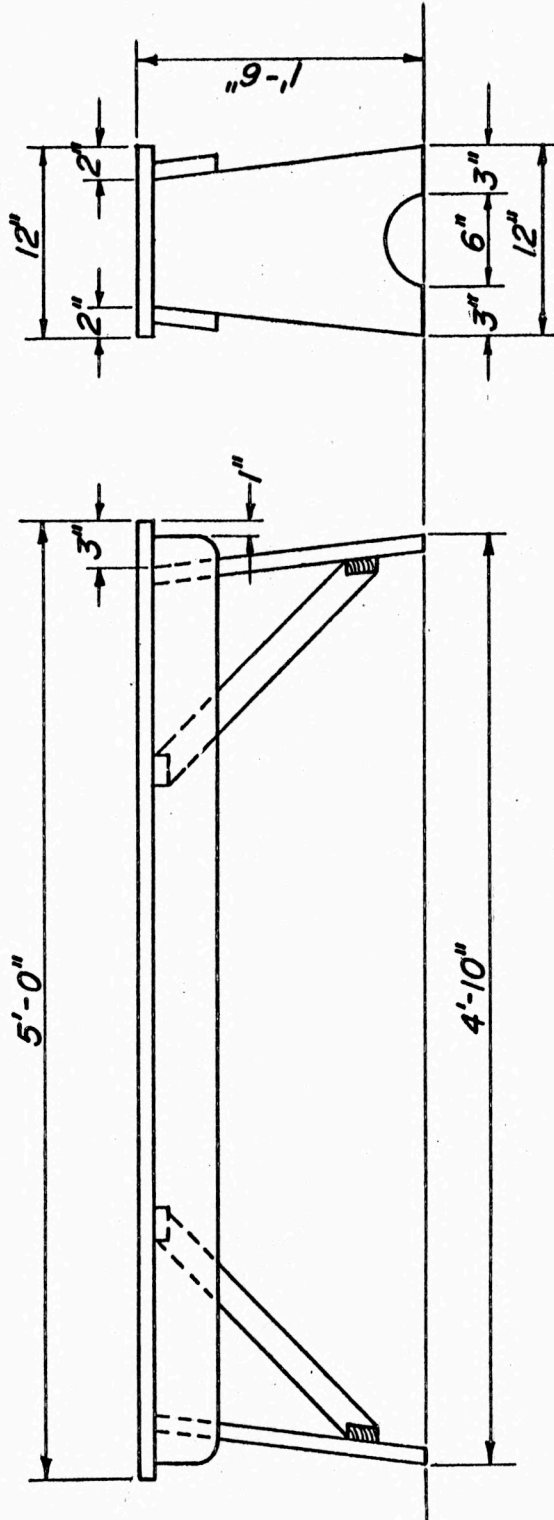
STOOL



WORK STOOL



BENCH



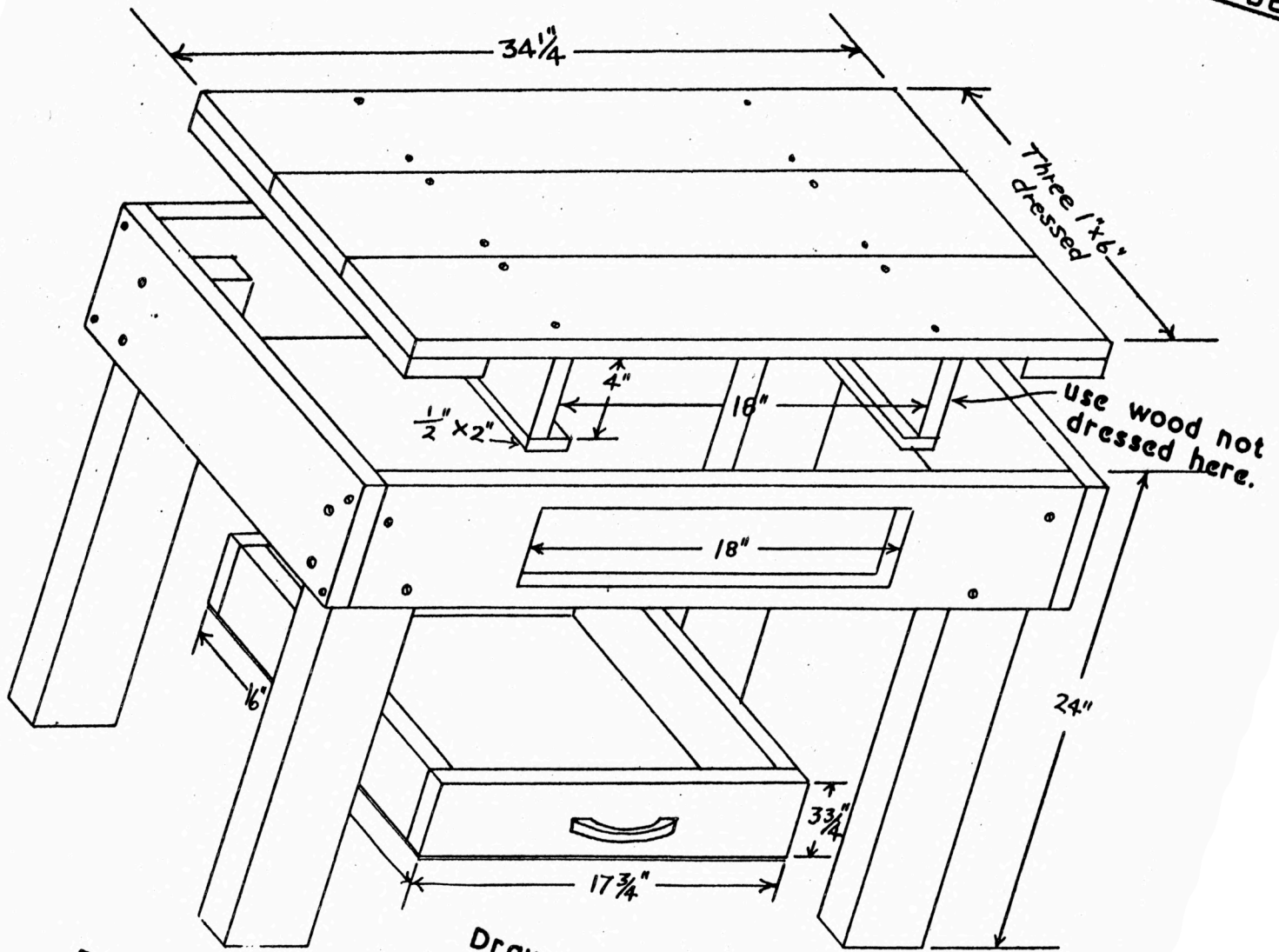
SCALE: 1" = 1'-0"

WORK BENCH

Small children like to hammer just for hammering sake but by the time they reach school age they want to make things. A bench like this may be useful in the primary or kindergarten rooms in the school.

Perhaps as industrial arts teachers or people with a particular interest in this area, we may be able to encourage work of this type in the primary grades.

WORK BENCH



Requires: 3 feet 1"x4" rough
20 feet 1"x6" dressed
8 feet 2"x4" dressed

Drawer

3 feet 1/2"x2" dressed
3 feet 1"x4" rough
6 feet 1"x4" dressed
Masonite 1/8 inch 16"x17 3/4"

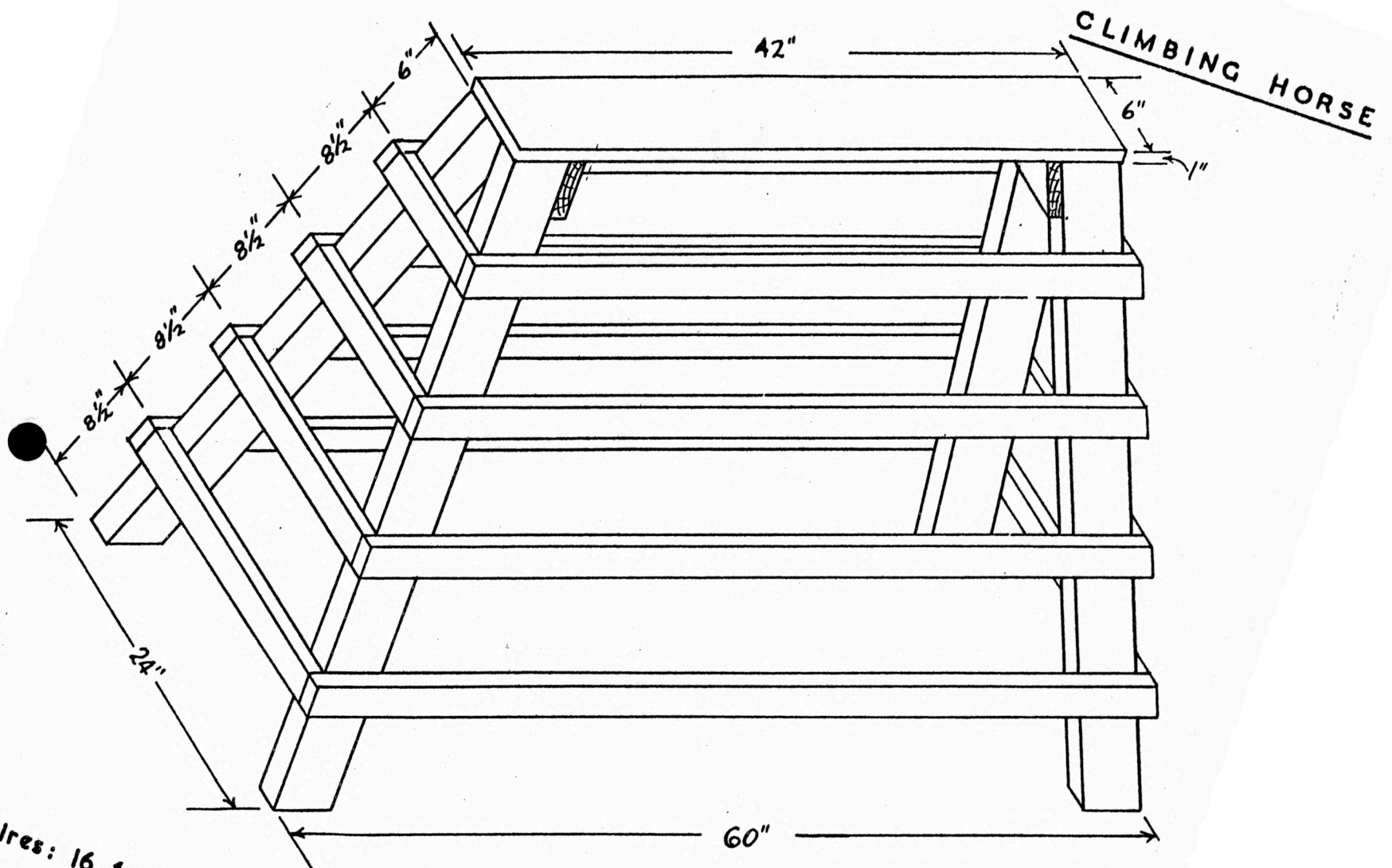
Make top first, then make frame to fit allowing top to sit flush.
A vise should be added to front right-hand corner.

Drawer optional

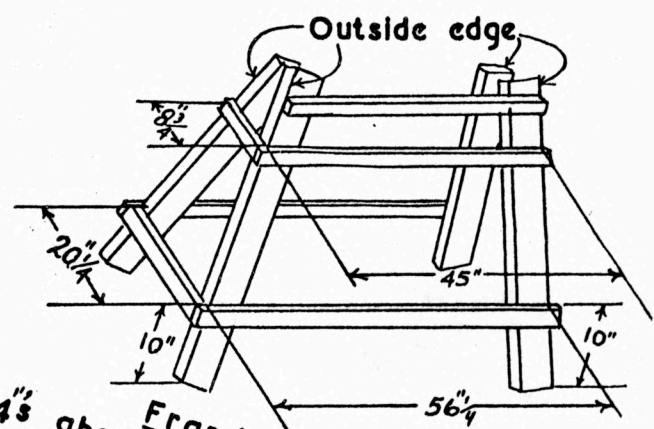
use wood not dressed here.

CLIMBING HORSE

Children love to climb and balance. This climbing horse is a simple form of apparatus which can create opportunities for exercise.

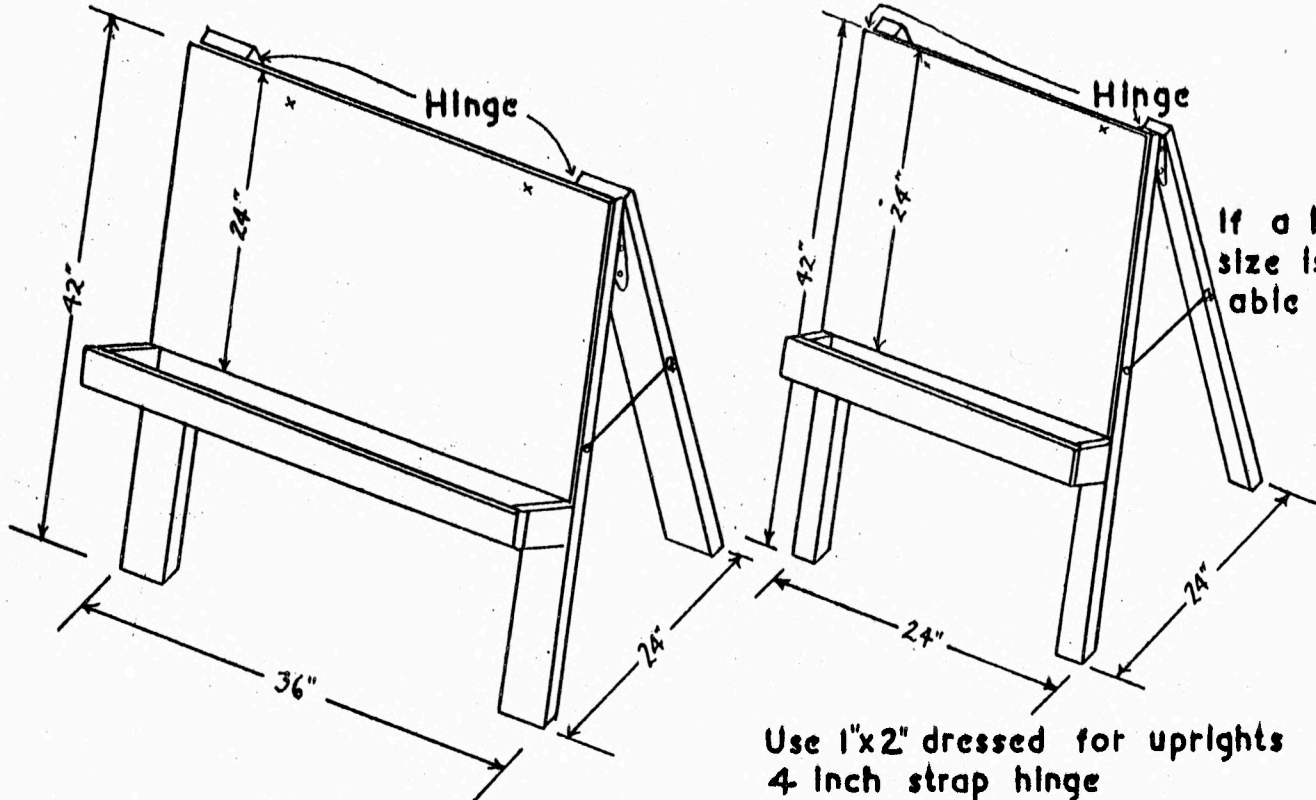


Requires: 16 feet of 2"x4"dressed
 1 1/2 feet of 1"x4"dressed
 54 feet of 1"x2"dressed
 (1"x2") should be hardwood)
 4 feet of 1"x6"dressed
 Use flathead screws or roundhead.
 If flathead screws are used holes
 must be countersunk.
 Round all corners and edges.



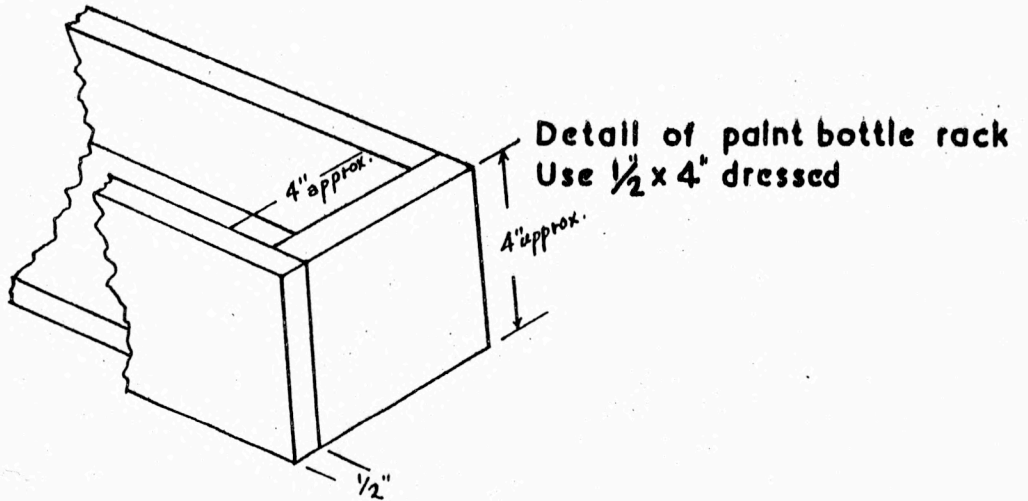
Framing
 Lay out 4 2"x4"s about 48 inches long. On
 outside edge lay out a 10" measurement as
 above. Frame up with top and bottom rungs.
 Temporarily fasten a batten as above in
 correct position for top line (measured up
 outside edge). Top line can now be pencilled
 for sawing. Follow around and do bottom
 of legs. Correct angles can be sawn.

from CHILDREN'S CENTERS



If a hook this size is unobtainable use chain

Use 1"x4" dressed for uprights
6 inch strap hinge

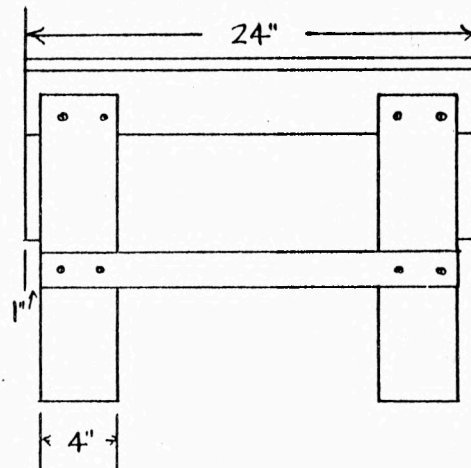
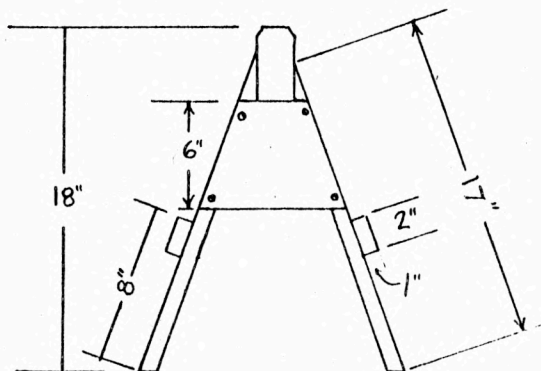
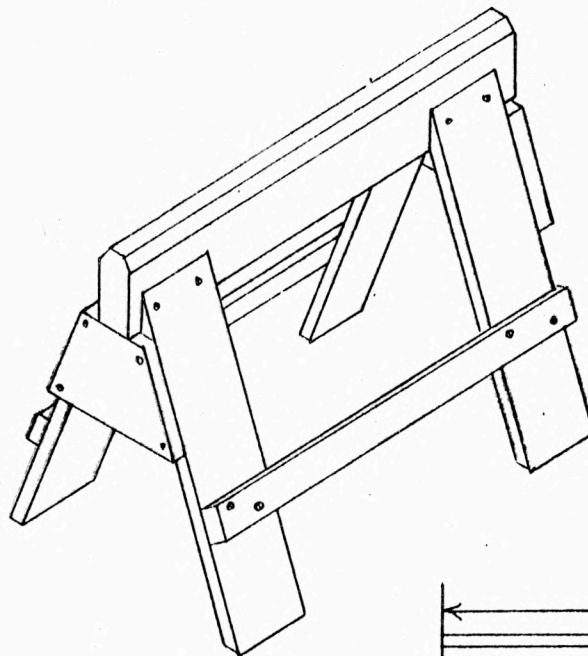


Finger painting is becoming very popular and easels will be welcomed in the primary grades and, in fact, in all grades. This project could be attempted on a mass-production basis.

1/4 inch plywood for painting surface
Small xes indicate brads for holding paper.

SAWHORSE

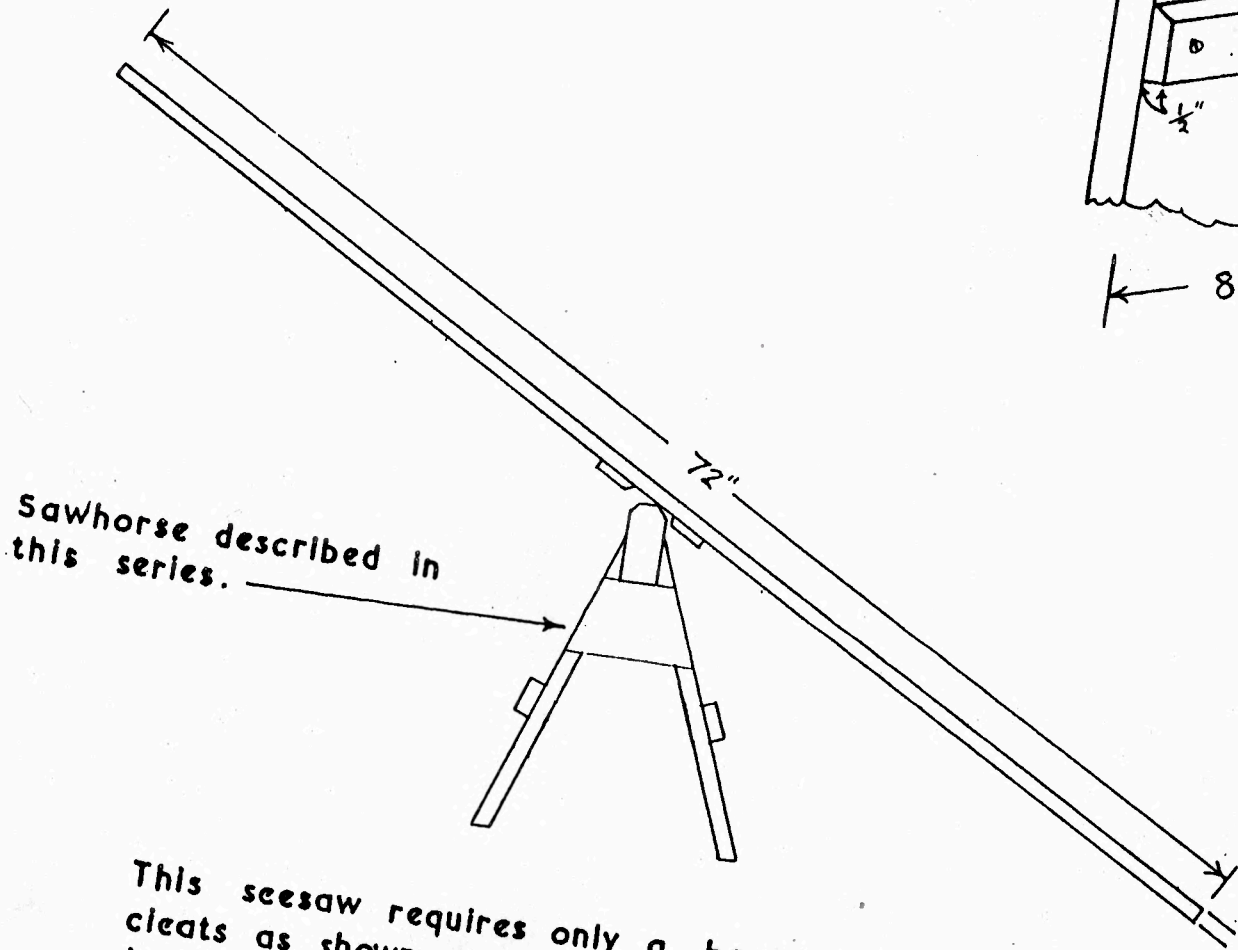
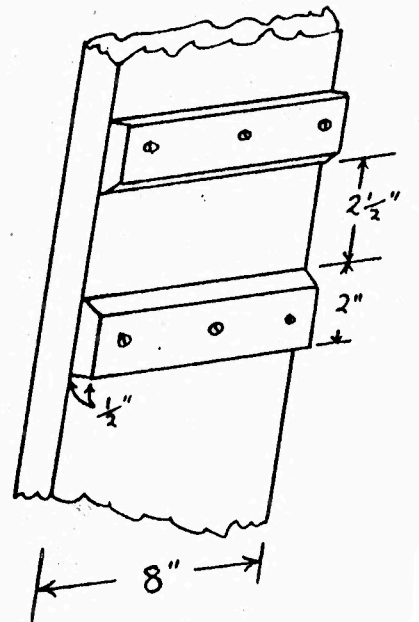
While not necessarily play equipment a sawhorse is a very useful project and can be converted to a teetertotter.



- Requires: 4 feet 1"x2" dressed
6 feet 1"x4" dressed
1½ feet 1"x6" dressed
2 feet 2"x4" dressed

Sand all corners and edges round.

SEESAW

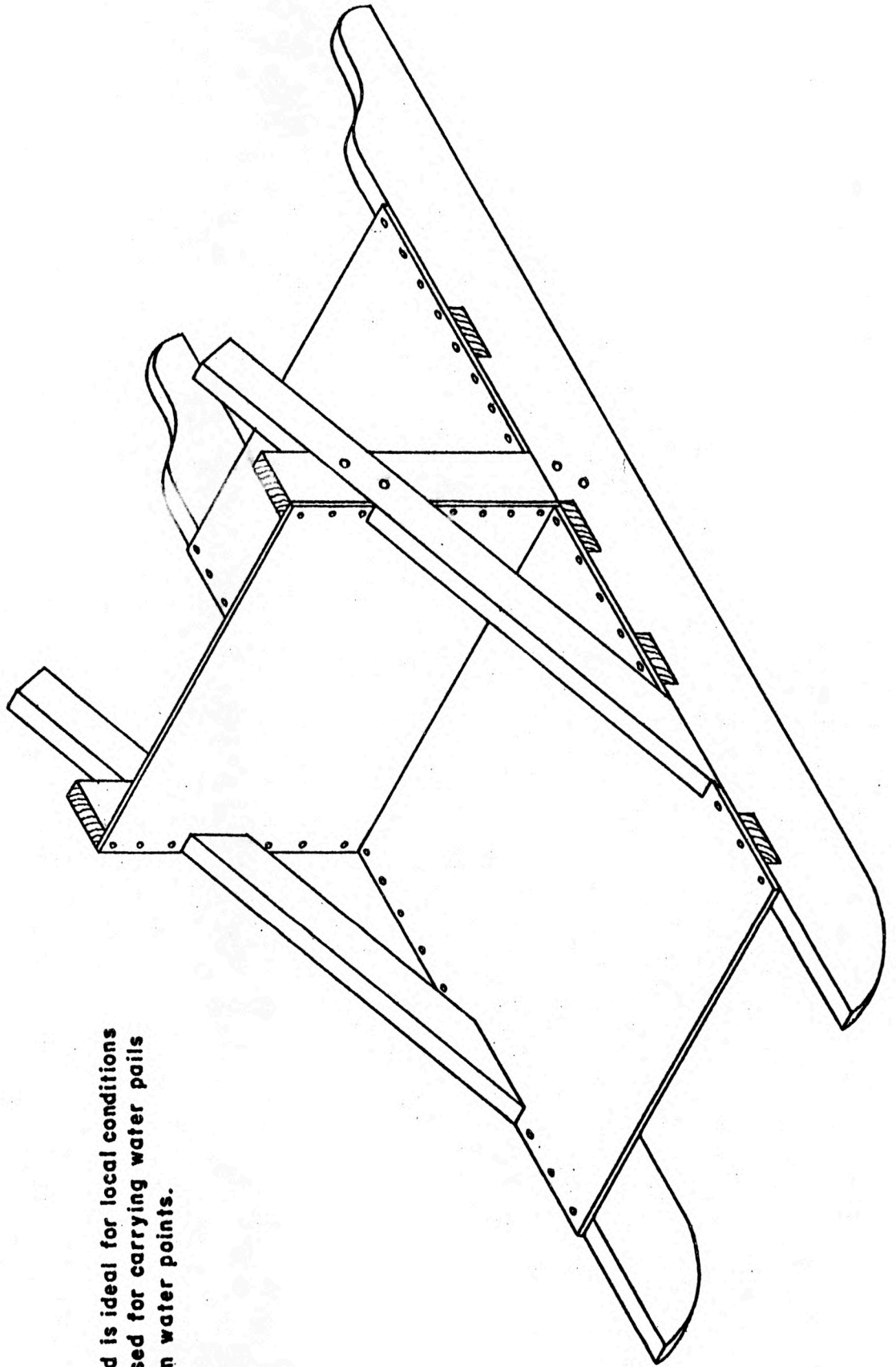


Sawhorse described in this series.

This seesaw requires only a board with two cleats as shown and one sawhorse as described in this series.

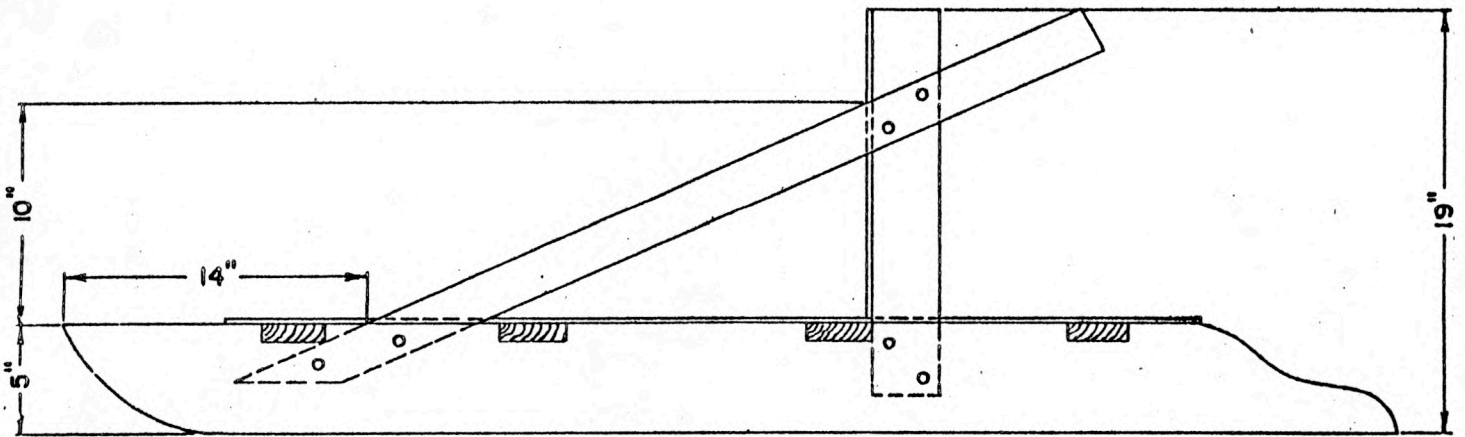
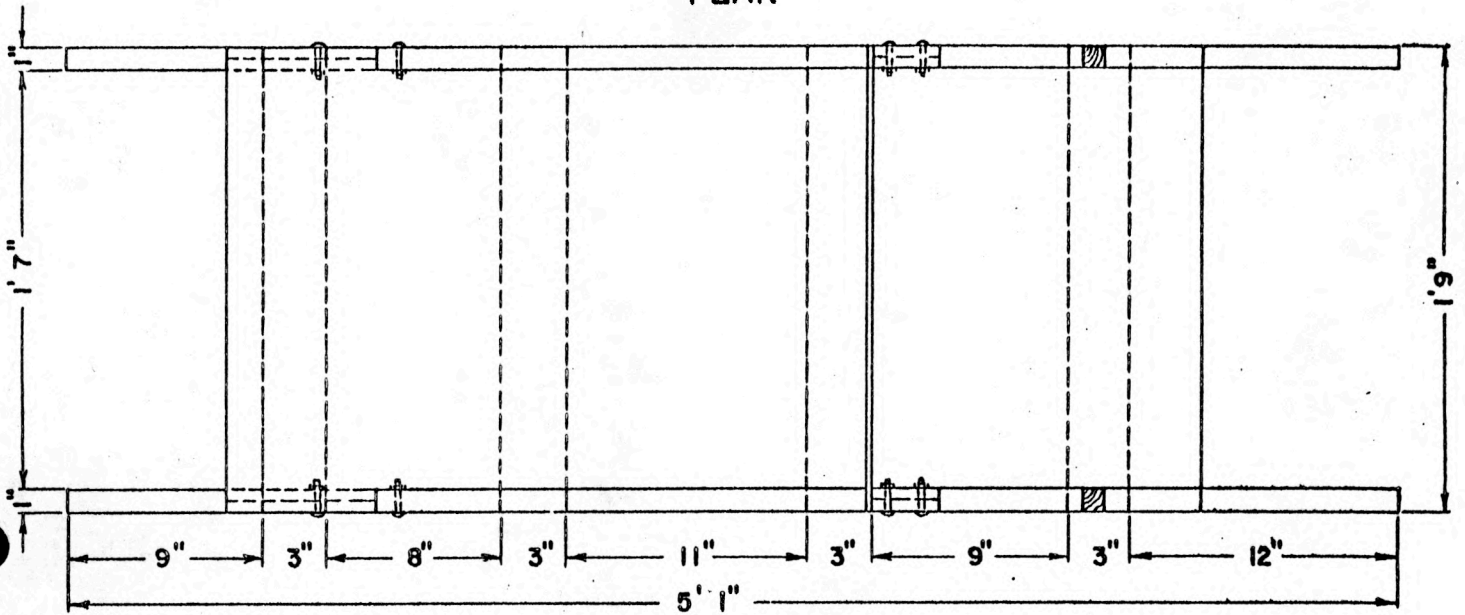
A project which is always useful in communities in the north is a sled. The drawing shown on page 128 shows a sled made in Rankin Inlet by Grades II and III. If the sled is to be pulled by a dog team, the lashed construction is preferred. In fact, in many communities this construction is the only one used. The degree of complexity of this project can be varied by doing the cross bars and varying the construction of the runners.

An interesting experiment was tried at Rankin Inlet with this project. One of the local Eskimos was invited to the shop to teach the pupils how to put mud on the runners. This proved to be a very informative experience.

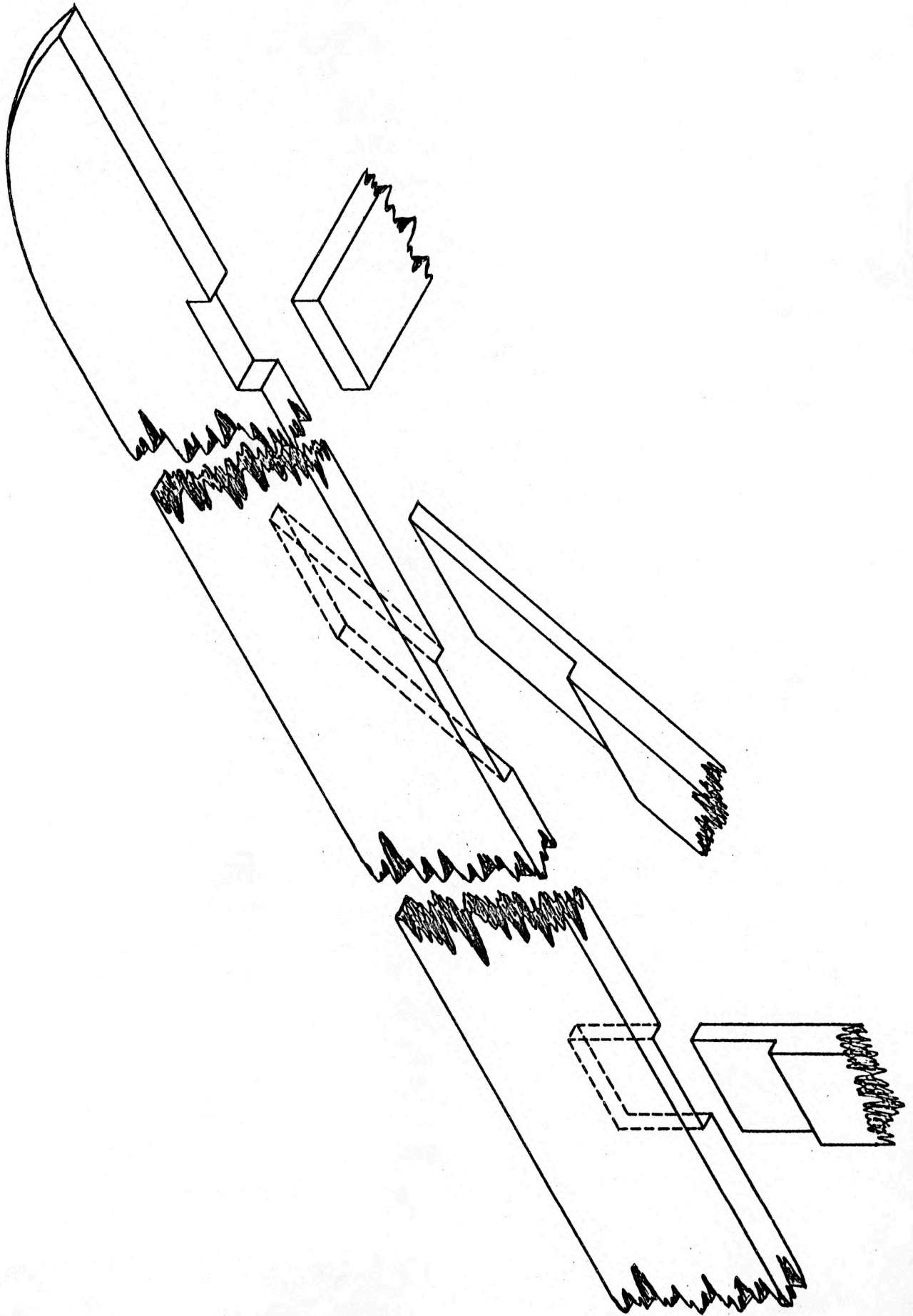


This sled is ideal for local conditions and is used for carrying water pails etc. from water points.

PLAN



SIDE ELEVATION



REHAB. I. NORTHERN SLED

INUVIK, 1963. 1 OF 5

STOCK LIST

FOR SLED WITH 10' DRAG

- 4 PIECES HICKORY OR BIRCH 16' x 4" x $\frac{5}{8}$ "
 - 10 PIECES HARDWOOD CROSSPIECES 15" x $\frac{1}{4}$ " x 1"
 - 25' OF $\frac{3}{8}$ " OR $\frac{1}{2}$ " ROPE
 - 30' OF ANY GAUGE WIRE (STOVE PIPE WIRE)
 - 80 $\frac{1}{4}$ " STOVE BOLTS $1\frac{1}{2}$ " LONG
- ADDITIONAL ITEMS

STEAM BOX

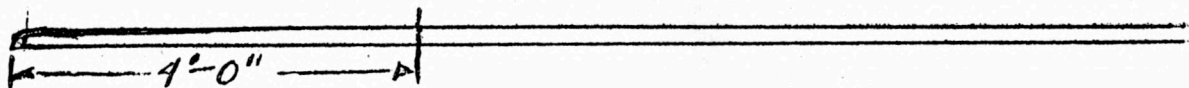
TUB FOR SOAKING

JIG FOR FORMING HEAD

JIG FOR CLAMPING HEAD

INSTRUCTIONS

1. THE 4 PIECES OF $\frac{5}{8}$ " HICKORY MUST BE FIRST TAPERED FROM THE FULL THICKNESS TO $\frac{1}{4}$ " THIS TAPER COMMENCES 4' FROM THE FRONT AS SHOWN BELOW :-

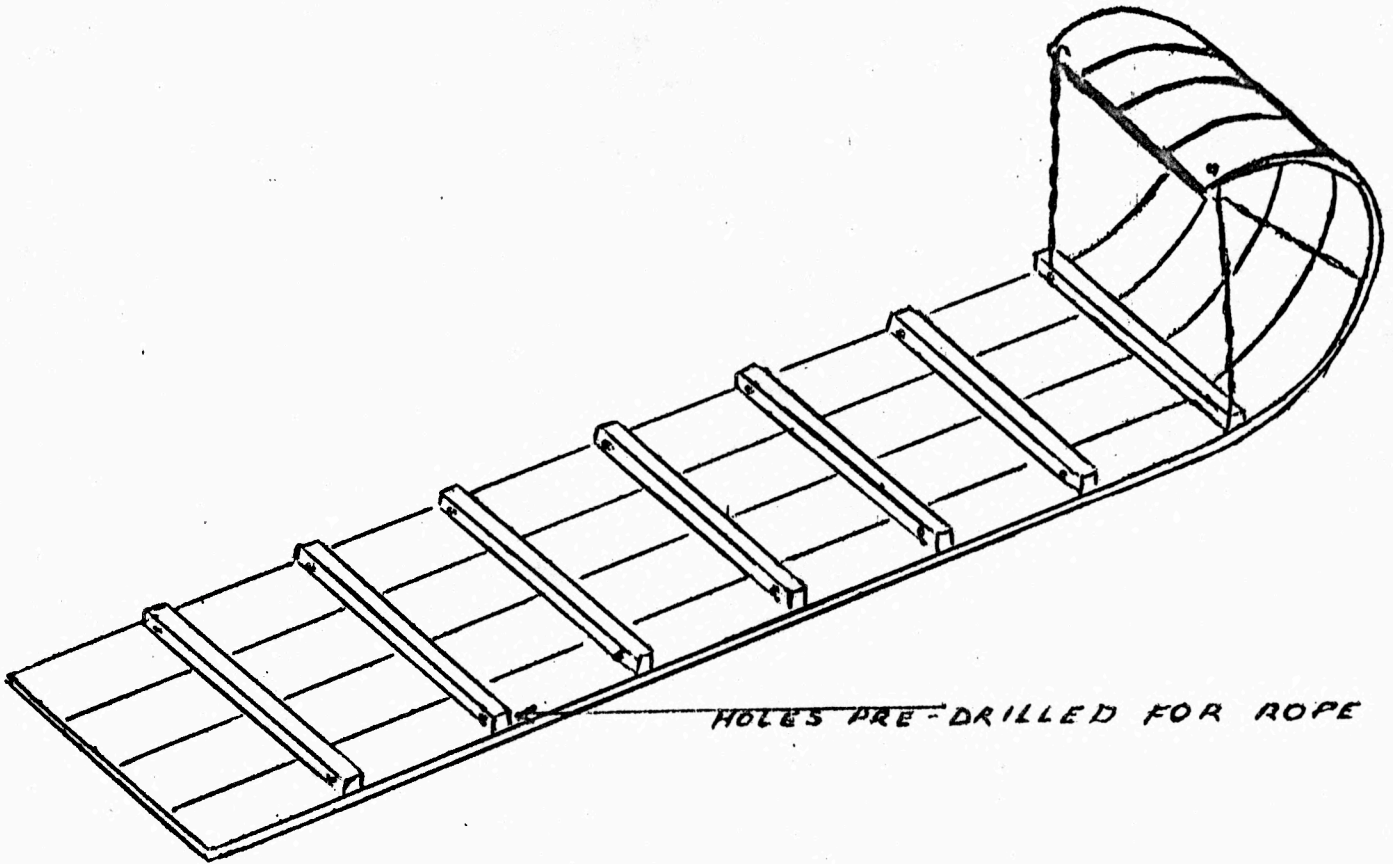


2. THE PIECES MUST THEN BE SOAKED IN WATER FOR 3 DAYS.
3. THEY ARE NOW ENCLOSED IN THE STEAM BOX FOR 20 - 30 MINUTES.
4. THE HEAD IS BENT ON THE JIG, THEN CLAMPED AND REMOVED TO DRY.
5. CROSSPIECES, READY BORED, ARE SCREWED ON.
6. THE HEAD IS WIRED.
7. FINISHING WITH LINSEED OIL.

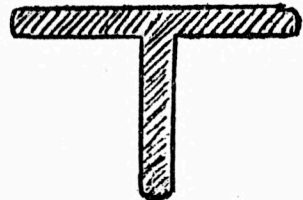
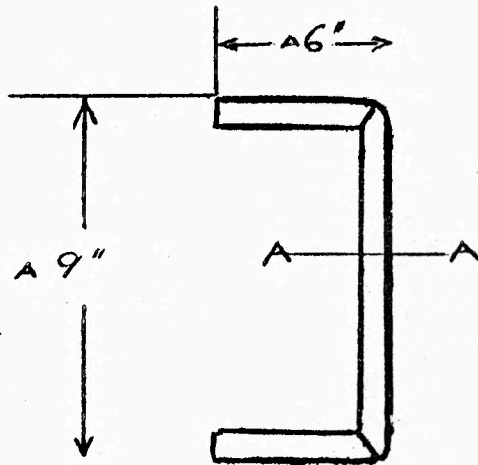
REHAB. I. NORTHERN SLED

INUVIK 1963

2 OF 5



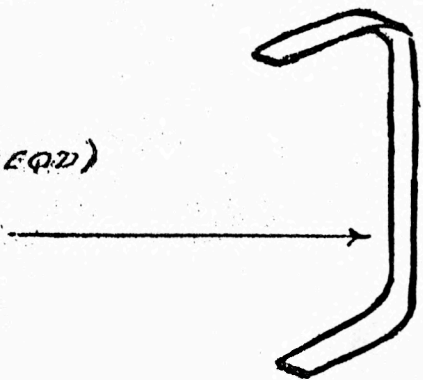
HOLES PRE-DRILLED FOR ROPE



SECTION A/A

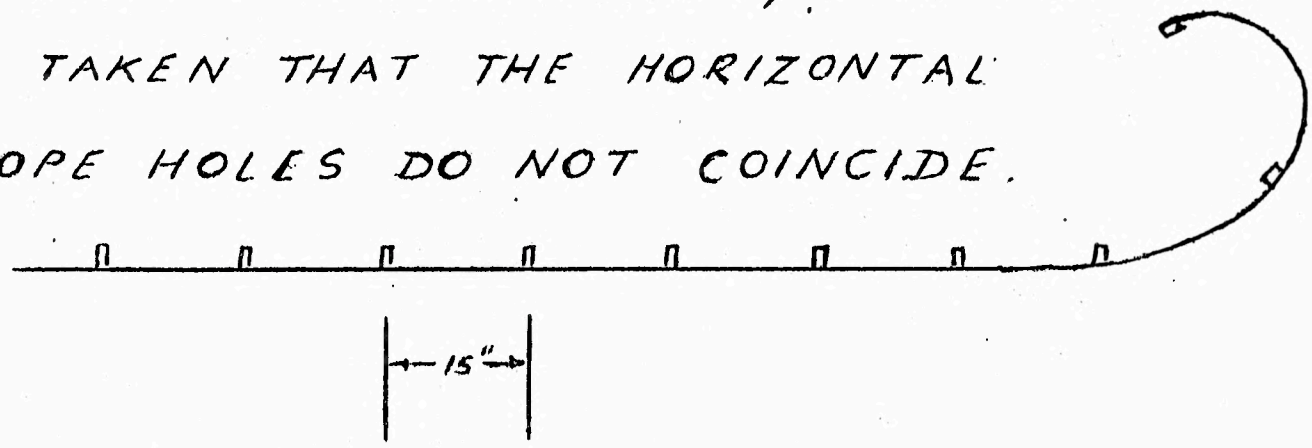
CLAMPING JIG FOR HEAD (2 REQD)

STRAP IRON MAY BE USED

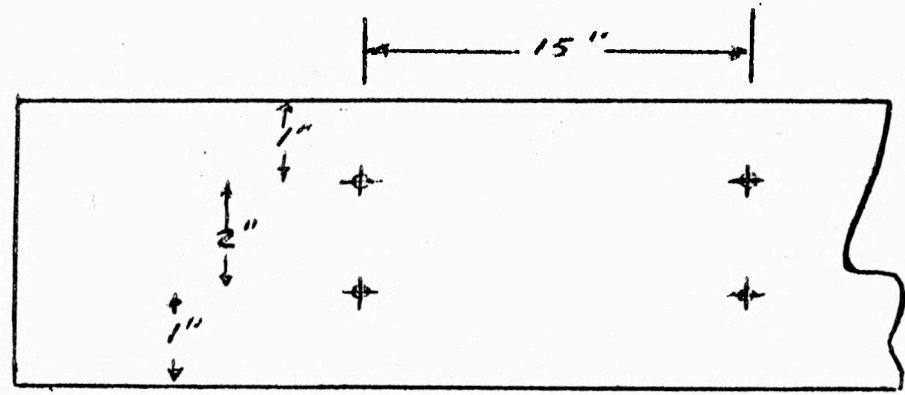
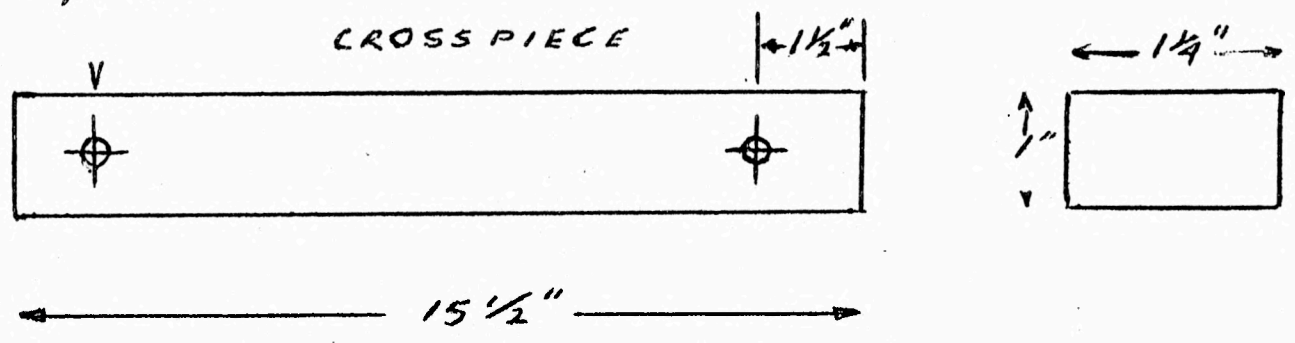


REHAB. I. ^{- 133 -} NORTHERN SLED
 INUVIK 1963 3 OF 5

WHEN DRILLING COUNTERSUNK BOLT HOLES IN CROSSPIECES, CARE MUST BE TAKEN THAT THE HORIZONTAL ROPE HOLES DO NOT COINCIDE.



1/2" OR 3/8" HOLE



PRE-DRILLED BOLT HOLES IN SLATS - COUNTERSUNK

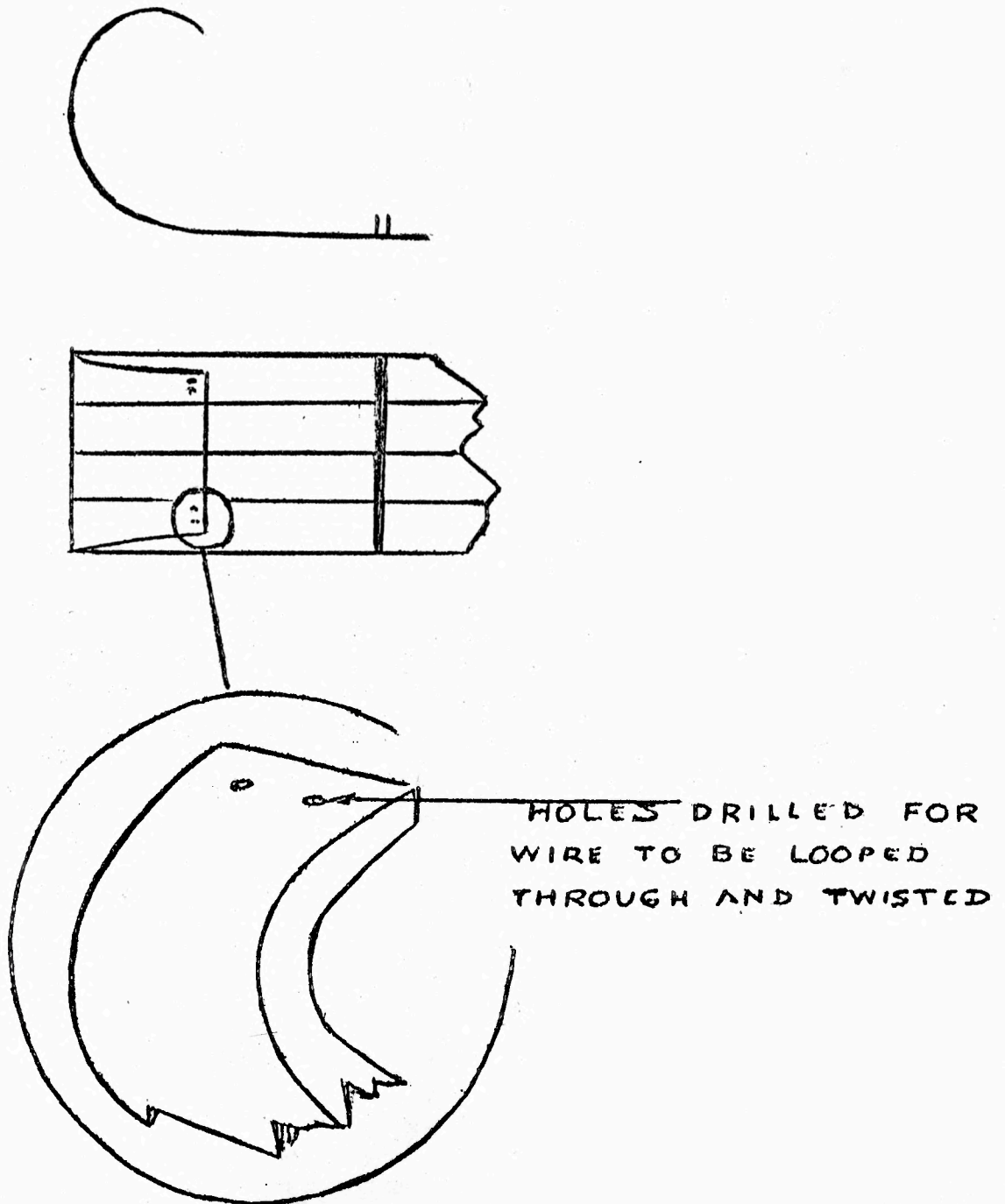
REHAB. I. NORTHERN SLED

INUVIK

1963

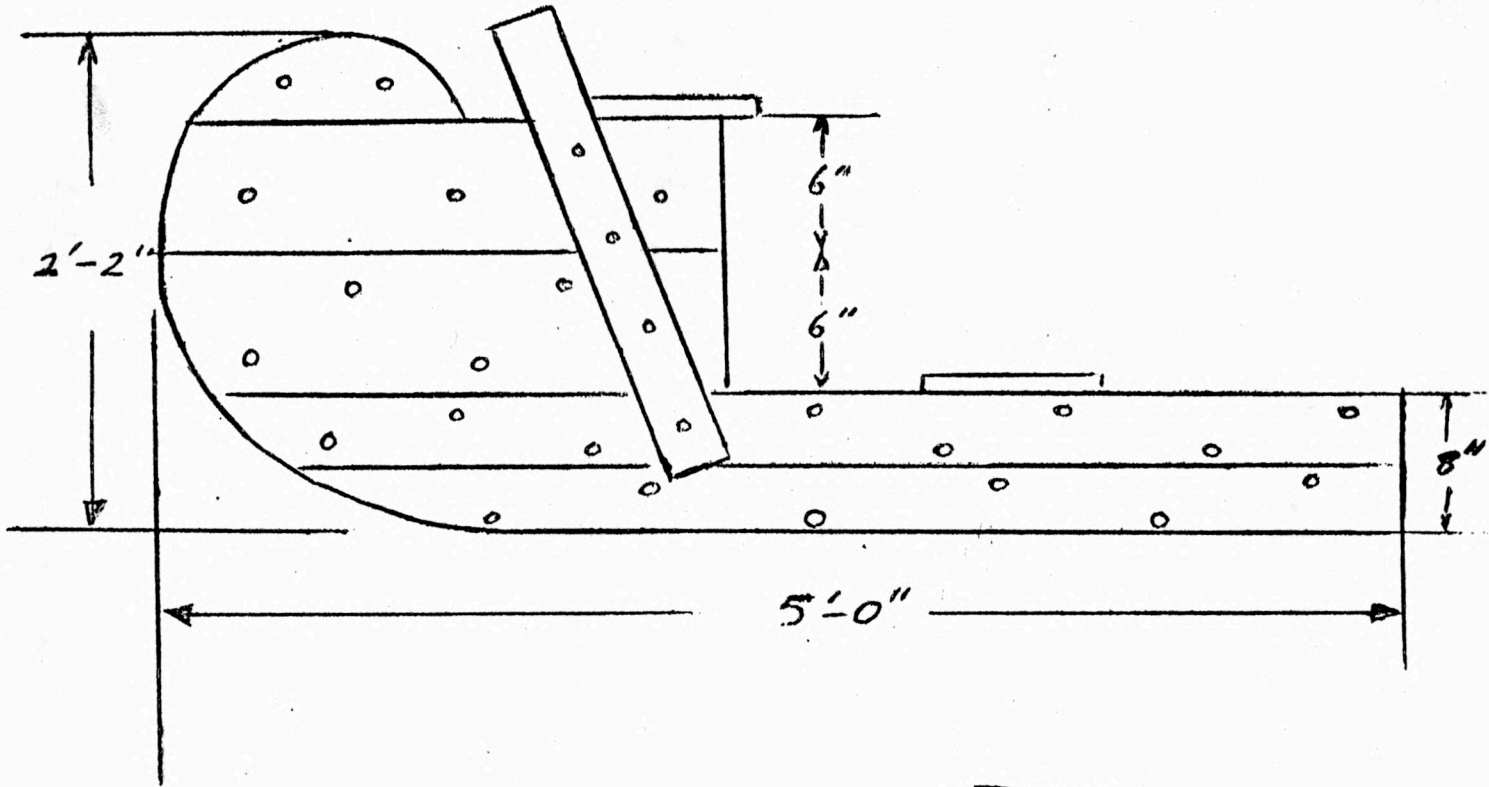
4 OF 5

WHEN SLED IS COMPLETED, A TAPER IS CUT FROM 1 1/2" IN AT THE HEAD TO 0" 2 FEET BACK AS SHOWN BELOW.

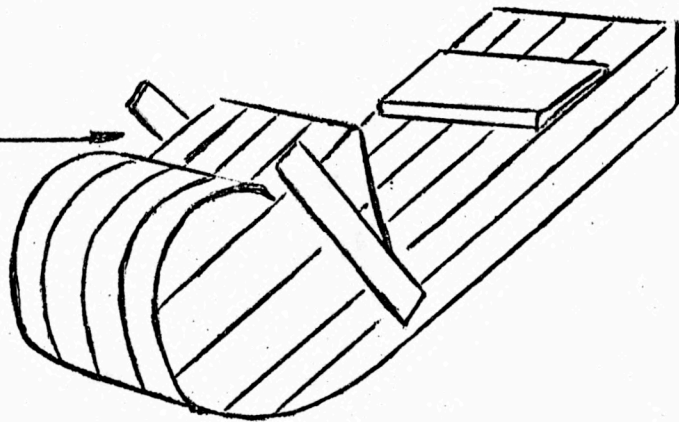


REHAB.I. NORTHERN SLED

INUVIK 1963 5 OF 5



WEDGES ARE
INSERTED TO HOLD
SLATS AFTER BENDING
(HOLDS TWO)

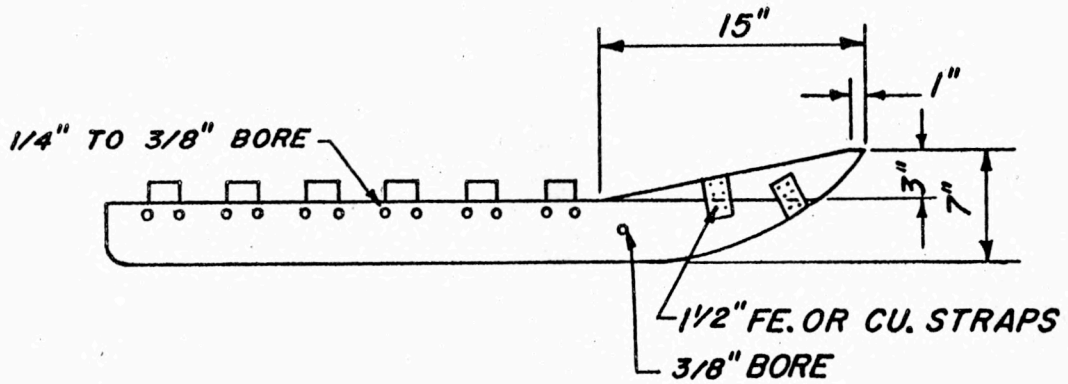
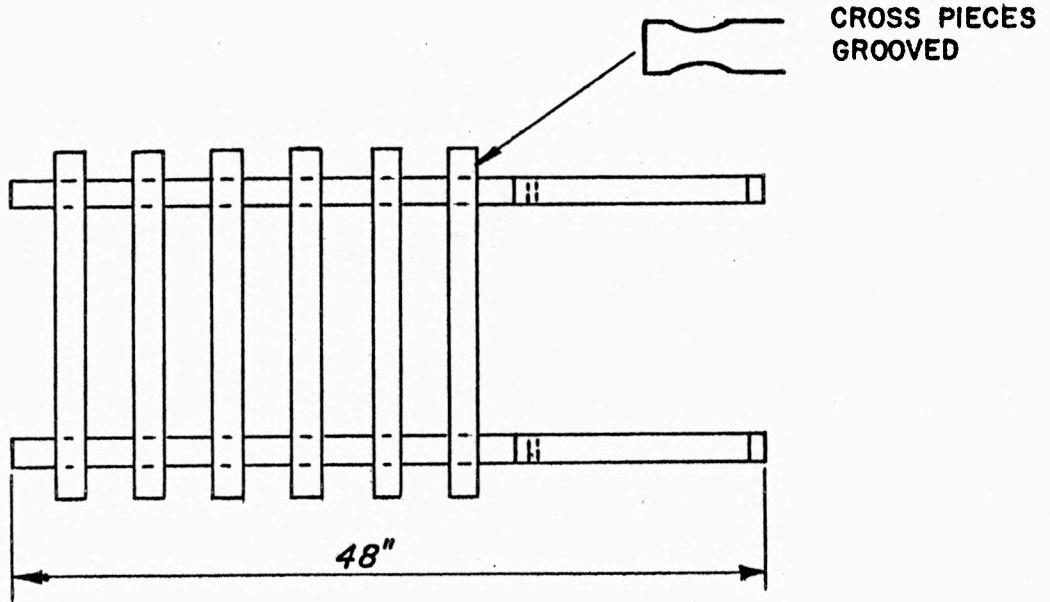


A SUITABLE
BENDING JIG

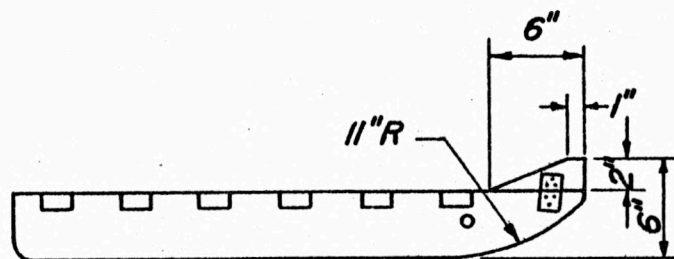
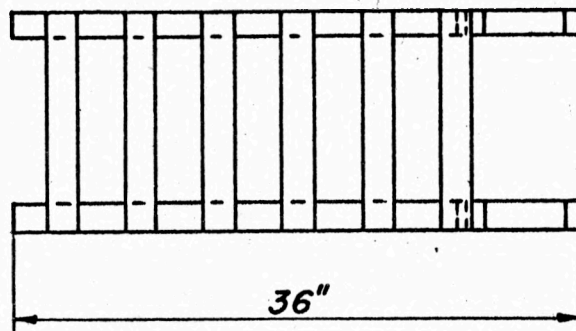
2X4'S AND 2X6'S ARE
USED IN CONSTRUCTION

ROPE TYPE SLED

RUNNERS: 2x4x48
CROSS PIECES 1x2x22.
RADIUS OF RUNNER - 22"



SOLID SLED

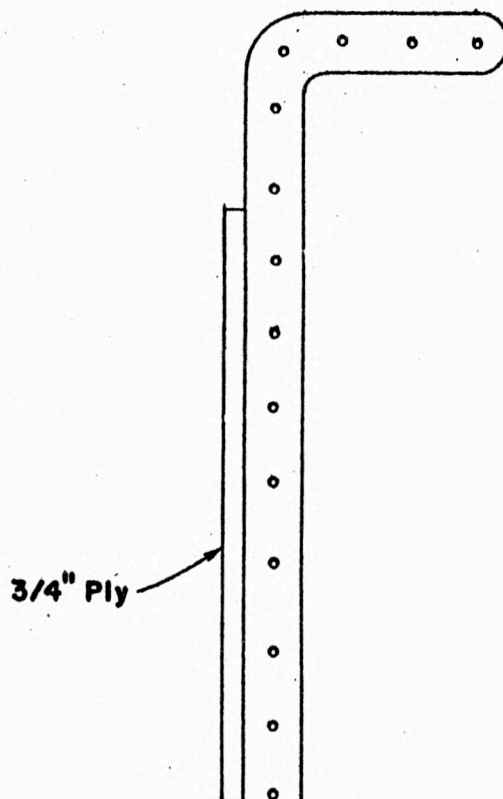
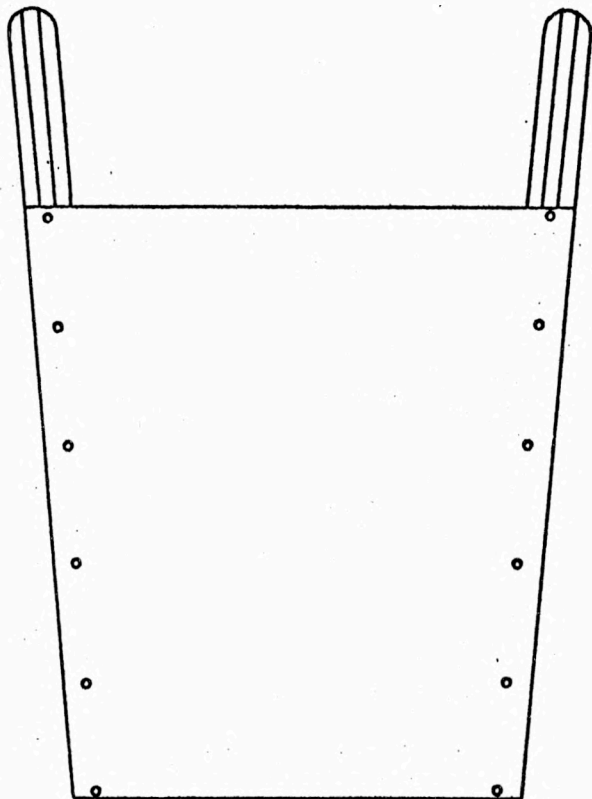


RUNNERS: 2x4x36

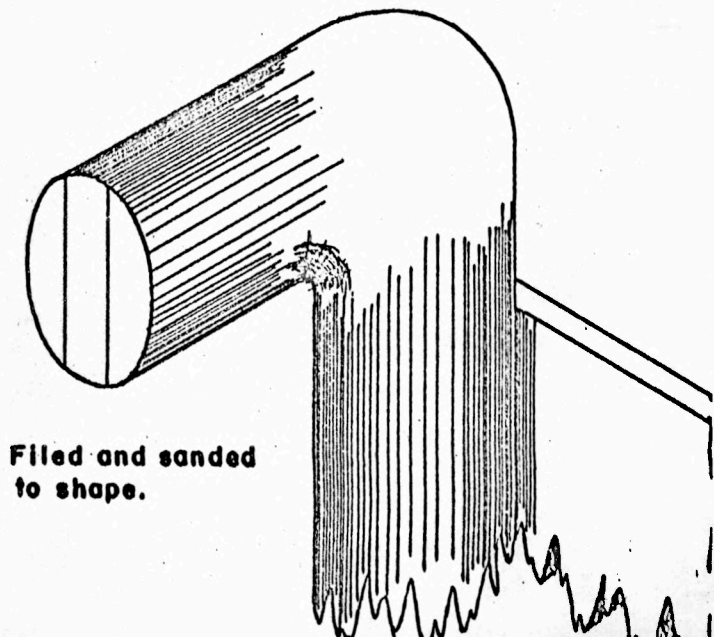
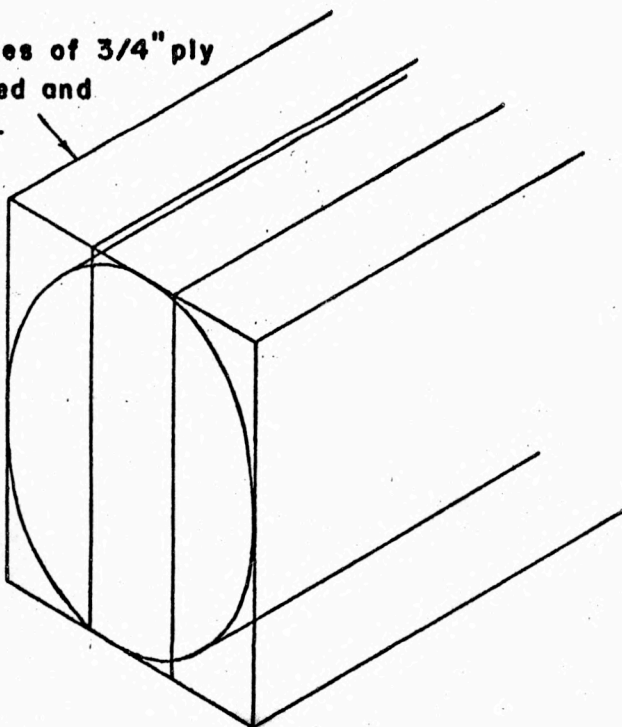
CROSS PIECES: 1x2x16

RADIUS OF RUNNER APPROX. 11"

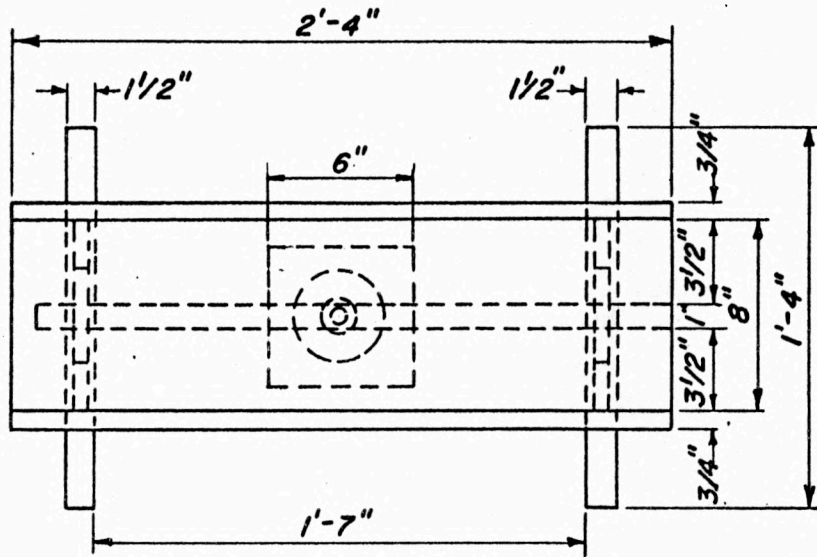
FORT McPHERSON SLED HANDLES-LOUCHEUX PATTERN



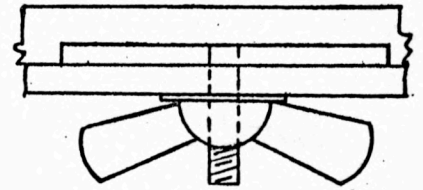
3 pieces of 3/4" ply
screwed and
glued.



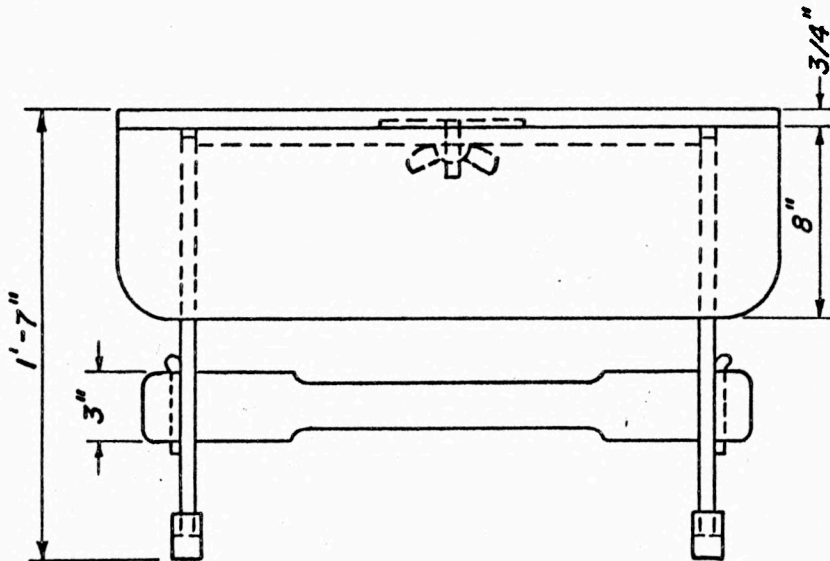
FOLDING TABLE



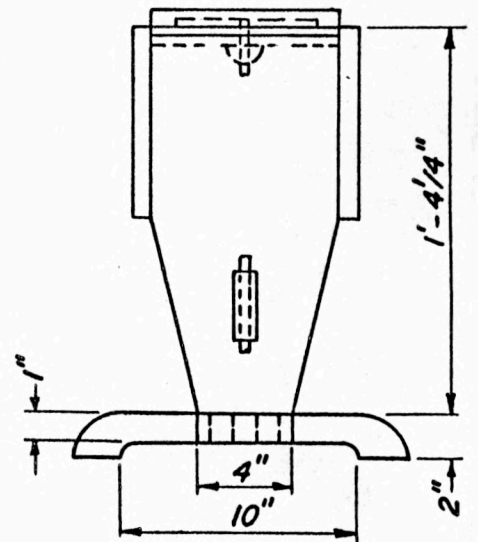
PLAN



WING NUT - DETAIL

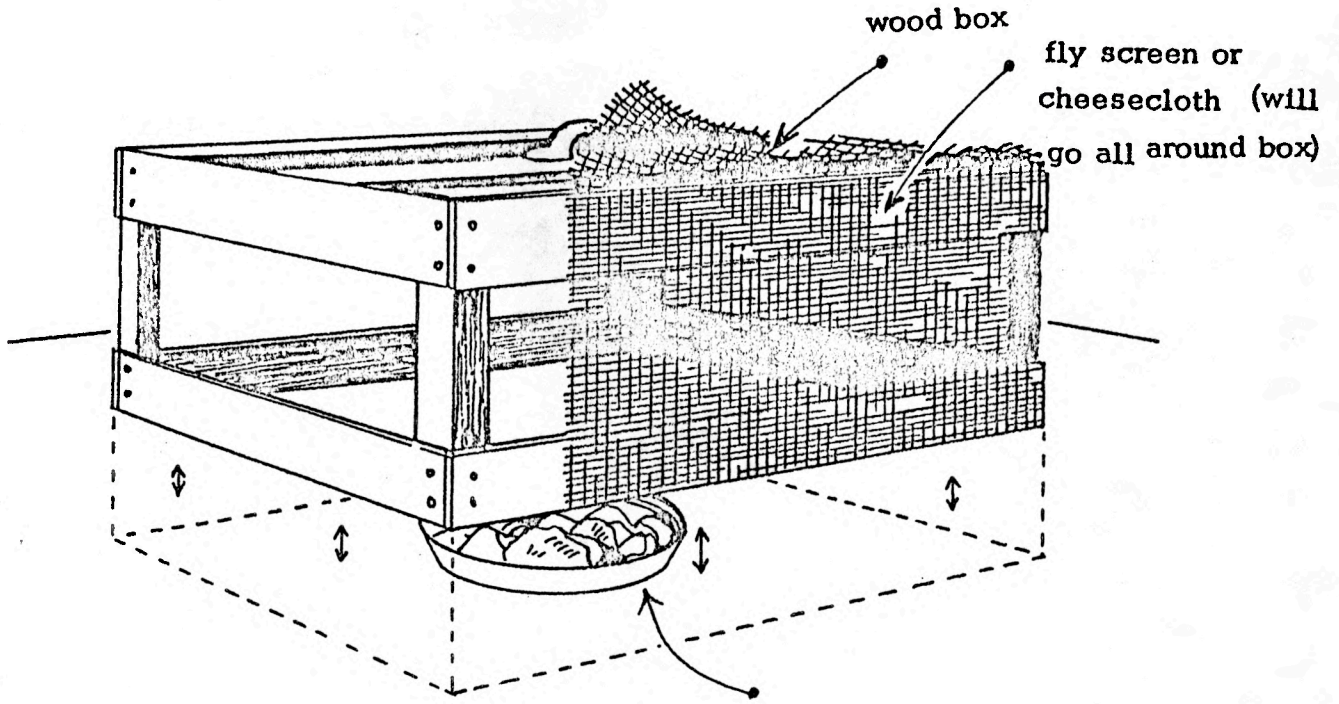


SIDE ELEVATION

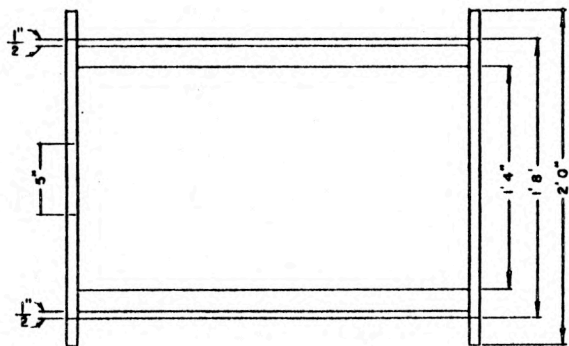


END ELEVATION

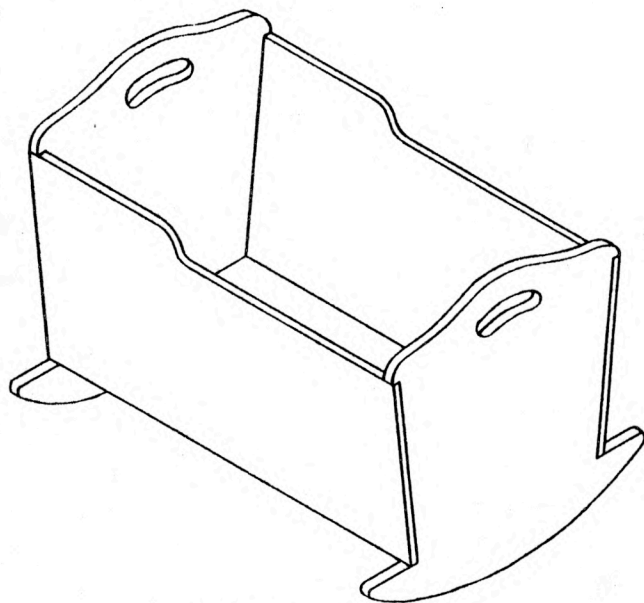
SCALE : 1/2" = 1'-0"



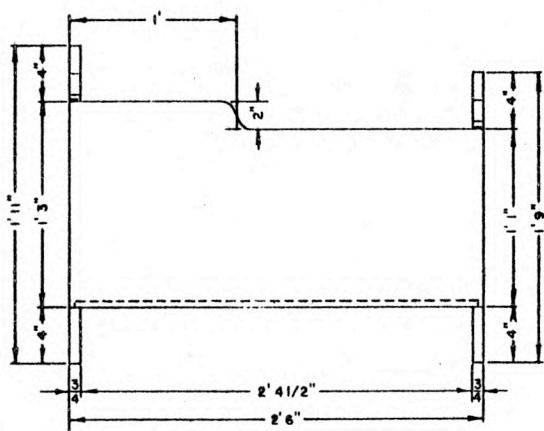
- 141 -
BABY CRIB



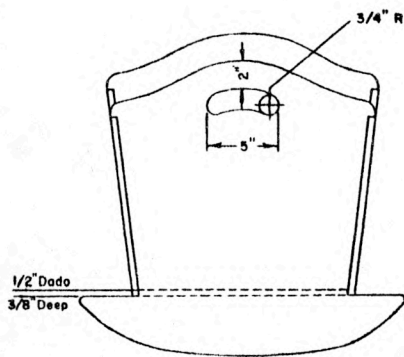
PLAN



ISOMETRIC



SIDE ELEVATION



END ELEVATION

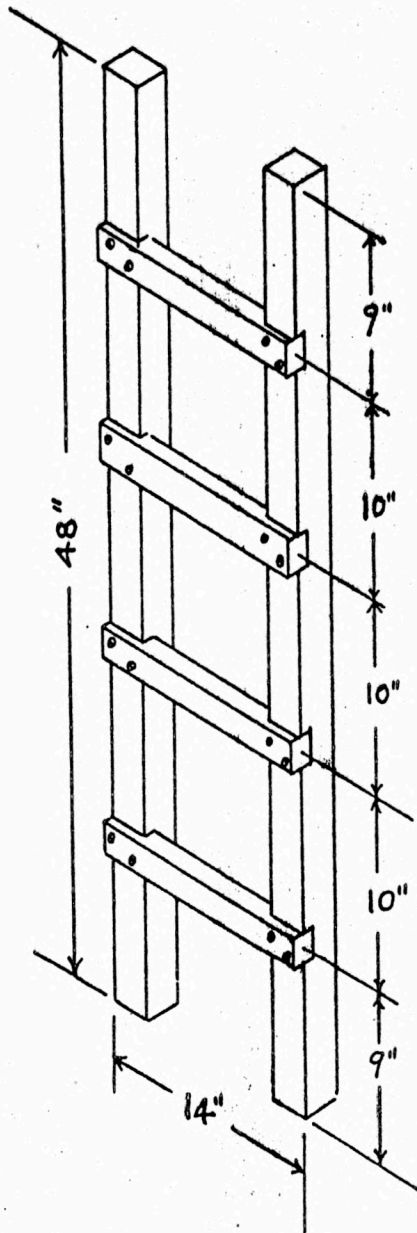
- SPECIFICATIONS**
 2 Ends - 3/4" Plywood
 2 Side - 1/2" Plywood
 Bottom - 1/2" Plywood

Scale: 1 1/2" = 1' 0"

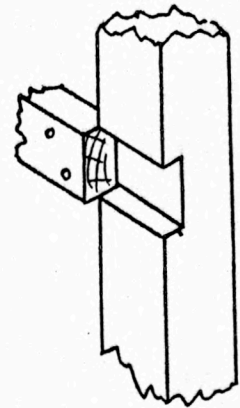
Small Ladder

A small ladder is intriguing to children and may be useful in the home. The length may vary with the ages of the children.

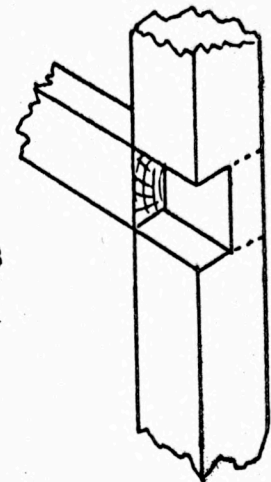
SMALL LADDER



DO cut posts like this
1/2 inch only.



DON'T cut posts for
rungs like this. Posts
will break on dotted
lines.



Use 2"x2" dressed for posts (8 feet)
Use 1"x2" dressed for rungs (6 feet)
Use flat-head screws drilling and
countersinking holes in rungs. If
you haven't a countersink use round-
head screws. (16 screws. 2 inch)

NOTE: 2 inch wood dressed is not 2 inches wide. Base cuts
on actual size.

Sandpaper all edges and corners round

Grub Box - Inuvik

Rough Stock

Sides	2 pcs.	3/4" x 9 1/4" x 26"
Ends	1 pc.	3/4" x 9 1/4" x 24"
Top	1 pc.	3/4" x 12 1/4" x 26"
Bottom	1 pc.	3/4" x 12 1/4" x 26"

Note: It is not necessary to follow the Steps for Planing Stock since the wood is already planed to thickness.

The Cover and Box are made as one unit and sawn apart after being assembled.

Sides and Ends

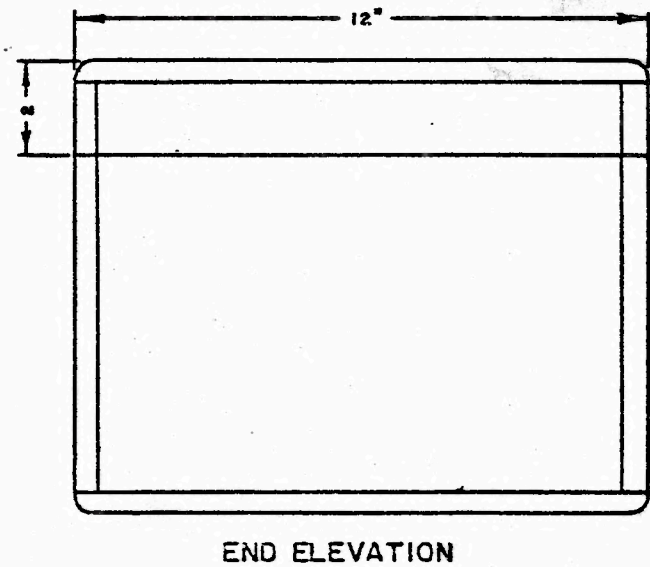
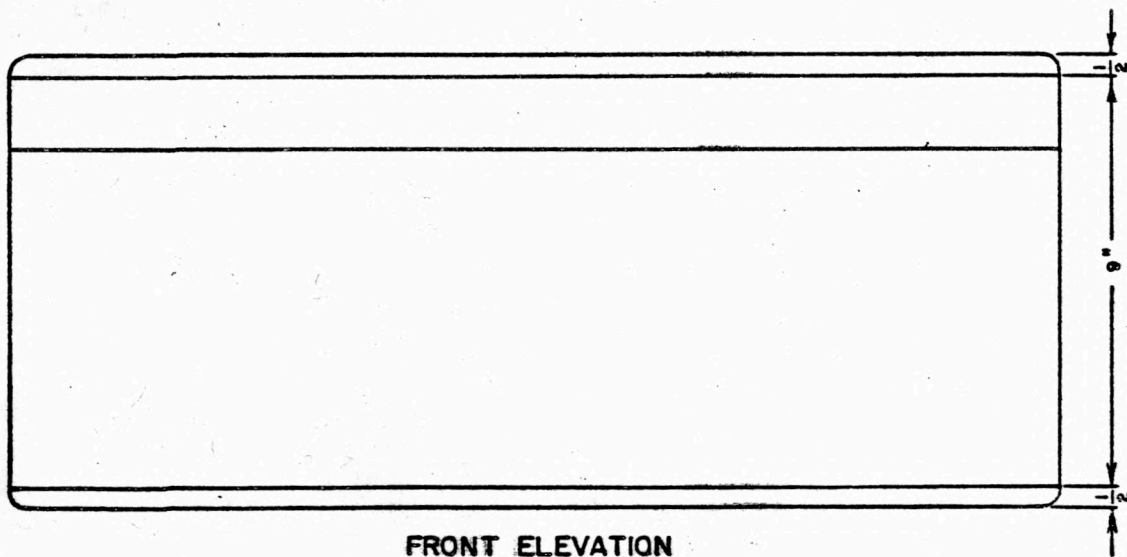
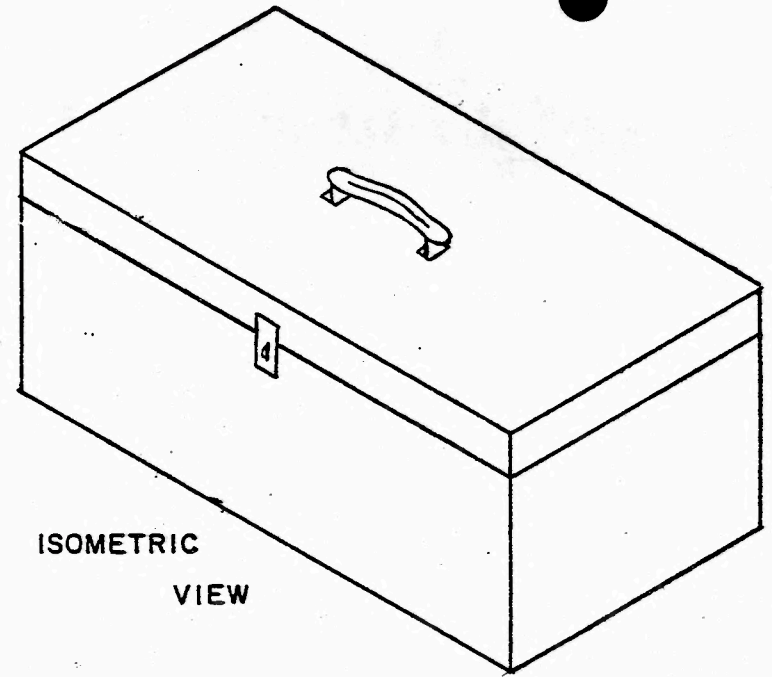
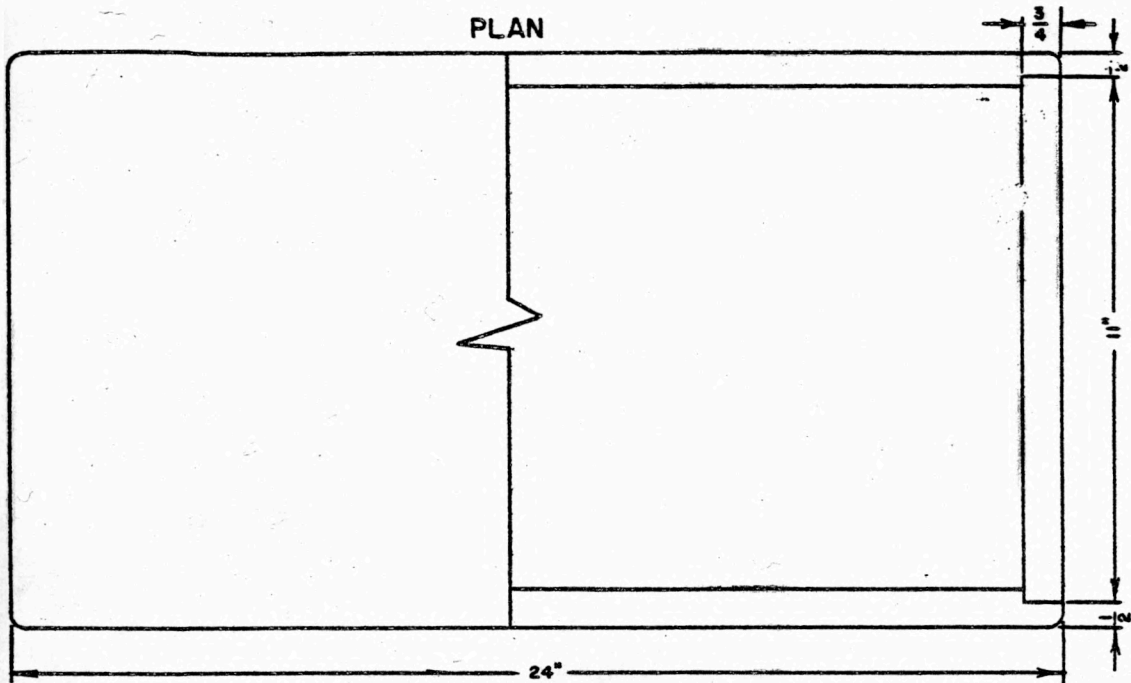
1. Plane one edge of each piece straight and square.
2. Gauge width on all pieces.
3. Plane to the gauge line.

(Note: When squaring the end on these pieces saw about 1/16" outside the line and finish with a plane set very fine.) Do not plane all the way across the end. Plane part way then finish by planing from the other edge.

4. Square one end on the two side pieces.
5. Square both ends of the piece to be used for the ends.
6. Square the sides to length. Square the ends to length.
7. Lay out and cut the end rabbet on the side pieces.
(This must be done very accurately.)
8. Have the rabbet cut in the sides to receive the lip which seals the joint between the box and the cover.

Top and Bottom

The procedure for the top and bottom is the same unless you use plywood. You will not find a piece wide enough to make the top and bottom so you will have to glue up three or four narrow pieces to make your 12 1/4" width.



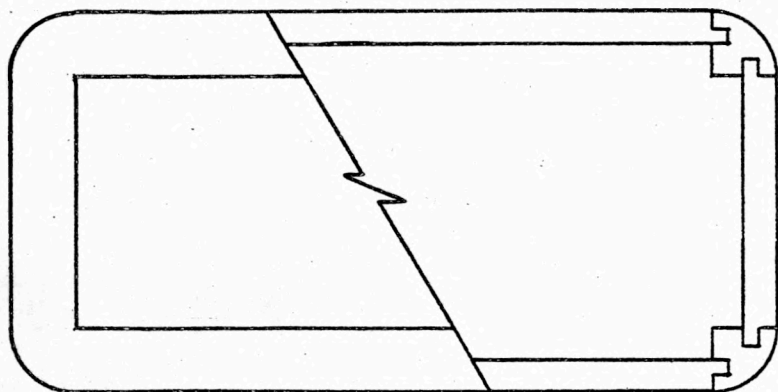
GRUB BOX
INUVIK

SCALE: 3" = 1'-0"

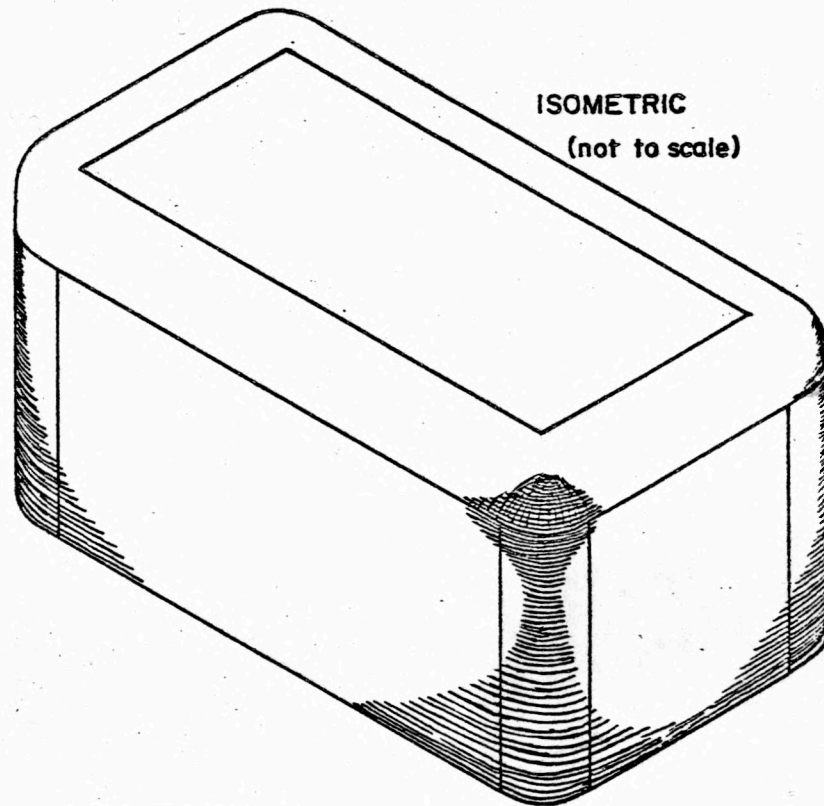
- 145 -

ALTERNATE DESIGN FOR GRUB BOX INUVIK

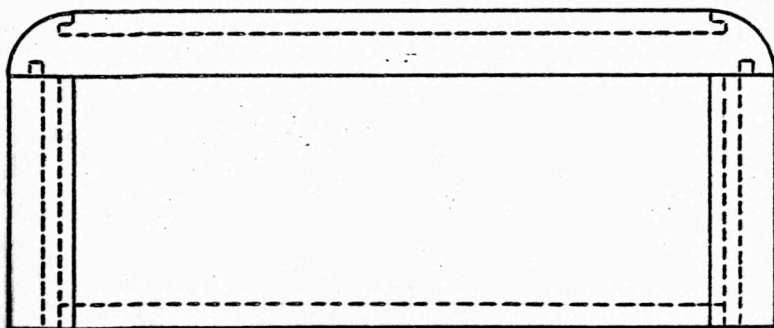
Scale: 2" = 1'-0"



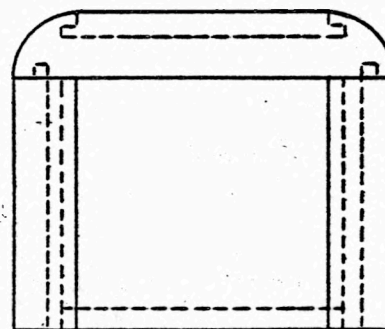
PLAN



ISOMETRIC
(not to scale)



FRONT ELEVATION

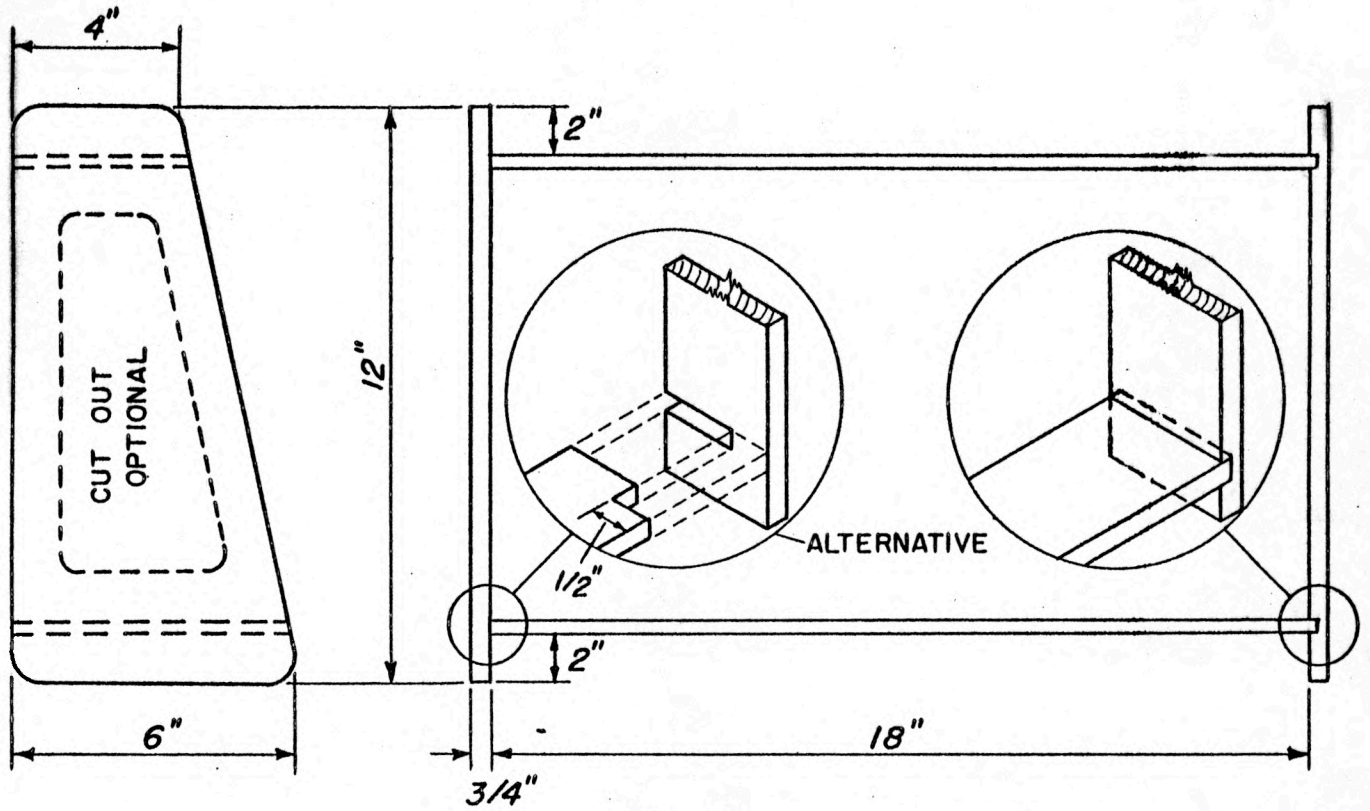


END ELEVATION

SPECIFICATIONS

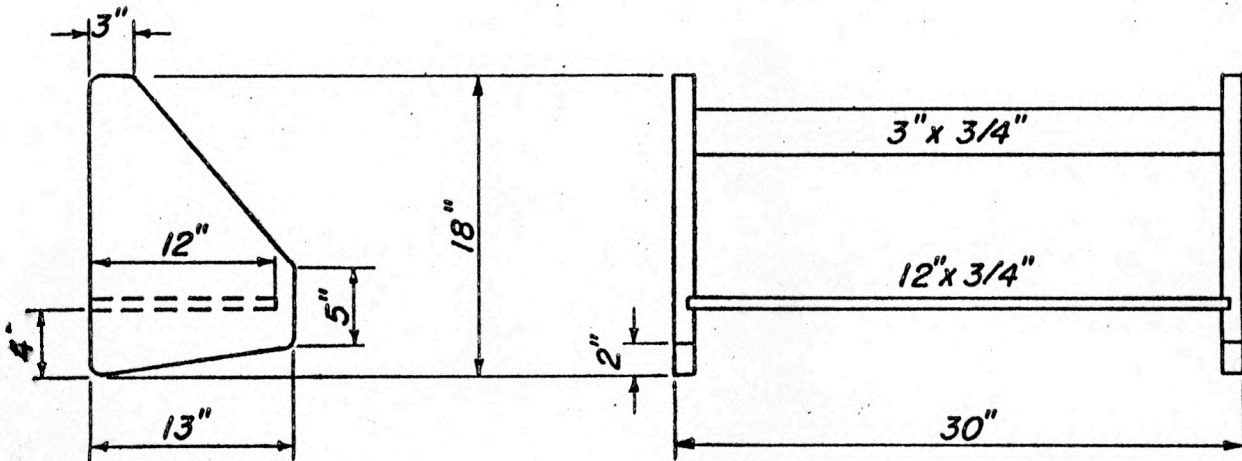
4 pieces 2" x 2" x 8" for corner posts, 2 pieces, 2" x 2" x 12" for ends of lid
 2 pieces 2" x 2" x 24" for sides of lid, 2 pieces 3/4" plywood 8 1/2" x 21" for sides
 2 pieces 3/4" plywood 8 1/2" x 9" for ends, 1 piece 3/4" plywood 9" x 21" for top
 1 piece, 3/4" x 10" x 22 1/2" for bottom

WALL SHELF



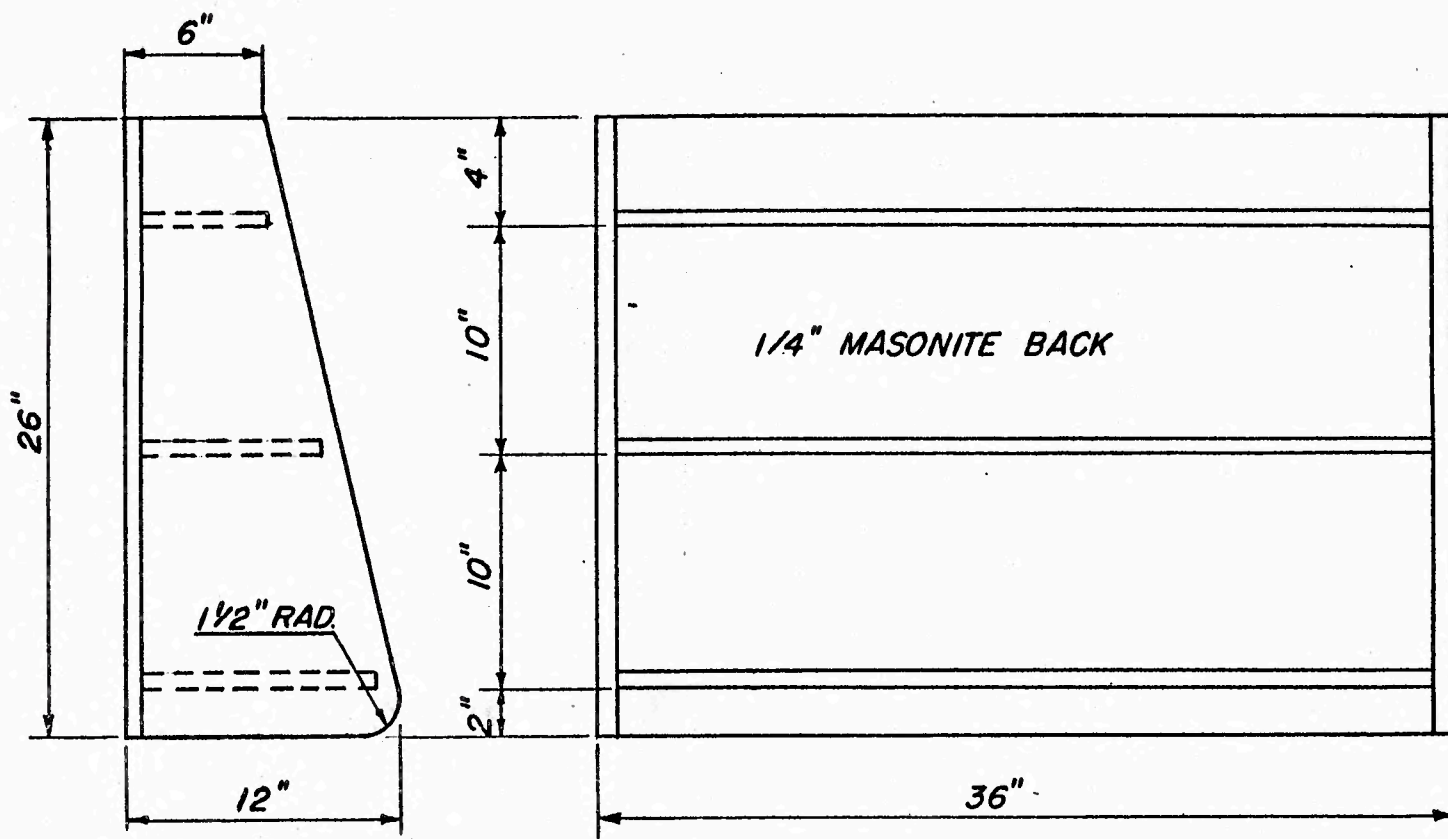
SCALE: 3" = 1'-0"

ALTERNATIVE



SCALE: 1" = 1'-0"

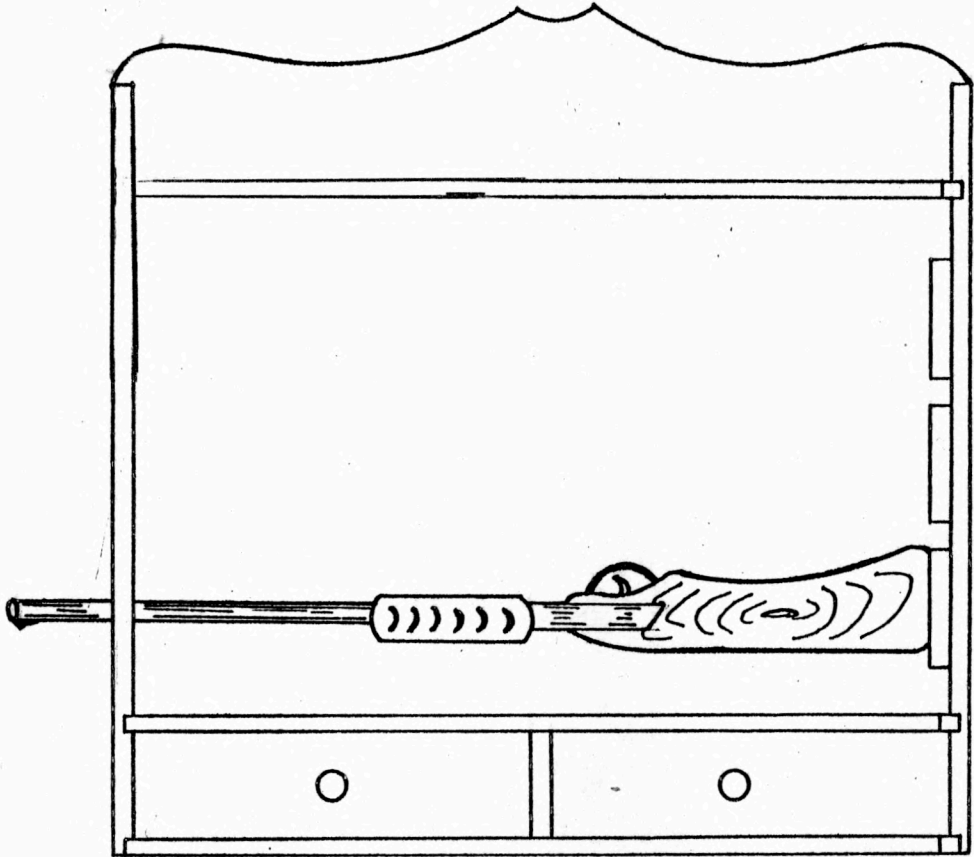
WALL HUNG BOOKSHELF



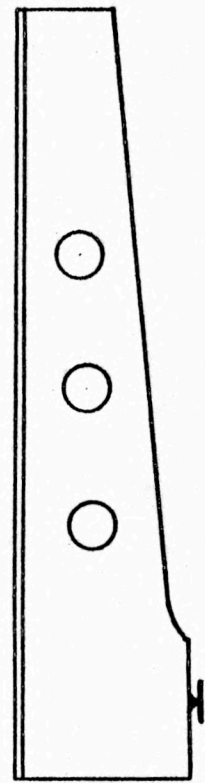
SCALE: 1/2" = 1'-0"

PROJECT VID ⁻¹⁴⁹⁻ FORT McPHERSON
 GUN RACK... SCALE = 1/8

J. MORGAN. 1963

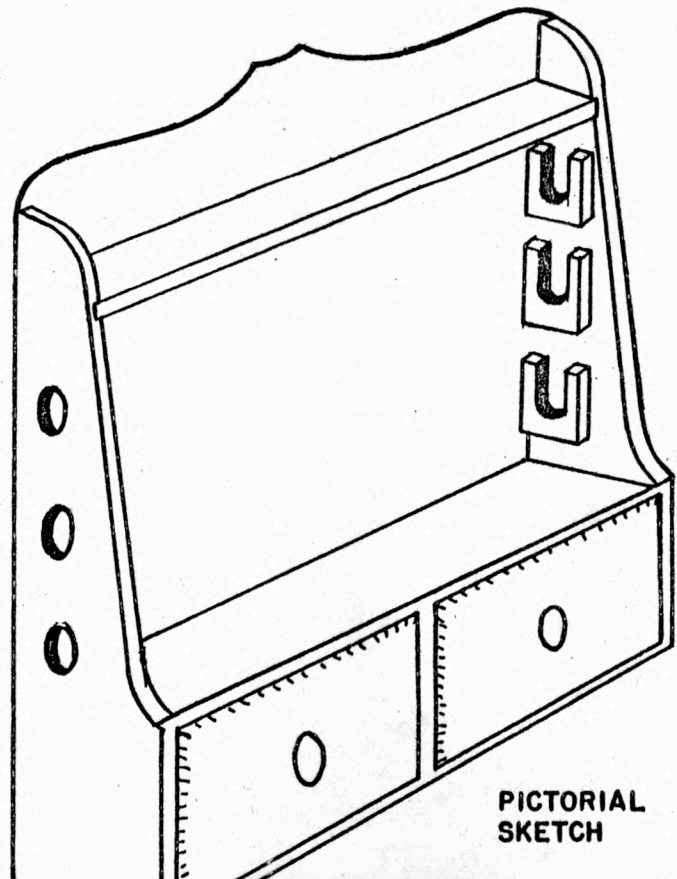


ELEVATION



END ELEVATION

1/4" PLYWOOD
 BACK

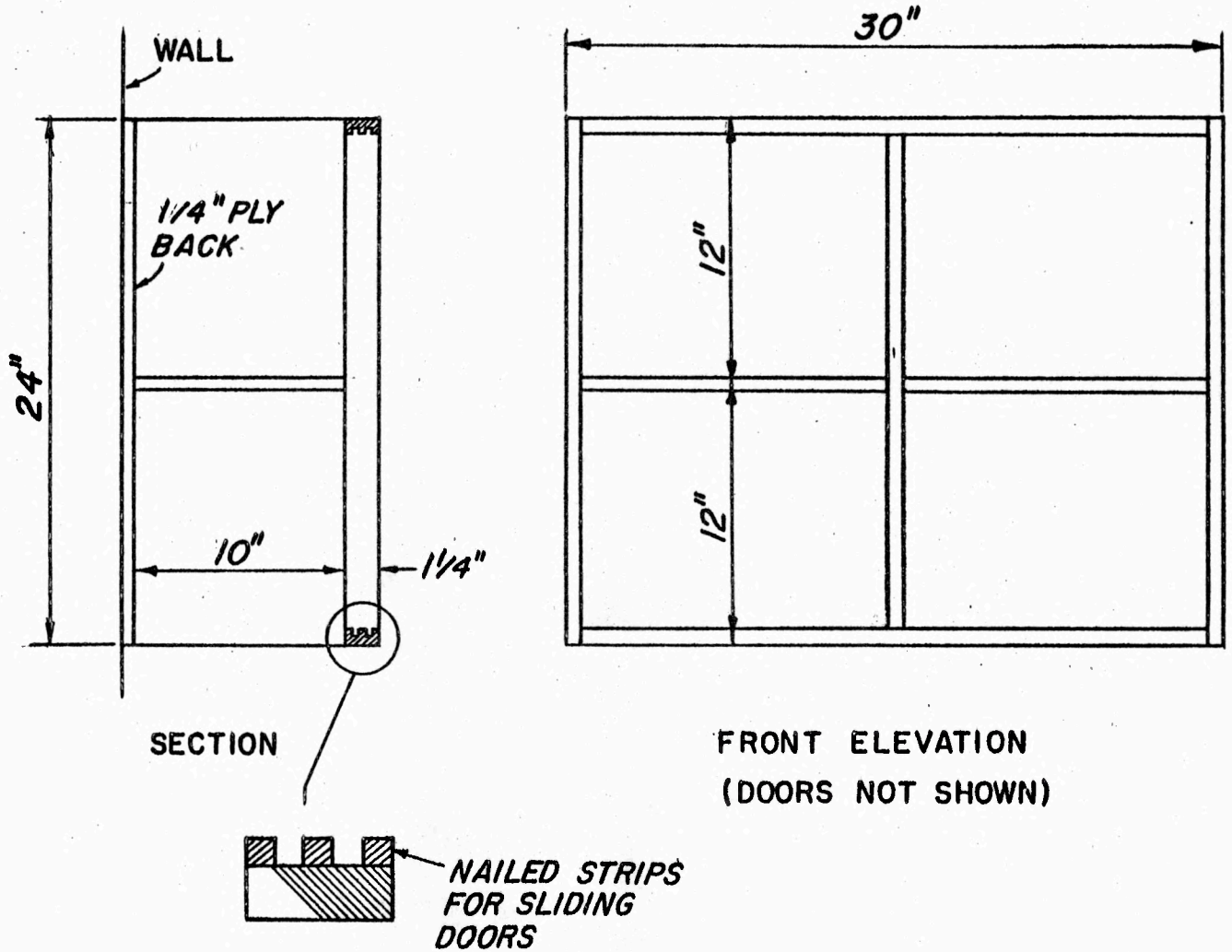


PICTORIAL
 SKETCH

Drawer Detail May Be
 Formulated According To
 Ability. Mass Production
 Ideas Used In Construction
 Of Dado Joints And
 Rebates.

MACHINE TOOLS :
 Table Saw + Dado Head
 Jig Saw, Drill Press
 Belt Sander.

WALL CUPBOARD

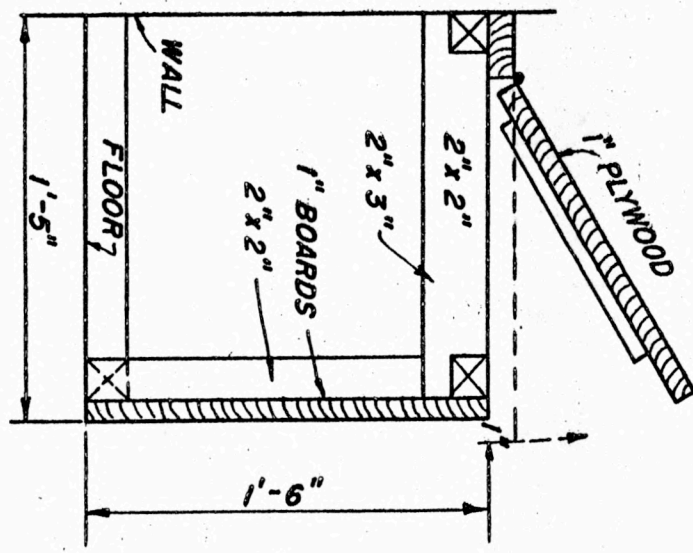
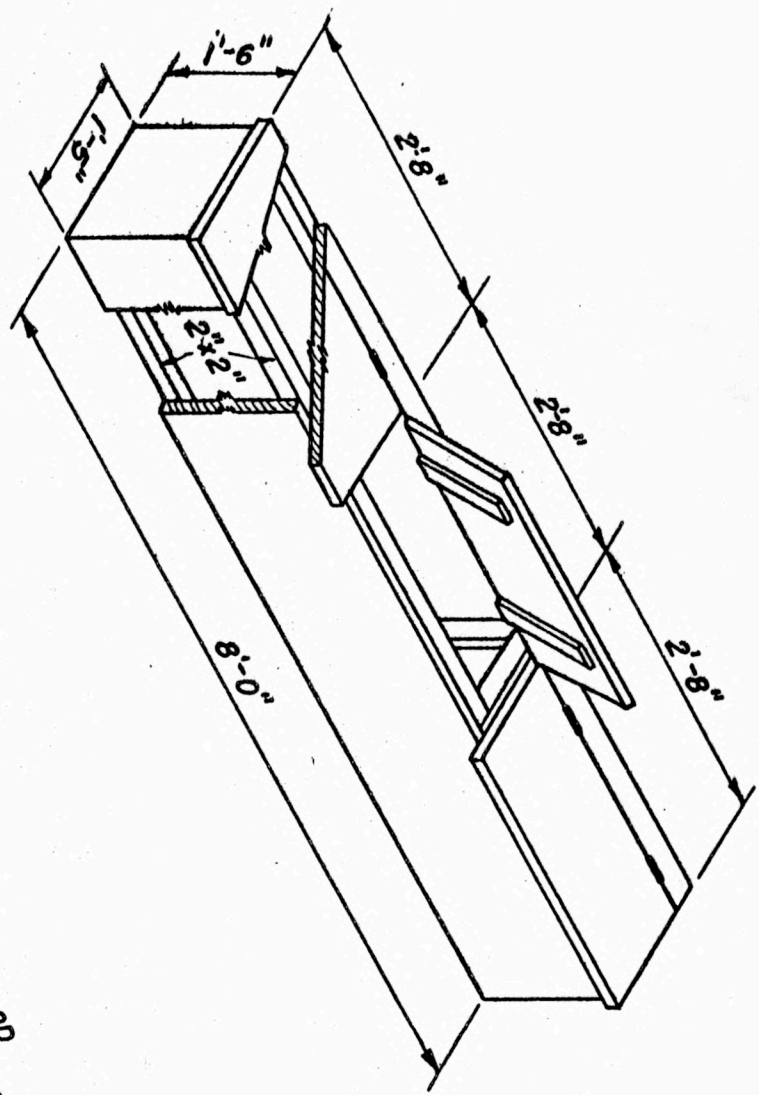


SECTION

FRONT ELEVATION
(DOORS NOT SHOWN)

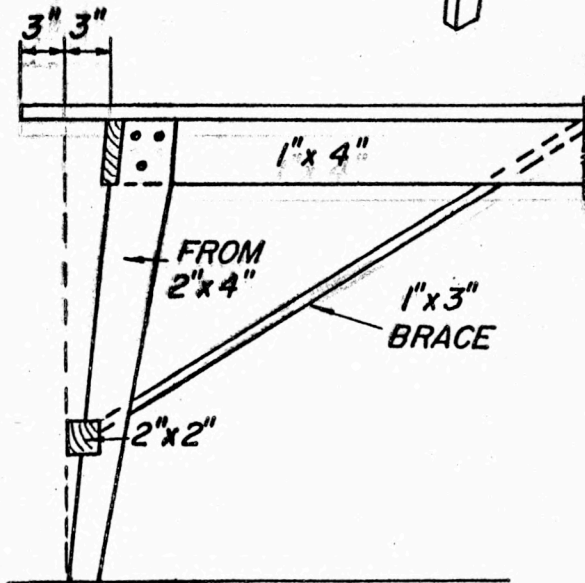
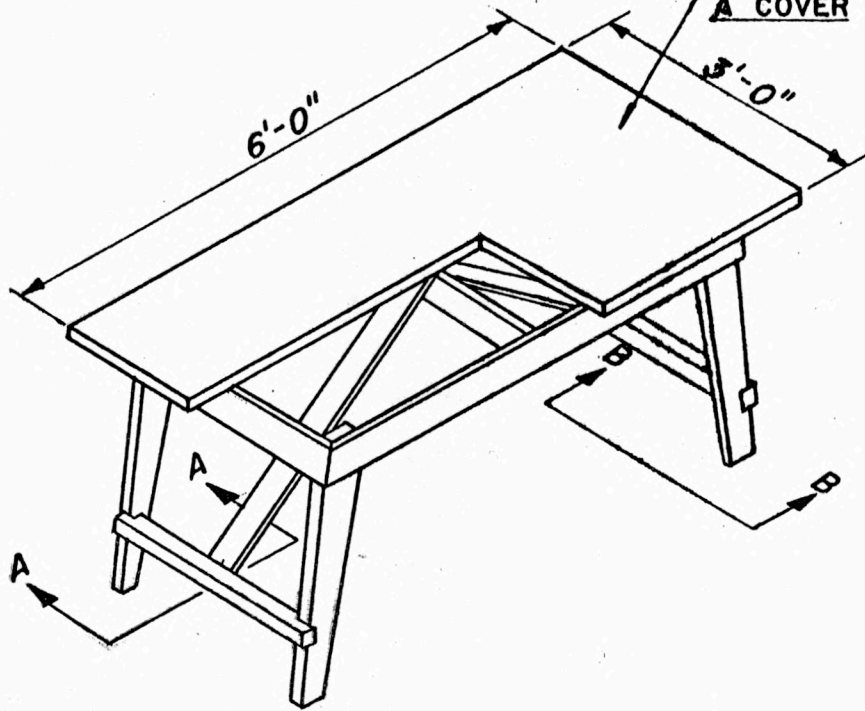
SCALE : $1\frac{1}{2}" = 1'-0"$

WALL BENCH & STORAGE

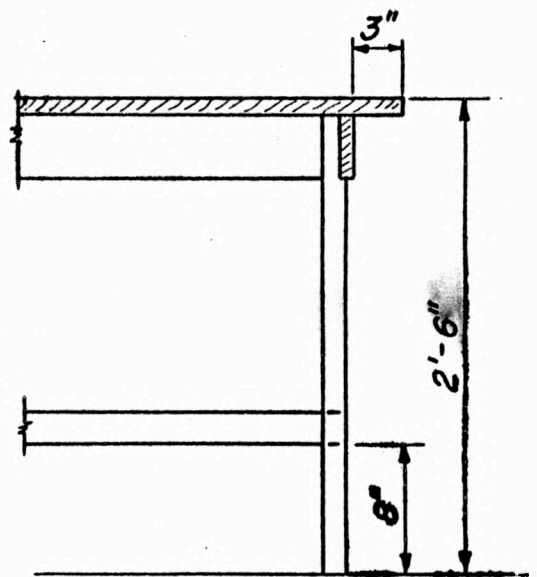


SOLID TABLE

TOP MAY BE PLYWOOD OR
PLANKS WITH OR WITHOUT
A COVER



SECTION A-A

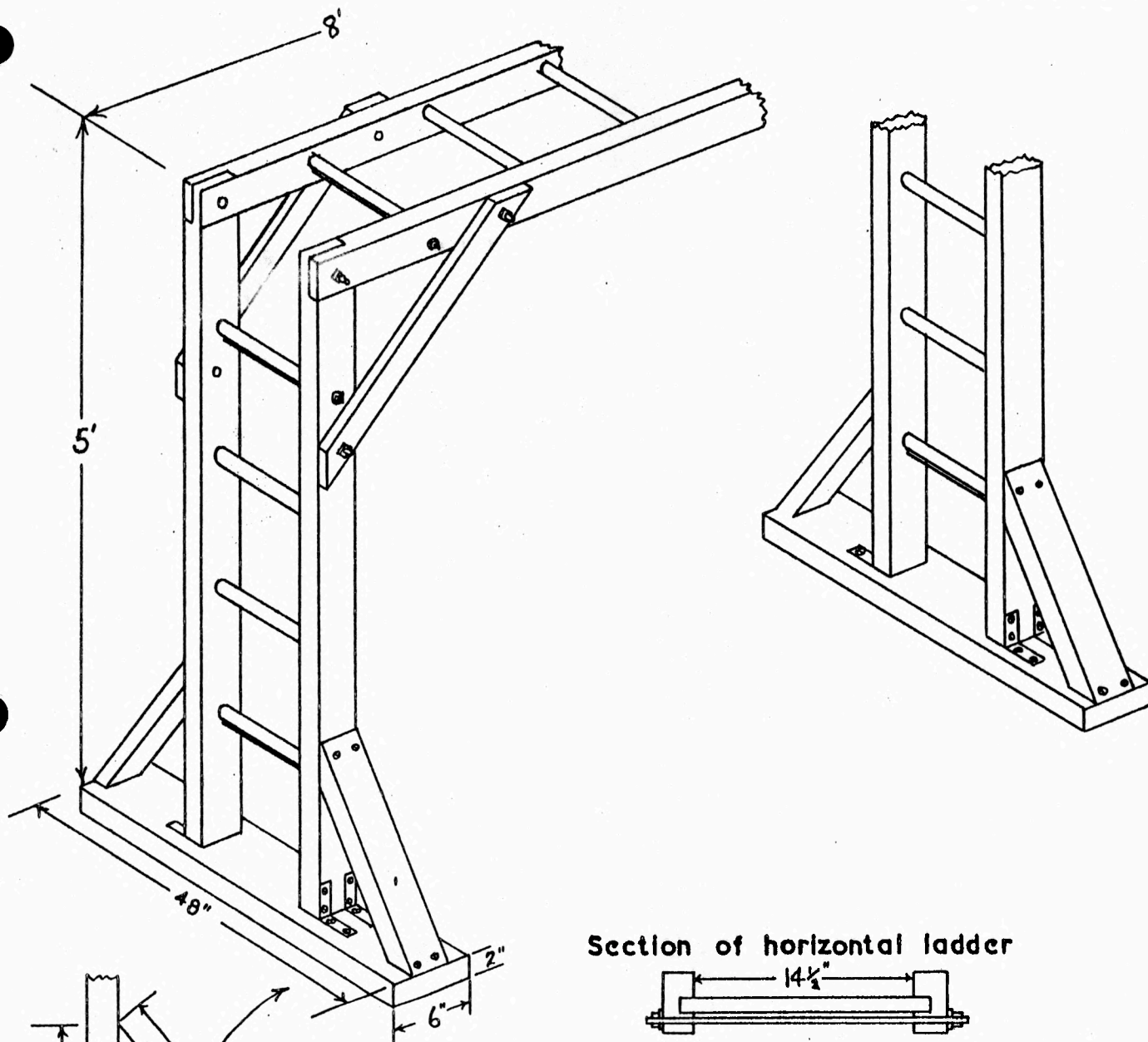


SECTION B-B

Climbing Arch

The climbing arch can be used indoors and outdoors. It is designed primarily for very young children but children of all ages will use it for make believe play. A swing may be hung from the cross bar or a plank placed on top of the rungs on the cross bar to make a platform.

CLIMBING ARCH



Section of horizontal ladder

- Requires: 10 feet 1"x2" dressed
44 feet 2"x4" dressed
20 feet 1" round hardwood
8 feet 2"x6" dressed
8 4" brackets
7 pieces iron rod 1/4" diameter
threaded both ends. with nuts
and washers. (tie rods)

Use tie rod under each end rung of ladders
and one in centre of horizal ladder.

Sand all corners and edges round.

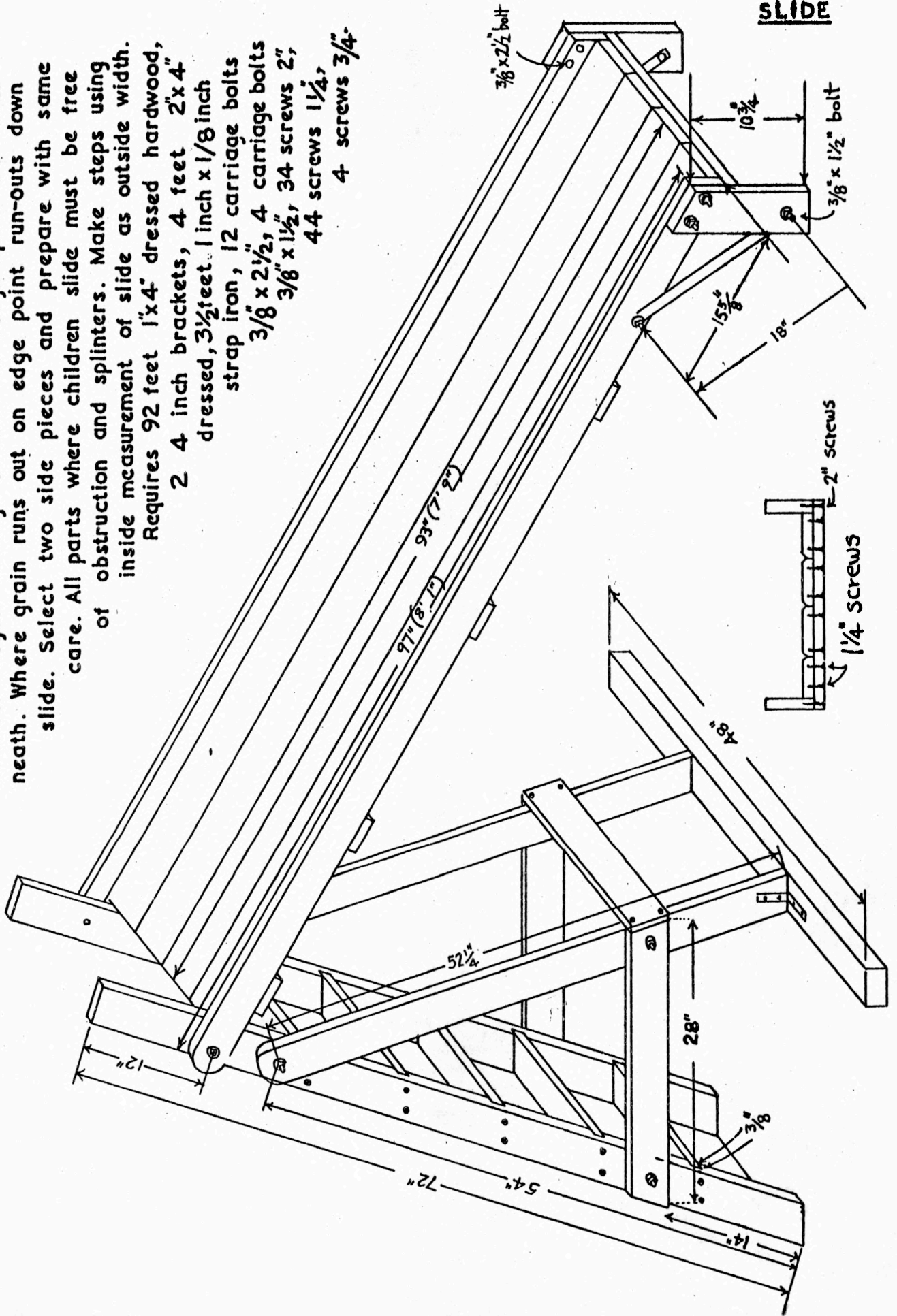
SLIDE

This slide could be used outdoors or indoors. It is sturdy but not very high. However, it will supply an outlet for high spirits and an opportunity to teach some elementary safety rules.

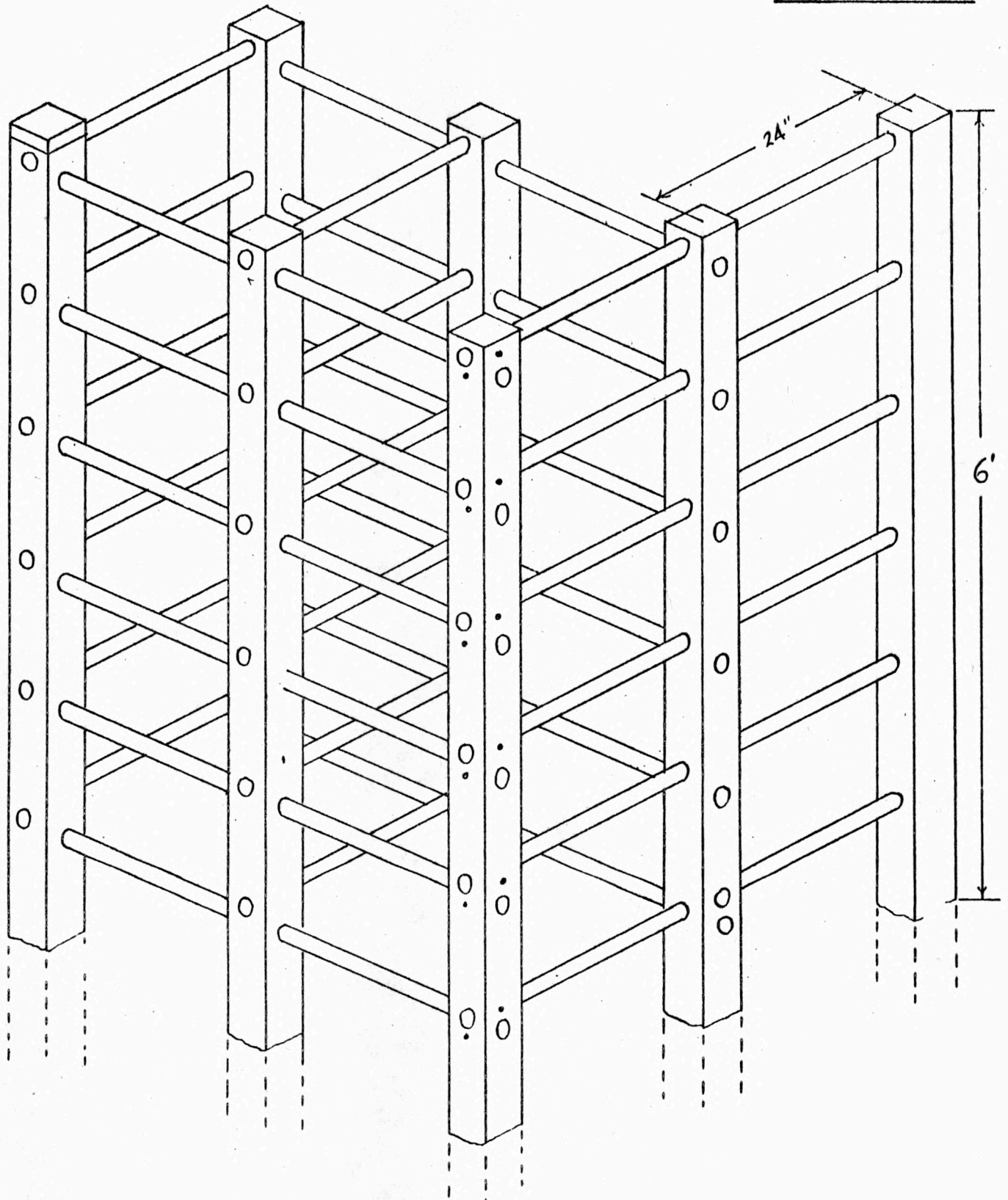
Except for 48 inch steadying bar (2x4) all wood is 1x4 dressed
All 1"x4" should be hardwood. Select four 8 foot lengths.

Chamfer edges. Arrange so that all rough spots are under-
neath. Where grain runs out on edge point run-outs down
slide. Select two side pieces and prepare with same
care. All parts where children slide must be free
of obstruction and splinters. Make steps using
inside measurement of slide as outside width.

Requires 92 feet 1"x4" dressed hardwood,
2 4 inch brackets, 4 feet 2"x4"
dressed, 3 1/2 feet 1 inch x 1/8 inch
strap iron, 12 carriage bolts
3/8" x 2 1/2", 4 carriage bolts
3/8" x 1 1/2", 34 screws 2",
44 screws 1 1/4",
4 screws 3/4"

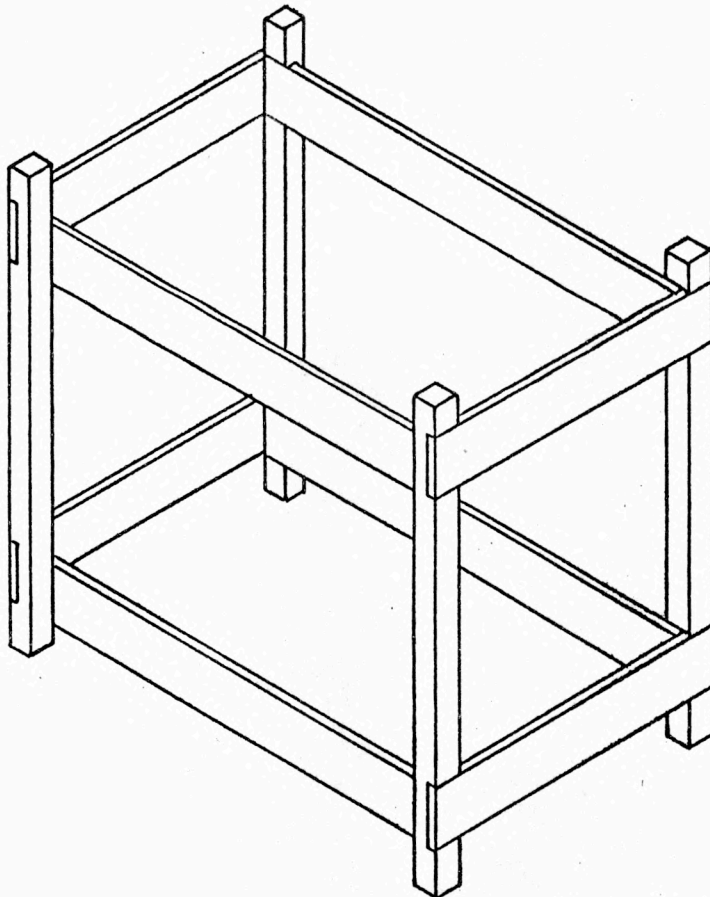
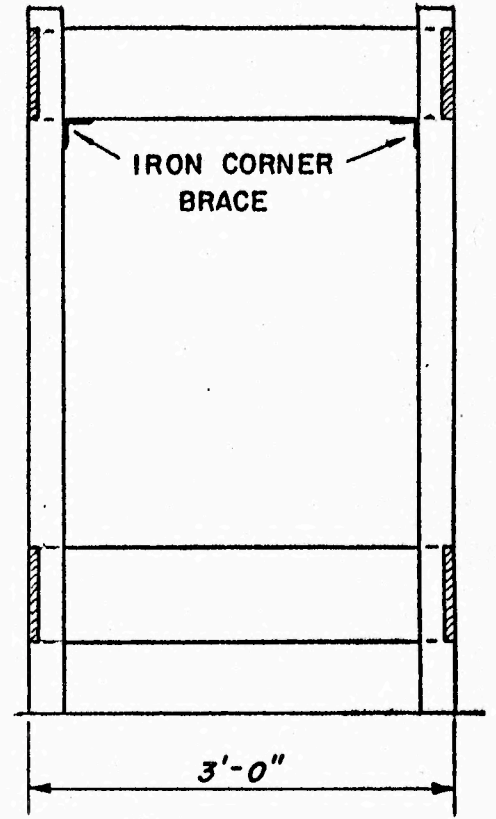
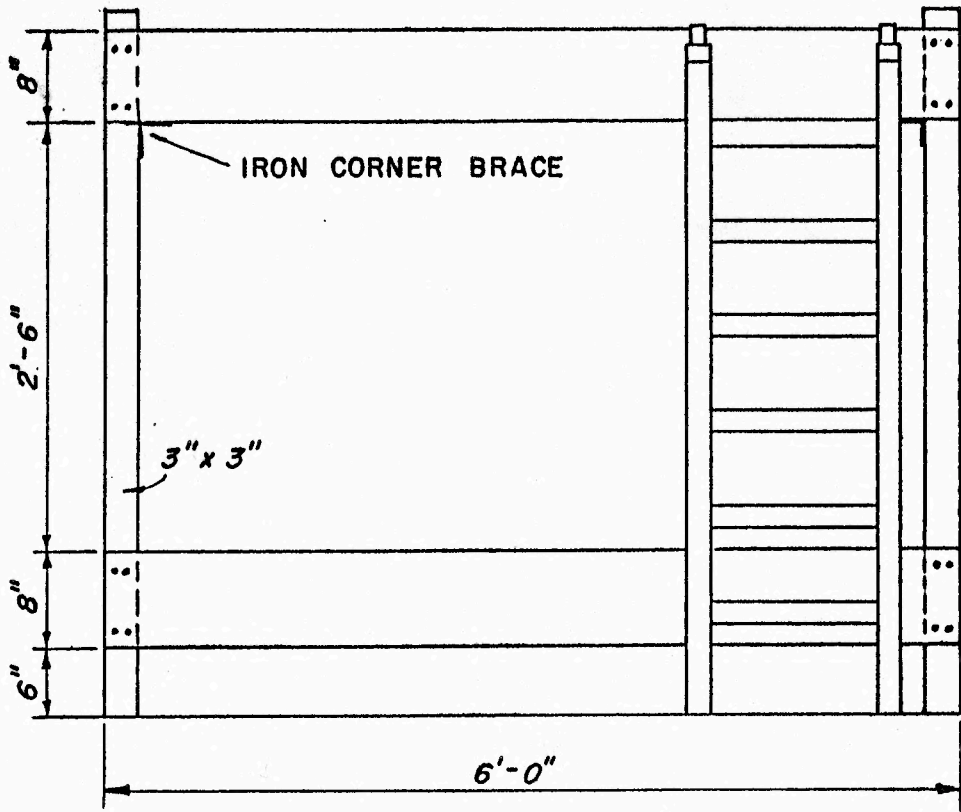


JUNGLE GYM

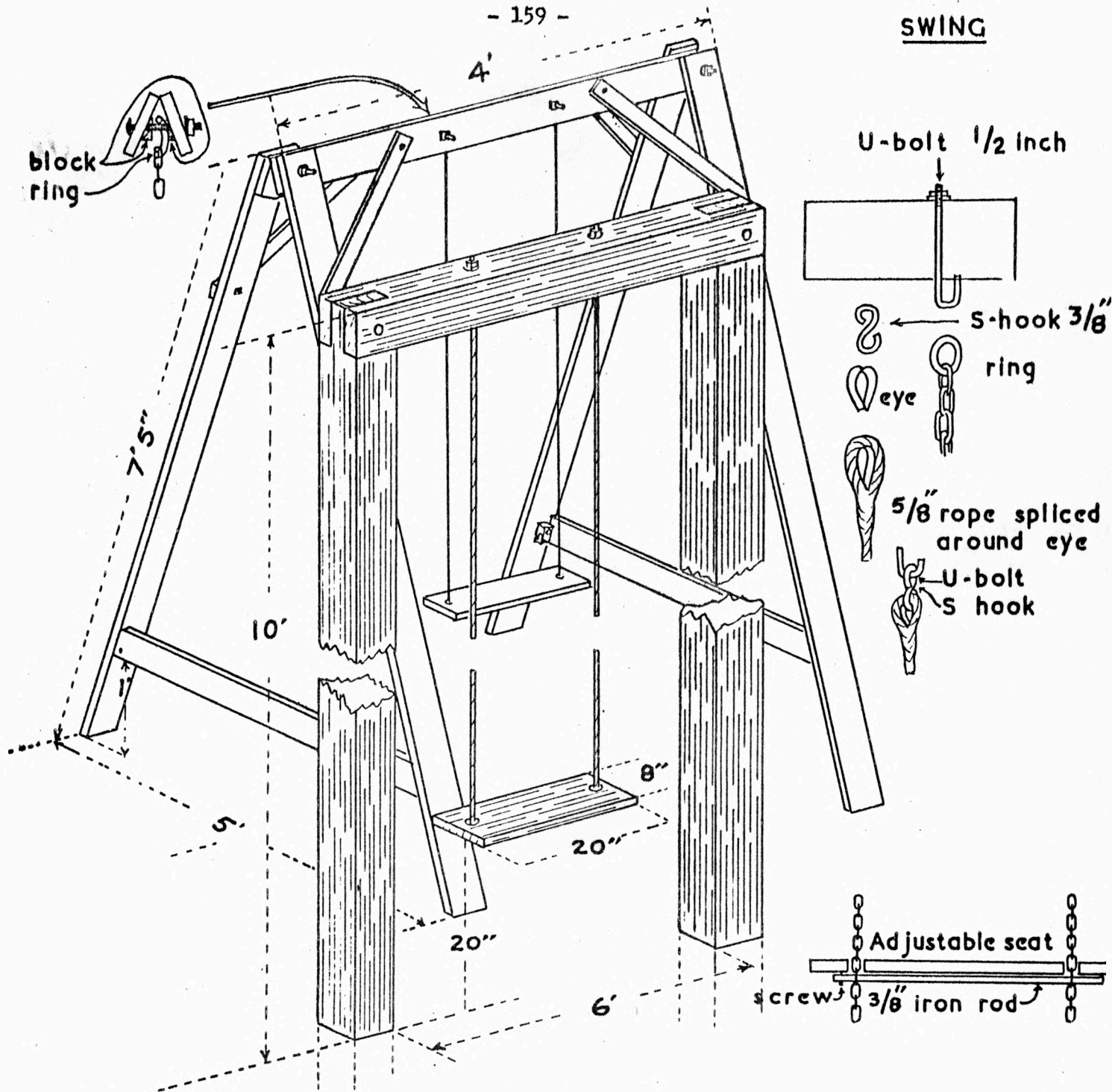


Use 4"x4" for posts (dressed)
1 1/4" hardwood dowelling for rungs.
Cap each post with 1"x4"
Any number of units can be made.
Bury ends 2 feet in ground.

BUNK BED



SWING



Swing frame can be built in many ways. 2" pipe is good. The two shown here serve different purposes. Front one will serve as family swing for many years. One in rear will do until children are about 8. The first is firmly fixed; second can be dismantled or moved.

Build the first swing of 6"x6" wood. Posts must be set in concrete, 1 1/2' x 1 1/2' x 3' deep in ground. If concrete is not used, firm bracing well anchored is required. With one more post this swing will serve as a basis for a horizontal bar. U-bolts can be made by blacksmith. For second swing use 1"x4" hardwood braced at top by 1"x2". 1/2" x 6" carriage bolts are used at top and 1/4" x 2 1/2" bolts on bracing. Use rope or chain.

Protect buried portions with creosote.

Grease moving parts also all bolts you wish to remove later.

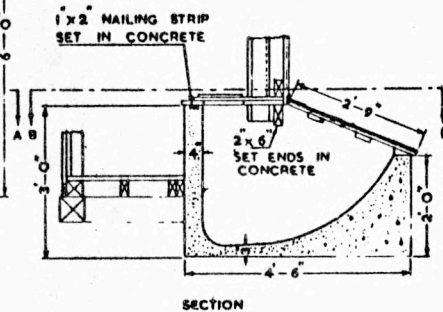
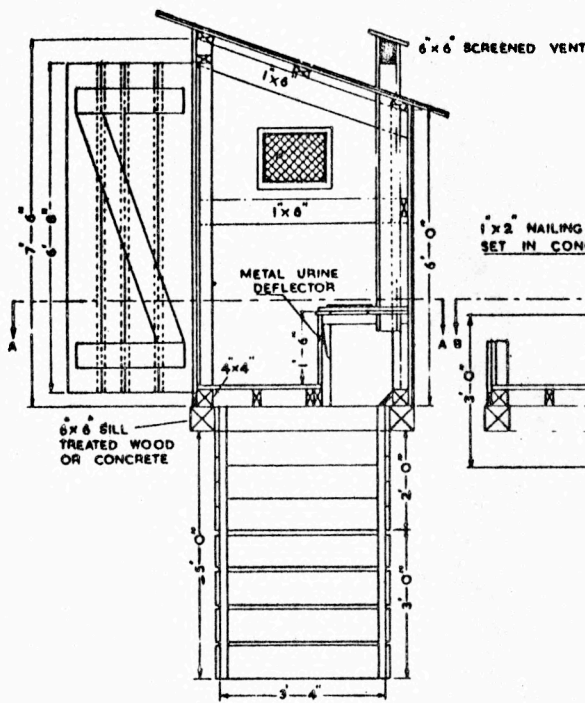
SANITARY PRIVY

PIT TYPE

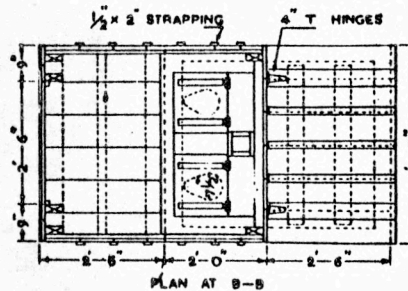
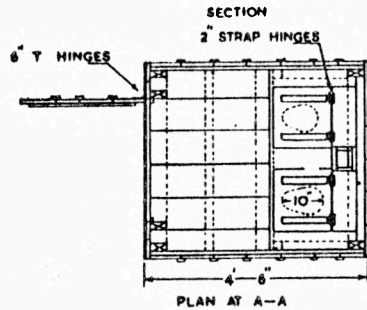
VAULT TYPE

MEMORANDA

ALL BOARDING TO BE 1" THICK, STUDS AND JOISTS TO BE 2x4" EXCEPT WHERE SHOWN.
 ALL OPENINGS TO BE SCREENED AND MADE FLYPROOF.
 A WEIGHT AND PULLEY OR SPRING SHOULD BE USED TO MAKE DOOR SELF-CLOSING.



DO NOT USE THIS TYPE OF PIT UNLESS YOU HAVE A PLACE FOR DISPOSAL OF SEWAGE.



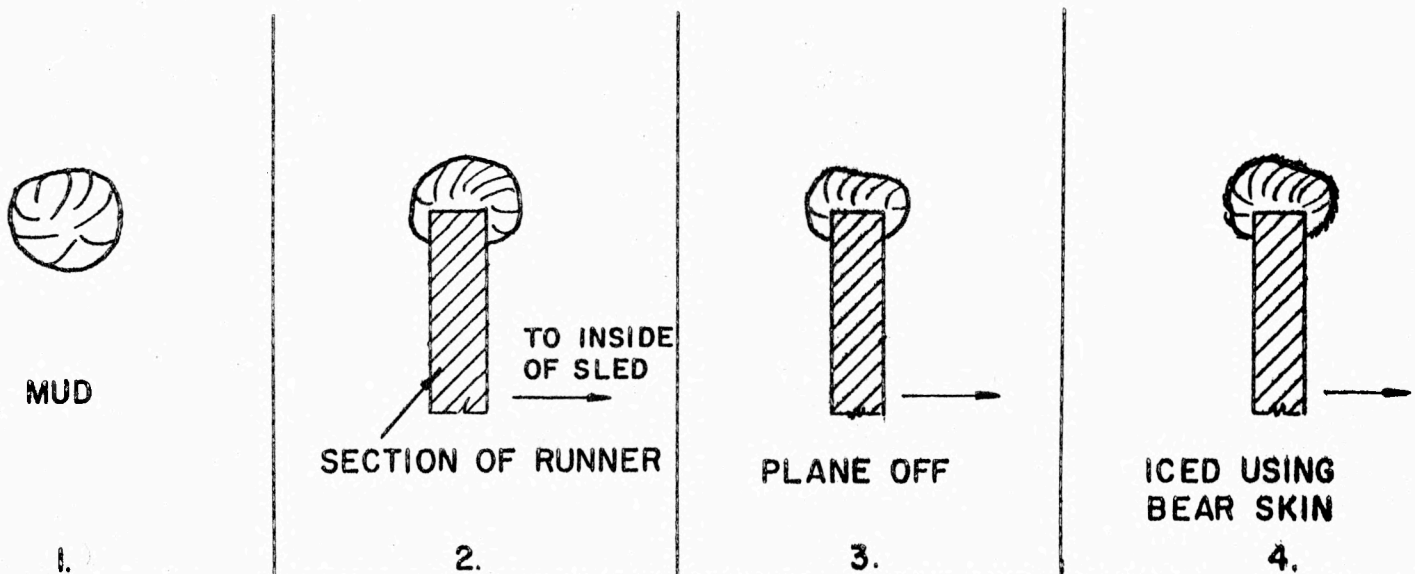
APPLICATION OF MUD ON SLED RUNNERS

G. Bossé,
Rankin Inlet.

Mud for sled runners is generally found around lakes or on hill tops. The mud is dark in colour and should be free from gravel or roots. Importance should be placed in the choosing of the mud in order to prevent easy breakage after hardening due to different grades of mud.

The mud is placed in a large container and mixed with an amount of water usually equal to about half the amount of mud. The sled is then placed with the bottom of the runners facing up. A fly screen may be nailed first under the runner before the mud is applied. The latter step is of great importance if the sled is being pulled but by a device other than a team of dogs where the mud is vigorously shaken.

Start applying the mud from the front of the sled by taking a handful of mud, rounding it into a ball and fitting it onto the runner as illustrated.



Figure

The mud is then left to dry outside for approximately two or three hours. The mud may be applied to the runners either inside or outside of a building but the drying has to be done outside in the cold. The mud is then planed to the shape as shown on the previous page, Ref. No. 3. A little more mud is planed off the inside of the runner than the outside in that the sled follows a straight trail. Water is then applied with a polar bear fur on top of the mud in order to make the mud more slippery. The mud should be watered every time the sled is used for any length of time.

PLAY EQUIPMENT

For permission to reproduce the drawings of play equipment included in the text, we are grateful to the Department of National Health and Welfare.

These projects should prove challenging enough for pupils of any age and be of value to the general school population. Some of the equipment could probably best be built as a group project in the shop and the pupils may become interested in proper use and maintenance of it in the school yard or kindergarten rooms.

Objectives

1. To introduce the pupils to woodworking skills commensurate with their maturity and ability.
2. To introduce to the use and care of tools.
3. To encourage the development of a sense of responsibility to improve the environment, and the initiative to act on this responsibility.
4. To encourage the pupil to recognize the versatility and use of different kinds of wood in various forms.
5. To encourage pupils to build useful articles which will tend to improve their standard of living.

SAFETY

Every shop must have an effective safety program. This does not mean merely that the promulgation of a set of rules and regulations will satisfy this end. Pupils must be taught, in each and every subject studied within the industrial arts framework, the "how's" and "why's" inherent in the safety program. Dress and deportment play an important part in the operation of a safe shop program. Pupils and instructor should be neatly dressed at all times and the instructor should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles and gloves should be used wherever necessary. It is the responsibility of the instructor to supply continuous and vigilant supervision and to ensure that all pupils engage in safe shop practices. A good safety program includes:

1. Regular and thorough instruction and revision of the program.
2. Constant vigilance.
3. Checks and evaluation by the instructor.
4. Complete first aid equipment kept in first-class condition.
5. Non-skid paint and clearly marked working areas around all machinery.
6. Proper clothing with particular attention to eye protection.
7. Machines and tools in good working condition.
8. Routine reporting of all accidents and an adequate system of record keeping. This record of accidents, cause and treatment given, is extremely important for two reasons:
 - (a) To indicate recurrent accident patterns so that they can be remedied.
 - (b) In case of suit for liability.
9. Good housekeeping.

The following is a sample of safety regulations:

1. No power machines shall be used by any pupil until specific instruction has been given with regard to safe operation and safety precautions.
2. No power machine shall be used by any pupil without the specific permission of the instructor each time the machine is used.
3. No power machine shall be used while the instructor is absent from the shop.
4. Safety guards must be in place on all power machinery.
5. Approved eye protection must be worn for certain operations.

Note: A good safety slogan at all times - "A place for everything and everything in its place."

There are five basic steps in safety education:

1. Set a good safety example for pupils.
2. Instruct each pupil thoroughly in the safety precautions of his job.
Check lists for power machinery.
3. Keep all tools sharp and in good condition, older pupils will assist in maintenance of tools.
4. Keep all safety devices in proper use.
5. Follow up safety instructions constantly. The shop will be as safe as the instructor makes it.

It should be pointed out that failure to comply with every reasonable safety precaution, may jeopardize the instructor's position in any claim for compensation. Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workman's Compensation Board.

INFORMATION SHEET

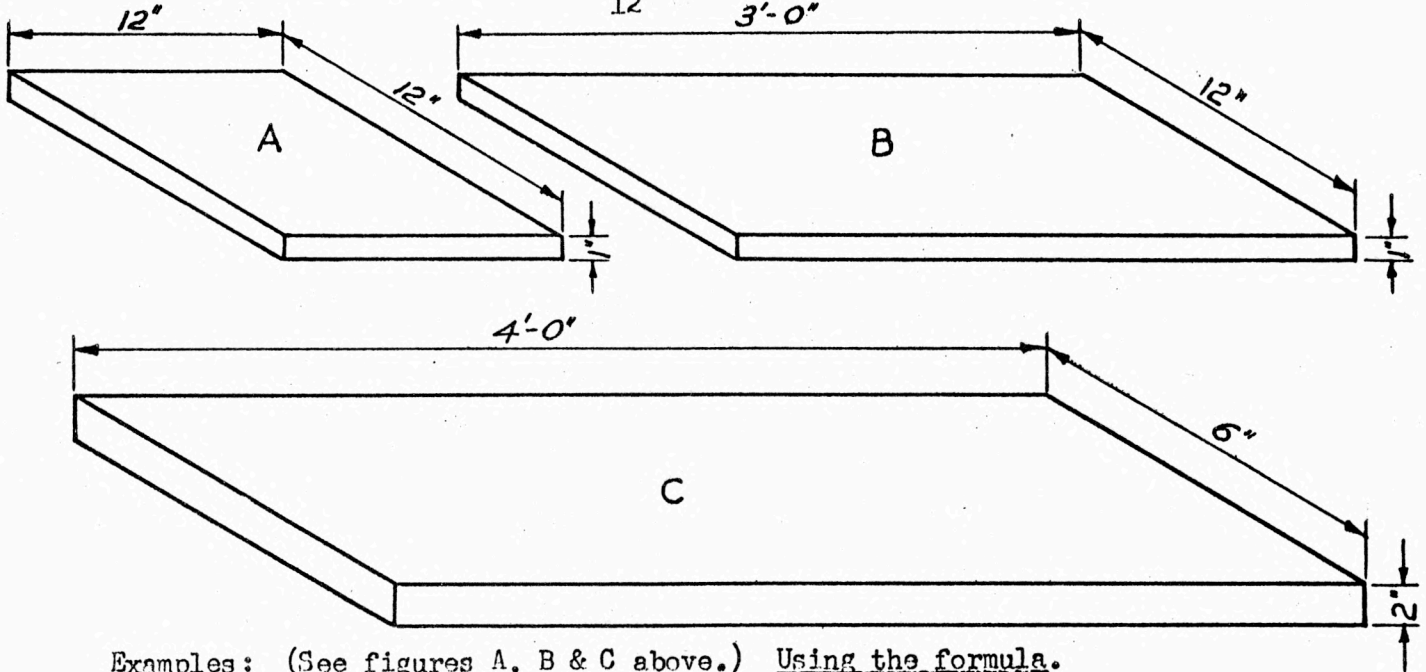
LUMBER

BOARD MEASURE

In working with the dimensions of a piece of lumber, the thickness is given in inches, the width in inches and the length in feet.

A formula for calculating board measure is as follows:-

$$\frac{\text{Thickness} \times \text{Width} \times \text{Length}}{12} = \text{Board Feet}$$



Examples: (See figures A, B & C above.) Using the formula.

Fig. A - $\frac{TWL}{12} = \frac{1 \times 12 \times 1}{12} = 1$ board foot.

Fig. B - $\frac{TWL}{12} = \frac{1 \times 12 \times 3}{12} = 3$ board feet.

Fig. C - $\frac{TWL}{12} = \frac{2 \times 6 \times 4}{12} = 4$ board feet.

Find the number of board feet in the following pieces of lumber:-

1. 2" x 8" x 16'

4. 1" x 4" x 14'

2. 4" x 12" x 10'

5. 2" x 4" x 10'

3. 1" x 10" x 12'

6. 8" x 8" x 6'

Lumber which is less than one inch in thickness is considered as if it were one inch in thickness.

7. Three boards $5/8'' \times 9'' \times 14'$

8. Four boards $3/4'' \times 8'' \times 15'$

The price of lumber is usually given per thousand board feet. (1000 is written as M) Therefore 12 boards $2'' \times 8'' \times 18'$ at \$150.00 per M cost:

$$\frac{12 \times 2 \times 8 \times 18}{12} \quad \times \quad \frac{150.00}{1000} \quad = \quad \$43.20$$

Find the cost of:

9. Ten boards $1''$ thick $\times 12''$ wide $\times 15'$ long at \$150.00 per M.

10. Fifteen boards $2'' \times 10'' \times 12'$ at \$180.00 per M.

PLANNING SHEET

Name _____ Grade _____ Teacher's Approval _____

Project _____ Date Started _____
Date Finished _____

Bill of Material - Finished Size

Part	Pieces	T	W	L	Material	Cost

Bill of Material - Rough Size

Part	Pieces	T	W	L	Material	Cost

Steps	Tools and Equipment
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Planning _____ Surface Preparation _____ Finishing _____
Accuracy _____ Tool Operation _____ Shop Efficiency _____

TOTAL

PRACTICAL PROBLEMS

BOARD MEASURE

1. The Bill of Material for a book rack made of pine is as follows: -

- (a) Two end pieces each $3/4"$ x $7\ 1/2"$ x $9"$
- (b) Two rails each $1/2"$ x $2\ 1/2"$ x $18"$

Find the number of board feet required to construct it.

2. A serving tray is made from the following lumber: -

- (a) Handles - 2 pieces each $3/4"$ x $2"$ x $1'$ - pine
- (b) Side Rails - 2 pieces each $1/2"$ x $1\ 1/2"$ x $18"$ - pine
- (c) Bottom - 1 piece of plywood $1/4"$ x $12"$ x $18"$

Find the cost of the material for the tray if pine sells at \$240.00 per M and the plywood at $18\frac{1}{2}$ ¢ a square foot.

3. A magazine rack is made of $3/4"$ pine and masonite. The material list is as follows: -

Pine 4 pieces each $3/4"$ x $2"$ x $24"$

2 pieces each $3/4"$ x $2"$ x $15"$

1 piece $3/4"$ x $3"$ x $15"$

1 piece $3/4"$ x $1"$ x $15"$

Masonite 2 pieces each $12"$ x $15"$

Find the TOTAL COST of the rack if pine is priced at \$240.00 per M and Masonite at $16\frac{1}{2}$ ¢ a square foot.

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WOODCARVING

L. Holbrook,
Inuvik.

Introduction

Woodcarving is a craft which requires little in the way of equipment and materials but which gives the student an appreciation of the structure and the beauty of wood. Woodcarving helps to bridge the gap between Fine Art and Industrial Arts because it has something of both.

Procedure

Subject:

Choose something that can be portrayed successfully in wood. Birds and animals which are native to the locale are always popular with pupils. A small carving will be easier to manipulate for the beginner. The fox shown on the enclosed sheets is an ideal first project.

Tracing:

Trace the subject on the wood with carbon paper so that the grain will follow (as nearly as possible) all long thin parts such as legs, tail etc. If these parts were cut out with cross grain it would be very difficult to carve them without breakage. Also avoid knots and other defects in the wood.

Material:

Softwoods such as Pine, Basswood and Spruce are excellent for beginners, as these woods carve easily and generally have a straight grain. Hardwoods like Mahogany and Walnut are harder to carve but they finish very well and should be used when the carver is more experienced.

Cutting Out:

Smaller projects can be cut with a coping saw or jig saw but larger carvings may require a band saw. A great deal of time can be saved by cutting out the carving in profile and also the top view as shown on page 175.

Cut out the profile first and then re-assemble the cut parts. These may be nailed together through the top outside the projects lines. This block can then be cut safely to the top view which will eliminate a great deal of carving.

Safety:

Because of the smallness of the work piece and the irregular cuts to be made, the above is a fairly complex operating procedure and each student should have instruction on the safe use of the band saw before proceeding.

Carving:

1. Hold the knife as comfortably as possible.
2. Do not try to remove too large a piece at one stroke.
3. It is easier to carve with the grain but this is not always possible.
4. Use care when carving and avoid placing fingers or other parts of the body in front of the blade.
5. Keep the knife sharp ALWAYS.
6. Do not carve one section of the project until it is finished and then move on to another section. Take a little wood off all over. In this way a better idea of the form results.
7. Keep referring to pictures and photographs of the subject being carved to get the correct form and proportions.
8. Take as much wood as possible off with the knife before attempting to sandpaper.

Finishing:

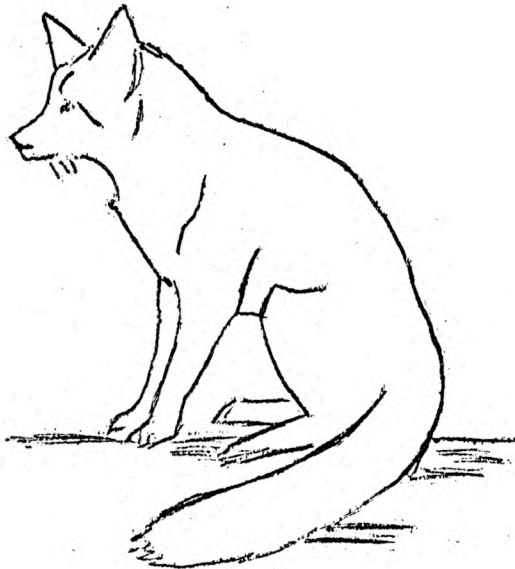
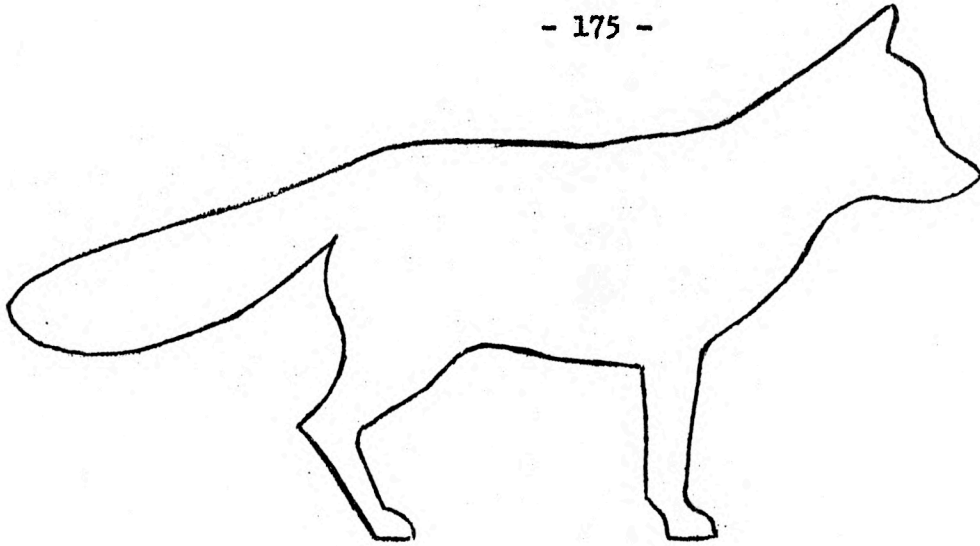
Wrap a piece of sandpaper round a pencil or simply roll it up. This will give good results for the rough sanding. Cloth backed sandpaper is the best for the final sanding as it is easier to manipulate into corners and around legs. The emery boards which ladies use to file their finger nails make excellent tools for finishing a project.

Always allow the grain of the wood to show through your finish whenever possible. NEVER paint over a beautiful hardwood grain. Paint can be used on some softwood carvings but even these can be finished very nicely with a transparent finish.

A very easily applied and excellent finish for hardwood is boiled linseed oil rubbed on with the hands. Paste wax also gives a very good finish.

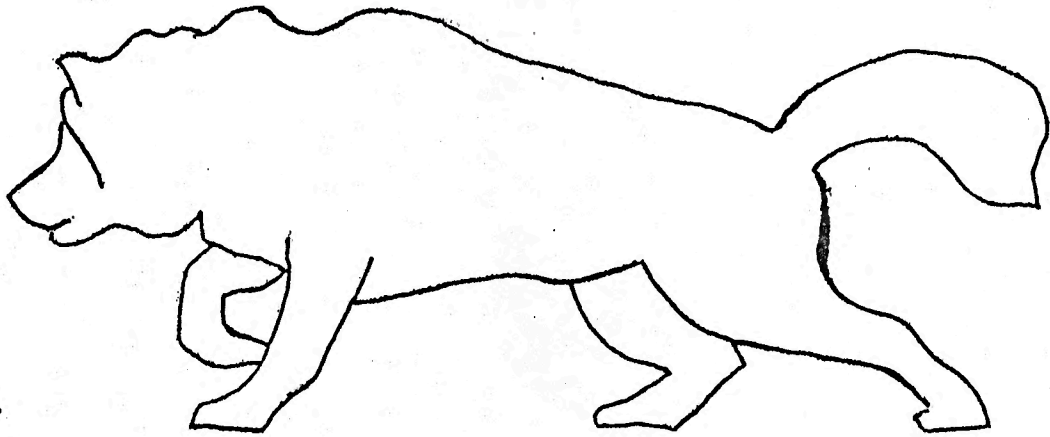
Mountings:

Most animal carvings do not need a stand but bird carvings generally do. Contrasting pieces of hardwood can be used. Make these fairly thin and cut them out in suitable shape. Small pieces of driftwood make excellent mounts for carved animals and birds. Legs for birds can be made from thin wire wrapped with thread and then covered with glue. This gives them a lifelike appearance.

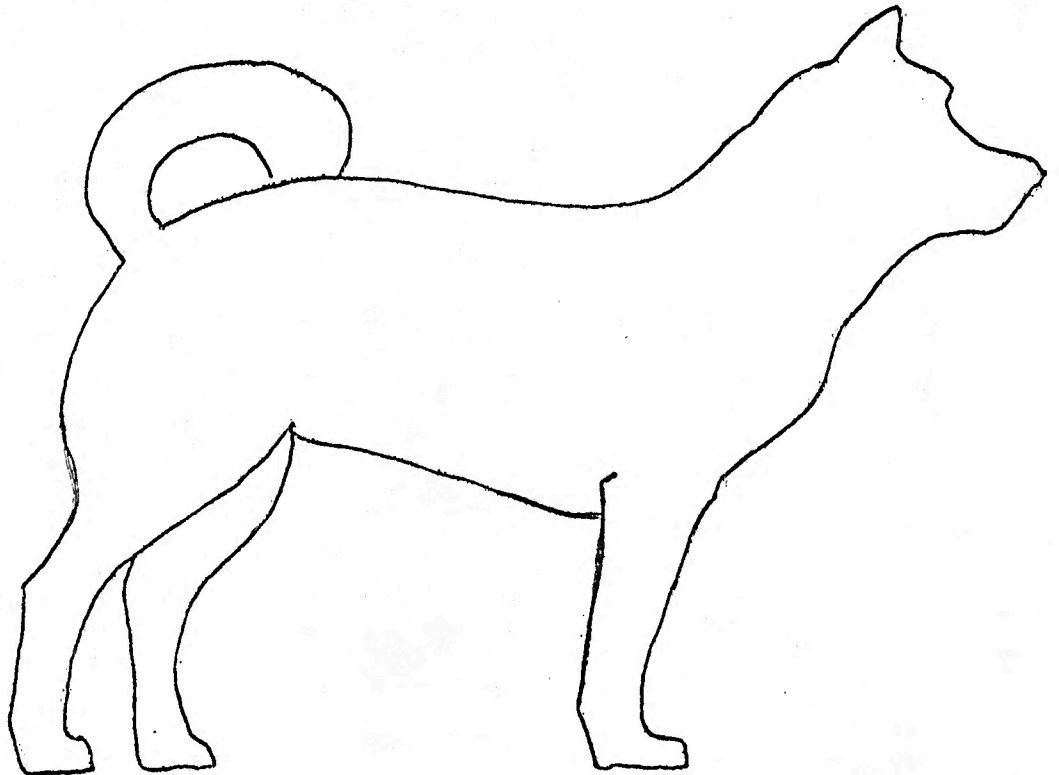


MATERIAL = $1\frac{1}{2}$ " SOFTWOOD OR WALNUT

HUSKIES

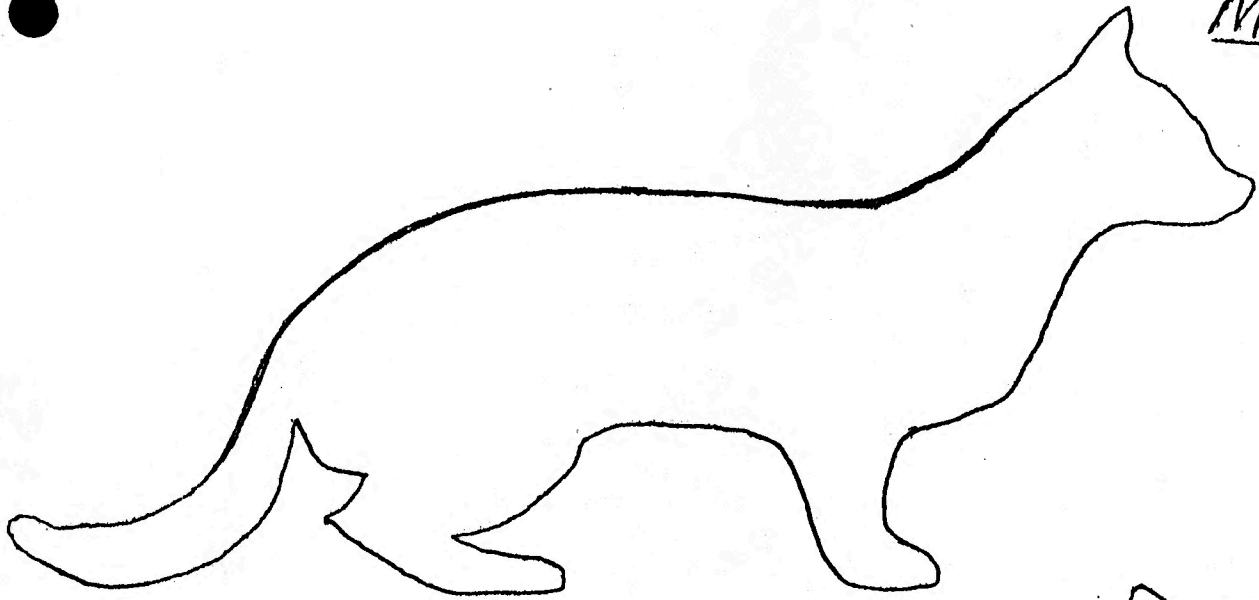


MATERIAL:
1 1/2" THICK.



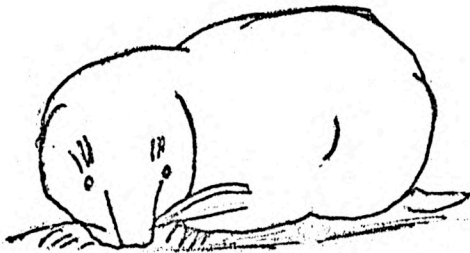
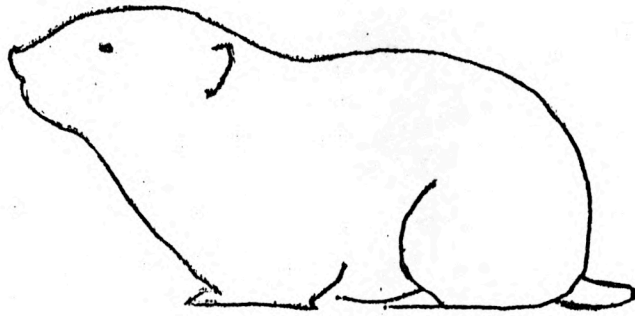
MATERIAL:
2" THICK.

MARTEN

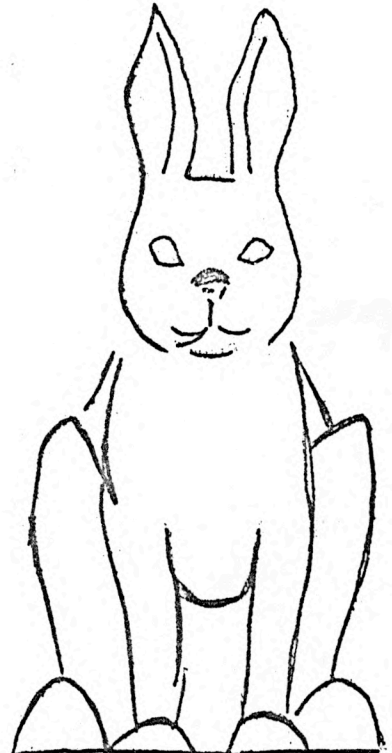
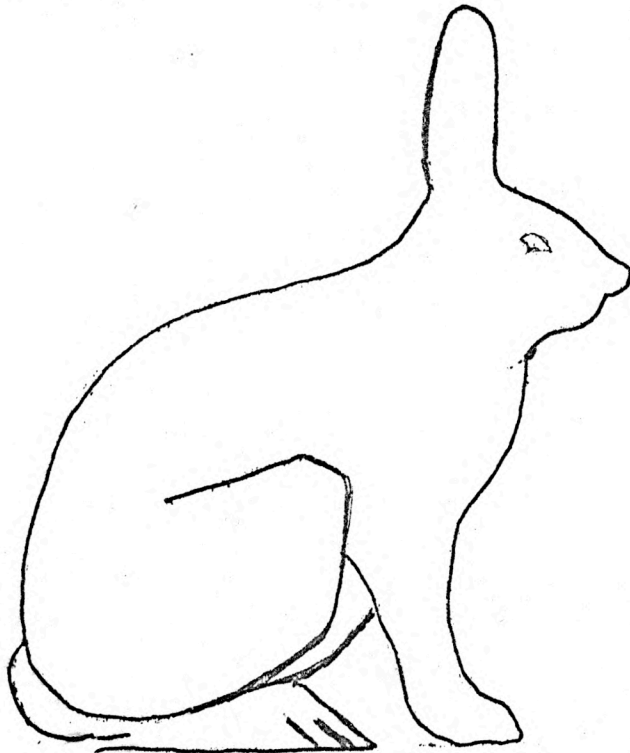


MATERIAL: 2" PINE, BASSWOOD or WALNUT.

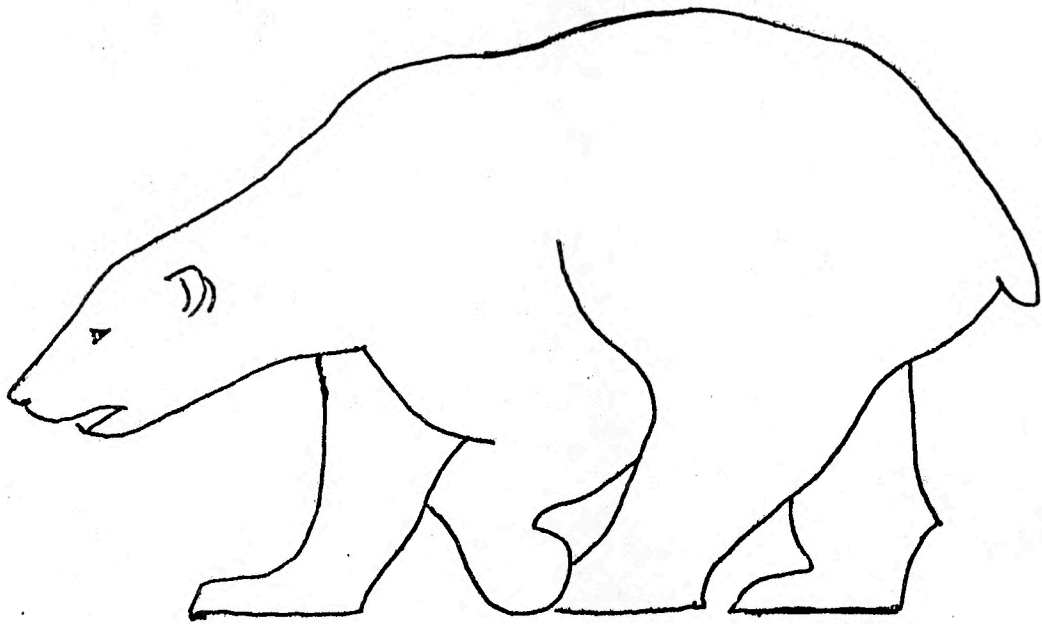
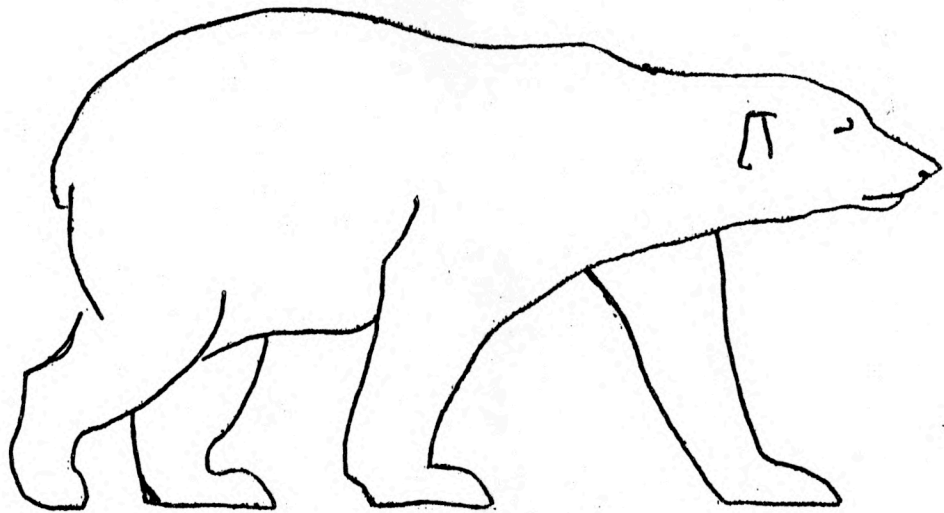
LEMMING

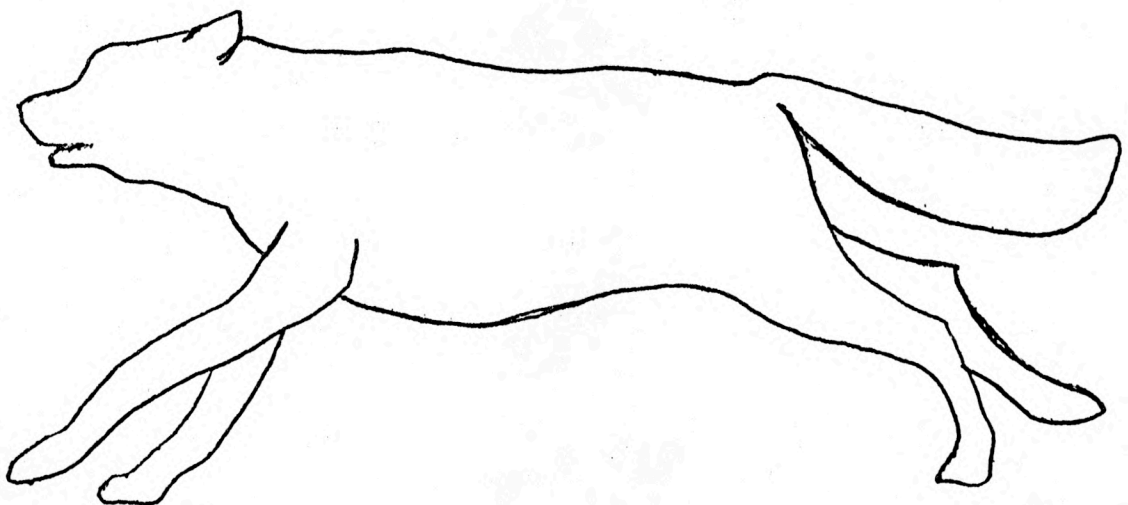
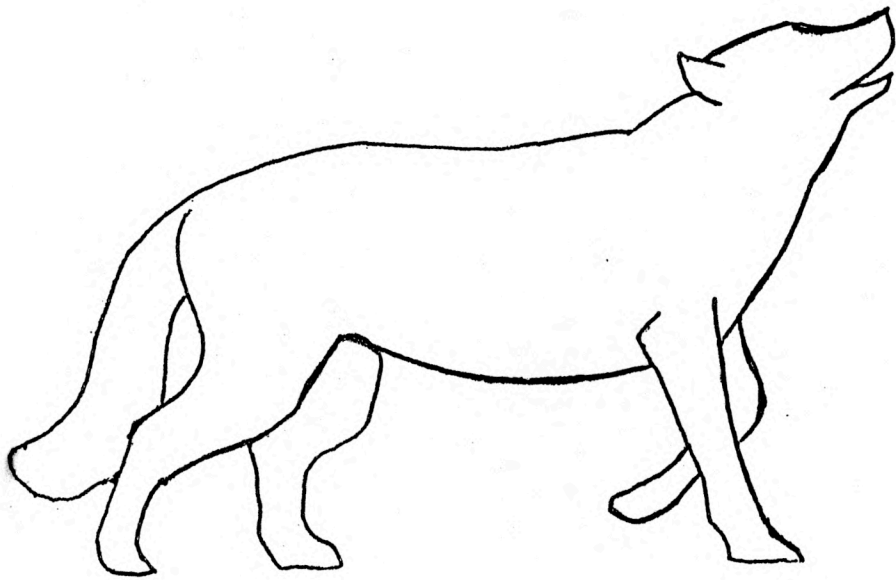
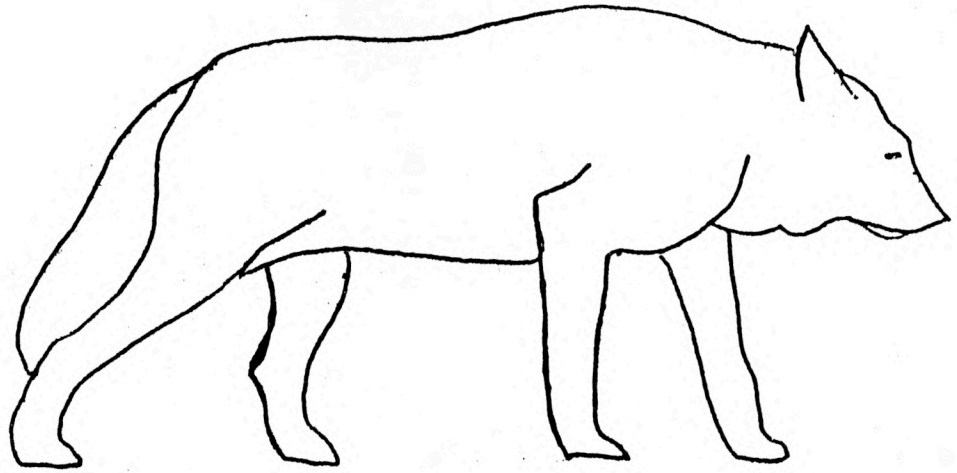


MATERIAL: 1/4" SOFTWOOD OR WALNUT.

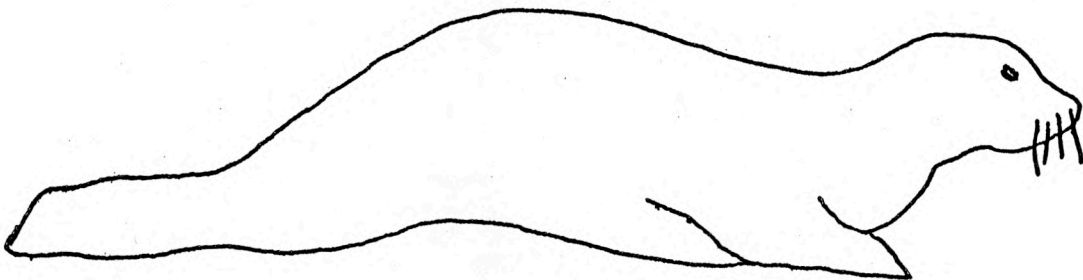
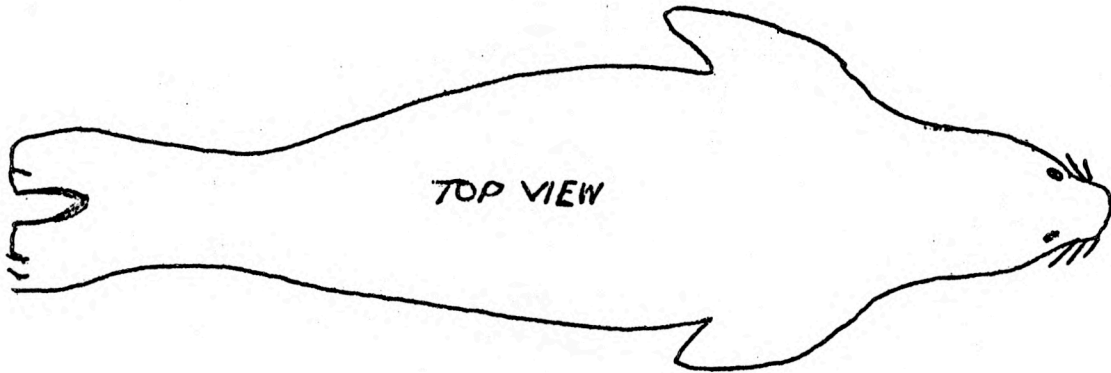
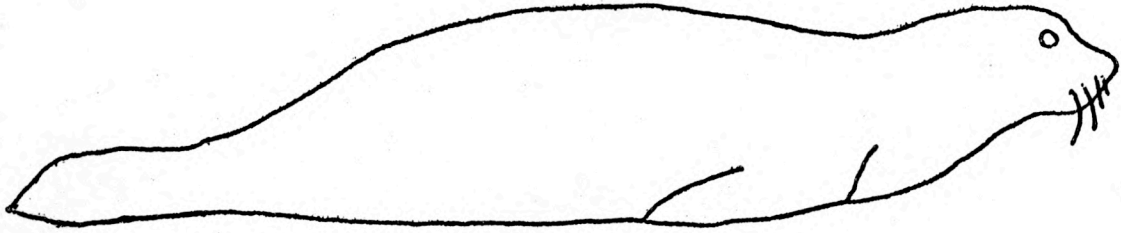


ARCTIC HARE





SEALS



Introduction

Wherever tools, materials and a skilled instructor are available, a course in the correct handling of tools for metalworking can be of great value to the pupils of any locality. The variety of projects possible is limited only by the physical facilities and the ingenuity, skill and initiative of the teacher and resource people in the community.

Equipment and Supplies

Requisition as outlined in the first section of this booklet.

COURSE OUTLINE

Sheet Metal Work

1. Planning and layout

Use of rule and templates

Use of tin snips

2. Folding

Use of folding equipment available but with particular attention paid to improvised methods.

3. Soldering

Use of propane torch

Use of soldering irons

Different types of solder (bar solder and resin core solder)

4. Flux

5. Use of punches and sheetmetal drills

6. Riveting

7. Painting

Preparation

Application

Bench Metal Work

1. Layout

Use of steel rule, square, scribe, center punch, calipers

2. Use of hacksaw - types of blades

3. Use of the file

Selection of the correct type of file

4. Drilling holes - hand drills, machine drills

5. Riveting

6. Forming

Use of improvised jigs in cold and hot bending

Welding

See section on welding.

Project Suggestions

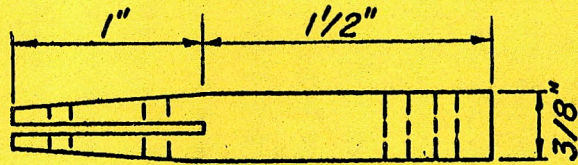
Fish lure, shelf bracket, gaff, small boxes, cookie cutter, cookie sheet.

Some further project suggestions follow.

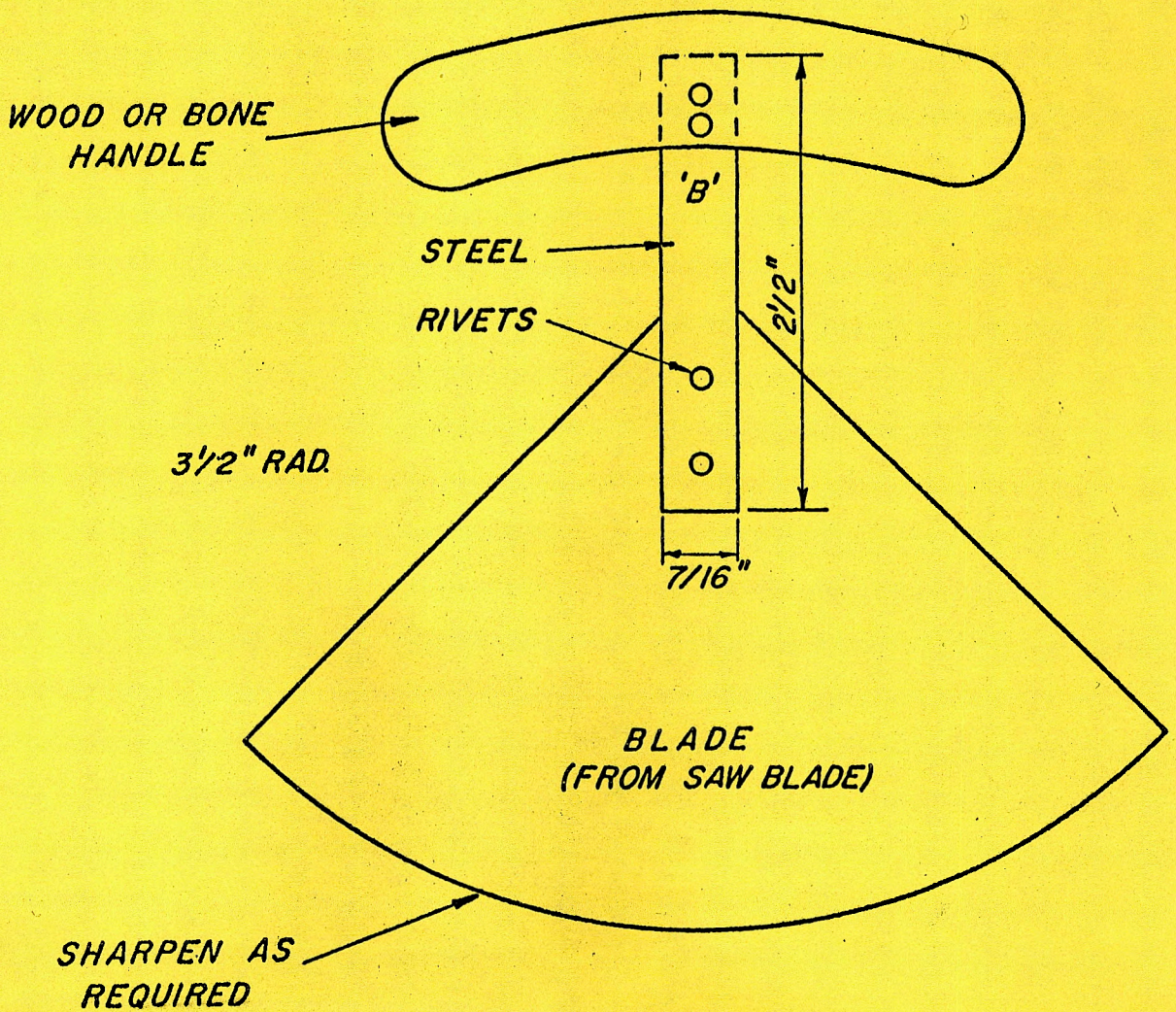
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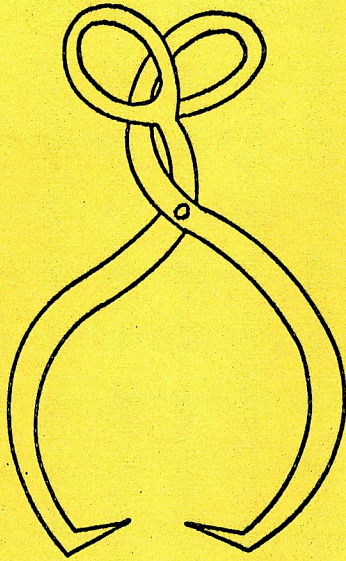
ULU



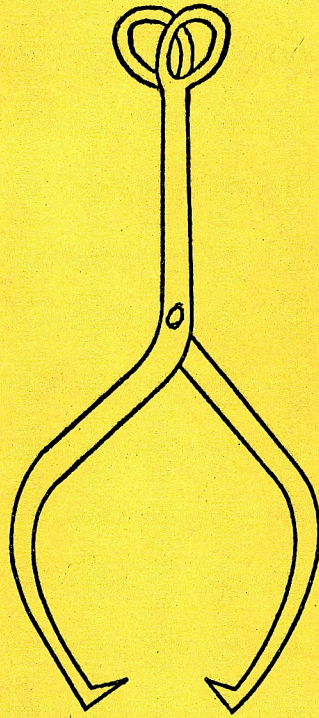
DETAIL OF 'B'



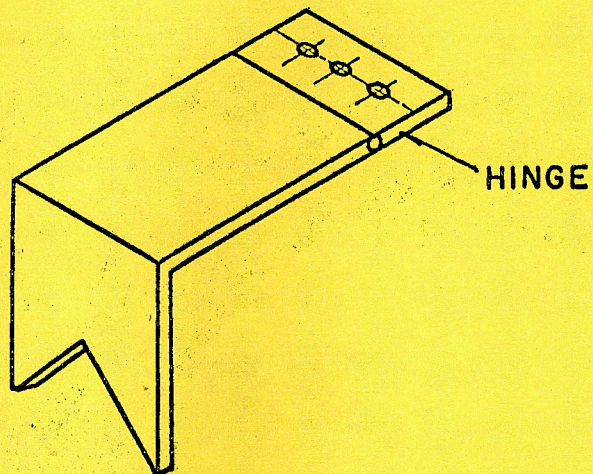
ICE TONGS



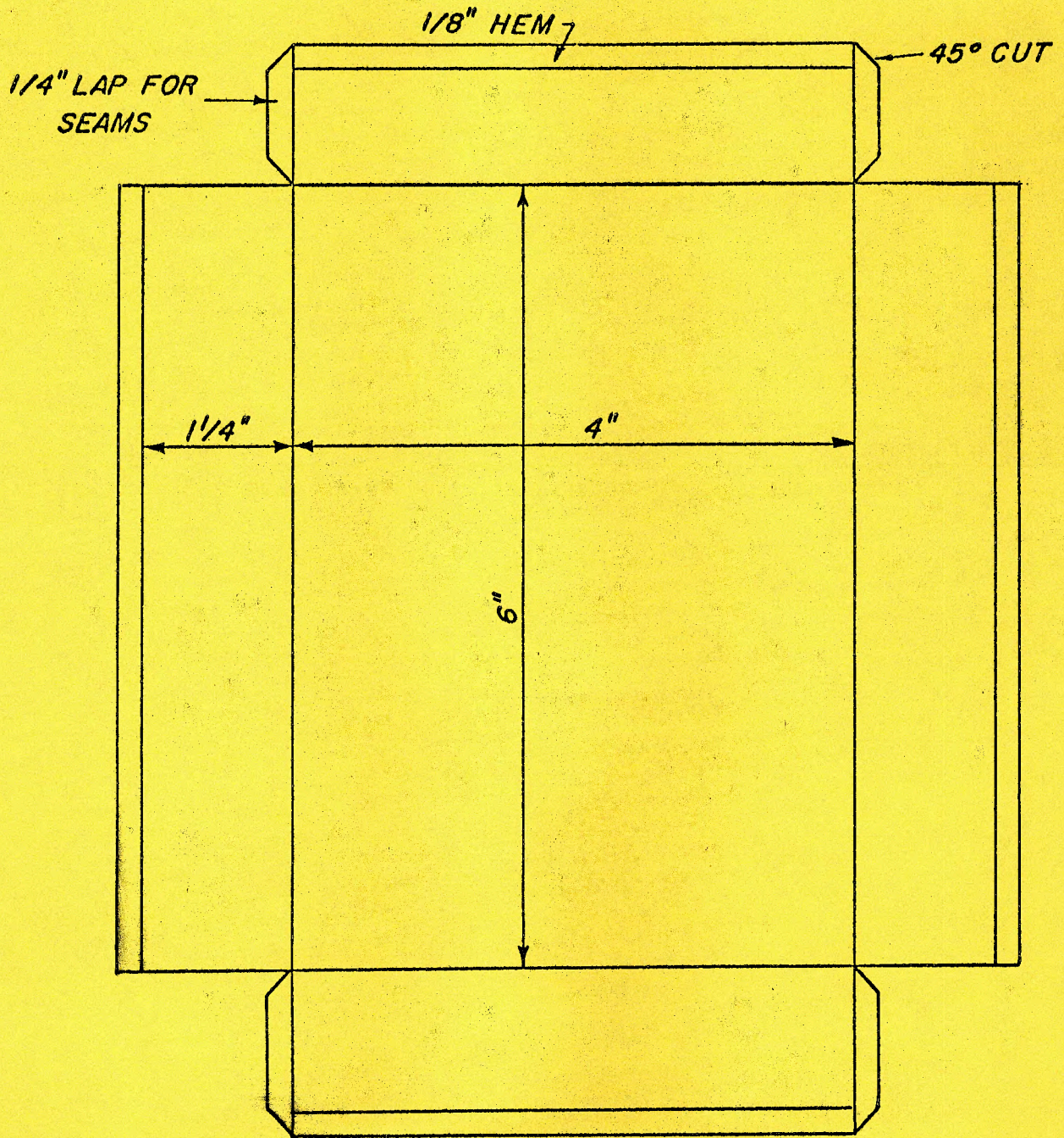
DRAG ICE TONGS

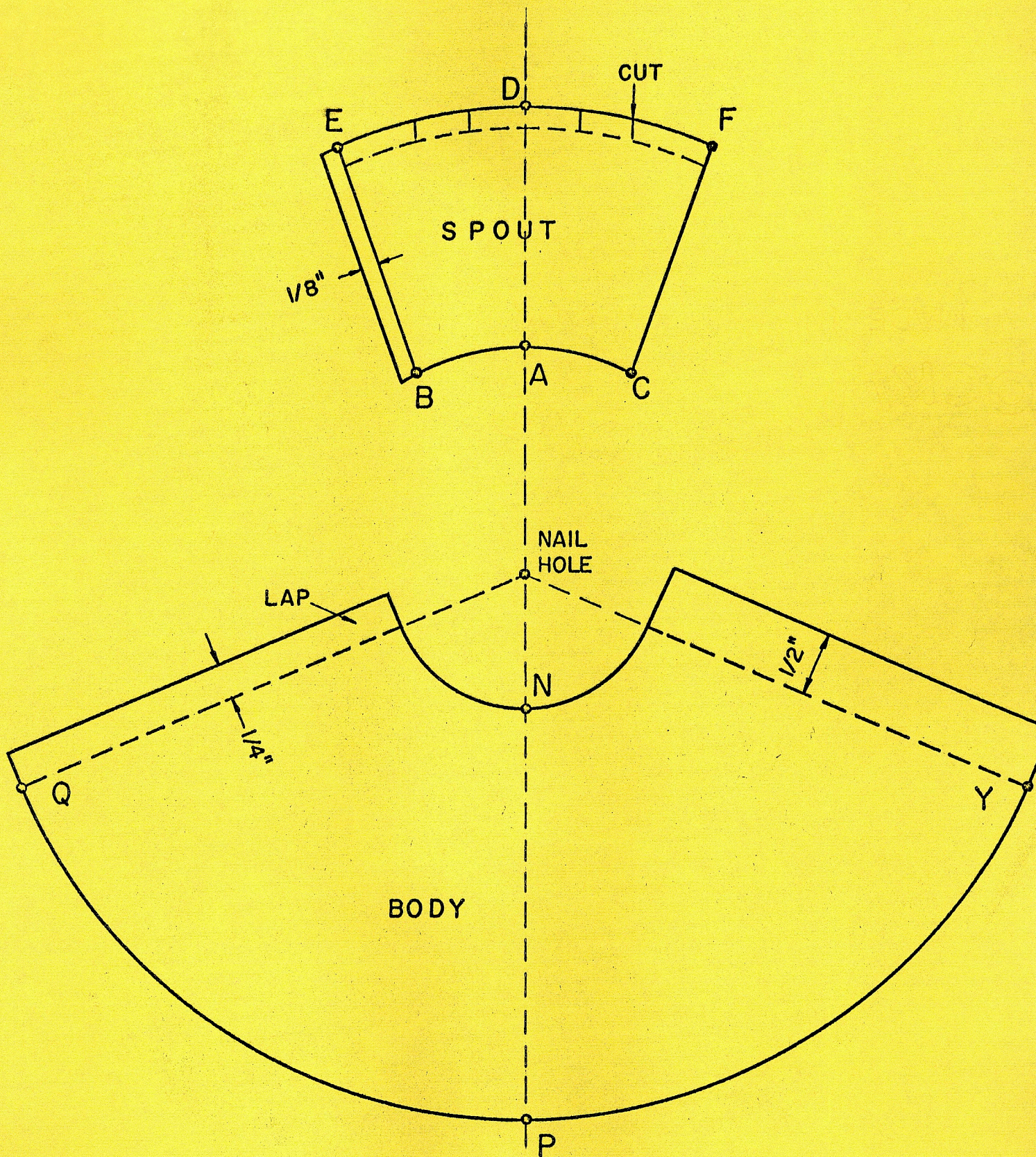


SLED BRAKE



BAIT OR NAIL BOX





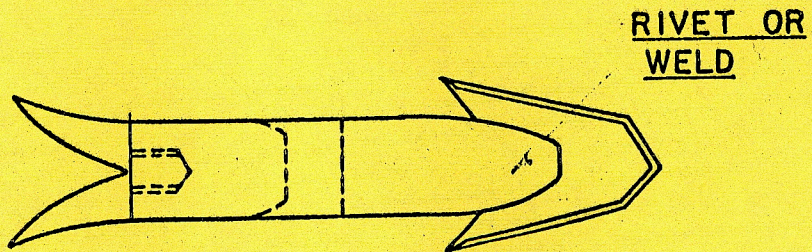
FUNNEL PATTERN
SCALE FULL SIZE

A project which fulfills an ever present need in any home where there is a hunter is the harpoon head shown on the following page. The drawing shown was taken from the type of weapon used in the Rankin Inlet area. Tools required: hacksaw, hammer, rivet set (or welding equipment), file, drill.

HARPOON HEADS



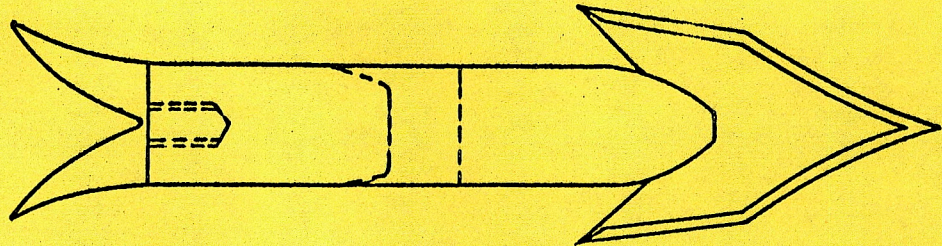
ALTERNATIVE HEAD



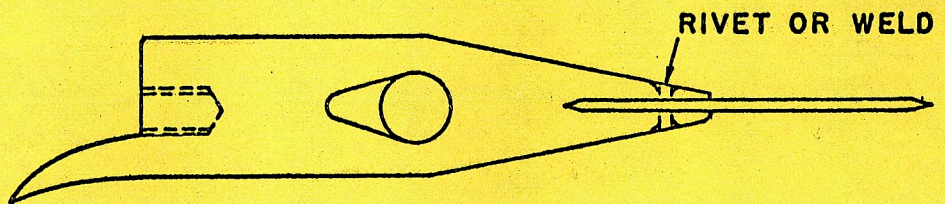
FOR SEAL

SCALE: FULL SIZE

HARPOON HEADS



FOR WALRUS , WHITE WHALE &
BEARDED SEAL



BLADE : SAW STEEL
BODY : MILD STEEL

SCALE : FULL SIZE

EGG LIFTER

METALWORK

GRADE VIII

Materials:

- 1 piece - 3 1/2 x 4 sheet Aluminum. (Alclad G20)
- 1 piece - 1/4 x 6 Aluminum Rod.
- 2 Mushroom headed rivets. 1/8 x 3/8
- 1 piece - Hardwood 1 x 4 for handle.
- 1 piece - 5/8 x 1/2 brass tube for ferrule.

Procedure for Blade:

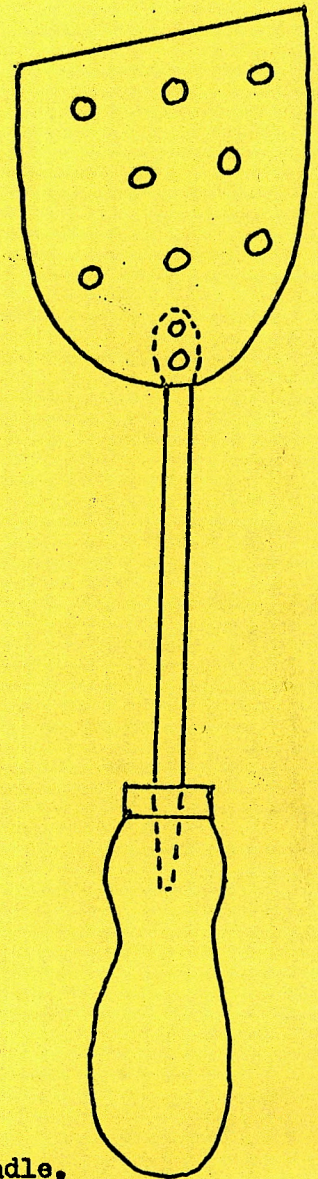
- 1. Layout design for blade on paper full size. Design of blade may be changed.
- 2. Layout points for design holes and rivet holes.
- 3. Cement paper to the 3 1/2 x 4 piece of Aluminum. Paper will be left on the metal until all cutting, punching and drilling has been done.
- 4. Cut out the blade with tinner's snips.
- 5. File edges smooth.
- 6. Punch out holes for design.
- 7. Drill two 1/8 rivet holes.
- 8. Remove paper and polish blade with steel wool.

Procedure for Rod:

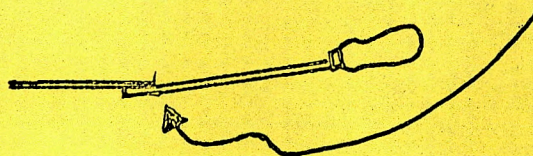
- 1. Flare one end of 6" rod as shown in drawing.
- 2. Form other end of rod into a square point for fixing into handle.
- 3. Drill two 1/8 rivet holes in flared end. These holes will match those drilled in the blade.
- 4. Rivet flared end of rod to handle. File rivets flush on bottom of blade.
- 5. Bend rod as shown in drawing and polish.

Procedure for Handle if not Manufactured:

- 1. Layout piece of hardwood for setting up on lathe.
- 2. Shape to desired design on lathe.
- 3. Sand and burnish.
- 4. Fix ferrule as shown on instruction sheet for chisel handle.
- 5. Drill 3/16 hole in handle to take rod.
- 6. Force pointed end of rod into handle for tight fit.

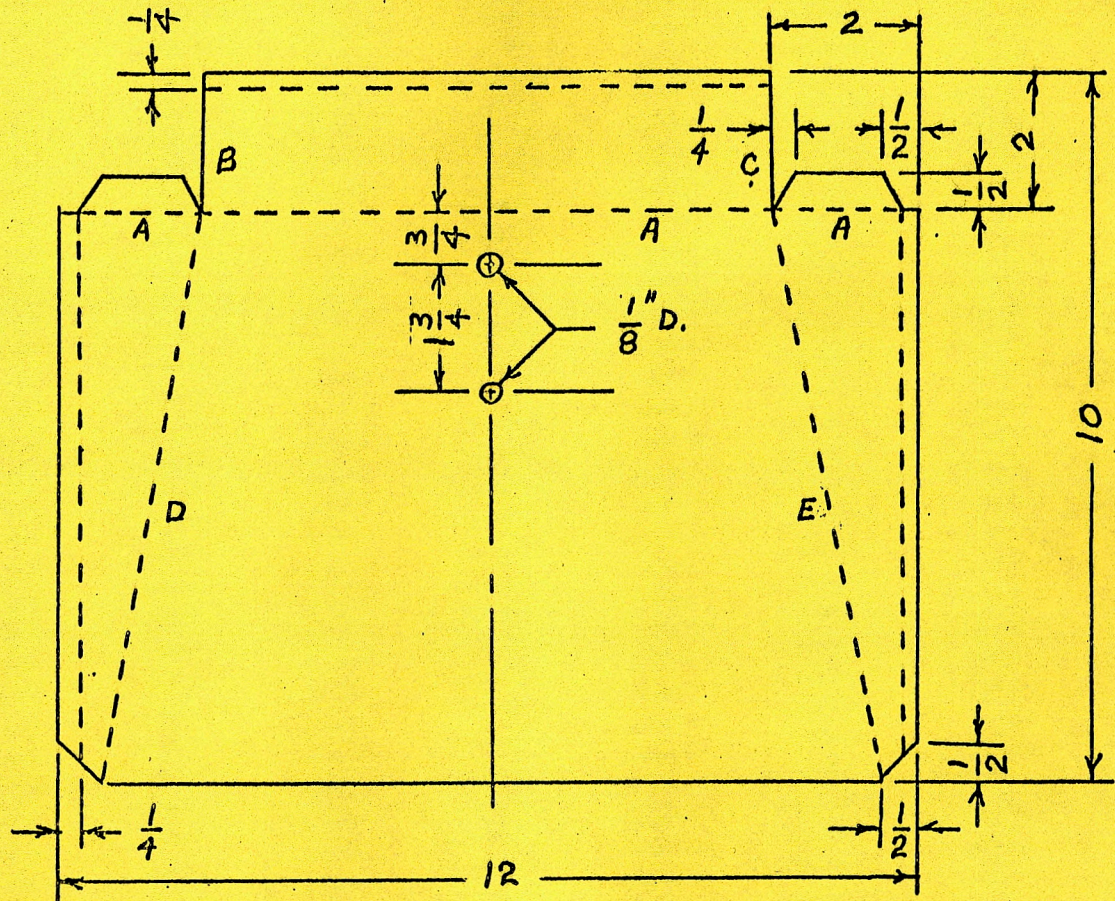


Bend Rod Here



SHEET I - 2 SHEETS

DUST PAN -- PAN



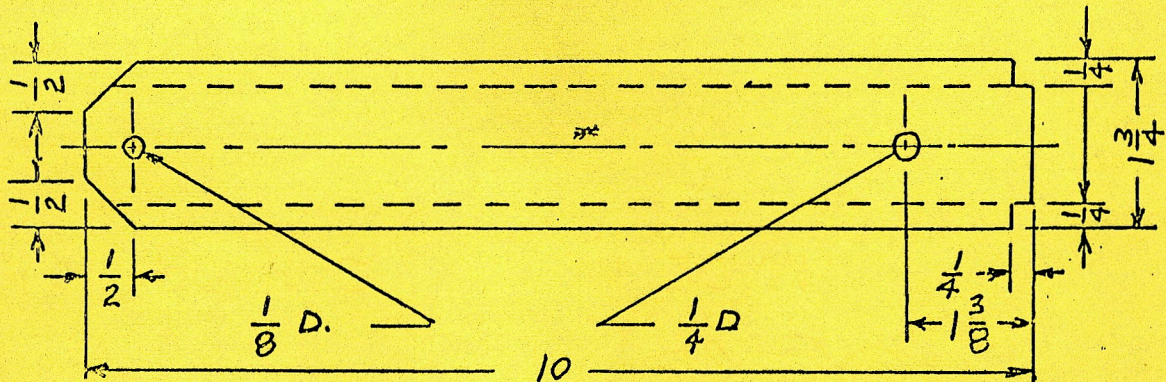
PROCEDURE :

Scale: $4\frac{3}{8}'' = 1' - 0''$

- | | |
|-----------|--|
| 1. TRUE | 26 Ga. G. I., or B. I., 10" x 12" |
| 2. LAYOUT | (a) Line A; B and C; then D and E
(b) Three Fold lines
(c) Centre line, and rivet holes
(d) Solder Laps |
| 3. STAMP | On centre line at # |
| 4. PUNCH | Two rivet holes |
| 5. CUT | Corners to shape |
| 6. FILE | Burred edges |
| 7. FOLD | Safe edges (away from lines) ---
- Do not close 'Back' Safe Edge - |
| 8. BEND | (a) Line A to 90 (include laps)
(b) Lines D and E to 90 |
| 9. SOLDER | Laps - under 'Back' Safe Edge |

SHEET 2 - 2 SHEETS

DUST PAN -- HANDLE

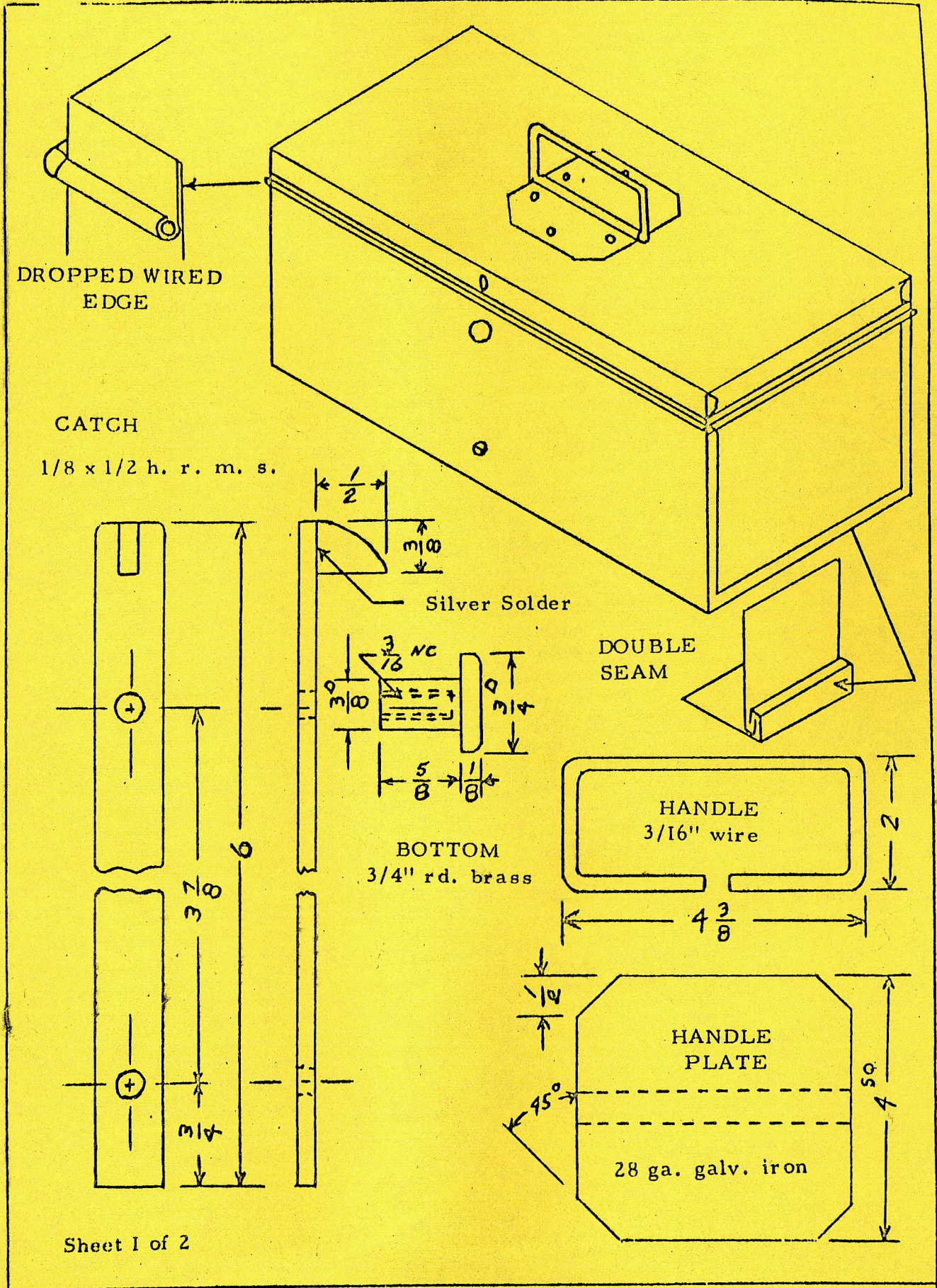


PROCEDURE:

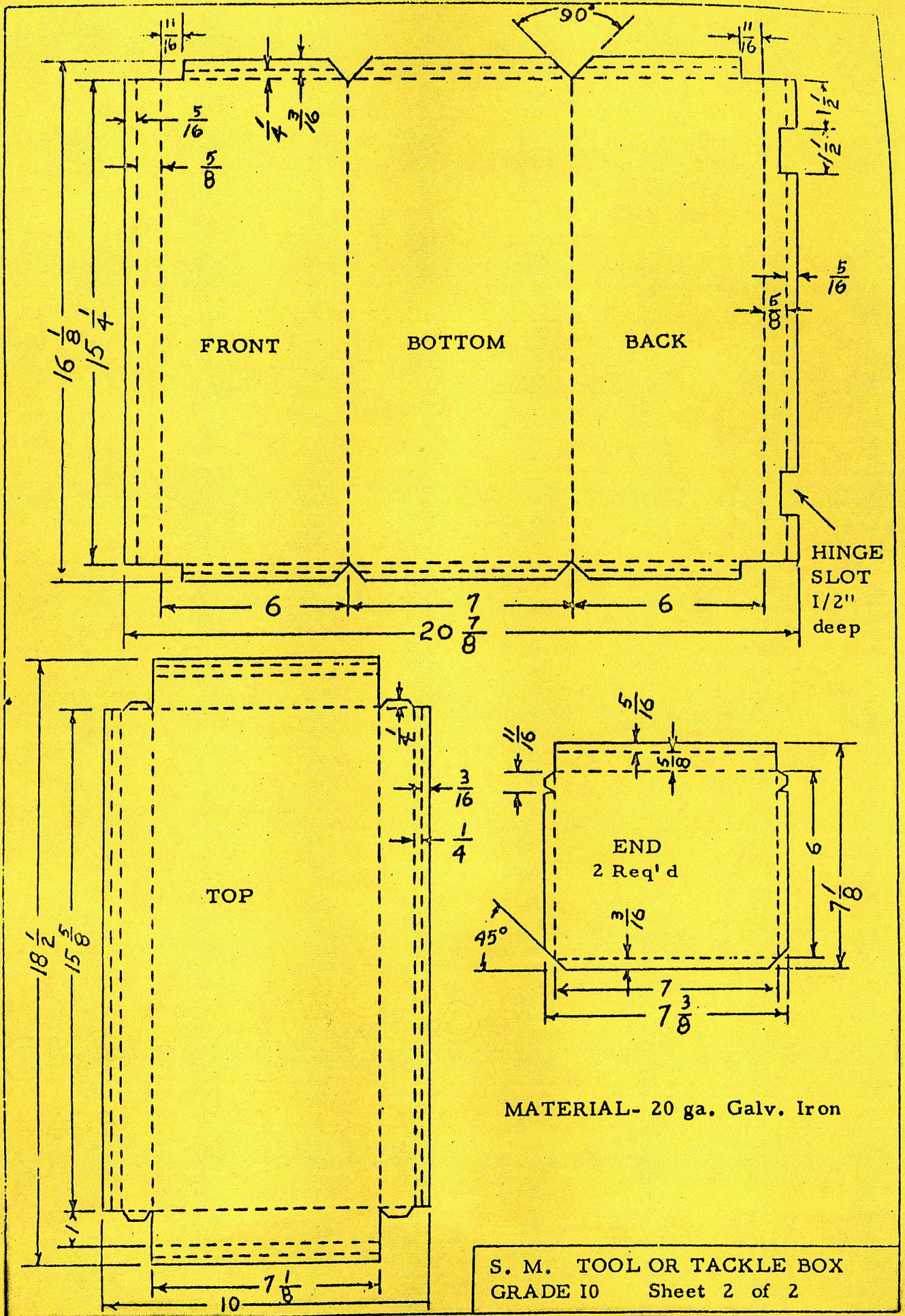
Scale: 6" = 1'-0"

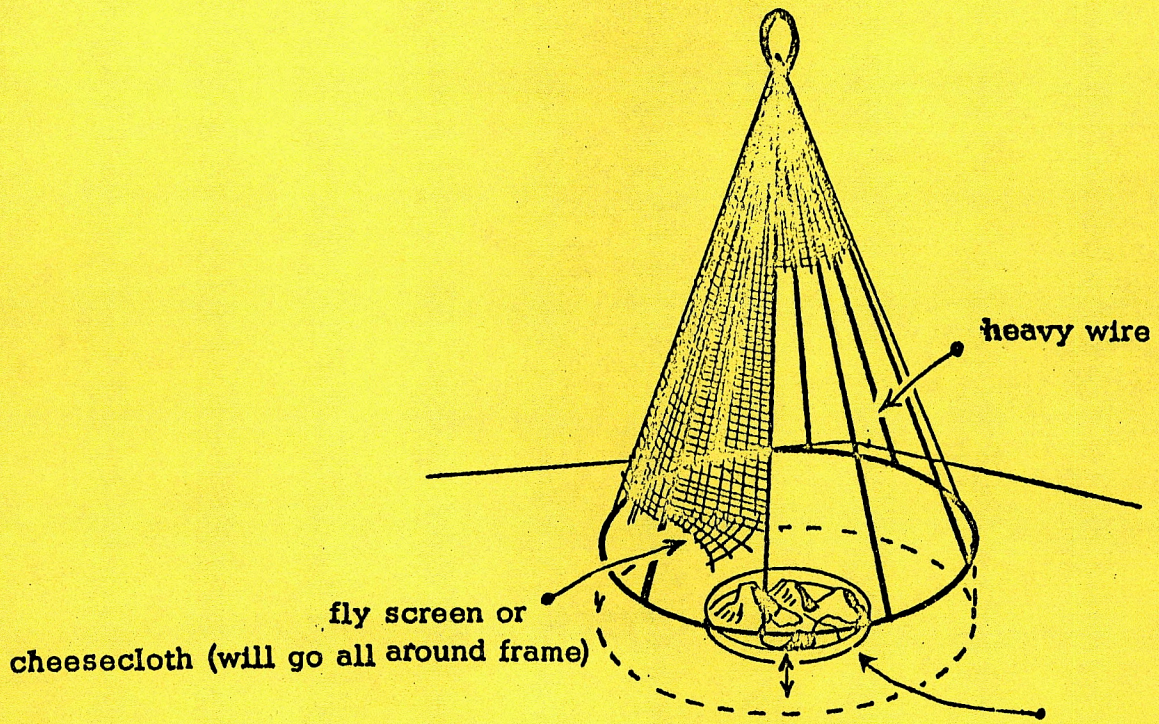
HANDLE

- | | |
|-------------|---|
| 1. TRUE | 26 Ga. G. I., or B. I., 1 3/4 " x 10 " |
| 2. LAYOUT | (a) Fold Lines
(b) Corners
(c) Centre line and hold |
| 3. STAMP | At # |
| 4. PUNCH | (a) End hole only
(b) 1/4 " hole H |
| 5. CUT | Corners |
| 6. FOLD | Safe edges (toward lines) |
| 7. BEND | End lap 90 (toward line) |
| 8. FORM | Handle to fit pan |
| 9. ASSEMBLE | (a) Insert solder lap under 'Back' Safe Edge
(b) Match centre lines - close safe edge
(c) Match end rivet holes |
| 10. RIVET | End rivet only |
| 11. SOLDER | Lap under safe edge |
| 12. PUNCH | Second hole |
| 13. RIVET | Second rivet |
| 14. CLEAN | (Steel wool) |



Sheet 1 of 2





PORTABLE FOOD COVER - wire and screen type

WELDING

Introduction

Welding is an extremely useful skill. It has great application with repair of equipment and is a good source of income in all parts of Canada. Welding is a skill which can be taught on several levels, from that of the "jobber" to that of the highly skilled technologist. The level attempted under the auspices of any school should depend upon the availability of space and equipment and a suitably skilled instructor. Where the teacher is not skilled in this particular skill, every attempt should be made to utilize other resource persons of the community to give the pupils instruction.

Permission to offer this course should be obtained from the Superintendent of Vocational Education.

Safety

Particular care must be taken in this field to ensure the safety of the pupils. Safety goggles and other equipment must be worn at all times. It is also imperative that adequate fire precautions be maintained.

Many excellent publications on safety are available from manufacturers of welding equipment and from the Department of Labour.

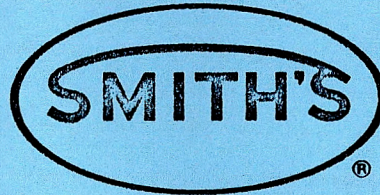
Equipment

Necessary equipment and a suitable building should be available before this course is offered. However, additional supplies (for example, welding rods, metal, safety equipment) should be requisitioned in the usual way and will be processed by the Superintendent of Vocational Education.

Course Organization

A complete course outline supplied by the Education Department of Smith Welding Equipment is reproduced here as a resource from which teachers can extract sections of interest or value in the local setting.

SMITH'S SHORT COURSE FOR GAS CUTTING, WELDING, BRAZING



Smith's Short Course is a condensation of basic training procedures which have been successfully used for introducing the beginning student to the use of a gas torch.

It is not intended to provide extensive knowledge in any given phase of torch use. But rather it gives a quick capsule view of the functions of a gas torch and its adaptability for the demands of practical metalworking. The course is divided into six sessions — an introduction and five course lessons:

1. Introduction — Page 3
2. Cutting and flat butt welding of light material — Page 8
3. The braze welding process (brazing) — Page 11
4. Braze welding of cast iron — Page 13
5. Silver brazing — Page 16
6. Hard-Surfacing — Page 17

Each section includes a complete outline of suggested Shop Work and a quiz on the lesson. (Both questions and answers are provided.)

A Glossary of terminology used in the industry is also included on Page 219.

EDUCATION DEPARTMENT OF SMITH WELDING EQUIPMENT
DIVISION OF TESCOM CORPORATION

27th AVE. & 4th ST. S. E. — MINNEAPOLIS 14, MINNESOTA

INTRODUCTION

Definition of the gas welding process and description of torch equipment functions.

I. DEFINITION

A. What is "Gas" welding?

Simply stated, it is the joining of two metal pieces through heat which is provided by the combustion of a fuel gas (acetylene or LP-Gases) and oxygen.

1. **FUSION WELDING** is the joining of ferrous metals through melting of two or more pieces. The melted portions flow together, forming one part. It is done with or without a "filler" rod.
2. **BRAZING OR BRAZE WELDING** is the joining of two similar metals by heating both pieces (without melting) and adding bronze welding rod as the filler material. The molten bronze adheres to the base metals, forming a bond.
3. **SOLDERING** is similar to brazing since no melting of the base metals occurs. Filler material is non-ferrous metal alloys; soft solders (lead alloys) and hard solders (silver alloys).
4. **HEATING** provides a necessary function in the use of oxy-acetylene or oxy-propane flame for bending, shaping, tempering, dehydrating and descaling of metals.

II. DESCRIPTION

A. USES OF THE WELDING FLAME

Adapt explanation to the interest of the class.

B. CHARACTERISTICS OF ACETYLENE:

1. It is a hydrocarbon (C_2H_2).
2. It burns in two stages with:
 - a. Primary combustion zone
 - b. Secondary combustion
3. It is an endothermic gas — heat is given up in the area of the primary combustion zone to effectively add to the heat produced by the chemistry of combustion.
4. It has a burning rate of about 330 feet-per-second (in a 1.1 to 1 mixture with pure oxygen through the tip).
5. It produces a neutral flame temperature of about 5900° F. at the end of the primary combustion zone (6300° F. with a slight increase in the oxygen — an oxidizing flame).
6. It has a net heat value of 1433 B.T.U.'s per cubic foot.
7. It requires 2½ parts of oxygen to consume one part of acetylene. One part oxygen is supplied through the torch and the remaining 1½ parts are obtained from the air surrounding the flame.
8. It is produced from carbide and water.

C. CHARACTERISTICS OF LP-GAS (PROPANE, etc.)

1. It is a hydrocarbon — although more complex than acetylene (C_3H_8).
2. Burns in two stages with:
 - a. A primary combustion zone
 - b. A secondary combustion zone
3. It is an exothermic gas which absorbs heat from the primary combustion zone to maintain the chemical burning reaction.
4. It has a burning rate of 60 feet-per-second with a mixture of between 3.6 and 4 volumes of oxygen to one of fuel through the tip.
5. It produces flame temperatures of about 4900° F. (about 5250° F. with an excess of oxygen).
6. It has a net heat value of 2309 B.T.U.'s per cubic foot.

D. OXY-ACETYLENE TORCH APPLICATIONS*

Joining Process	Treating Processes
Welding	Flame cleaning
Brazing	Flame hardening
Braze Welding	Flame scarfing
Soldering	Preheat
Severing Processes	Postheating and stress relieving
Flame Cutting	Paint removal
Manual	Descaling
Salvage	Tempering
Shape	Annealing
Remodelling	Heating
Plate Cutting	Metal Removing
Rivet Cutting	"J" Grooving
Machine	Gouging
Straight-line	Desearing
Shape	Rivet Washing
Contour	Scarfig
Bevelling	

*Use of LP-gases with oxygen are generally not recommended for fusion welding above 16 gauge metal because the heat cone is less concentrated; but they are successfully used in severing and heating processes.

E. COMPARATIVE FUEL GAS TEMPERATURES USING OXYGEN

Acetylene.....	5900° F. to 6300° F.
Propane	4900° F.
Natural Gas.....	4600° F.

F. FUNDAMENTALS OF SAFETY

1. The Mathematics of Safety
Accidents SUBTRACT from your pleasure,
ADD to your miseries, DIVIDE your income
and MULTIPLY your worries.

2. Triangle of Combustion

- a. Three elements must be present at the same time for combustion to be possible:
 - (1) Fuel
 - (2) Kindling point
 - (3) Oxygen

3. Ten basic rules for safe handling of oxygen fuel gases and equipment:

- a. Do not compress or use acetylene (in free state) to pressures higher than 15 PSI.
- b. Use no oil on welding equipment or hose.
- c. Blow out cylinder valve (crack valve for a second) before attaching regulators.
- d. Release adjusting screw on oxygen regulator before opening cylinder valve.
- e. Stand to side of regulator when opening cylinder valve.
- f. Open cylinder valves slowly.
- g. Purge oxygen and fuel gas passages (individually) before lighting torch.
- h. Light fuel gas before opening oxygen valve on torch.
- i. Do not use oxygen as a substitute for air.
- j. Keep heat, flames, and sparks away from combustibles.

III. EQUIPMENT

- A. Combination welding and cutting torches in sufficient number for class use — such as Smith's Big 98 outfit or equal.
- B. Wrenches and tongs or pliers
- C. Canvas gloves
- D. Cylinder of oxygen
- E. Cylinder of fuel gas
- F. Welding table with fire bricks
- G. Supply of practice material, rod, and solders
- H. CO₂ or dry powder type of fire extinguisher in the welding area is a necessity.

IV. PROCEDURE

Demonstrate the procedure for setting up the equipment and review safety rules involved.

- A. Cylinders should be securely fastened together with a chain or to a cylinder cart or wall to prevent tipping. If cylinder is tipped, acetylene gas, being in a fluid state in the cylinder, can enter the welding hose and regulator.
- B. Remove cylinder valve caps and store them in a convenient place so they may be replaced on cylinders when returned. Cylinder caps protect the cylinder valve from accidental damage.
- C. Examine cylinder valve threads. Remove dirt, oil or grease on cylinder valve. Never use oil on welding or cutting equipment. Oxygen under pressure and oil ignite with explosive violence.

D. Open each cylinder valve for a second or two, then close. This blows out foreign material which may have accumulated in the valve. Do not face the valve opening — stand to one side.

E. Attach regulator to cylinder valve with wrench.

F. Turn adjusting screw counter-clockwise to "Out" position.

G. Slowly open oxygen cylinder valve to wide open position. Then open acetylene cylinder valve (not over 1½ turns). Do not stand facing gauges stand to one side.

H. Purge regulators for a few seconds, then close.

I. Attach welding hose to regulators.

J. Attach torch body to welding hose. Wrench tighten all connections. It is impossible to attach hoses incorrectly to regulators or torches since oxygen connections have right hand threads, and acetylene connections have left hand threads. Also, acetylene nuts on hoses and regulators are identified by a machined groove on the outside surface of the nuts.

K. Set regulator pressures on the oxygen and fuel gas regulators. Check data charts for proper pressures according to metal thickness and tip used. Check hose connection fittings and regulator inlets for leaks. Use soap-water mixture.

L. Purge lines: Open torch fuel gas valve one-half turn (one to two seconds), then close. Repeat with oxygen.

M. Inserting welding tip into torch body. Methods for all makes of equipment are similar; however, when inserting a SMITH'S "O" ring welding tip, proceed as follows:

1. Give tip a quarter-turn in the fingers as you insert tip into torch head. Slip tip into the torch body head and spin the tip nut into the torch body until it seats at the bottom. **HAND TIGHTEN ONLY** — no wrench is needed. "O" rings provide perfect gas tight seal. Tip can be turned to desired position without loosening the tip nut because of the "O" ring construction.

N. How to Light and Adjust to Neutral Flame (continuing from Step M in Section IV with welding tip inserted):

1. Crack torch fuel-gas valve.
2. Light acetylene with flint lighter. **NEVER USE MATCHES OR CIGARETTE LIGHTER.**
3. Open torch fuel-gas valve until flame is free of smoke.
4. Open torch oxygen valve slowly until flame is neutral.

TO EXTINGUISH FLAME:

5. Close torch acetylene valve.
6. Close torch oxygen valve.
7. Close line or cylinder acetylene and oxygen valves.

8. Open acetylene torch valve until indicator on acetylene regulator returns to zero. Close acetylene torch valve, and release tension on acetylene regulator adjusting screw.
9. Repeat step 8 for oxygen.
 - a. Point out characteristics of a neutral flame. SMITH'S Flame Comparison Charts are available, illustrated in color, showing neutral, carburizing and oxidizing flames for welding tips and cutting tips.
 - b. Differences between the three types of flames.
 - (1) **NEUTRAL** — burns equal amounts of oxygen and acetylene. Identified by clear, well defined white cone.
 - (2) **CARBURIZING** — burns excess of acetylene. Identified by the feathery edges of the white cone.
 - (3) **OXIDIZING** — burns excess of oxygen. Identified by short white inner cone.
 - c. Effect of a carburizing flame
 - (1) Introduces carbon into the weld, causing hardening of the metal. Metal boils and is not clear. Resultant weld is weak.
 - d. Effect of an oxidizing flame
 - (1) Flame is hotter than neutral flame and burns or oxidizes the weld, making it brittle.

O. PRACTICE PERIOD

**Shop Work Sheet No. A.1
SET UP EQUIPMENT**

1. **OBJECTIVE:**
 - a. To learn the proper method of safely setting up and connecting welding equipment.
2. **GENERAL INSTRUCTIONS:**
 - a. Be sure all connections are clean and free from dirt; that all connections are tight and without leaks. Support tanks in an upright position so they cannot be tipped.
3. **EQUIPMENT, TOOLS AND MATERIALS:**
 - a. Fuel gas tank, hose and acetylene regulator
Oxygen tank, hose and oxygen regulator
Welding torch body and tips
Wrenches to fit connections
Goggles, gloves, tongs for handling hot metal
4. **PRECAUTIONS:**
 - a. Never use oil on welding equipment.
 - b. Keep cylinders in vertical position.
5. **OPERATING STEPS:**
 - a. Fasten cylinders in a vertical position.
 - b. Remove caps from cylinders.
 - c. Crack valves of each cylinder.
 - d. Connect oxygen regulator to oxygen cylinder.
 - e. Connect fuel gas regulator to cylinder.
 - f. Purge regulators, then close.
 - g. Connect hoses to regulators.
 - h. Connect torch body to hoses.
 - i. Insert welding tip.
 - j. Set regulator pressures on oxygen and fuel gas regulators.
 - k. Purge lines.
 - l. Test the connections for leaks with soap suds and water. If bubbling occurs, a leak is indicated.
- c. Do not tighten connections too tightly.

**Shop Work Sheet No. A.2
ADJUSTING TORCH AND FLAME**

1. **OBJECTIVE:**
 - a. To learn the proper adjustments of regulators, torch and flame.
2. **GENERAL INSTRUCTIONS:**
 - a. Use pressures recommended by the manufacturer.
 - b. Set static gas pressure with the valves of the torch closed.
 - c. Explain three types of flame: neutral, which is the result of all gases being completely consumed; oxidizing (excess oxygen); and carburizing (excess fuel gas).
3. **EQUIPMENT, TOOLS AND MATERIALS:**
 - a. Oxygen and fuel cylinders, regulators, hoses, torch bodies, and tips, goggles, lighters, gloves, tongs, welding table.
4. **PRECAUTIONS:**
 - a. Never use over 15 lbs. pressure on acetylene line.
 - b. Close fuel gas and oxygen tank valve when finished.
 - c. Release pressure from regulators and leave adjusting screws in the out position.

- d. Never allow fuel gas to escape into the air.
- e. See that the torch is not pointed at anyone when lighting.

5. OPERATING STEPS:

- a. Open valves on torch individually.
- b. Turn adjusting screws "in" until desired operating pressure is reached.
- c. Close valves on torch.
- d. Hold torch in left hand (if right handed) and vice versa.
- e. Open fuel valve on torch.
- f. Light the gas at tip end.
- g. Open oxygen valve on torch.

- h. Adjust to carburizing flame.
- i. Adjust to neutral flame.
- j. Adjust to oxidizing flame.
- k. Adjust to neutral flame.
- l. Close fuel gas valve on torch.
- m. Close oxygen valve on torch.
- n. Close cylinder valve on oxygen and fuel gas cylinders.
- o. Open valves on torch and release pressure.
- p. Shut valves on torch.
- q. Release adjusting screw pressures on oxygen and fuel gas regulators.

P. DEMONSTRATE THE PROCEDURE FOR RUNNING A STRINGER BEAD ON LIGHT GAUGE MATERIAL USING THE SEMI-CIRCULAR MOVEMENT METHOD.

The torch moves in progressive semi-circles along the line of the weld. The rod is moved in the same manner but alternating with the torch movement.

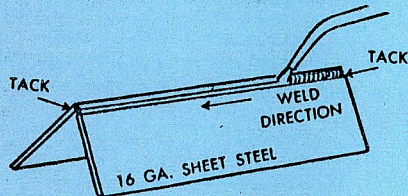
**Shop Work Sheet No. A.3
WELDING A BEAD**

1. OBJECTIVE:

- a. To teach the basic movement of the welding tip and rod, and proper control of the molten puddle.

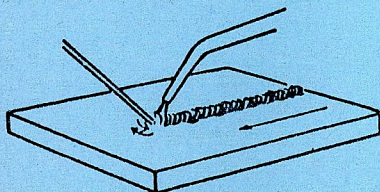
2. GENERAL INSTRUCTIONS:

- a. Use the oxy-LP flame to join together two pieces of 16-gauge sheet steel without the use of a filler rod. Set up two pieces of sheet steel in an "A" shape.



ILL. A.1

shape. Begin at right side as shown and melt contacting edges together. Use welding tip designed for propane (SMITH'S size No. 10—MW410 or No. 10LP tip end with Multi-tip Mixer). Hold tip at 45° angle from direction of travel and slowly weave flame side to side across the weld. Practice until pieces can be joined without burning the metal.



ILL. A.2

- b. Form puddle on right edge of flat 14 gauge plate. Travel from right to left (forehand technique) if you are right handed. Melt base metal to form puddle before adding filler rod. Rod should precede torch. Place rod in fore edge of puddle to add filler metal to form the bead. Keep the puddle the same size and shape the entire length of the bead. Practice until weld is uniform in width and thickness.

3. EQUIPMENT, TOOLS AND MATERIALS:

- a. Equipment same as for Work Sheets Nos. A.1 and A.2.
Several pieces of 16 gauge sheet metal 1" wide and 6" long.
3/32" mild steel rod.
2 pieces of light steel plate (14 gauge and 16 gauge thick).

4. PRECAUTIONS:

- a. Keep flame cone 1/16" from molten puddle.
- b. Use an oxidizing flame.
- c. Use correct size tip cleaner when cleaning tip.

5. PROCEDURE FOR MAKING A BEAD WITH FILLER ROD:

- | | |
|--|--|
| a. Place metal flat on table. | tip and rod. |
| b. Light and adjust torch. | e. Withdraw rod from puddle. |
| c. Form puddle on metal. | f. Move puddle forward with torch. |
| d. Add rod to puddle using semi-circular motion of | g. Continue to add rod and move puddle forward until bead is complete. |

QUIZ

SETTING UP EQUIPMENT

- | | |
|--|--|
| 1. Why should acetylene cylinders always be kept in a vertical position? | 6. How do we test for leaks around connections? |
| 2. Why are steel caps placed on all gas cylinders when they are being moved? | 7. Why should tank valves always be shut off when we are through using equipment for any length of time? |
| 3. Why do we crack the cylinder valve before connecting the regulator? | 8. How can we tell an oxygen connection from a fuel gas connection? |
| 4. Why should we never use oil on welding equipment? | 9. Can oxygen equipment be connected to fuel gas or vice versa? |
| 5. What are the safe working pressures for fuel gases? | 10. What three elements are necessary for combustion? |

QUIZ

ADJUSTING TORCH AND FLAME

- | | |
|---|--|
| 1. How can you identify a neutral flame? | 6. What effect does an oxidizing flame have on a weld? |
| 2. How many parts of oxygen does it take to burn one part of acetylene? | 7. What effect does a carburizing flame have on a weld? |
| 3. Why should we turn the fuel gas off first? | 8. What is the temperature of the neutral oxy-acetylene flame? |
| 4. Acetylene gas is produced from _____ and _____. | 9. Can any other gases be used for welding? |
| 5. Why should acetylene never be used at pressures higher than 15 PSI? | |

QUIZ

WELDING A BEAD

- | | |
|--|---|
| 1. When starting a weld, why should base metal be melted first? | 5. At what angle should the tip be held? |
| 2. How long should the rod be left in the puddle? | 6. What should be the angle of the rod? |
| 3. Where should the rod be placed in the puddle? | 7. Why isn't a larger size rod used for this job? |
| 4. Why is it important to keep the puddle the same size and shape? | 8. What type of rod should be used for this job? |
| | 9. Why is it important to use the right size tip cleaner? |

MISSION ONE
Cutting and Flat Surf. Welding
of Light Material

I. DEFINITION

A. What is cutting (or burning)?

It is the severing of ferrous metals by heating and rapid oxidization of the metal with pure oxygen. The metal is heated to its kindling temperature by the cutting tip preheat flames (4 or 6 flames); then rapidly oxidized by a high pressure stream of oxygen from the oxygen jet (center hole) of the cutting tip. The kindling temperature is approximately 1600° F. Cutting is primarily a chemical process involving the chemical affinity of oxygen for heated ferrous metals. In addition to the chemical action, there is a noticeable and helpful mechanical eroding effect produced by the energy of the cutting oxygen stream which washes away some of the metal in an unconsumed metal form (slag). This eroding effect may be as great as 30 to 40% at high speeds.

B. Difference between welding and cutting tips.

1. Number of orifices
2. Purpose

II. DESCRIPTION OF THE CUTTING ATTACHMENT

A. Explain and demonstrate insertion of cutting assembly into torch body; and cutting tip into cutting assembly head.

B. Seal rings and flexible cutting tip seats. Keep gases from mixing and forming combustionable mixture in the torch handle.

C. Refer to cutting and welding data charts for pressure and flame adjustments. Explain that hottest preheat flames are oxidizing.

D. Students practice lighting and adjusting the flames.

E. Explain and demonstrate the use and function of special tips which fit the cutting assemblies. (Explain use of slag box and fire danger from hot slag.)

1. Gouging
2. Plate Cutting
3. Rivet Cutting

III. PROCEDURE

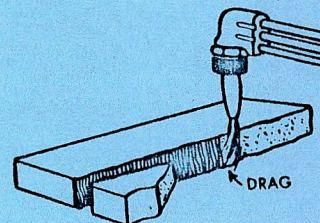
Make demonstration cut in $\frac{3}{16}$ " steel plate.

A. Demonstrate the effect of different flame settings on cut starting time. Oxidizing preheat flame will start the cut faster than neutral flame setting.

B. Demonstrate the effect of cutting speed on cut quality. There is an optimum speed for each metal thickness. Using this speed with the proper size tip will yield the best quality cut. If speed is increased, the "lag" or "drag" lines in the cut will be more pronounced. Cutting at a slower speed will result in burn-over on the top edge of the metal.

C. Explanation of "lag" or "drag" lines.

1. This refers to the situation in which the most distant portion of the cutting stream lags behind the stream nearest the cutting tip. It can be caused by too fast cutting.



ILL. 1.1

2. Losing a cut is generally caused by:

- a. Trying to cut too fast, by moving torch more rapidly than the combustion of the steel can take place.
- b. Inadequate preheat.
- c. Insufficient oxygen.
- d. Improper pressure.

D. Students practice straight cuts in $\frac{3}{16}$ " steel plate.

Shop Work Sheet No. 1.1
USE OF THE CUTTING ATTACHMENT

1. OBJECTIVE:

- a. To learn the theory of flame cutting and flame adjustments and make cuts in $\frac{3}{16}$ " steel plate.

2. GENERAL INSTRUCTIONS:

- b. In cutting steel, the oxygen pressure and size of tip depend upon the thickness of the plate.

3. EQUIPMENT, TOOLS AND MATERIALS:

- a. Equipment is same as for Section III of the Introduction.
- b. $\frac{3}{16}$ " steel plate, 4" x 6".

4. PRECAUTIONS:

- a. Always set the oxygen pressure for each thickness of metal.
- b. Use hottest flame on the preheating orifices.
- c. Check preheat flames with oxygen jet wide open.
- d. Place metal to cut in such a position that the hot slag does not fall on the hoses, wooden floor, or other combustible materials. The use of a metal slag box is recommended.

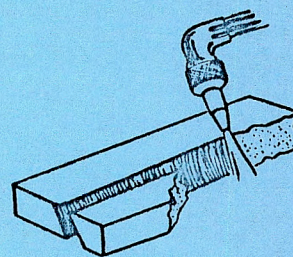
5. OPERATING STEPS:

- a. Measure thickness of metal to be cut.

- b. Check cutting chart for tip size and oxygen pressure.
- c. Set oxygen pressure for thickness of metal. Check operating pressure with cutting jet lever depressed.
- d. Light fuel gas at tip end.
- e. Adjust to hottest flame.
- f. Check preheat flames with cutting jet open.
- g. Hold preheat flames about $\frac{1}{16}$ " from top of plate at left edge. When red spot appears on metal, depress cutting jet lever and move from left to right across plate.
- h. If cut is "lost," release cutting jet lever and preheat another spot at point where cut stopped. Continue on as in Step g.
- i. Practice cutting until progress is satisfactory.

E. DEMONSTRATE PROPER PROCEDURE FOR MAKING A BEVEL CUT IN $\frac{1}{4}$ " STEEL.

- 1. Explain necessity to increase oxygen pressure due to increased metal thickness. Angle actually increases the thickness to exceed $\frac{1}{4}$ ".
- 2. Explain that a 45° bevel cut increases the metal thickness by 50%.
- 3. Check cutting data chart to see if proper tip for $\frac{1}{4}$ " thickness will also cut the $\frac{3}{8}$ " bevel cut.
- 4. Practice making bevel cuts.



ILL. 1.2

**Shop Work Sheet No. 1.2
MAKING 45° BEVEL CUT**

1. OBJECTIVE:

- a. To learn the correct technique to be used in bevel cutting.

2. GENERAL INSTRUCTIONS:

- a. Plate should be clean from scale and rust.
- b. Set oxygen pressure for thickness of the metal.
- c. Start cut on edge of plate.
- d. Speed of travel should be just fast enough that a light "drag" is present.

3. EQUIPMENT, TOOLS AND MATERIALS:

- a. Equipment same as for Section III of the Introduction.
- b. $\frac{1}{4}$ " mild steel plate, 4" x 6".

4. PRECAUTIONS:

- a. Do not let preheat flames touch metal.
- b. Keep $\frac{1}{16}$ " above metal. Be sure to check preheat

flames with the cutting jet wide open.

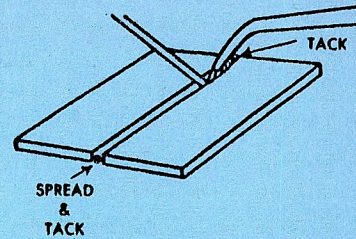
- c. Do not use more oxygen than the cutting chart calls for.

5. OPERATING STEPS:

- a. Place metal on table with the part to be cut over slag box.
- b. Check cutting chart and adjust oxygen regulator to recommended pressure.
- c. Light and adjust cutting tip flames.
- d. Preheat edge of metal until it is dull red.
- e. Open oxygen jet and begin cut, holding torch at 45° angle.
- f. If cutting action stops, release cutting jet and preheat edge where cutting action stopped.
- g. Practice these cuts until instructor is satisfied with progress.

F. DEMONSTRATE TECHNIQUE IN MAKING A BUTT WELD WITH PIECES OF 14 GAUGE SHEET STEEL.

1. Remove cutting attachment from torch body and insert welding tip. (SMITH'S Tip size No. 3, MW203, AW203, SW203).
2. Review procedure for lighting torch.
3. Explain how to set up metal with proper gap for expansion.
4. Explain the semi-circular (weave) movement method.



ILL. 1.3

**Shop Work Sheet No. 1.3
MAKING A FLAT BUTT WELD
WITH LIGHT MATERIAL**

1. OBJECTIVE:

- a. To learn the technique of joining metal together by a flat butt joint.

2. GENERAL INSTRUCTIONS:

- a. Cut metal into strips 1" wide.
- b. Place the edges together at one end, leaving the other end open (about 1/4" to the foot) to allow for distortion.
- c. Do not add excess rod.
- d. Bead should be built up very little and the edges feathered out.
- e. Speed of travel should be slow enough to allow a little metal to show through on the other side.

3. EQUIPMENT, TOOLS AND MATERIALS:

- a. Equipment same as for Lesson One.
- b. 14 gauge metal, 1" x 6".
- c. 3/32" mild steel welding rod.

4. PRECAUTIONS:

- a. Be sure both ends of the weld are finished.
- b. Leave enough space so the edges of the metal do not overlap.

5. OPERATING STEPS:

- a. Cut metal into strips with shears or cutting attachment.
- b. Lay strips flat on the table.
- c. Line up metal to allow for distortion.
- d. Light and adjust torch.
- e. Form puddle at right hand end of metal.
- f. Add filler rod.
- g. Weld seam using semi-circular movement method.
- h. Test weld by bending it in a vise.
- i. Practice.

G. REVIEW USES OF THE CUTTING PROCESS ON THE FARM AND INDUSTRY OR ACCORDING TO SPECIAL INTEREST OF THE CLASS.

QUIZ

USE OF THE CUTTING ATTACHMENT

1. What causes an excess of slag at the bottom of a cut?
2. How do you determine proper tip size and oxygen pressure for various steel thicknesses?
3. How would you cut light-gauge metal?
4. How is a cut started?
5. What causes "lag" lines?
6. What is the difference in procedure between a bevel cut and a straight cut with the tip held at a right angle to the metal surface?
7. What happens if the torch is moved too fast?
8. What is the procedure if the cut is lost?
9. What happens if oxygen pressure is too low?

QUIZ

MAKING A FLAT BUTT WELD WITH LIGHT MATERIAL

1. What is the proper flame adjustment for most welding with acetylene?
2. What can be done to counteract the effect of expansion and contraction when doing this job?
3. What is the thickest metal which can be welded with the No. MW203 tip?
4. What happens if the speed of travel is too fast?
5. What happens if the speed is too slow?
6. How is the weld tested?

LESSON TWO

The Braze Welding (Brazing) Process

I. DEFINITION

The difference between Fusion and Non-Fusion Welding.

- A. Fusion welding means actual melting of the metal to form a fused (homogeneous weld) bond, while non-fusion (brazing) welding requires heating of the metal to a cherry red heat, but no melting. Bronze is heated till it flows.
- B. Explain the effect of expansion and contraction in fusion welding, especially of cast iron.
- C. Methods of controlling expansion and contraction in cast iron welding:
 1. Preheating — to provide uniform expansion.
 2. Braze welding — heating cast iron to a cherry red will not seriously affect the characteristics of the cast iron nor will there be any serious problem of expansion if the heat is properly applied.

II. DESCRIPTION

How a bond is formed in the bronze welding process.

- A. Preparatory cleaning by grinding
 1. Surface must be clean of dirt, grease and rust, so that a good surface bond can be made between the metal and bronze. A rough surface is better than a very smooth one with cast iron.
- B. Tinning of the metal
with a thin film of bronze. Surface must be clean. Use a good flux and maintain surface metal at temperature which will melt the bronze rod.

C. Flame adjustment

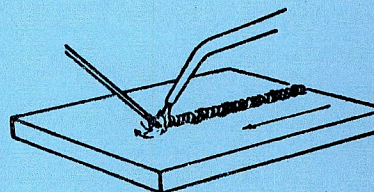
1. Use neutral flame setting. Control temperature by adjusting distance of flame from work. Do not attempt to control heat by using a carburizing flame.

D. The use of proper flux

1. To dissolve and prevent the formation of oxides, nitrides or other undesirable inclusions formed in welding.
2. Instructor demonstrates what happens when flux is not used.
3. A good grade of flux (like SMITH'S N3) chemically dissolves the oxide film so that the bronze can penetrate the metal pores.

III. PROCEDURE

Making a stringer bead with bronze rod on steel plate.



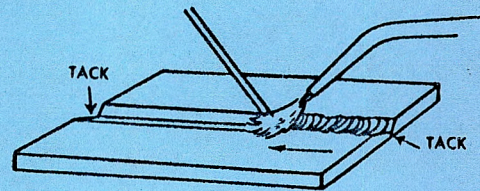
ILL. 2.1

- A. Demonstrate method and review flame adjustment procedure.
- B. Student practices on 6" square plates of 16 gauge steel.
 1. The area of the bronze weld is "tinned" or coated

Shop Work Sheet No. 2.1
BRONZE WELDING BEADS ON LIGHT METAL

1. OBJECTIVE:
 - a. To teach the technique of bronze welding beads on light material, puddle control and control of heat.
2. GENERAL INSTRUCTIONS:
 - a. Cut 16 gauge stock in squares not over 6" x 6".
 - b. Grind on an emery wheel to remove the surface oxide scale.
 - c. Proper heat of the base metal is most important and should not be overheated. Be sure the flame is not excessively oxidized.
 - d. Use flux for bronze welding steel.
3. EQUIPMENT, TOOLS AND MATERIALS:
 - a. Welding tip (SMITH'S size 3, SW203, MW203, or AW203)
 - b. 1/8" bronze rod
 - c. 16 gauge sheet steel
 - d. Brazing flux (SMITH'S N3) or equal
4. PRECAUTIONS:
 - a. Heat base metal to cherry red
 - b. Watch for overheating
 - c. Wear goggles when grinding
5. OPERATING STEPS:
 - a. Use 16 gauge material and cut to size.
 - b. Remove scale by grinding.
 - c. Place material on fire brick.
 - d. Adjust to a neutral flame. Heat end of rod and

- e. dip into flux.
 - e. Heat an area of the base metal about 1/2" in diameter to cherry red and apply flux only.
 - f. Bring the rod into the flame and deposit a small amount of bronze.
 - g. Test specimen for bronze adherence.
- C. Making a single vee butt joint using 1/4" steel plate with bronze rod.



ILL. 2.2

1. Demonstrate flame adjustment.
 - a. Material is thicker, so more heat is required. Tip flame is lengthened by adding more fuel gas.
 - b. Neutral flame is used.
2. Review the "tinning" procedure and build up of deposited bronze.
3. Complete the weld.
4. Student practice.

Shop Work Sheet No. 2.2
BRONZE WELDING BUTT JOINT
ON HEAVY STEEL PLATE

1. OBJECTIVE:
 - a. Technique of brazing a butt weld on 1/4" steel plate, preparation of the material and control of puddle and heat.
2. GENERAL INSTRUCTIONS:
 - a. Bevel plates with cutting torch to 45° bevel. Remove the oxide scale left by cutting torch at bottom of bevel with slag chipping hammer. The scale on sides of bevel can be removed by grinding. Use a neutral flame. Be sure to use flux.
3. EQUIPMENT, TOOLS AND MATERIALS:
 - a. Welding tip (SMITH'S size 5, SW205, MW205, AW205)
 - b. 3/16" bronze rod
 - c. Two pieces 1/4" plate, beveled
 - d. Brazing flux (SMITH'S N3 or equal)
4. PRECAUTIONS:
 - a. Use the proper adjustment of flame.

- b. Do not carry an excessively deep puddle.
 - c. "Tin" base metal ahead of weld.
5. OPERATING STEPS:
- a. Secure stock of 1/4" plate and bevel with cutting assembly.
 - b. Remove the slag and oxide scale from plates by chipping and grinding.
 - c. Place pieces to be welded on fire brick.
 - d. Adjust the torch to a neutral flame.
 - e. Preheat the end of the rod and dip into flux.
 - f. Heat an area of the base metal about 1/2" in, each side of the bevel, to cherry red and apply flux only.
 - g. Bring the rod into the flame and deposit a small amount of bronze.
 - d. Review practical use of bronze welding for joining steel parts.

QUIZ

BRONZE WELDING BEADS ON LIGHT MATERIAL

1. What type of flame is used for this job? or flux?
2. Which is applied first when starting this job, bronze
3. How is the steel prepared before starting this job?

QUIZ

BRONZE WELDING BUTT JOINT ON HEAVY STEEL PLATE

1. What is the angle of the bevel? torch?
2. How deep is the bevel usually made?
3. How is the oxide removed that is left by the cutting
4. When starting to braze, why do we apply the flux before the bronze?

LESSON THREE Braze Welding (Brazing) of Cast Iron

I. DEFINITION

Peculiarities of cast iron.

- A. It contains a high percentage of carbon, silicon, phosphorus and graphite. Low strength of cast iron is due to the graphite flakes present in the cast iron.
- B. Effects of expansion and contraction: Cast iron is not ductile and therefore cannot withstand thermal stresses. Heat during brazing and preheating must therefore be carefully controlled.
- C. Methods of preventing distortion or breakage during and after welding.
 1. Preheating
 - a. If cast iron is overheated, free carbon from the cast iron will migrate into the weld metal in quantity beyond the absorption limits of the bronze. This excess carbon will form grain boundaries, weakening the weld and causing contraction stresses. After preheating the cast iron must be gradually and uniformly cooled.
 2. Use of bronze welding method
 - a. Reasons for the popularity of braze welding cast iron.
 1. It is necessary to heat metal only to a cherry red heat; expansion and contraction are minimized.
 2. Braze welding is faster and less expensive than fusion welding of cast iron.
 3. With cast iron castings, it is usually not necessary to preheat the entire casting.

II. DESCRIPTION

How to recognize cast iron by visual inspection.

- A. Fracture is uniform grey in color. The grey color comes from the graphite flakes.
- B. Difficult to cut with cutting torch.
- C. Fairly soft and easily machined.
- D. Spark test on grinding wheel will show very few sparks.

III. PROCEDURE

Instructor demonstrates welding a "knob" of bronze onto cast iron. (See instructions on Shop Work Sheet No. 3.1.)

- A. Review flame setting.
 1. Use neutral flame.
- B. Demonstrates need for proper cleaning of metal.
 1. Removes surface by grinding.
 2. Sears surface with hot flame.
 3. Knocks off knob with hammer to show penetration of bronze into the base metal.
- C. Students practice building up a knob of metal and testing for bronze penetration into the cast iron.

Shop Work Sheet No. 3.1
BRAZE WELDING A KNOB ON CAST IRON

1. OBJECTIVE:

- a. To teach the student control of the puddle, heat, flame, and rod manipulation and preparation of material for brazing.
- c. Preheat work to cherry red heat.
- d. The area of preheating should be $\frac{1}{2}$ " in diameter, and 2" in length.

2. GENERAL INSTRUCTIONS:

- a. Prepare cast iron surface by grinding.
- b. Sear surface for brazing operation.
- c. Flame adjustment should be neutral.
- d. Use flux for bronze welding of cast iron.

3. EQUIPMENT, TOOLS AND MATERIALS:

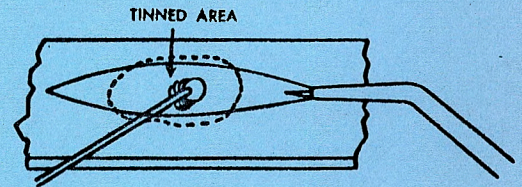
- a. Welding tip (SMITH'S No. 5, SW205, MW205, AW205) — Select tip on basis of metal thickness.
- b. $\frac{1}{8}$ " or $\frac{3}{16}$ " bronze rod.
- c. One piece cast iron per student.
- d. Flux for bronze welding cast iron (SMITH'S N2 or equal).

4. PRECAUTIONS:

- a. Preheat base metal properly before depositing the flux and the bronze rod.
- b. Use a neutral flame.
- c. Use safety goggles when grinding.

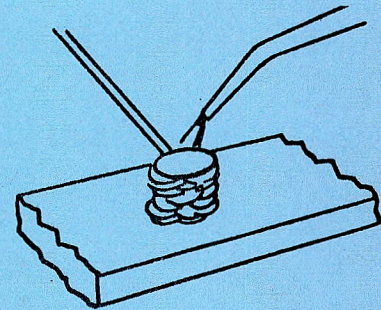
5. OPERATING STEPS:

- a. Prepare cast iron stock by grinding.
- b. Torch adjustment is oxidizing.



ILL. 3.1

- e. Flux and tin the preheated area.

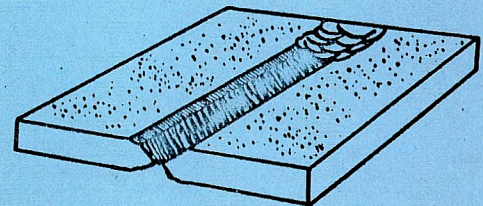


ILL. 3.2

- f. Deposit bronze until knob is desired size (approx. $\frac{3}{4}$ " to 1" tall).
- g. Test specimen.

D. DEMONSTRATE TECHNIQUE USED IN MAKING A BUTT JOINT WELD IN CAST IRON WITH BRONZE ROD.

1. Preparation of broken edges.
 - a. Beveling.
 - b. Searing.
2. Method used in lining up broken pieces.
3. Application of flux on tinning operation.
 - a. Use neutral flame.
 - b. Uses cast iron flux (SMITH'S N2 or equal).
4. Demonstrates method of testing the weld.



ILL. 3.3

E. STUDENT PRACTICE.

Shop Work Sheet No. 3.2
BRONZE WELD A BEVEL BUTT JOINT
IN CAST IRON

1. OBJECTIVE:

- a. To teach the student different methods of preparing the work for brazing, control of heat, rod manipulation for tinning operation.

2. GENERAL INSTRUCTIONS:

- a. Prepare the cast iron pieces by bevelling the edges, top and bottom, to 45° angle.
- b. Bevel the broken edges by grinding. After the bevel has been ground, grind through top of the base metal back from the edge of bevel approximately 1/2". Repeat this operation from the bottom of the bevel.

3. EQUIPMENT, TOOLS AND MATERIALS:

- a. Welding tip (SMITH'S size No. 5, SW205, MW205, or AW205).
- b. 1/8" or 3/16" bronze rod.
- c. Two pieces cast iron 1/2" or 3/4" thick.
- d. Cast iron flux (SMITH'S N2 or equal).

4. PRECAUTIONS:

- a. Use safety goggles when grinding.

- b. Use neutral flame.

- c. Sear the bevelled edges.

5. OPERATING STEPS:

- a. Secure and prepare the cast iron for welding.
- b. Use neutral flame.
- c. Place the work on fire bricks and line up edges.
- d. Sear the beveled edges.
- e. Heat one end of break and tack.
- f. Preheat by moving torch slowly back and forth along bevels and bring cast iron to cherry red heat.
- g. Heat the end of bronze rod and dip into flux.
- h. Apply flux only into bevel.
- i. Start tinning immediately after flux has been applied.
- j. When laying top pass, tinning should take place on each side of bevel by extending bead 1/8" to 1/4" on top of base metal. Beads in the "vee" should be concave.
- k. Test specimen.

QUIZ

BRAZE WELDING A KNOB ON CAST IRON

1. What are the advantages of bronze welding cast iron?
2. Why do we sear the cast iron when grinding is used in preparation of materials?
3. Does bronze welding require more heat than fusion welding?
4. Why do we use more preheating for fusion welding cast iron than bronze welding?

QUIZ

BRONZE WELD A BEVEL BUTT JOINT
IN CAST IRON

1. What bevel is used in brazing cast iron?
2. What is the purpose and reason for bevelling the pieces?
3. Should the appearance of the beads in the "vee" be concave or convex?
4. If in the preparation of the butt joint the bevel was made over 3/4 of the way through the base metal, will the bronze penetrate to the bottom of the break?
5. Why?
6. Are locked up stresses high or low in a bronze weld?

LESSON FOUR Silver Brazing

I. DEFINITION

The Silver Brazing Process

Silver brazing is one of a group of welding methods wherein the base metals are heated to temperatures somewhat above 800° F. and are joined by non-ferrous fillers having a melting point below the base metal. Capillary attraction distributes the filler material (silver solder) in a closely fitted joint by displacing the flux.

II. DESCRIPTION

A. Preparation

1. Cleaning—mechanical or chemical.
Metal is cleaned to remove foreign materials and loose oxide and then coated with a flux which dissolves the remaining oxide.
2. Joint fitting.
 - a. Should fit closely and evenly. Space between the parts should be wide enough for a single sheet of paper.
3. Fluxing.
 - a. Flux is used as an aid in cleaning the metal by reducing the oxide on the metal surface. It also provides protection from oxide formation before and during brazing.
 - b. There are many fluxes available and should be selected according to the metal, temperatures required, degree and length of oxidization protection, assistance to capillary attraction, toxicity, corrosive action and ease of removal after brazing.
 - c. When silver brazing, it is best not to use borax based flux. These fluxes are primarily for higher temperature brazing.

B. Explanation of capillary attraction and its importance in silver brazing joints.

1. The action which takes place when the molecules of a liquid (silver solder) are attracted by a solid (the metal pieces) causing the liquid to flow, distributing the filler metal between the properly fitted surfaces of the joint. The capillary attraction spreads the silver solder uniformly throughout the joint area.

2. Demonstration.

- a. Take two pieces of glass, press them together, and dip them into a shallow plate or container of water or ink. The liquid will slowly rise between the two glass pieces. If additional pressure is added, fluid will rise faster.

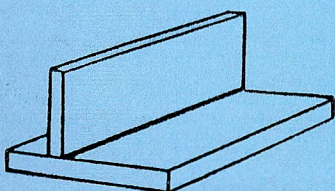
C. Facts about Silver Solder.

1. A good solder joint has approximately 4500 PSI tensile strength.
2. Properties of silver solder:
 - a. Relatively low melting temperature.
 - b. Very little required to make a satisfactory joint.
 - c. Deposit is non-oxidizing and non-toxic.
3. Some reasons for using silver solder rather than bronze.
 - a. Lower application temperature required.
 - b. Excellent adhesive qualities.
 - c. Very small amount required to make a good joint.
 - d. Non-oxidizing.
4. Some reasons for using silver solder rather than soft solder.
 - a. Stronger joints.
 - b. Can be used where non-toxic joint is required. (Silver solder is used in repairing food containers, dairy equipment and other areas when it is important for the metals to be non-toxic and non-corrosive.)
5. Silver solder is used extensively in the electrical industry because:
 - a. It is an excellent electrical conductor.
 - b. It makes strong joints that are not affected by vibration.
 - c. It will not corrode.

III. PROCEDURE

Demonstrate the technique of making three types of joints.

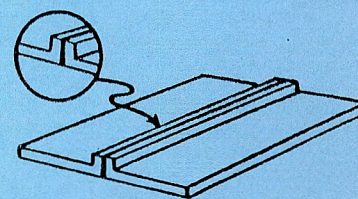
- A. Vertical plate to horizontal plate, Illustration 4.1.
- B. Lap joint, Illustration 4.2.
- C. Flange-type joint, Illustration 4.3.



ILL. 4.1



ILL. 4.2



ILL. 4.3

Shop Work Sheet No. 4.1
SILVER BRAZING ON STEEL

1. OBJECTIVE:

- a. To learn the technique of silver soldering the various joints used in the welding trade when joining together steel sheets, tubes and wires.

2. GENERAL INSTRUCTIONS:

- a. Silver brazing is a combination of soldering and brazing.
- b. Rub with emery cloth or grind the area to be soldered.
- c. A thin coating of flux is applied to the joint area.
- d. Heat joint until flux is watery in appearance.
- e. Quickly apply wire solder to joint. If temperature is correct solder will flow without aid of the torch.

3. EQUIPMENT, TOOLS AND MATERIAL:

- a. Same as used in all previous lessons.
- b. Use Size 3 welding tip (SMITH'S AW203, MW203, SW203).
- c. Grinder, emery paper, wire silver solder—Grade No. 1, 2, or 3, Handy Flux.
- d. Small pieces of 16 gauge steel (2" x 2").

4. PRECAUTIONS:

- a. Remove all dirt or scale from solder area.
- b. Flux only area to be soldered.
- c. Use a neutral flame on torch.
- d. Do not overheat the metal.
- e. Use a very small amount of solder.

5. OPERATING STEPS:

- a. Grind solder area free of rust and mill scale.
- b. Position plates on welding table.
- c. Support upper plate so there is clearance of a thin sheet of paper between it and the lower plate. (Allows solder to flow through joint.)
- d. Brush flux evenly over solder area.
- e. Use neutral flame to preheat joint.
- f. Heat metal until flux is in watery condition.
- g. Move torch away from work and apply solder quickly.
- h. Solder should flow through the joint due to the heat of base metal.
- i. If solder fails to flow, reheat the plates to a higher temperature.
- j. Allow to cool, then wash with water.

QUIZ

SILVER BRAZING

1. A good solder joint has about what tensile strength?
2. What is capillary attraction?
3. What are some of the properties of silver-solder?
4. What are some of the reasons for using silver-solder rather than soft solder?
5. What are some reasons for using silver solder rather than bronze?
6. A flange type joint might be filled with silver-solder when used in the manufacture of dairy equipment. Why?
7. Silver-solder is used extensively in the electrical industry. State some reasons.
8. When repairing food containers, or containers used in dairy equipment, why is silver solder always used rather than soft solder?

LESSON FIVE
Hard Surfacing

I. DEFINITION

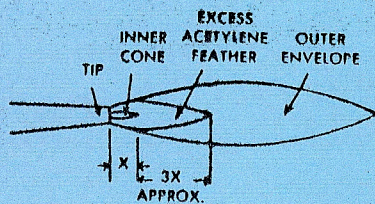
- A. Hard surfacing is the overlaying of a metal with high-hardness characteristics on a softer base metal to give the softer metal an increased useful life. Hard surfacing and the application of hard metals will lengthen the useful life of agricultural and industrial equipment.
- B. Hard surfacing metal provides durability of the base metal because of its hardness, abrasion resistance, impact resistance, heat resistance or decreased friction.

II. DESCRIPTION

- A. Three classes of hard surfacing metals:
1. Ferrous alloy (have an iron base and are alloyed with chrome, manganese, silicon and similar metal).
 2. Non-ferrous alloy (composed primarily of chromium, tungsten, and cobalt).
 3. The diamond substitutes (alloys composed of carbides of tungsten, tantalums, titanium and bron and the borides of chromium).

III. PROCEDURE

- A. The example given in this section covers the type of rod (non-ferrous alloy) which is widely used for plow shares.



ILL. 5.1

1. The hard surfacing is applied with a carburizing flame and with the acetylene feather twice as long as the inner cone known as a 3X flame. The carburizing flame carburizes the base as it heats uniformly, thus lowering the melting point of the surface.
2. Hard surfacing metal should be "sweated" on—not amalgamated with the base metal as in welding. In this method it is similar to brazing in that it does not make a fusion bond. The

"sweating" of the base metal is identified by the glistening appearance of the metal as the base is carburized. In hard surfacing the forehand method is recommended over the backhand method. The forehand method limits the possibility of diluting the base metal which often occurs when the backhand method is used.

3. Additional facts on hard surfacing.
 - a. Foaming or bubbling of the deposit indicates the flame is too hot and should be more carburizing. However, too much acetylene will cause an excessive amount of carbon to be deposited and slow down the surfacing.
 - b. The surface of the base metal should be cleaned of scale, rust and dirt.
 - e. In most cases, flux need not be used. However, it should be used on cast iron or where it is not possible to clean the surface as in tight corners.
 - d. Care should be taken so as not to warp the base metal when hard surfacing.
 - e. Use a carburizing flame to prevent overheating of the base metal. The 3x flame will provide this as well as a soft smooth flame.
4. Demonstrate on 1/4" steel plate, the technique employed in hard surfacing a plow share.
 - a. Wide choice of rods available for different requirements.
 - b. Use Group 2 rod such as Stoodite.
 - c. Bring base metal to a "sweat" heat and melt hard surfacing rod on heated surface.
 - d. Explain control of width and thickness of overlay.
 - e. Demonstrate how to bring metal to edge of plate to make smooth sharp cutting surfaces.
5. Demonstrate process on an actual plow share (if possible).
6. Students practice.

Shop Work Sheet No. 5.1 HARD SURFACING

1. OBJECTIVE:

- a. To learn the technique of hard surfacing mild steel, using cast type rods.

2. GENERAL INSTRUCTIONS:

- a. Clean area to be hard surfaced, thoroughly removing rust and scale.
- b. Set torch to a 3X carburizing flame.
- c. Preheat plate until a "sweat" covers the weld area.
- d. Apply rod to this area and move puddle along with the flame.
- e. Remove flame from puddle in a gradual spiral motion.

3. EQUIPMENT, TOOLS, AND MATERIALS:

- a. Welding tips (SMITH'S Size #5, SW205, MW205, AW205 or equal).
- b. 3/16" hard surfacing rod (Stoodite or equal).
- c. Scrap steel plate, 1/4" x 4" x 6".
- d. Grinder (and plow share for each student if available).

4. PRECAUTIONS:

- a. Check flame carefully (acetylene feather twice the length of inner cone).
- b. Clean steel surface is necessary.
- c. Make certain metal "sweats" before the rod is added.
- d. Don't try to push the puddle with the rod.

5. OPERATING STEPS:

- a. Grind plate to obtain clean surface.
- b. Place flat on welding table.
- c. Preheat the area to be hard surfaced.
- d. Adjust torch carefully to obtain a 3X carburizing flame.
- e. Start heating the right hand corner.
- f. When a visible sweat appears on the surface of the plate, add rod, and move across the plate from right to left.
- g. The flame is used to flow the puddle over the area desired.
- h. If bubbles appear on the surface of the puddle, it indicates the metal is cold and should be heated before trying to add rod again.
- i. Any dirt or rust should be floated to the surface. Any dirt that won't float should be dislodged with the rod.
- j. On completion of weld, withdraw torch in a spiral motion to cool puddle slowly.

QUIZ

HARD SURFACING

1. What is hard surfacing?
2. What does a 3X flame (excess of acetylene) do in the hard surfacing process?
3. What does foaming, or bubbling of a deposit indicate?
4. What appearance will the deposit have if the gas mixture is correct?
5. What is the purpose of bringing the surface to a "sweating" temperature?
6. What is the main objection of deep penetration when hard facing with this type of alloy (non-ferrous)?
7. Is it good practice to use multi-pass deposit when hard surfacing?

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GLOSSARY OF WELDING TERMS

Base Metal: The metal to be welded or cut.

Bead Weld: A type of weld made by one passage of electrode or rod.

Bevel Angle: The angle of bevel on the prepared edge of a part to be joined by a groove weld.

Brazing: A group of welding processes wherein the filler metal is a non-ferrous metal or alloy whose melting point is higher than 1000° F. but lower than that of the metals or alloys to be joined.

Butt Joint: A welded joint between two abutting parts lying in approximately the same plane.

Carburizing Flame: A gas flame having the property of introducing carbon into the metal heated.

Cone: The conical part of a gas flame that is next to the orifice of the tip.

Convex Fillet Weld: A fillet weld having a convex face.

Cutting Attachment: A device that is attached to a welding torch to convert it to a cutting torch.

Cutting Tip: A gas torch tip especially adapted for cutting.

Cylinder: A portable container used for storage of a compressed gas.

Deposited Metal: Metal that has been added by a welding process.

Filler Metal: Metal to be added in making a weld.

Flux: A fusible material or gas used to dissolve and prevent the formation of oxides, nitrides, or other undesirable inclusions formed in welding.

Fusion Welding: A group of processes in which metals are welded together by bringing them to the molten state at the surfaces to be joined, with or without the addition of filler metal, without the application of mechanical pressure or blows.

Gas Pocket: A cavity in a weld caused by gas inclusion.

Gas Welding: A nonpressure (fusion) welding process wherein the welding heat is obtained from a gas flame.

Hard-facing: The application of a hard, wear-resistant alloy to the surface of a softer metal by a gas-welding process.

Kerf: The space from which the metal has been removed by a cutting process.

Lap Joint: A welded joint in which two overlapping parts are connected by means of fillet, plug, slot, spot, projection, or seam welds.

Neutral Flame: A gas flame wherein the portion used is neither oxidizing nor reducing.

Overlap: Protrusion of weld metal at the toe of a weld beyond the limits of fusion.

Oxidizing Flame: A gas flame wherein the portion used has an oxidizing effect.

Oxy-acetylene Welding: A gas-welding process wherein the welding heat is obtained from the combustion of oxygen and acetylene.

Oxygen Cutting: A process of severing ferrous metals by means of the chemical action of oxygen on elements in the base metal at elevated temperatures.

Pass: The weld metal deposited by one general progression along the axis of a weld.

Penetration: The penetration, or depth of fusion, of a weld is the distance from the original surface of the base metal to that point at which fusion ceases.

Porosity: The presence of gas pockets or inclusions.

Postheating: Heat applied subsequently to welding or cutting operations.

Preheating: Heat applied prior to welding or cutting operations.

Weld: A localized consolidation of metals by a welding process.

Weld Metal: The metal resulting from the fusion of the base metal or the base metal and the filler metal.

Welding Procedure: The detailed methods and practices involved in the production of a welded structure.

Welding Rod: Filler metal, in wire or rod form, used in the gas-welding process.

Welding Tip: A gas-torch tip especially adapted for welding.

Welding Torch: A device used in gas welding for mixing and controlling the gases.

SMITH'S SHORT COURSE FOR GAS CUTTING, WELDING, BRAZING



ANSWER KEY



INTRODUCTION

A. Quiz Answers—Setting up the Equipment

1. LP Gas and acetylene gas are both in a liquid state within the cylinder. Therefore, the tank should always be used in an upright position in order to eliminate the possibility of liquid getting into the hose.
2. To protect the cylinder valve from accidental damage.
3. To blow out dust and dirt which might have settled in the cylinder valve outlet.
4. Oxygen under pressure and oil ignite with explosive violence. Oxygen is always present in the welding torch or cutting assembly.
5. LP Gas is a relatively stable gas so it can be safely used at pressures up to 30 PSI. Acetylene is an unstable gas and it begins to dissociate into its elements of hydrogen and carbon at pressures over 15 pounds. Consequently, acetylene should never be used at pressures greater than 15 pounds per square inch.
6. The safest way is to use soapsuds.
7. This is to eliminate the possibility of someone accidentally opening the torch valves and filling a room with explosive gases. Also, if there should be a leak anywhere in the hose or connections, shutting the tank valve eliminates the hazard.
8. Oxygen connections always have a right hand thread. Acetylene connections (except certain cylinder connections) always have a left hand thread. Acetylene connections (left hand) have a groove machined around the nut.
9. No. Oxygen connections are right hand, fuel gas connections are left hand.
10. (1) Kindling Point; (2) Oxygen; (3) Fuel.

B. Quiz Answers—Adjusting Torch and Flame

1. In the LP-Oxygen flame, the inner cone will have a short point, the edges will be well defined, and it will be nearly white in color. The oxy-acetylene flame has a pure white inner cone with a sharp point and sharp, well defined edges.
2. In the oxy-acetylene flame, it requires $2\frac{1}{2}$ parts of oxygen to completely consume one part of acetylene. The torch supplies one part of oxygen to every part of acetylene that passes through it and the flame obtains $1\frac{1}{2}$ parts of oxygen from the air surrounding it to complete the combustion.
3. When the fuel gas is shut off, there is nothing to burn so the flame is extinguished instantly.
4. Acetylene gas is made from *carbide* and *water*.
5. Acetylene, being an unstable gas, will begin to dis-

sociate into its elements of hydrogen and carbon at pressures in excess of 15 PSI.

6. It tends to burn the weld and makes it brittle. However, the Oxy-LP flame needs to be oxidizing in order to provide maximum flame temperature. This has been found not to be detrimental in the welding of 14 and 16 gauge metal.
7. The metal boils and is not clear. Resultant weld is not strong. NOTE: A carburizing flame is recommended in most hard surfacing applications.
8. It is given by most authorities as 5900° F.
9. Through the development of special tips, it is now possible to fusion weld light gauge metals with the oxy-propane flame.

C. Quiz Answers—Welding a Bead

1. To insure fusion with the base metal.
2. Just long enough to build the weld up to the required thickness.
3. In the middle just ahead of the end of the tip flame envelope.
4. At about 45° behind the direction of travel.
5. At about 45° ahead of the direction of travel.
6. A larger rod would require more heat than is needed for this thickness of base metal.
7. A mild steel copper coated rod.
8. If the cleaner is used that is too small for the hole, it will not do a proper cleaning job. If too large a cleaner is used, the hole will be reamed oversize and the tip will not operate properly.

LESSON ONE

A. Quiz Answers—Use of the Cutting Attachments

1. This is usually caused by the torch being moved along the cut more rapidly than the combustion of the steel can take place. It could also be caused by insufficient oxygen pressure, or inadequate preheat.
2. Refer to the manufacturer's published information.
3. Use reduced oxygen pressure and move rapidly along the piece to be cut.
4. By preheating the edge of the metal until a red spot appears, then depressing the oxygen cutting jet control lever.
5. These are caused by the torch being moved along the cut more rapidly than the combustion of the steel can take place.
6. The cut proceeds more slowly and pressures and flame adjustment may have to be varied to compensate for the additional thickness of the cut in beveling.
7. Incomplete cutting, loss of cut, or excess slag.

8. Release cutting jet control lever, heat another spot with the preheat flame, then depress lever.
9. Trouble starting cut and incomplete cutting.

B. Quiz Answers—Making a Flat Butt Weld in Light Material

1. Neutral flame.
2. Lay the edges together at one end but space the other end open about $\frac{1}{4}$ " to the foot.
3. Approximately $\frac{3}{32}$ ".
4. Holes are burned in the base metal.
5. Incomplete fusion.
6. For this test, the piece is held in the vise just below the weld. The top piece is then hammered from the bottom side so that the weld is placed in compression.

LESSON TWO

A. Quiz Answers—Bronze Welding Beads on Light Material

1. Neutral.
2. Flux.
3. The surface oxide is ground off.

B. Quiz Answers—Bronze Welding Butt Joint on Heavy Steel Plate

1. 45° .
2. Approximately three-fourths of the way through the thickness of the piece.
3. By chipping and grinding.
4. The flux breaks up any oxide remaining and helps to float it to the surface of the puddle.

LESSON THREE

A. Quiz Answers—Braze Welding a Knob on Cast Iron

1. The chief advantage is that bronze welding requires less heat, so usually the need for preheating is eliminated in order to control expansion and contraction.
2. To burn out the graphite flakes that are exposed by the grinding operation.
3. No.
4. To eliminate unequal expansion and contraction strain which would result in breakage of the part while being heated or after welding.

B. Quiz Answers—Bronze Weld a Bevel Butt Joint in Cast Iron

1. 45° .
2. In order to assure penetration of the bronze clear to the bottom of the break.
3. Concave.
4. Yes, but there is a good possibility that the metal would run out at the bottom.

5. In some thick sections it may be necessary to vee from both the top and the bottom. Bronze makes a very fluid puddle, and would have a tendency to flow away if the vee is cut all the way through.
6. They are low if the bronze weld is properly made.

LESSON FOUR

A. Quiz Answers—Silver Brazing

1. About 45,000 lbs. PSI Tensile.
2. The results attending the mutual attraction between the molecules of a liquid and their attraction by a touch solid. The fluid rises above their level.
3. (1) Relatively low melting temperature.
(2) Very little required to make a satisfactory joint.
(3) Deposit is non-oxidizing and non-toxic.
4. (1) Lower application temperature required.
(2) Excellent adhesive qualities.
(3) Very small amount required to make a good joint.
(4) Non-oxidizing.
5. (1) Stronger joints.
(2) Can only be used where non-toxic joint is required.
6. To eliminate any place for bacteria to cling and breathe.
7. (1) Has excellent electrical conductivity.
(2) Makes strong joints that are not affected by vibration.
(3) Will not corrode.
8. Because it is non-toxic and non-corrosive.

LESSON FIVE

A. Quiz Answers—Hard Surfacing

1. Hard surfacing is a process of over-laying by welding a metal with high-hardness characteristics on a metal of lesser hardness.
2. It assures that the base metal will not be overheated and it provides a soft smooth flame.
3. This indicates that the flame is too hot and should be more carburizing.
4. It will be clear and smooth.
5. To indicate when the surface is at the proper temperature and to make the hard surfacing metal adhere to the base metal with a strong bond.
6. This particular type of alloy is put on without any penetration whatsoever. Penetration, or amalgamation with the base metal, would destroy some of the hard-surfacing qualities.
7. No. The deposit should be built up to the required thickness in the first pass. If considerable buildup is necessary to obtain proper shape or contour, an inexpensive type of buildup rod should be used first.

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