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DEPARTMENT OF REGIONAL
ECONOMIC EXPANSION

PRELIMINARY PRODUCT ANALYSIS:
CONSTRUCTION EQUIPMENT

October 5, 1973

Wrick, Currie and
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I. EXECUTIVE SUMMARY

This study included examination of manufacturers' shipments of the major classes of construction equipment to identify opportunities for manufacturing such equipment in Canada. The markets for cranes and derricks were assessed in other studies, and were thus excluded from this study.

A. THE PRODUCT

The construction equipment examined included:

- tractors, loaders, and hydraulic excavators;
- scrapers, graders, and rollers;
- off-highway trucks, trailers and wagons;
- concrete and asphalt equipment;
- aggregate processing equipment; and
- compressors, drills, and pumps.

The market for parts was also examined.

B. SUMMARY OF CONCLUSIONS

The Canadian market for construction equipment and parts is large, with shipments estimated at \$545 million in 1972 and projected at almost \$800 million by 1977. However, most opportunities for manufacturing construction equipment in Canada have already been exploited. Only one additional major market, crawler tractors and crawler loaders, is large enough to justify production capacity in Canada, and tariff barriers would be required to stimulate the required investment. Also, opportunities for production of non-proprietary spare parts may exist. Other equipment is either currently manufactured in Canada, or low volumes of shipments have precluded investment in production facilities.

- The annual value of shipments of crawler tractors and crawler loaders is estimated at \$90 million in 1972, growing to \$133 million by 1977. Construction-type models of this equipment are entirely imported on a duty-free basis. A market of this magnitude could support assembly operations in Canada.
- Total shipments of spare parts for construction equipment in Canada is estimated at \$165 million in 1972, and projected at \$240 million by 1977. Opportunities are limited for production of proprietary parts in Canada. However, annual shipments of crawler undercarriage parts, and standard transmissions, axles, wheels, and hydraulic cylinders and components are estimated at greater than \$80 million, and merit detailed investigation beyond the scope of this study.
- Production facilities currently exist in Canada for wheeled loaders, graders, rollers, concrete mixers, off-highway vehicles, asphalt pavers, compressors, pumps and drills. Additional facilities are not required.
- Domestic volumes would not support major production capacity for excavators, scrapers, crushers, and batch plants.

II. INTRODUCTION

The purpose of this study was to identify opportunities for manufacturing construction equipment in Canada, and detailed market analyses were performed for each major equipment class. For all classes, these analyses included estimates of historical and current shipments, and projections of growth rates and of shipments in 1977. In some cases, initial market evaluation indicated that detailed evaluation of market segments, manufacturing implications, and key market features would be necessary. In others, initial analyses indicated strongly that no viable opportunity existed for establishing or expanding production in Canada and such analyses are appropriately more abbreviated.

Market estimates developed during this study were derived from a variety of sources. Statistics Canada data were available and cross-referred to U.S. and industry data. Also, Statistics Canada data on equipment imports were found inconsistent with Urwick, Currie client information and it was necessary to develop estimates of import data. Historical and current market data, as well as growth projections, were therefore based upon:

- Statistics Canada data;
- Data from U.S. agencies on equipment sales and construction growth, and on known relationships between U.S. and Canadian shipment volumes;
- Knowledge of equipment rental rates for various classes, of rental-purchase practices, and of seasonal factors affecting rentals; and
- Distributors and private sources.

The results of these analyses are set out in this report.

III. THE PRODUCT

Uses and features of the construction equipment studied are summarized in the following table.

<u>EQUIPMENT</u>	<u>TYPES/FEATURES</u>	<u>APPLICATIONS</u>
Crawler Tractors	Tracklaying. Good traction. Attachments include rippers, dozer blades.	Used for earthmoving, clearing overburden, moving scrapers.
Crawler Loaders	Tracklaying, good traction.	Excavation, loading and haulage equipment.
Wheeled Loaders	More mobile than crawler types, flexible, less expensive.	Loading, excavation.
Scrapers	Self-propelled or moved by tractor.	Excavation, moving, depositing of earth.
Graders	Single blade for scraping surfaces, minor earthmoving.	Road building and maintenance. Snow ploughing.
Rollers	Steel or pneumatic road rollers. Vibratory compactors, including sheepsfoot.	Asphalt rolling. Soil or aggregate compaction.
Off-highway Haulage Units	Trucks, trailers, dump wagons.	Haul materials from material storage or excavation point to dumping area.
Mixers, Pavers & Related Equipment	Concrete batch plants and truck-mounted mixers, asphalt plants and pavers.	Batching, mixing, handling, placing of concrete and asphalt.
Aggregate Processing Equipment	Crushers, screens, and related washing plants and conveyors.	Processing of stone, gravel and sand.

<u>EQUIPMENT</u>	<u>TYPES/FEATURES</u>	<u>APPLICATIONS</u>
Air Compressors	Centrifugal, rotary or piston types.	Driving assorted construction tools such as drills and breakers.
Pumps	Diaphragm or centrifugal.	Dewatering.
Drills	Hand held or mounted.	Drilling rock for blasting purposes.

More detailed descriptions of these products are included as Appendix I. Prices for selected items are shown as Appendix II.

IV. THE TOTAL MARKET

A review of the total market for new construction equipment revealed that in 1972:

- The new equipment market is large, amounting to shipments valued at \$380 million.
- Sales of tractors, loaders, and excavators comprise over 50% of the equipment market, with shipments valued at \$195 million.
- Sales of scrapers, graders and rollers account for the second largest equipment category in the market at approximately \$50 million.
- Shipments of parts amount to approximately \$165 million or 30% of the total value of shipments. This amount is more than double that of 1963.

ESTIMATED VALUE OF SHIPMENTS OF
NEW CONSTRUCTION EQUIPMENT AND ATTACHMENTS

	<u>1963</u>	<u>1967</u>	<u>1972</u>
	(\$ Millions)		
Tractors, Loaders & Excavators	102	146	195
Scrapers, Graders, Rollers	32	42	49
Off-highway Trucks, Trailers, Wagons	17	31	29
Mixers, Pavers, Related Equipment	7	10	11
Aggregate Processing Equipment	2.5	9	11
Compressors, Pumps and Drills	1.5	16	21
Other Construction Equipment	42	55	64
Total	<u>204.0</u>	<u>309</u>	<u>380</u>
Parts	<u>70</u>	<u>120</u>	<u>165</u>
Total	<u><u>274</u></u>	<u><u>429</u></u>	<u><u>545</u></u>

- Total shipments of construction equipment are expected to grow to almost \$800 million by 1977. This projection is based on different growth rates for the various product groups, on historical trends and on expectations for such projects as expressways, airports, and hydro-electric projects.

PROJECTED VALUE OF SHIPMENTS OF NEW CONSTRUCTION
EQUIPMENT AND ATTACHMENTS, 1977

<u>Equipment</u>	<u>Value of Shipments in 1977</u>
	(\$ Millions)
Tractors, Loaders & Excavators	295
Scrapers, Graders, Rollers	65
Off-highway Trucks, Trailers, Wagons	40
Mixers, Pavers, Related Equipment	14.5
Aggregate Processing Equipment	15
Compressors, Pumps and Drills	27
Other Construction Equipment	92
Total Equipment	<u>549.5</u>
Parts	<u>240.0</u>
Total Equip. & Parts	<u><u>789.5</u></u>

The construction equipment industry has experienced severe cycles in revenue in the past five years. Sales of construction equipment had increased steadily during the period from 1963 to 1969, supported by major road building and commercial and government building projects, and by the Expo '67 project. In 1970, the equipment industry suffered a major reduction in sales volumes, and capital shortages contributed to an increased emphasis by users on rentals of heavy equipment. In addition, since 1967 the entry of Japanese and European manufacturers of heavy equipment into the Canadian market has had an adverse effect on margins. The equipment and parts market recovered significantly during 1971 and 1972. Overall annual growth at 6 to 8% is anticipated over the next five years.

V. TRACTORS, LOADERS AND EXCAVATORS

1. The Market

Estimates of the market for tractors, loaders and excavators revealed major equipment groups:

- Crawler tractors and crawler shovel loaders represent shipments of approximately \$90 million in 1972; the largest single category of equipment identified during the study.
- Shipments of wheeled front-end loaders are estimated at over \$70 million in 1972, the second largest equipment category identified.
- Growth of the hydraulic excavator market has been significant since 1967, and shipments during 1972 amounted to approximately \$20 million.

SHIPMENTS OF TRACTORS, LOADERS
AND EXCAVATORS, 1967 AND 1972

	1967	1972
	(\$ Millions)	
Crawler Tractors	57	65
Crawler Loaders	17	24
Wheeled Front End Loaders	50	71
Hydraulic Excavators	8	20
Miscellaneous Tractor Dozers, Small Tractors	13	15
Total	145	195

2. Imports

- All construction-type crawler equipment over 60 h.p. is imported, primarily from the U.S.
- Approximately 40% of construction-type wheeled front-end loaders are imported.
- Approximately 75% of hydraulic excavators are imported.

3. Canadian Production

Manufacturers of rubber-tired construction-type shovel loaders in Canada include: Caterpillar, Hough, Allis-Chalmers, Terex, and Michigan Clark.

Assemblers of hydraulic excavators, all units below 2½ yard capacity include Koering and Hyhoe.

Canadian production shipments have increased in value from \$20 million in 1967 to over \$50 million in 1972. This production consisted primarily of rubber-tired loaders and attachments.

CANADIAN MARKET: IMPORTS, EXPORTS
AND CANADIAN PRODUCTION

	<u>1963</u>	<u>1967</u>	<u>1972</u>
	(\$ Millions)		
Imports (including duties)	105	125	140
Canadian Production	-	20	51
Less: Exports	-	1.7	2
	<u> </u>	<u> </u>	<u> </u>
Market	<u>105</u>	<u>143.3</u>	<u>189</u>

4. Exports

Exports of these equipment classes have been less than \$2 million annually.

5. Market Growth

Based on projections for construction, it is estimated that shipments of tractors, loaders and excavators will increase at an average rate of 8% to total shipments of almost \$300 million in 1977.

PROJECTED SHIPMENTS OF CRAWLERS,
LOADERS AND EXCAVATORS IN 1977

	Estimated Shipments in 1977 (\$ Millions)
Crawler Tractors	95
Crawler Loaders	38
Wheeled Front-end Loaders	105
Hydraulic Excavators	33
Miscellaneous Tractor Dozers, Small Tractors	24
	295

6. Market Segmentation

In analyzing market segments, major areas were identified:

a. Crawler Tractors

- Large units with over 200 h.p. engines account for 31% of unit sales and over 50% of total value.
- Mid-range units, with 80 to 200 h.p. accounted for 45% of units sales, and 40% of total value.

ESTIMATED DISTRIBUTION OF CRAWLER
TRACTOR SHIPMENTS BY SIZE, 1972

	Large (200+ H.P.)	Medium (80 to 200 H.P.)	Small (35 to 80 H.P.)
Units	400	650	350
Value of Shipments	\$32 million	\$25 million	\$8 million

b. Crawler Loaders

Shipments of crawler loaders show approximately 50% of the unit sales to be in the low horsepower range and 40% to be in the medium power range. Shipment value for the two categories were approximately equal.

c. Rubber-Tired Front-End Loaders

Estimates of the segmentation of rubber-tired loaders, by size, show that mid-range models account for 60% of the unit sales and shipment values.

ESTIMATED SEGMENTATION BY SIZE OF
RUBBER-TIRED FRONT-END LOADERS, 1972

	Small (35 to 79 H.P.)	Medium (80 to 200 H.P.)	Large (200+ H.P.)
Unit Sales	400	1,000	400
Value of Shipments	\$5 million	\$44 million	\$22 million

d. Excavators

Analysis of shipment data on hydraulic excavators shows that in 1972:

- 80%, or approximately 210 units/year, are crawler mounted, and
- 60%, or approximately 160 units/year, have a rated shovel capacity of less than one yard.

7. Key Marketing Factors and Trends

Several key factors affect ease of entry into the tractor, loader and excavator market:

- End users rely on the manufacturer's reputation for product performance and reliability and for supply of parts. This reliance presents a formidable barrier to the successful development of a new product line.
- Most manufacturers sell their products through distributors. The reputation of the distributor for service is important to the end user.
- The purchase price is an important but secondary consideration relative to equipment reliability and performance.
- The market is dominated by large manufacturers including Caterpillar, International Harvester, Allis-Chalmers, Hough, Koering, Poclain and Warner-Swasey.

8. Cost and Tariff Information

a. Costs

Production of tractors, loaders and excavators requires substantial investment in fabricating equipment, jigs and fixtures. Welders and machinists constitute the key production skills. Development of new products would require substantial investment in design skills.

Major cost components are:

<u>Cost Category</u>	<u>Cost as a % of Manufacturer's Revenue</u>
Design	4%
Service and Warranty	3%
Jigs and Fixtures	2%
Materials and Components	60%
Labour	12%
Transportation	1%
Marketing, Administration and Profits	18%
Total	<u>100%</u>

b. Tariffs

- Crawler tractors and crawler loaders enter Canada duty-free. Tariffs on exports include 5% to U.S.A. and 5½% to the U.K.
- Tariffs on imports of loaders and excavators are 15%.

9. Location

Location of a manufacturing site near a major metropolitan centre is desirable for availability of:

- suppliers of components, castings, and supplies;
- subcontracted processes; and
- large labour markets.

This requirement is not insurmountable, however, as illustrated by Canadian Car's tree harvester facilities in Thunder Bay, Ontario.

10. Conclusions

a. Crawler Tractors and Loaders

The market for crawler tractors and loaders is large enough to support manufacturing facilities in Canada. However, dominance of existing U.S. manufacturers, coupled with user reliance on known products, would virtually preclude the successful development of new brands in this market. Tariff protection would be required to create circumstances in which a U.S. manufacturer could obtain a competitive advantage by assembling these products in Canada.

b. Wheeled Loaders

A major market exists for large construction-type wheeled loaders. A number of manufacturers currently assemble in Canada, primarily using imported components. An opportunity may exist to increase the Canadian content of production through establishment of component production operations or encouraging increased proportions of fabrication in Canada. Such items as cylinders, transmissions, axles and hydraulic components should be investigated for common application.

c. Hydraulic Excavators

Most hydraulic excavators are imported, and of those manufactured in Canada, a high percentage of the manufacturing cost is in imported major components. Several key considerations mitigate

against increased manufacturing operations in Canada:

- A wide product line and substantial investment in inventories to meet distributor's needs for competitive delivery.
- A limited, highly competitive market.

VI. SCRAPERS

1. The Market

Estimated shipments of scrapers indicate that:

- Shipments during 1972 amounted to 180 units for an estimated value of \$17 million.
- Unit shipments declined by 22% during the period 1967 to 1972.

ESTIMATED SHIPMENTS OF SCRAPERS

	<u>1967</u>	<u>1972</u>
Units	230	180
Value of Shipments	\$18 million	\$17 million

2. Imports

All scrapers are imported into Canada, almost entirely from the U.S.

3. Market Growth

Market growth is projected at 5% per year and shipments in 1977 are forecast at 230 units valued at \$21.5 million.

4. Market Segmentation

Approximately 60 to 70% of scraper shipments have a capacity of less than 18 cubic yards. The remainder range in capacity up to 37 cubic yards.

5. Key Marketing Factors and Trends

- Major U.S. manufacturers, primarily Caterpillar and Terex, dominate the Canadian market.
- Manufacturers sell their products through distributors.
- Product reputation is important but purchase price and delivery would be also significant factors in the purchasing decision.

6. Manufacturing

To provide for competitive deliveries, inventories of a range of scraper sizes would be required. Minimum annual production volumes in excess of 200 units would be required to prevent minor market variations from creating major problems at the manufacturer level. The total Canadian market is only about 200 units per year, however, and production of scrapers in Canada does not appear justifiable.

7. Conclusions

The Canadian market would not justify the development of scraper production facilities due to:

- the high investment required in inventories to provide for adequate delivery of a variety of sizes;
- the low unit volume and attendant sensitivity to minor fluctuations in demand.

VII. GRADERS1. The Market

Analysis of the grader market in Canada showed that:

- The total value of shipments amounted to \$24 million in 1972.
- Growth of unit shipments has been slight during the period 1967 to 1972.

ESTIMATED SHIPMENTS OF GRADERS

	<u>1967</u>	<u>1972</u>
Units	670	710
Value of Shipments	\$19 million	\$24 million

2. Imports

In 1972, imports were estimated at \$8 million, or approximately one-third of the Canadian shipments.

3. Canadian Production

Canadian production capacity supplies approximately 70% of the Canadian shipments, or 20 million. Producers in Canada include Dominion Road machinery, WABCO, Caterpillar, and BLH. Galion also perform some assembly operations.

4. Exports

Canadian grader manufacturers exported an estimated \$4 million in shipment value during 1972.

ESTIMATED IMPORTS, CANADIAN PRODUCTION
AND EXPORTS, 1967 AND 1972

	<u>1967</u>	<u>1972</u>
Imports	\$11 million	\$ 8 million
Canadian Production	11 million	20 million
Less: Exports	<u>3 million</u>	<u>4 million</u>
Canadian Market	\$19 million	\$24 million

5. Market Growth

Market growth of 7% is projected during the next five years, to provide shipments of over 1,000 units valued at \$34 million.

6. Market Segmentation

Approximately 90% of graders shipped are self-propelled. Grader sizes are broken down as follows:

Light Maintainer	5%
Medium 115 to 145 h.p.	60%
Heavy duty construction and snow removal	25%

7. Key Marketing Factors and Trends

- Municipalities and provincial roads departments are major users of graders, and purchase on a tender basis. Frequently, distributors are by-passed and direct sales are made by manufacturers.
- Price is frequently the most important factor in grader purchases.

8. Cost and Tariff Information

a. Costs

Production of graders involves welding and sheet metal work for the canopy and chassis, and the purchase of engines, transmissions, axles, wheels, tires, bearings and converters. Relatively low investment is required in design and tooling.

Major cost components are:

<u>Cost Category</u>	<u>Cost as a % of Manufacturer's Revenue</u>
Design	1%
Service and Warranty	1%
Jigs and Fixtures	1%
Materials and Components	75%
Labour	8%
Transportation	1%
Marketing, Administration and Profits	13%
Total	<u>100%</u>

b. Tariffs

<u>From/To</u>	<u>Imports</u>	<u>Exports</u>
U.S.	15%	5%
U.K.	15%	-
E.E.C.	15%	7.5%

9. Location

Location close to a major centre would assist in supplier relationships and subcontracted processes, but is not vital to the success of a production operation.

10. Conclusions

At least five grader manufacturers now exist in Canada, and expansion of this capacity to meet increasing market requirements can be anticipated. Additional manufacturers do not appear to be justified.

VIII. ROLLERS1. Total Market

Major changes have affected the roller market during the period 1967 to 1972.

- Shipments of road rollers, both steel and rubber-tired have declined from 325 units in 1967 to 250 units in 1972, or over 23%.
- Shipments of the more expensive self-propelled vibratory compactors have increased moderately from approximately 100 units in 1967 to 150 units in 1972.
- Sales of towed compactors have declined by 60% since 1967.
- More expensive compactors, along with the short road building season, caused contractors to rent a high proportion of their roller needs. Total value of roller shipments in 1972 is estimated at \$6,070,000.

ESTIMATED SHIPMENTS OF ROLLERS, 1967 AND 1972

	1967		1972	
	Units	Value	Units	Value
<u>Road Rollers</u>				
Steel	240	\$1,400,000	180	\$1,300,000
Rubber	85	1,100,000	70	870,000
Total	<u>325</u>	<u>\$2,500,000</u>	<u>250</u>	<u>\$2,170,000</u>
<u>Compactors</u>				
Self-propelled	100	\$1,500,000	150	\$3,000,000
Towed	190	1,000,000	80	900,000
Total	<u>290</u>	<u>\$2,500,000</u>	<u>230</u>	<u>\$3,900,000</u>
Grand Total	<u>615</u>	<u>\$5,000,000</u>	<u>480</u>	<u>\$6,070,000</u>

2. Imports

Approximately 40% of roller requirements, valued at \$3.0 million, were imported in 1972.

3. Canadian Production

Canadian production of rollers is estimated at \$4.8 million in 1972. Canadian producers include Bros. (American Hoist), Canadian Ingersoll Rand, limited models of Bomag, and minor assembly by Galion. Operations consist primarily of assembly of U.S.-built components.

4. Market Growth

A relatively low annual growth rate of 4% is projected for the rollers market, shipments of \$9½ million in 1977. This projection is based on:

- major cutbacks in expressway programs;
- uncertainty of major airport construction programs; and
- long product life of the only growing market segment, self-propelled compactors.

5. Conclusion

Prospects are limited for expanded production of rollers in Canada, based on the following factors:

- Growth in only one segment of the market, self-propelled compactors, and declining sales in the remaining segments.
- Low unit volumes make production operations very sensitive to relatively minor fluctuations in unit volume.

- Manufacturers now exist in Canada.

IX. OFF-HIGHWAY TRUCKS, TRAILERS, WAGONS

1. The Market

Analysis of shipments of off-highway haulage equipment indicates that:

- unit sales declined since 1967 by over 20% during the period 1967 to 1972, while the value of shipments has declined by 5%;
- annual shipments in 1972 are estimated at almost \$29 million; and
- rear dump vehicles comprise over 95% of units shipped.

	<u>1967</u>		<u>1972</u>	
	<u>Units</u>	<u>Value</u>	<u>Units</u>	<u>Value</u>
Rear Dump	310	\$30,000,000	240	\$28,000,000
Bottom & Side	20	800,000	15	600,000
Total	<u>330</u>	<u>\$30,800,000</u>	<u>255</u>	<u>\$28,600,000</u>

2. Imports, Exports, and Canadian Production

Off-highway vehicles fall under the U.S.-Canadian Automotive Agreement and are imported and exported duty-free between the U.S. and Canada. Manufacturing facilities currently existing in Canada for rear dump equipment include Euclid and Terex. Manufacturers in Canada tend to produce a limited product line for North American or world-wide distribution.

3. Market Growth

Shipments have declined in Canada over the past five years. Sales of these units depends to a high degree on airport, power and road building projects. Growth is projected at an average 7% annually, or approximately the projected rate of North American heavy construction. This would result in domestic shipments of \$40 million by 1977.

4. Conclusion

With the Automotive Agreement operative for off-highway trucks, there is no incentive to build this type of equipment in Canada. Also, the total unit Canadian volume is less than 300 units annually. Consequently, major export shipments would have to exist to provide adequate volume for a viable manufacturing operation. Investment in plant, equipment, and inventories of engines, transmissions, and axles would be substantial. Inventories of finished chassis and dumps would be required to meet competitive delivery needs.

There does not appear to be an opportunity for establishing additional production facilities for this equipment in Canada.

X. MIXERS, PAVERS AND RELATED EQUIPMENT

1. Total Market

Analysis of market data revealed that:

- Total shipments for major concrete equipment amounted to almost \$7 million in 1972.

- Total shipments of asphalt paving equipment amounted to \$4,400,000 in 1972.
- Unit sales have declined since 1967.

ESTIMATED SHIPMENTS OF CONCRETE
AND ASPHALT EQUIPMENT, 1967 AND 1972

	<u>1967</u>		<u>1972</u>	
	<u>Units</u>	<u>Value</u>	<u>Units</u>	<u>Value</u>
<u>Concrete</u>				
Truck Mixers	460	\$ 3,100,000	450	\$ 3,400,000
Batch Plants	84	2,500,000	72	3,300,000
Total		<u>\$ 5,600,000</u>		<u>\$ 6,700,000</u>
<u>Asphalt</u>				
Plants	30	\$ 2,800,000	20	\$ 2,700,000
Pavers	100	1,900,000	70	1,700,000
Total		<u>\$ 4,700,000</u>		<u>\$ 4,400,000</u>
Grand Total		<u>\$10,300,000</u>		<u>\$11,100,000</u>

2. Imports

Approximately 30% of total shipment of concrete truck mixers and 40% of concrete batch plants are imported. Ninety percent of all asphalt mixing equipment and 70% of asphalt paving equipment is imported.

3. Canadian Production

- Facilities exist in Canada for the production of truck-mounted concrete mixers.

- Concrete batch plants are partly erected on site using domestic materials and labour, and imported mixing, control and conveying equipment.
- Asphalt paving equipment is produced in Canada by Allatt Ltd. only.

4. Market Growth

Relatively low annual growth of 4% is anticipated for this market, amounting to \$14,500,000 in 1977.

5. Conclusions

Development further of these segments of the equipment industry is not considered viable.

- Adequate capacity exists for producing truck-mounted mixers in Canada.
- Unit volumes of concrete and asphalt batch plants are low and would not warrant investment in plant and design capability.
- Unit volumes of asphalt paver units are low and a manufacturer already exists in Canada.

XI. AGGREGATE PROCESSING EQUIPMENT

1. Total Market

The total value of shipments made in 1972 amounted to \$12,950,000. Major segments included:

- Construction crushers - \$4,200,000
- Screens - \$ 850,000

There has been a decline in crusher units shipped during this period, while the value of shipments has remained relatively static.

	1967		1972	
	Units	Value	Units	Value
<u>Crushers</u>				
Probable & Stationary	70	\$4,200,000	40	\$ 4,200,000
<u>Screens</u>	112	1,400,000	40	850,000
<u>Other Aggregate Processing Equipment, incl. conveyors, washing plants, other screens</u>		4,000,000		6,000,000
Total		<u>\$9,600,000</u>		<u>\$11,050,000</u>

2. Imports

All major crushing, screening, and washing equipment is imported. Two major U.S. suppliers of crushers, Cedar Rapids and Pioneer, dominate the market in Canada.

3. Canadian Production

There are no manufacturers of major crushing equipment in Canada. Stephens Adamson Limited of Belleville and Forano Ltd. are major producers of aggregate conveyor equipment.

4. Market Growth

The volume of shipments of aggregate processing equipment fluctuates substantially with major expressway, canal, and airport projects. Minor growth of 4% is anticipated in this market and shipments in 1977 are projected at \$15,000,000.

5. Conclusions

There is not a viable opportunity for developing production facilities in aggregate processing equipment in Canada.

- Low unit volume would not encourage current U.S. manufacturers to build in Canada.
- Minor growth prospects.
- Major investment required in plant and engineering.
- Existing manufacturers of conveying equipment.

XII. COMPRESSORS, PUMPS, AND DRILLS

1. The Market

Analysis of total shipments of air compressors, pumps and drills in 1967 and 1972 indicates that:

- Unit sales of air compressors has been relatively static while the value of shipments increased from \$7 million to \$9 million.
- Unit sales and shipment values of pumps declined.
- Unit sales of rock drills remained static while value of shipments increased, largely due to increased usage of track-mounted and multiple head drills for tunnelling and for construction of major rock cuts.

	1967		1972	
	Units	Value	Units	Value
Compressors	1,100	\$ 7,000,000	1,200	\$ 9,000,000
Pumps	7,000	3,800,000	5,100	3,300,000
Rock Drills	1,200	5,000,000	1,200	9,000,000
		<u>\$15,800,000</u>		<u>\$21,300,000</u>

Here also, the increased tendency towards rental of heavy equipment was indicated. Distributors report a high level of competition and price stability.

2. Imports and Canadian Production

Specific data on imports were not available in any of these classes of equipment. However, it was noted that adequate production capacity exists in Canada to supply the Canadian market. Major manufacturers in Canada include:

Air Compressors: Canadian Ingersoll-Rand, Joy, Jaegar, Holman, Worthington, Gardner-Denver.

Pumps: Canadian Ingersoll-Rand, Worthington, Sihi, Hayward-Gordon.

Rock Drills: Canadian Ingersoll-Rand, Joy, Gardner-Denver.

3. Market Growth

Market growth is projected at 5% with shipments valued at \$27 million in 1977.

4. Conclusion

Opportunities do not exist for increased production capacity in Canada for air compressors, pumps, and rock drills. There is currently adequate capacity to supply the market and competition is intense.

XIII. PARTS FOR CONSTRUCTION EQUIPMENT

1. The Market

Shipments of parts amounted to an estimated \$165 million in 1972, or 30% of the total value of shipments, and are expected to grow to \$240 million by 1977. Detailed data is not available for this market.

2. Market Characteristics

Characteristics of the parts business are:

- Parts for resale as repair spares are normally manufactured in the same production runs as the components included in the original assembly. Thus, spare parts tend to be manufactured in the country where equipment is originally designed and produced.
- High profit margins often from 40% to 100%, permit distributors to earn reasonable returns on imported parts, even though duties are paid. Consequently, incentives are not high to encourage investment in parts production in Canada.

- Equipment warranty normally specifies that the equipment manufacturers' parts be used. Also, many users have greater confidence in such spare parts. These factors discourage use of "counterfeit" or alternate parts.

While manufacturers of counterfeit parts exist, for example, for Caterpillar tractors, major users of such equipment have not supported suppliers of these parts. Exceptions exist in the supply of crawler undercarriage pins, rollers, and seals and of hydraulic components. Shipments of these items, as well as such standard components as wheels, axles, and transmissions are estimated to exceed \$80 million annually.

3. Conclusion

Despite the size of the total market, the economies of large production runs and high profit margins act against equipment manufacturers producing proprietary repair parts in Canada. However, standard components and crawler undercarriage parts should be investigated in detail.

XIV. REGIONAL DISTRIBUTION AND MAJOR BUYERS

1. Regional Distribution

A regional breakdown of shipments of construction equipment was developed on the basis of the value and type of construction work performed in each province, and is summarized for 1971 as follows:

	<u>% of Total</u>
Maritimes	4
Quebec	24
Ontario	42
Manitoba & Saskatchewan	7
Alberta	9
B.C.	14
Total	<u>100%</u>

2. Major Buyers

The major buyers of all types of construction equipment are:

	<u>Estimated % of Total Shipment Value</u>
Contractors (primarily heavy & hwy.)	50
Governments	17
Mining, including oil and gas	20
Forest Products	10
Other	3
	<u>100%</u>

XV. CONCLUSIONS

The total market for construction equipment is large and growing. However, few opportunities remain for manufacturing this equipment in Canada.

- The annual value of shipments of crawler tractors and crawler loaders in Canada is projected at over \$130 million by 1977. Construction-type models of this equipment are not manufactured in Canada, and imports enter duty-free.

This market would support an assembly industry. Tariff barriers would be required to stimulate investment in production facilities.

- Manufacturing of spare parts in Canada is limited by the economies of producing proprietary parts in conjunction with runs of assembly parts at parent plants. However, opportunities may exist for production of common crawler undercarriage parts, and non-proprietary transmissions, axles, wheels, and hydraulic cylinders and components. This market would require detailed investigation.
- Production facilities currently exist in Canada for wheeled loaders, graders, rollers, concrete mixers, off-highway vehicles, asphalt pavers, compressors, pumps and drills. Additional facilities are not required.
- Domestic volumes would not support major production capacity for excavators, scrapers, crushers, and batch plants.

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

ILLUSTRATIONS AND DESCRIPTIONS OF CONSTRUCTION EQUIPMENT

I. CRAWLER OR TRACK TYPE TRACTORS

The crawler unit provides the basic power unit for various items of construction equipment. Figure 1 shows a crawler tractor equipped with bulldozer. The crawler mounted unit provides the best traction for general use in excavation work with power ratings for different models ranging from 45 to 770 horsepower.

A. BULLDOZERS

These widely used items come equipped with different blades ranging from 6 to 23 feet in width and from 2 to 5 feet in height.

- Straight blades can be tilted but
- Angling blades can, in addition, be angled in relation to tractor centre line.
- U blades are fitted to large units to "drift" more material.

Blade control can be hydraulic or by cable.

B. RIPPERS

Illustrated in Figure 2 a steel shank behind the tractor extends to a depth of about $2\frac{1}{2}$ feet to break up soft rock.

C. FRONT-END LOADERS

Fitted with buckets ranging from $\frac{1}{2}$ to 10 cubic yards. See Fig. 3. These units;

- Load sand, rock and other materials into hauling units or hoppers.
- Lift and haul items such as bricks or concrete on construction sites.
- Excavate, replacing a bulldozer.
- Clear land.

In short, they combine characteristics of power shovels, cranes, bulldozers and scrapers.

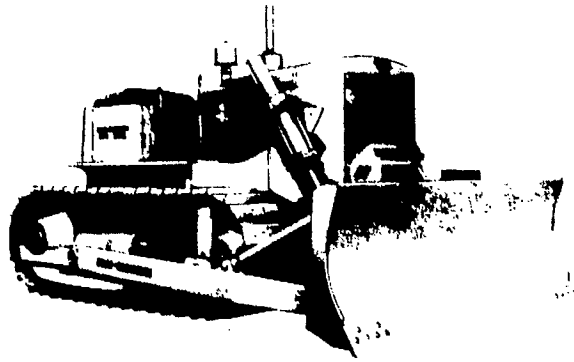


Fig. 1. Crawler tractor with straight bulldozer blade, hydraulic control.

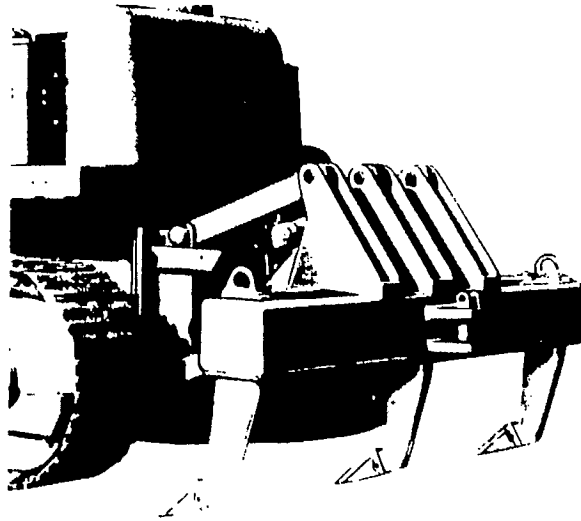


Fig. 2. Crawler tractor with three shank ripper.

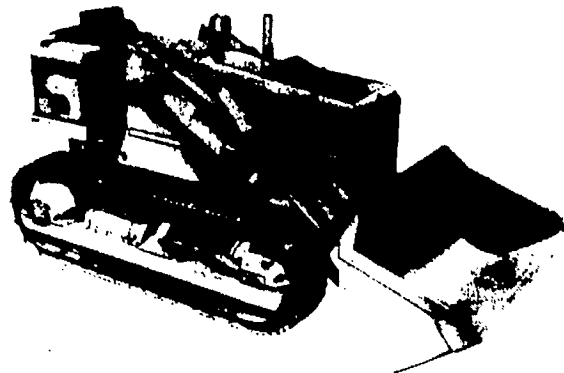


Fig. 3. Crawler tractor with front end loader.

D. OTHER ATTACHMENTS

- Special rakes, vee blades, balls and chains for bushclearing.
- Special devices for materials handling including steel pipe, concrete pipe, bricks, etc.

II. WHEEL TYPE TRACTORS

Extensively used in construction in the configurations described above for crawler tractors, wheel type tractors offer the advantage of higher speeds and maneuverability at the cost of poorer traction and heavy tire wear and tear. Figure 3 illustrates a tractor of this type equipped with front-end loaders.

III. SCRAPERS

A wheel type tractor pulling a scraper is illustrated in Figure 5. Capacities range to 50 cubic yards and more. They load and discharge material and since they operate independently a breakdown does not result in a chain of excavators, loaders, haul and spreader units being idle.

IV. DUMP WAGONS

A rear-dump wagon is shown in Figure 6. These off-highway units haul material. They must be loaded but dump automatically.

- Bottom-dumps dump free flowing material in windrows.
- Side-dumps dump over side hills on the move.
- Rear-dumps are used like tip-trucks. They are the most maneuverable type.

Dumping action can be hydraulic rams, cables and electric motors, mechanical devices or gravity.

V. TRENCHERS AND DITCHERS

These machines can be used in firm soil to excavate trenches for utility lines, oil lines, etc.

- The wheel type trencher is illustrated in Figure 7. Trench depths go to 8 feet and widths to 60 inches from 20 or less.

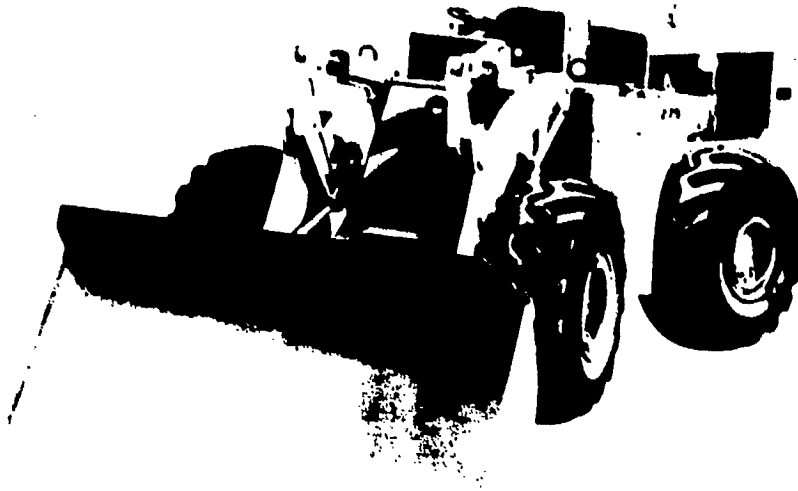


Fig. 4. Wheel tractor with front-end loader.

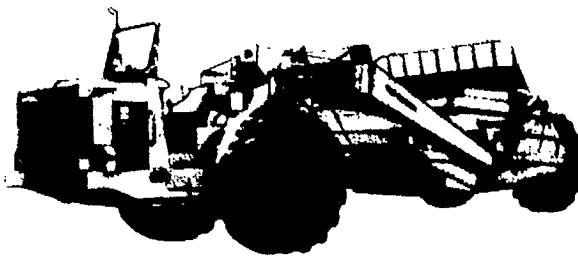


Fig. 5. Self propelled scraper.

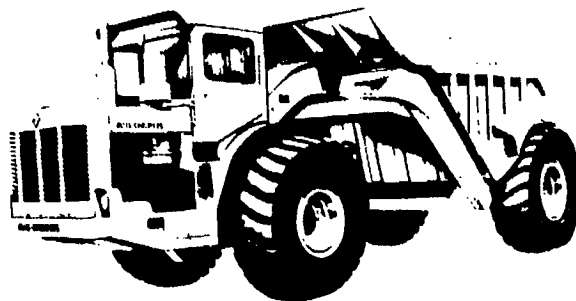


Fig. 6. Rear-dump wagon (off-highway haul unit).

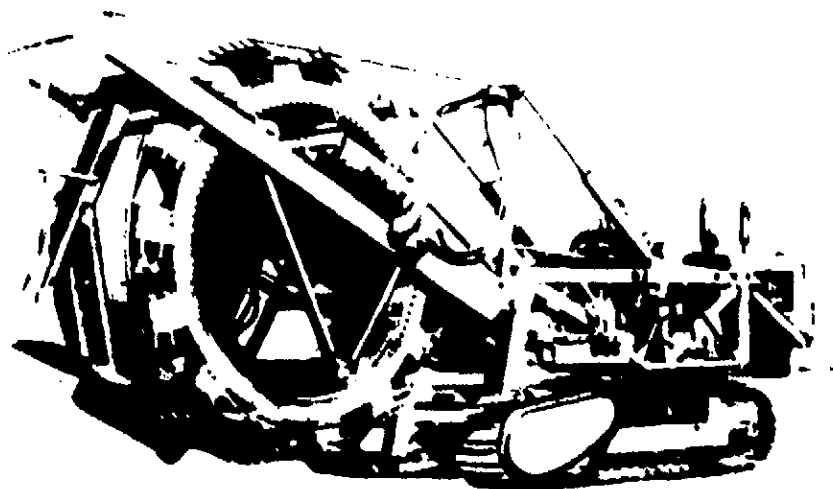


Fig. 7. Wheel-type trenching machine.

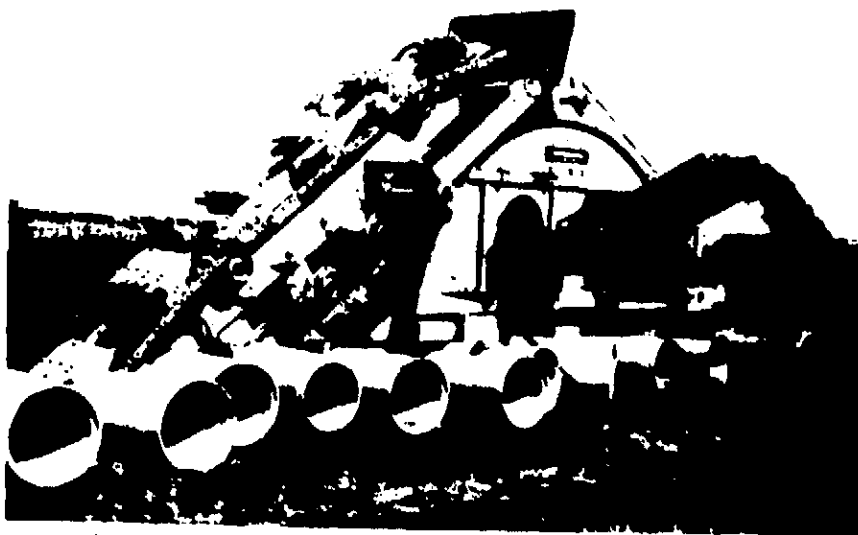


Fig. 8. Ladder-type trenching machine.

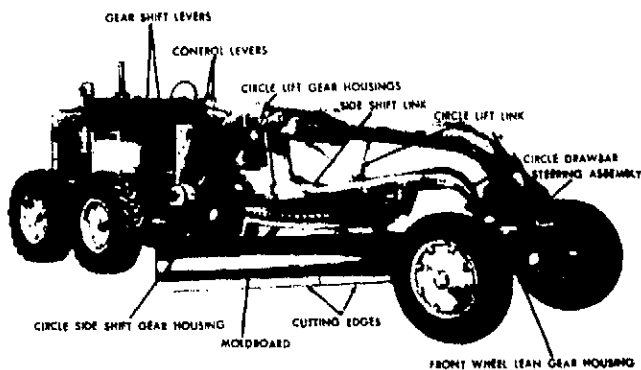


Fig. 9. Major components of a motor grader.

- The ladder type trencher is shown in Figure 8. These more elaborate machines excavate to 30 feet or more in depth and 12 or more in width.

Both types have a range of speeds to suit soil conditions.

VI. MOTOR GRADERS

A typical motor grader is illustrated in Figure 9. This versatile machine is almost essential on modern earth moving jobs where it is used in spreading fill, excavating ditches, sloping banks, scarifying, snow removal and general maintenance of haul roads.

It consists essentially of a blade or mould board and circle mounted on draw bars connected to the front of the frame. The operator can change blade positions, lean the front wheels and operate any attachments which are powered mechanically or hydraulically.

Blade widths vary from 10 to 20 feet. Flywheel horsepower varies from 60 to 640.

VII. COMPACTION EQUIPMENT

Compaction is obtained by applying energy to soil by the use of one or a combination of kneading action, static weight, vibration and impact. The major types of compaction are the following.

A. TAMPING ROLLERS

Illustrated in Figure 10 is a self-propelled sheep's foot roller for compaction of clay. The feet penetrate the surface as the roller moves over the surface providing a kneading action and pressure to mix and compact the soil.

B. SMOOTH WHEEL ROLLERS

A typical example is illustrated in Figure 11. These machines are effective for compacting granular material. Weights range to 20 tons.

C. PNEUMATIC TIRED ROLLERS

Pneumatic tired rollers are available in sizes from 15-200 tons gross weight. The wheels are often mounted to give them a wobbly effect increasing the kneading action designed to provide compaction below the surface. A machine of this type is illustrated in Figure 12.

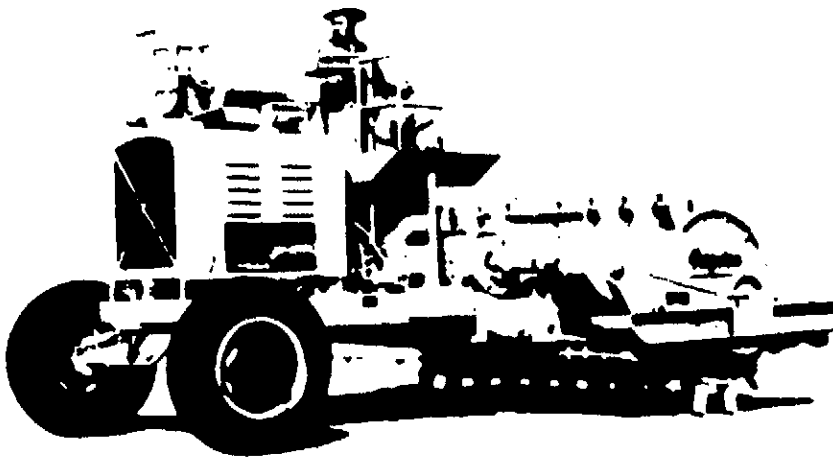


Fig. 10. Self-propelled sheep's foot roller.

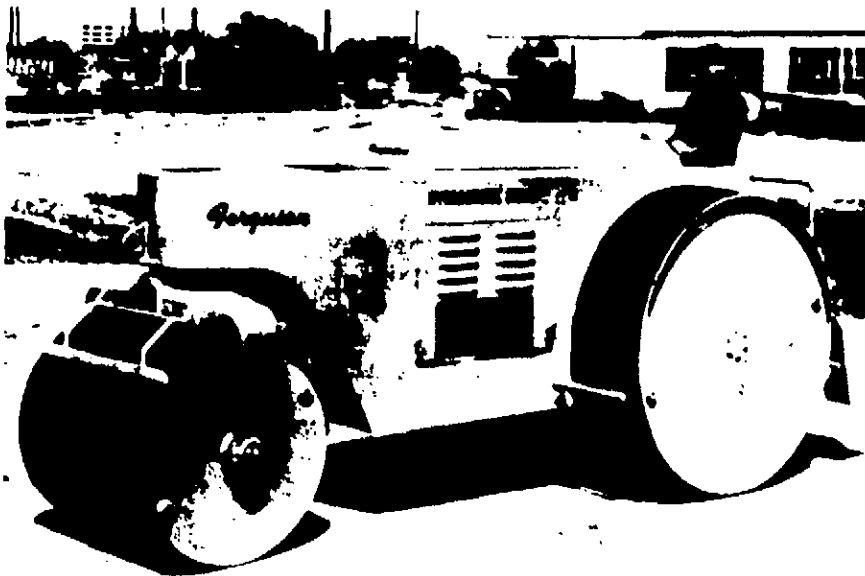


Fig. 11. Smooth wheel roller.

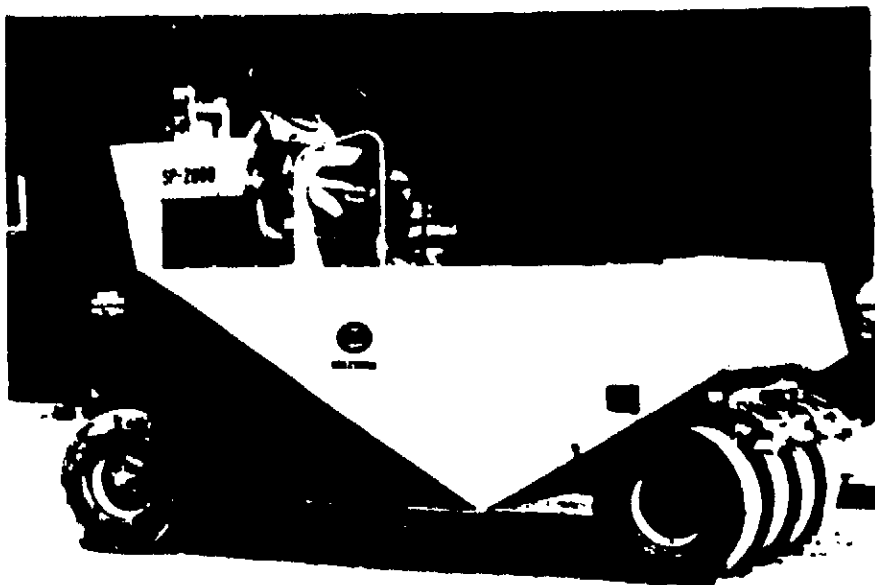


Fig. 12. Pneumatic tired roller.

D. VIBRATING COMPACTORS

In sandy or gravelly soils, compaction is aided by vibration. Rollers are made to vibrate by the addition of a separate motor rotating a horizontal shaft with eccentric weights. Vibrations vary from 1,000 to 5,000 per minute to suit the characteristics of the soil.

E. VIBRATING PLATES

Figure 14 illustrates a manually operated vibrating plate compactor extensively used on construction sites for compacting soils in locations where larger units are not practical.

VIII. AIR COMPRESSORS

Portable air compressors are widely used. They are available in single or two-stage reciprocating or rotary types.

- Reciprocating compressors depend on a piston moving back and forth in a cylinder for the compressing action. A typical machine is illustrated in Figure 14.
- Rotary compressors have increasingly displaced reciprocating compressors. They offer advantages of weight, compactness, maintenance-free operation, uniform flow and long life.

Capacities range up to 2,000 c.f.m. with 600 c.f.m. as the most popular size for general use in construction.

IX. ROCK-DRILLS

A wide range of equipment is available for drilling rock. Three of the most widely used items of equipment include:

A. JACKHAMMERS

These are hand-held air-operated percussion-type drills. A complete unit consists of a hammer, drill, steel and bit. Operated by compressed air, percussion energy is transmitted to a bit while air flows through a hole in the drill steel and bit to remove cuttings and act as a coolant. A cutaway section is shown in Figure 15.

Jackhammers are used to drill holes to 10 feet in depth and 2½ inches diameter.

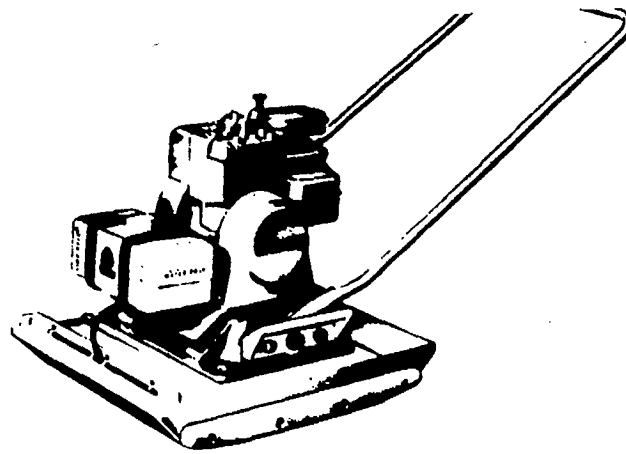


Fig. 13. Self-propelled, hand guided vibrating plate compactor.

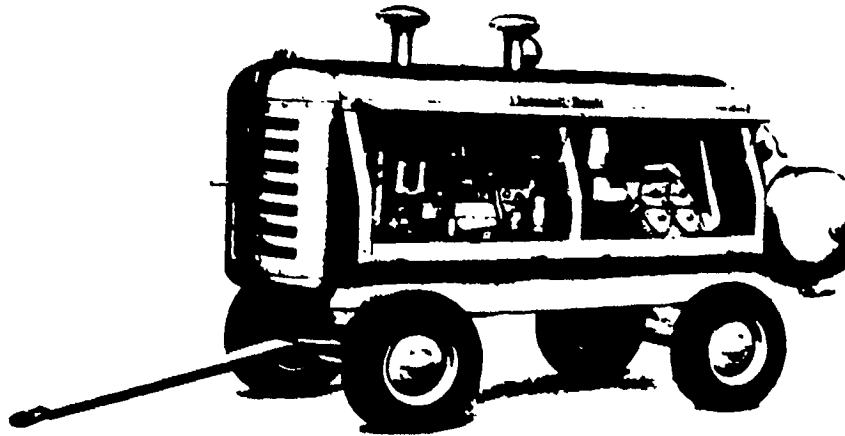


Fig. 14. Two-stage diesel-engine operated portable reciprocating air compressor.

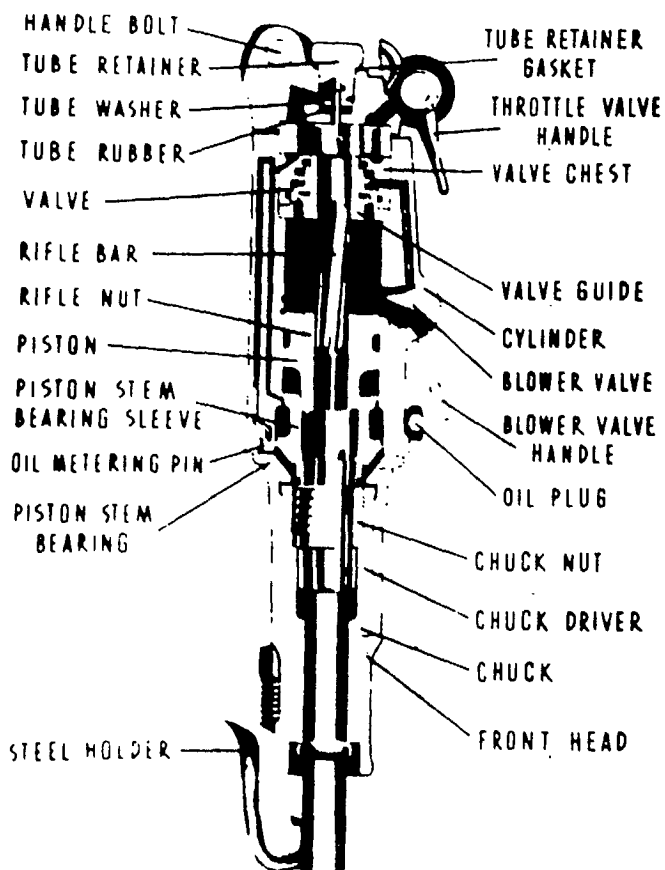


Fig. 15. Section through a jackhammer.

B. WAGON DRILLS

Drifters are large jackhammers requiring mechanical support. They can be mounted as wagon drills on masts mounted on wheels to provide portability. They drill holes up to 4½ inches diameter and 30 feet in depth at angles from the vertical to slightly above horizontal track mounted drills.

C. TRACK MOUNTED DRILLS

Similar to wagon drills but mounted on tracks, as illustrated in Figure 16, and with a hydraulically manipulated boom its production rate may be three or more times that of a wagon drill. These machines drill holes to 6 inches in diameter and 50 feet or more in depth.

In addition, the following rock-drills are used by rock contractors:

- Rotary percussion drills combining the reciprocal action of the percussion drill with the turning under pressure action of the rotary drill.
- Piston drills which allow adjustment of stroke and rotation to give the best performance for a particular type of rock.
- Blast hole drills employing a rotating tri-cone roller type bit.
- Shot drills which depend on the abrasive action of steel to penetrate the rock.
- Diamond drills used for exploratory drilling to obtain cones.

X. PUMPING EQUIPMENT

Pumps are extensively used on construction for dewatering pits, tunnels, cofferdams and for jetting. The most commonly used types are:

- Reciprocating pumps which operate by the movement of a piston in a cylinder.
- Diaphragm pumps operated by the raising and lowering of a flexible diaphragm. This pump is very popular for construction work since it will handle water containing a high degree of particulate matter. It is manufactured to standards laid down by the American General Contractors Association.



Fig. 16. Track-mounted drill.

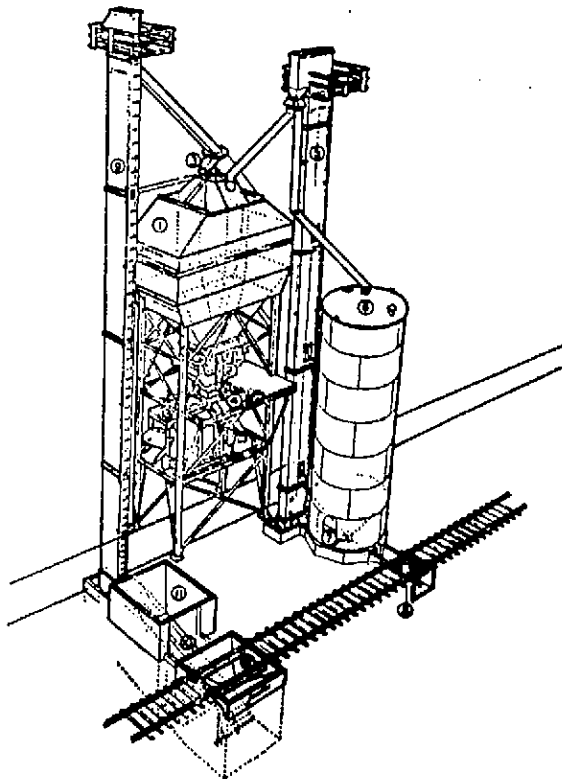


Fig. 17. Layout for a central concrete mixing plant.

- Centrifugal pumps in which a rotating impeller imparts energy to the water passing through. These pumps are extensively used in construction often in a submersible design that can be dropped into standing water. They are powered by compressed air or electricity.

XI. CONCRETE MACHINERY

The following stages comprise the manufacture of concrete:

- Batching the materials
- Mixing
- Handling and transporting
- Placing
- Finishing

Equipment is available for use in each stage. Only the major items will be described.

A central mixing plant is illustrated in Figure 17. A large silo is provided to store cement. Vertical conveyors are provided to raise aggregate from the hoppers for dumping to the storage hoppers. From the storage hoppers aggregate is fed into the mixer where cement and water are added and mixed to form concrete. Output can vary to 150 cubic yards per hour and upward.

Transportation from the central mixing plant can be by transit mixer truck as illustrated in Figure 18. Water can be added and final mixing may take place enroute or the mix may merely be agitated. Dump trucks with bodies designed to handle concrete may also be used where distances are short.

A paving mixer in operation is illustrated in Figure 19. Used to mix and place concrete for highways this mixer is mounted on crawler tracks to move along with the placing of concrete. Aggregate is hauled to the mixer in dump trucks. Output can vary to about 120 cubic yards per hour.

Concrete can be placed by a variety of means. Crane and bucket, transit mixer and dump trucks, conveyors and concrete pumps are all extensively used. Once in place the concrete is commonly consolidated with an electric or air-powered vibrator. Finishing is done by hand or using a power-float where the volume of work is sufficient.

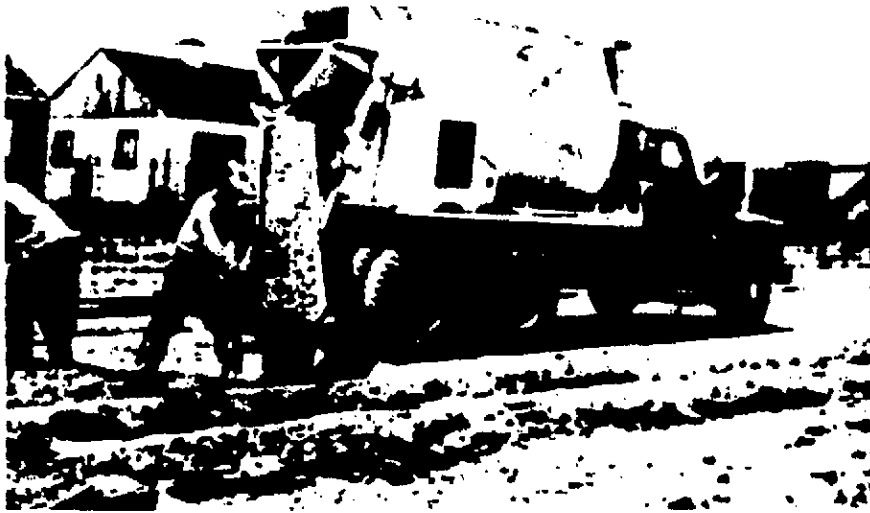


Fig. 18. Discharging concrete from a transit mixer truck.



Fig. 19. Paving mixer in operation.



Fig. 20. In-line batch plant for mixing asphalt.

XII. ASPHALT EQUIPMENT

Simply stated the production of asphalt involves:

- Batching the materials
- Mixing
- Handling and transporting
- Placing and Finishing

A typical central batch plant is illustrated in Figure 20. Aggregate is fed from stock piles into a dryer the action of which is shown in Figure 21. Batches of heated aggregate are then mixed with hot molten asphalt and dumped into trucks for transportation to site.

On site an asphalt finisher places the asphalt as illustrated in Figure 22 and Figure 23. Finishing and final compaction of the asphalt is accomplished using a smooth wheel roller.

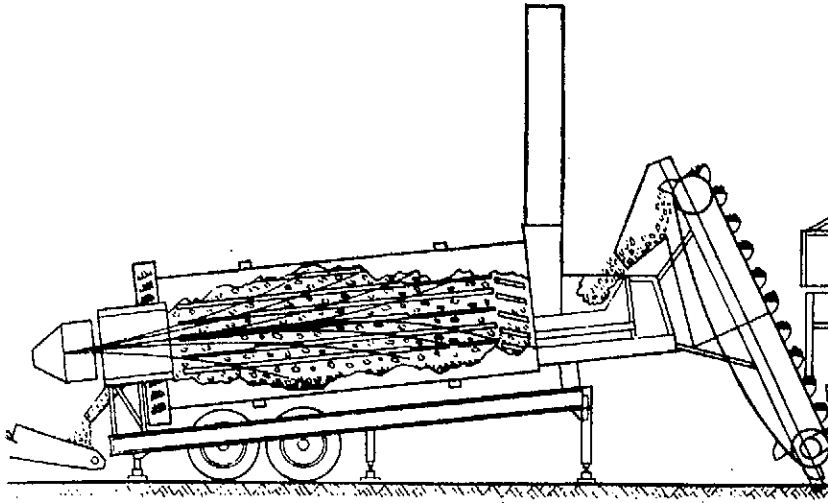


Fig. 21. Schematic section of dryer. Material moves from cold feed on right towards burner.

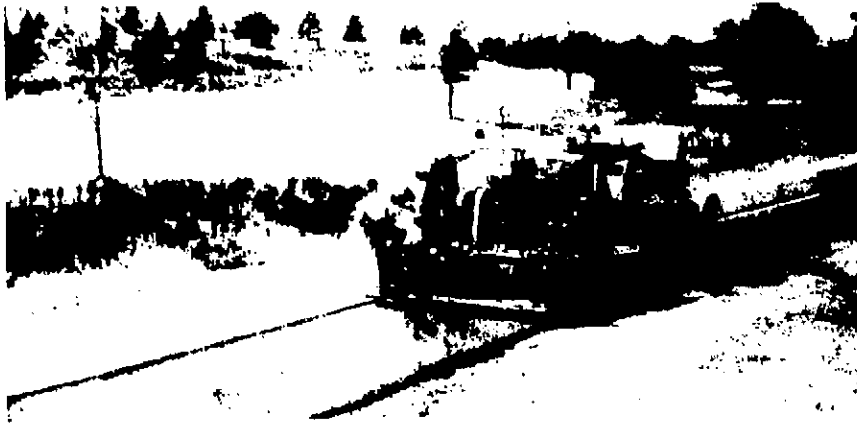


Fig. 22. Asphalt finisher placing first course.

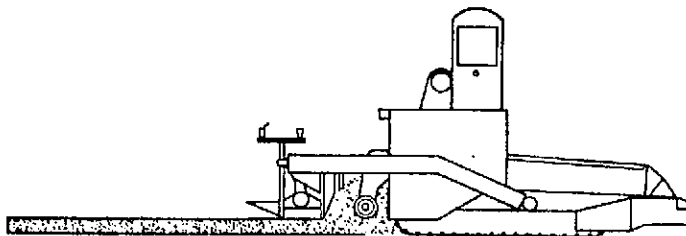


Fig. 23. Action of asphalt finisher.

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

PRICES FOR SELECTED ITEMS OF CONSTRUCTION EQUIPMENT

The following are approximate prices f.o.b. Toronto,
Federal Sales Tax included.

1. Crawler tractors equipped as bulldozers with hydraulically operated angling blade range in price from \$43,000 for a 65 h.p. model with a 10'-0 blade to \$137,000 for 385 h.p. machine equipped with 16'-0 blade.
2. A typical single shank ripper for a 270 h.p. crawler tractor is priced at about \$16,000 complete with hydraulic controls.
3. Crawler type front-end loaders range in price from about \$30,000 for a 80 h.p. 1½ cu. yd. machine to about \$100,000 for a 275 h.p., 5 cu. yd. machine.
4. Wheel type front-end loaders range in price from \$35,000 for a 80 h.p. 1½ cu. yd. model to \$140,000 for 325 h.p., 6 cu. yd. model.
5. Motor graders range in price from \$42,000 for a 125 h.p. model equipped with a 26'-0 blade to \$108,000 for a 225 h.p. model with 31'-0 blade.
6. A typical scraper with 14 cu. yds. struck or 20 cu. yds. heaped capacity is priced at \$110,000 for a 300 h.p. wheel tractor model. A self-loading elevating scraper of the same size is price at about \$120,000 while a twin-motor tandem-powered model of the same capacity and a horsepower rated at 450 is priced around \$130,000.
7. Portable compressors range in price from \$4,800 for a diesel powered reciprocating compressor rated at 85 c.f.m. to about \$58,000 for a 1,200 c.f.m. rotary compressor. The most popular 600 c.f.m. rotary model is priced at \$34,000.
8. Hand-held jackhammers range in price from \$600 to about \$1,200.
9. Crawler mounted drills range around \$39,000 in price.

10. Air-operated diaphragm or centrifugal pumps commonly used in construction range around \$800 in price.
11. Typical off-highway haulers range from \$65,000 for a 240 h.p., 22 ton model to \$350,000 for a 1,600 h.p., 150 ton model.
12. Self-propelled vibrating rollers range from about \$30,000 for a smooth wheel model at 9 tons dry weight to about \$150,000 for a 23 ton model.
13. Wheel type trenchers range from about \$30,000 for a model capable of digging trenches 5' deep x 20 inches wide to \$90,000 for a model to dig trenches 10' deep x 5' 6" wide. Large models are available for overburden removal and bulk excavation.
14. Asphalt spreaders range from about \$50,000 to \$90,000 depending on features and operating characteristics.

All items vary considerably in price depending on quality and features provided.

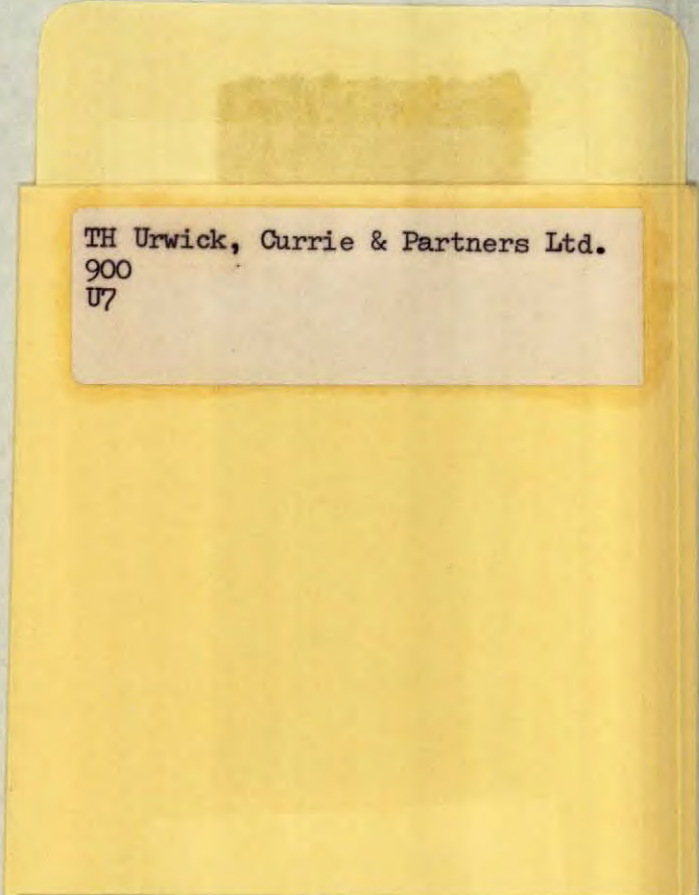
10. Air-operated / hydraulic or centrifugal pumps commonly used in construction range around 2000 to 4000 lbs. Typical dry-hydraulic haulers range from 200,000 to 400,000 lbs. 75 ton model is 250,000 lbs. for 1.500 lbs. 150 ton model.

11. Self-propelled vibrating rollers range from about 150,000 to 250,000 lbs. A single wheel model is 2 tons dry weight. 20 ton model is 20,000 lbs. for a 20 ton model.

12. Wheel type tractors range from about 250,000 lbs. to 400,000 lbs. of loaded tractors 2' deep x 50 inches wide to 250,000 lbs. for a model to dig tractors 10' deep x 60 inches. Large models are available for over 400,000 lbs. and 60 inch excavator.

13. Hydraulic excavators range from about 250,000 to 400,000 lbs. depending on features and operating characteristics.

All items very variable in price depending on quality and features.



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