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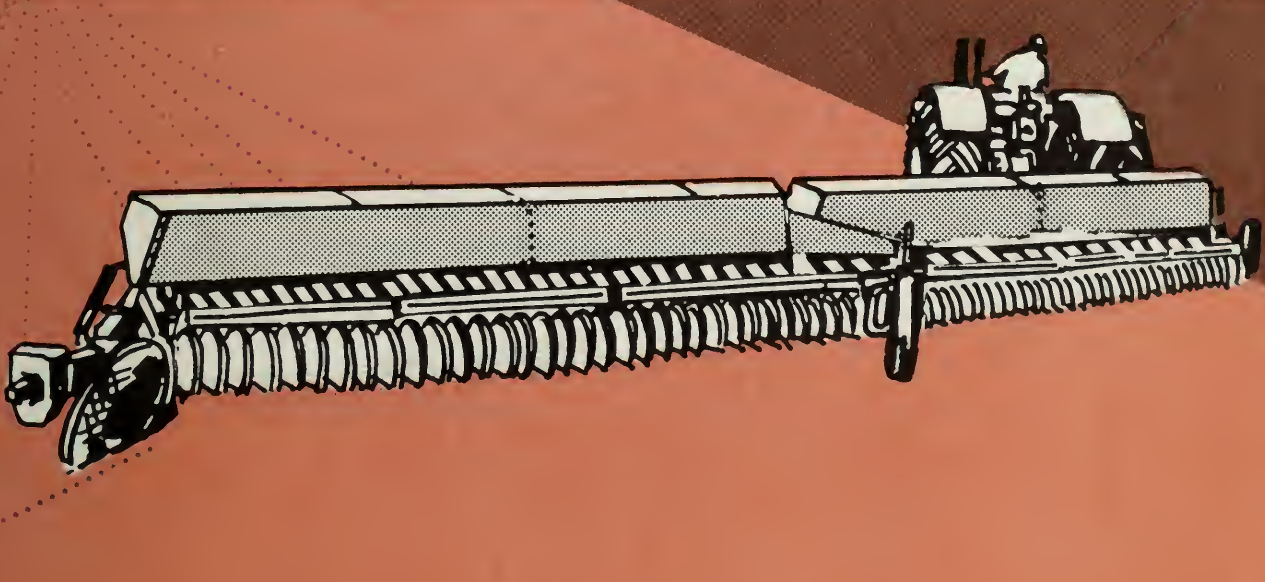
DISCERS



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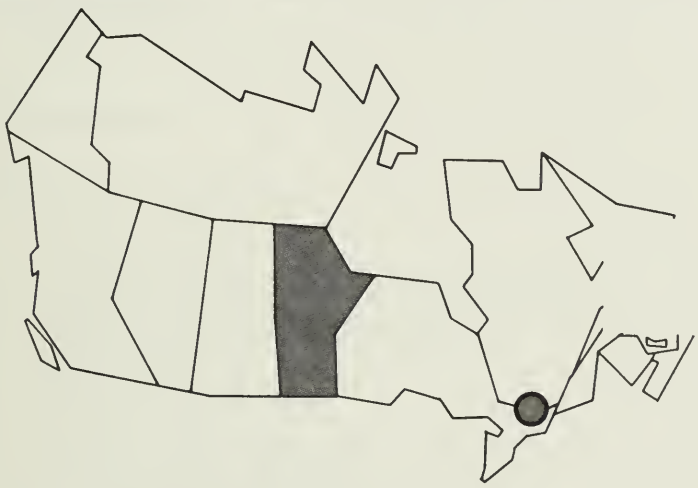

CANADA/MANITOBA

DISCERS

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CONTENTS

INTRODUCTION

Discers are the most common tillage and seeding machines on western Canadian farms. Since many discers are not operated and adjusted as well as they should be, this booklet has been prepared to explain the principles and procedures of good discer adjustment.

Proper adjustment is important for the following reasons:

- A well adjusted discer can do a good uniform tillage job under many different soil and trash conditions.
- Power requirements, and wear and breakage of the discer, are reduced to a minimum when it is adjusted and operated correctly.
- When used as a seeding machine, proper adjustment results in more uniform and correct seed placement and, therefore, better germination and higher yields.

GENERAL CHARACTERISTICS

DEPTH CONTROL

Most discers are built to work at a depth of about 2 to 4 inches (5 to 10 cm). Trying to work deeper than this may cause plugging and instability problems. In excessively hard ground it may not be possible to work at the depth desired because the increased pressure on the discs removes weight from the wheels. This may make it impossible to keep the wheels in the furrows and to maintain the desired disc angle. When such conditions exist, a shallower depth must be used, or the soil loosened first by another machine.

Variations in depth of cut will occur in almost all fields if the hydraulic cylinder is kept at the same setting. These variations in depth are due to differences in soil hardness, and they may be as much as 1 3/4 inches (4.5 cm) above and below the average depth. Such large variations are unacceptable in most discer operations, and especially when seeding. Careful observation of the depth and appropriate changes in the depth control setting are required to keep these variations to a minimum.

With large discers, and especially with tandem units, it is very difficult for the operator to accurately judge the depth of cut, due to dust and the long distance between the tractor and the rear of the last discer. Some discers have depth gauges on them, but these do not take into account the differences in wheel sinkage and tire deflection with different loads and varying soil hardnesses. A better method of controlling depth of cut is therefore desirable.

Several types of automatic and mechanical depth controls are presently being developed. One type uses a ski or gauge wheels running on the unworked land to sense the relative position of the discer frame, and another sensor to indicate the relative position of the discs. Signals from the two sensors are combined to produce an actual depth reading. By using an electro-servo valve in the hydraulic system to adjust the hydraulic cylinder, automatic depth control is obtained. The depth can be controlled within about 1/2 inch (1 cm) above or below the predetermined setting with such a system. This system is not yet commercially available.

A mechanical depth control attachment which is presently being manufactured uses a trailing caster wheel to regulate the depth of cut.

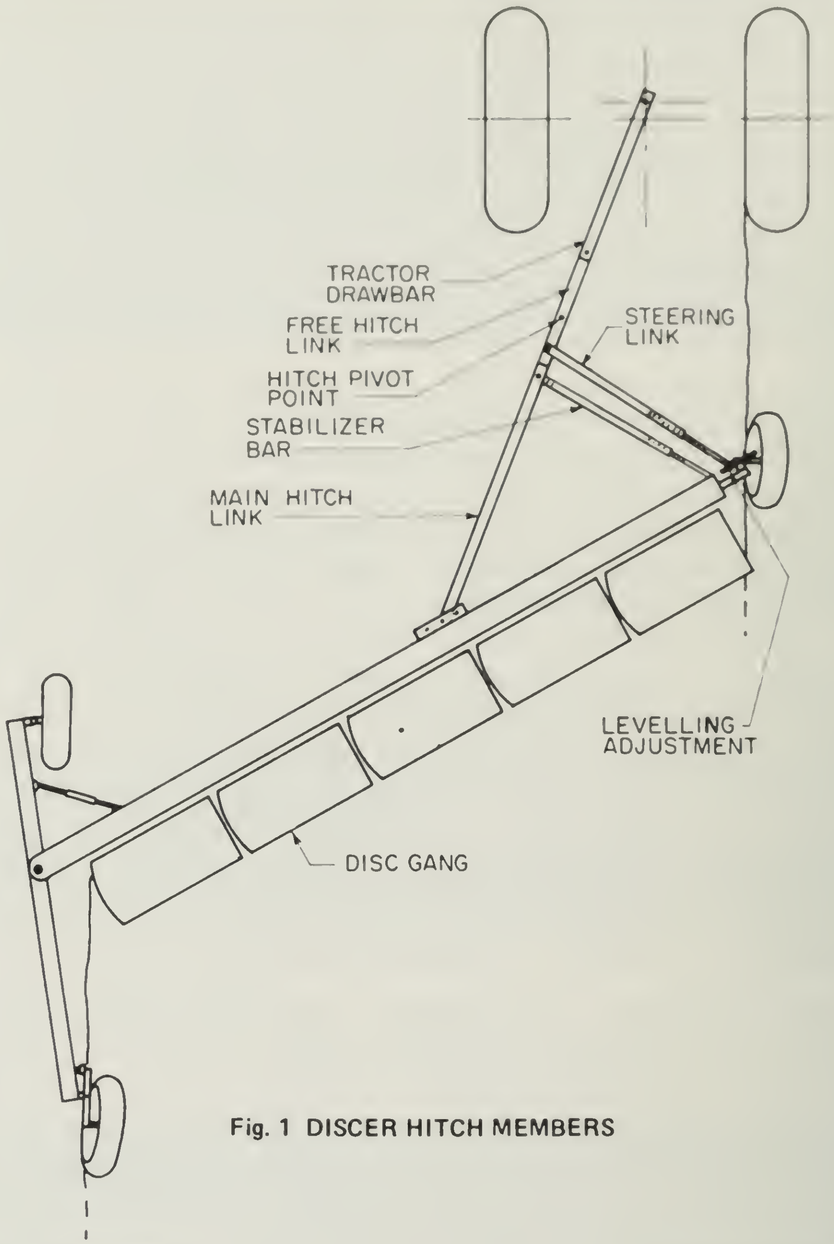


Fig. 1 DISCER HITCH MEMBERS

One unit is attached to each gang of the discer, and the depth is adjusted on the spindle of the caster wheel arm. The linkage from the hydraulic cylinder is disconnected so that it doesn't exert any downward force on the discs. Weights are added to the disc gangs to provide sufficient downward force for disc penetration. The hydraulic cylinder is then used only to lift the discs.

Increased depth can usually be achieved by decreasing the width of cut. If the soil is excessively hard, this may not allow a significant increase in depth unless weight is added to the wheels, or a rear coulter attachment is used. On soft, loose soils, a narrow width of cut may result in a deeper cut than desired.

Increased forward speed usually results in a decrease in the depth of cut. Discs with deep concavities do not penetrate as easily in hard ground as those with shallow concavities, unless a narrow width of cut is used. In soft ground the deeper concavity discs may tend to 'suck in' more than the shallow ones. In hard ground, smaller discs penetrate more easily than large discs.

Mechanical depth control (Jeanotte)

TRASH COVERAGE, CLEARANCE AND PLUGGING

A discer will normally reduce the trash cover by about 50% on each operation, when working at a depth of 3 to 4 inches (8 to 10 cm). Shallower depths of operation will result in less trash reduction. Using a narrower width of cut or discs with deeper concavities will increase the amount of trash covered. Operating at a high forward speed tends to leave the remaining trash loose on the soil surface.

Trash clearance depends largely on the construction of the discer. Seed tubes, bearing mounts, gang hangers, and trash bars can contribute to poor trash clearance. Generally, greater clearances between discs and other machine parts improve trash clearance. A vertical guard, about 6 inches (15 cm) wide, can be used above the gang bearings to prevent trash build-up on the gang hangers. Trash guards should be positioned and angled to allow the mud and straw to fall down behind the discs after it hits the guard.

A decrease in depth of operation will usually result in less plugging. An increase in forward speed may increase or decrease plugging, depending on how the plugging occurs. Allowing the soil and trash to dry usually reduces trash handling problems. A narrower width of cut increases plugging tendencies in sticky or very loose soils.

Discs with deep concavities tend to plug with soil more easily than those with shallow concavities. Scraper attachments are available for most discers. These must be carefully adjusted to keep the discs clean without causing excessive wear. On heavy clay soils scrapers may tend to pack a thin layer of mud against the discs which doesn't come off easily.

WIDTH OF CUT AND DISC ANGLE

The width of cut of a discer is determined by the disc angle. As the disc angle is increased, the width of cut is reduced. Most discers have a range of disc angles from about 30° to 45°. The nominal width of a discer is usually its greatest width of cut, which is obtained at a disc angle of 30°. The table on the following page gives the widths of cut at other disc angles.

Reducing the width of cut (increasing the disc angle) has several effects:

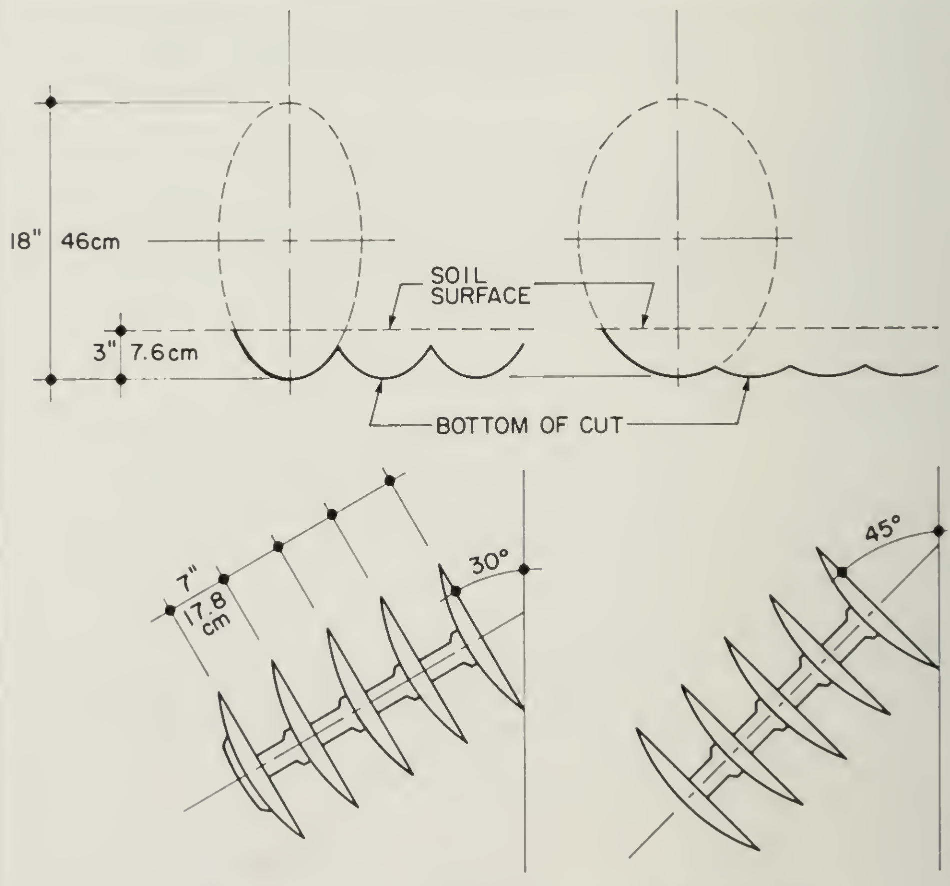
- It permits deeper operation.
- It results in greater trash coverage.
- It produces a more uniform depth of cut (see Figure 2).
- It is more likely to cause disc breakage in stony land.

WIDTH OF CUT AT OTHER DISC ANGLES

Nominal Width (30° disc angle)		35°		40°		45°	
Feet	Metres	Feet	Metres	Feet	Metres	Feet	Metres
9	2.74	8′6″	2.59	7′11″	2.42	7′4″	2.24
12	3.66	11′4″	3.46	10′7″	3.24	9′10″	2.99
15	4.57	14′2″	4.32	13′3″	4.04	12′3″	3.73
16	4.88	15′1″	4.61	14′2″	4.32	13′1″	3.98
18	5.49	17′0″	5.19	15′11″	4.86	14′8″	4.48
20	6.10	18′11″	5.77	17′8″	5.40	16′4″	4.98
21	6.40	19′11″	6.05	18′7″	5.66	17′2″	5.23
24	7.32	22′9″	6.92	21′3″	6.47	19′7″	5.98
27	8.23	25′6″	7.78	23′11″	7.28	22′0″	6.72
28	8.53	26′6″	8.07	24′9″	7.54	22′10″	6.96
30	9.14	28′4″	8.64	26′7″	8.08	24′6″	7.46
32	9.75	30′3″	9.22	28′4″	8.62	26′2″	7.96
33	10.06	31′2″	9.51	29′2″	8.90	26′11″	8.21
36	10.97	34′0″	10.37	31′10″	9.70	29′4″	8.96

- It increases the seeding rate for a given seed rate setting.
- It increases the tendency of discs to plug in sticky soils.

There are two considerations to be made in selecting the width of cut for a particular job — the type of job desired and the limitations of the discer. Where deep penetration and considerable trash burial or soil pulverization is desired, a narrow width of cut is used. In a fall tillage operation, where a shallow cut is required to bury weed seeds and reduce the straw cover slightly, a wide setting could be used. If the soil is hard, a narrow cut may be needed to keep the discer stable. For seeding, a relatively shallow depth is required for most seeds, and in most cases it is desired to cut the weeds off at the same time. In order to do both jobs, a relatively narrow width of cut must be used. A width of cut about 10% less than the nominal width of the discer is usually satisfactory. Figure 2 illustrates the type of cut obtained at the widest and narrowest settings of a discer. At a 30° disc angle (widest cut) and 18 inch (46 cm) discs, there is a depth variation of about 2 inches (5



30° DISC ANGLE   45° DISC ANGLE

Fig. 2 UNIFORMITY OF CUT

cm). With 20 inch (51 cm) discs the variation is 1 3/4 inches (4.5 cm). To get a complete weed-cut with a 30° disc angle, it is necessary to operate at a depth of at least 3 inches (7.6 cm). This is too deep for many types of seeds. At a 45° disc angle there is a depth variation of only 2/3 inch (1.7 cm), which will produce a complete weed-cut at a depth of 1 1/2 to 2 inches (4 to 5 cm).

Certain soil conditions may not allow the desired width of cut to be used, due to instability of the discer. In a very hard soil it may not be possible to get adequate penetration with a wide setting. The discer may pull over to the left and the rear furrow wheel ride on the unworked land. In this case a narrower width of cut must be used. In a very soft soil, it may not be possible to maintain a shallow depth with a narrow width of cut due to the suction of the discs. In this case a wider cut would have to be used.

The width of cut (or disc angle) is changed by means of frame and hitch adjustments. The frame adjustment consists of changing the angle between the rear furrow wheel axle support and the main frame (Figure 4), or changing the angle between the main frame and the sub-frame (Figure 5). When this adjustment is made, it is usually necessary to readjust the hitch linkages to align the hitch pivot point with the center of pull and the center of resistance (Figure 3). The lead on the furrow wheels may also need to be corrected. On discers that provide for it, the hitch point of the main hitch link should be moved forward (right) on the main frame when the width of cut is narrowed, and backward (left) when a wider cut is desired. If these frame and hitch adjustments are made properly, there ahould be very little side thrust on the wheels. Sharply angled furrow wheels and excessive weights on the wheels should not be required to maintain the desired width of cut. Improper hitch adjustments or the wrong disc angle should be suspected if excessive weight or wheel lead appears to be required. The furrow wheels should be set to have no more than 7° lead, and unless the discer is operating in very hard soil, large amounts of added weights should be unnecessary.

FORCES ON DISCERS

There are three different forces exerted on the discs by the soil. There is a vertical force, a side thrust force and a draft force. The vertical force usually pushes up on the discs and is opposed by the weight of the discer through the gang linkage. In very soft soil, the discs may be pulled down, due to the angle and curvature of the discs.

Side thrust tends to push the discs to the left (Figure 3). This force is opposed by the pull of the tractor and the wheels of the discer.

The side thrust forces act at the bottom of the discs and are resisted at the center of the discs through the gang bolt (Figure 6). This

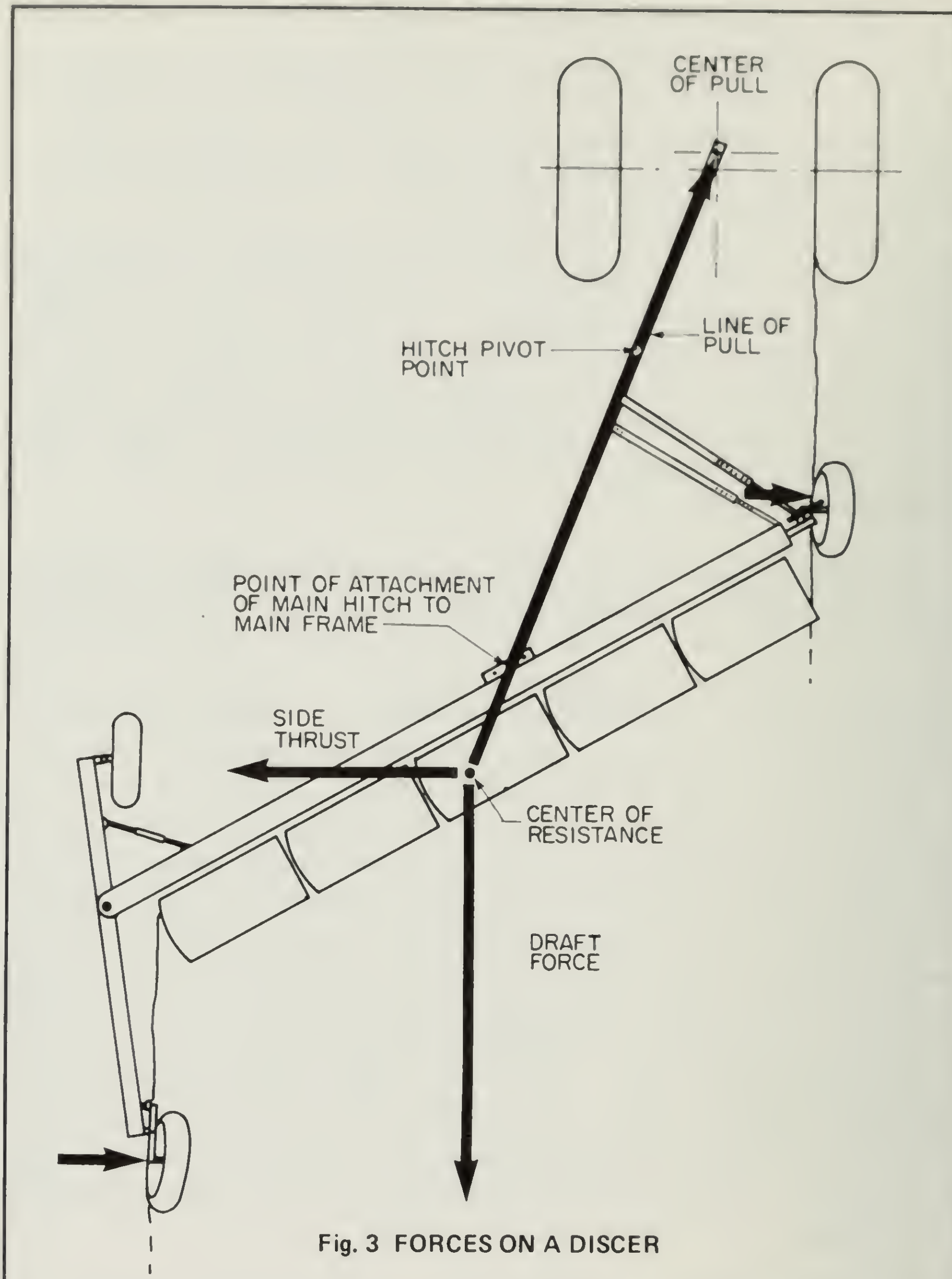


Fig. 3 FORCES ON A DISCER

combination of forces tends to twist the disc gang, forcing the front (right) end down. To counteract this twisting force, the spring force on the gangs is normally applied near the left end of the gang. Some discers provide individual gang adjustments to raise the front end of each gang. Because of these forces on the disc gangs, there is also a tendency for the front end of the discer to cut deeper than the rear. When operating in hard ground, the front of the discer will need to be raised considerably to compensate for these twisting forces. A field check under actual operation is the only way to ensure that the discer is cutting evenly.

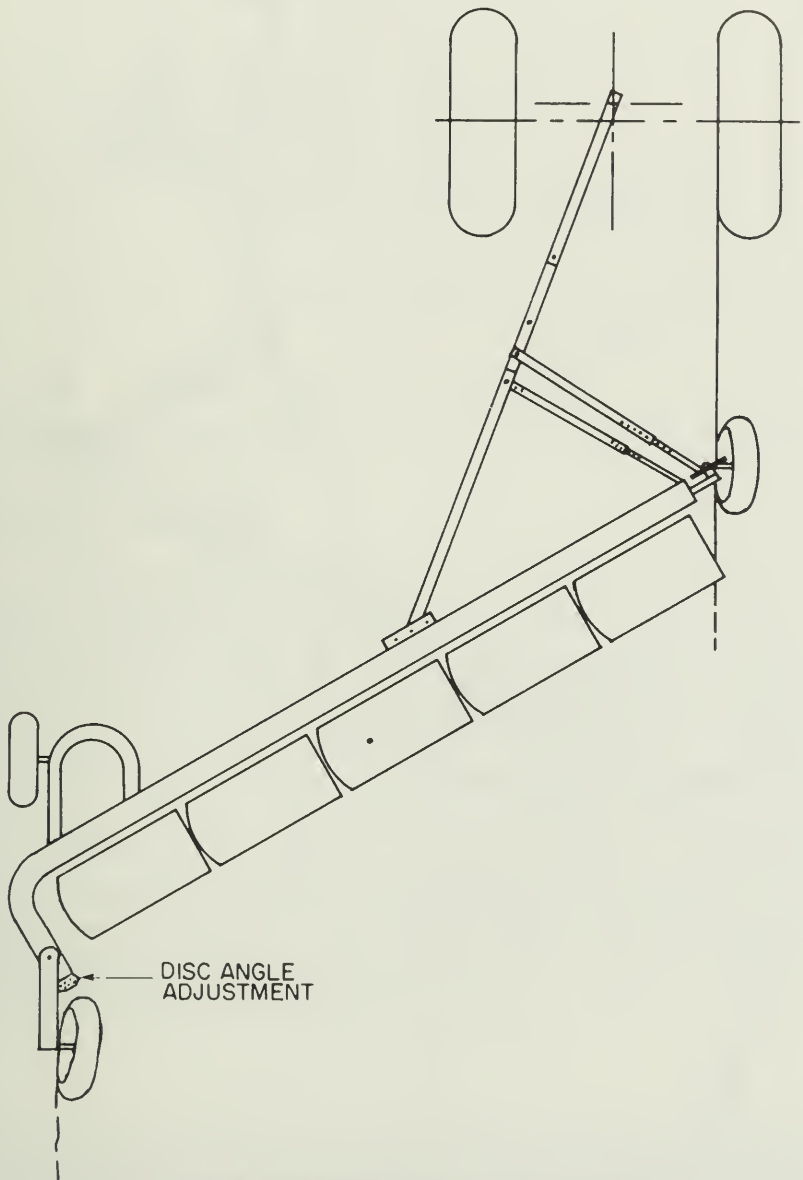


Fig. 4 INDEPENDENT FRAME DISCER

The draft force is in the direction opposite to the direction of travel. It is increased by harder soil, a deeper cut, increased forward speed, greater disc angle and dull discs. There is also a draft force on the wheels of the discer which increases with firmer soil, a greater amount of weight carried, and increased lead on the wheels.

The individual forces on the discs and wheels can be considered as acting through one point, which is called the center of resistance. This point is located near the bottom of the center disc. The center of pull of the tractor is normally located at the point where the drawbar is

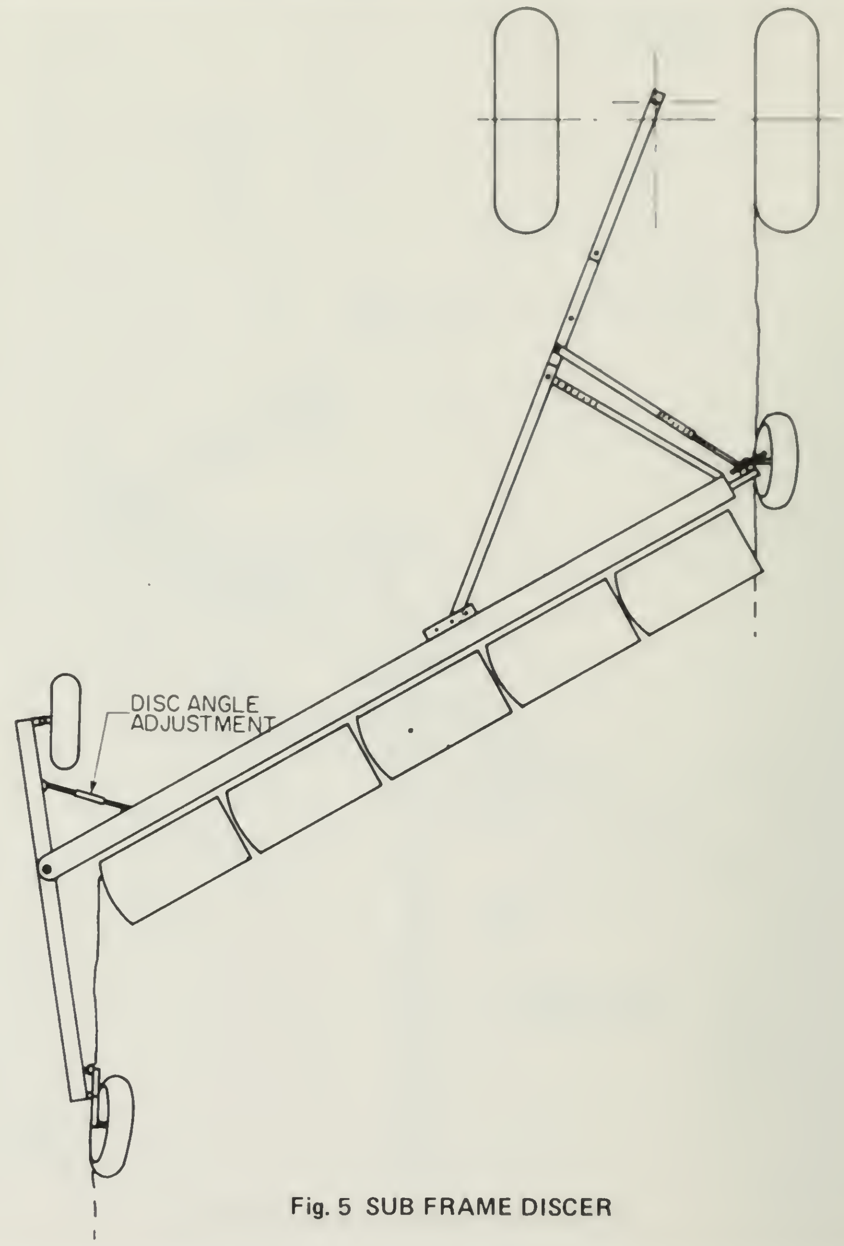


Fig. 5 SUB FRAME DISCER

attached to the tractor frame. When adjusting the discer hitch, the center of pull, the hitch pivot point and the center of resistance must be in a straight line. The swinging drawbar and the free hitch link will automatically line up on this line of pull.

NOTE: The main hitch link should be on the line of pull or slightly to the left, but in no case should it be to the right of the line of pull, since this would put the stabilizer link in compression.

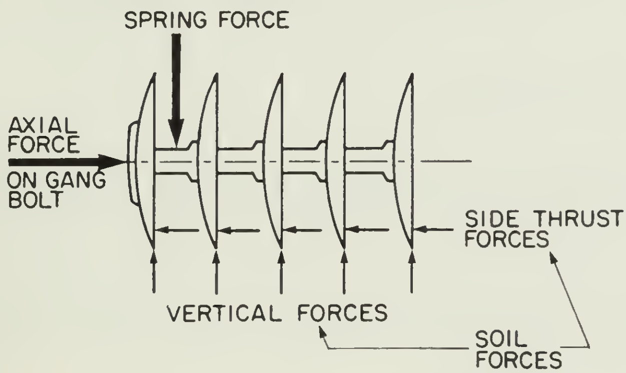


Fig. 6 FORCES ON A DISC GANG

STABILITY OF DISCERS

In most fields there are variations in soil moisture and density which change the magnitude of the forces on the discer. This may cause a change in the location of the center of resistance and move the discer to the right or left. When this occurs, the width of cut (disc angle) usually changes as well, due to the rotation of the discer about the hitch point. Discers cannot self-compensate for large changes in soil conditions or hillside slopes without some change in the width of cut. However, coulter attachments and cast iron rear furrow wheels can do much to reduce these problems. Proper leveling and hitching are very important in resisting undesirable discer movements. Stability can be improved by reducing the speed and depth of operation, increasing the disc angle, or adding weight to the furrow wheels.

Hillside coulter on discer

A special hillside coulter is available to help maintain a uniform width of cut on side hills and in very soft or very hard ground.

SPEED OF OPERATION

Changing the speed of operation of a discer affects the type of job that is done and also the durability of the discer. Higher speeds result in:

- Higher power requirements.
- More soil pulverization.
- A shallower depth of cut.
- More variation in the depth of cut.
- More disc breakage on stony land.
- Increased forces on the discer frame and bearings.
- More instability in the trailing and width of cut of the discer.

Under most conditions a maximum speed of 5 mph (8 km/h) is recommended. In stony land a lower speed should be used. Under certain conditions where soil pulverization is desired and the land is free of stones, higher speeds may be used.

POWER REQUIREMENTS

Discers operated at a depth of 3 inches (7.5 cm) and a speed of 4.5 mph (7.2 km/h) normally require about 3 to 4 pto hp per nominal foot of width (7 to 10 kW/m). Higher speeds and greater depths require more power. Heavily loaded seed and fertilizer boxes add to the rolling resistance of the discer, but this is usually offset by shallower working depths and mellower soil conditions while seeding. Packers or harrows pulled behind the discer may add about 1/2 hr/ft (1.25 kW/m) to the power requirements.

DISC SHARPENING

Disc sharpening is sometimes required to obtain a clean cut in soft, sticky soils, to improve penetration in hard soils, or to cut through a heavy straw cover. There are several disadvantages in sharpening discs which should also be considered. Resharpening may be effective for only a short period of time, thus requiring the job to be repeated frequently; the chances of mechanical damage to the disc are increased considerably due to the thinner edge and the addition of grinding marks or hairline cracks; and the diameter of the discs will be reduced more rapidly, thus requiring more frequent replacement.

Two methods of sharpening are commonly used. Rolling appears to be preferred to grinding because it does not remove metal and therefore does not reduce the disc diameter. However, work hardening may produce a brittle edge and hairline cracks may be started by the rolling process. Grinding actually removes metal from the discs, and may also cause stress concentrations from the grinding marks. Grinding should be done only in a narrow band, not more than 3/8 inch (1 cm) wide. Grindstones mounted on a special stand for disc sharpening are available. These allow good control of the grinding process, and should be used whenever the discs are ground. A V-pulley can be attached to the gang axle and a small motor can then be used to turn the discs while sharpening.

In both grinding and rolling, care must be taken not to make the edges of the discs too thin. Extreme caution should be used for the first few hours of operation after sharpening to prevent disc breakage. If a disc breaks, the new blade should be placed at the rear of the disc gang.

ADJUSTMENTS

LEVELING

Proper leveling of the discer is essential to obtain a uniform cut and seeding depth, to prevent ridging, and to make the discer trail correctly. The level adjustment must be checked in the field under normal operating conditions. The soil reaction against the discs tends to force the front of the discer to cut deeper than the back, especially in hard ground. It is therefore important to check the uniformity of cut in the field to make sure that the front discs do not cut deeper than the rear.

To check the leveling of the machine, remove the loose soil from the cut of the first two or three discs of one round and the cut of the last two or three discs of the previous round, and compare depths. This comparison must be made where the discer was operating at normal speed and depth, and with the furrow wheels properly located in the furrows. All tires should be of the recommended diameter and inflated according to specifications.

The leveling adjustment is usually made by means of a leveling screw at the front of the discer frame. When the discs are in the raised position, the front discs will normally be higher than the rear discs. On some discers, each disc gang is individually adjustable. On these, consult the Operator's Manual for recommended adjustment procedures.

If the spring pressure is adjustable, it should be set the same on all disc gangs so that all discs are forced down equally. The gang hangers and bearings should be checked to make sure that they are not loose or bent, since this can cause ridging between gangs.

HITCHING

The following procedure may be used to adjust a discer:

- Select a level, uniform part of the field, and make a cut with the discer at the desired working depth, using the appropriate width of cut (see page 10).
- Pull the discer into position with the front discer wheel in the furrow, regardless of the position of the tractor wheels. Make a short run at the normal working speed and depth.
- Check the leveling adjustment as discussed previously, and correct if necessary.
- If the tractor wheels are not in the desired location, unhook the tractor and reposition it. Be sure that the tractor drawbar is free to swing.
- Remove the adjusting pins from the stabilizer bar and front steering link. Align the center of pull, the hitch pivot point and the center of resistance (see Figure 3 and page 14).
- Replace the pin in the stabilizer link. Adjust the front furrow wheel to have a slight lead toward the worked land and replace the pin in the steering link.
- Pull ahead at the desired speed and depth and check for any problems.

PROBLEMS AND SOLUTIONS

Any one, or any combination of the following problems may occur. The changes required to solve the problems are not necessarily listed in the order that they should be made.

NOTE: Right and left sides are given when facing in the direction of travel.

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1. Front disc cutting too wide (Figure 7).
   a) Shorten the main discer hitch. Be careful not to shorten it enough to cause interference between the tractor wheel and discer when making turns.
   b) If the right tractor wheels are operating on the land, move them towards the furrow.

c) Lengthen the stabilizer link (see Note on page 16). This will likely require a change in the length of the steering link. Make these adjustments only one or two holes at a time. This adjustment will probably increase the width of cut slightly.

d) Check the lead on the front and rear furrow wheels. They should have a slight lead towards the worked land, but not more than 7°.

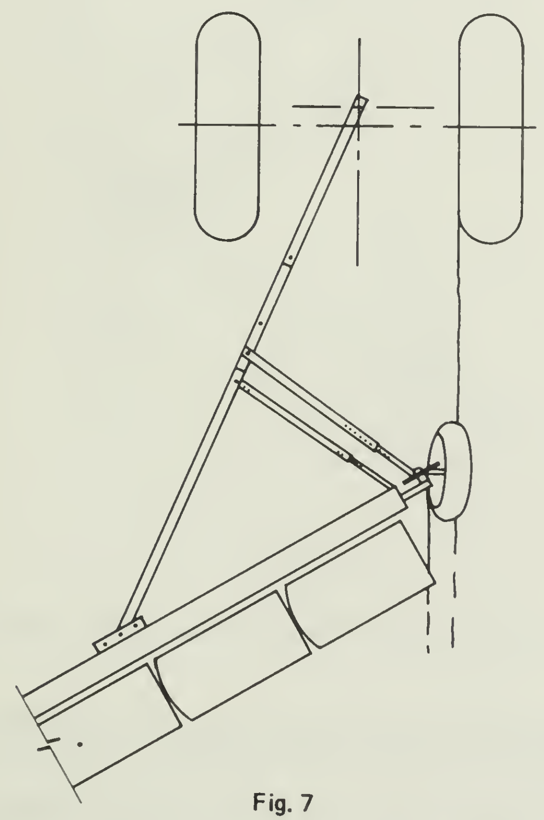


Fig. 7

e) Reduce the width of cut by increasing the disc angle (see page 10).

2. Front disc cutting too narrow (Figure 8).
   a) Lengthen the main discer hitch.
   b) If the tractor drawbar is against the left stop, use a drawbar offset, or operate the right tractor wheels on the land.
   c) Shorten the stabilizer link. This will likely require a change in the length of the steering link. Make these adjustments only one or two holes at a time. This adjustment will probably decrease the width of cut slightly.
   d) Check the lead on the front and rear furrow wheels. Reduce or eliminate the lead if necessary.
   e) Increase the width of cut by reducing the disc angle (see page 10).

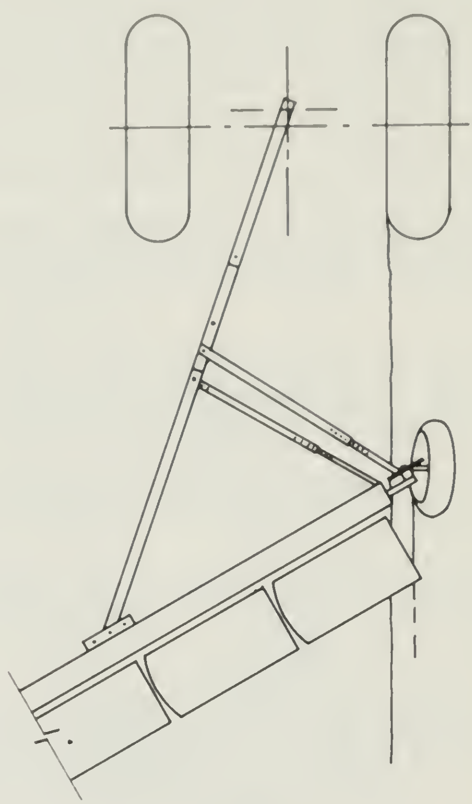


Fig. 8

3. Front furrow wheel out of position with the front disc cutting the proper width.

   Each make of discer has a different method of solving this problem but, in most cases, the front axle support arm, or the stub axle, is moved as required. Check your Operator's Manual.

4. Rear furrow wheel running on unworked land (Figure 9).
   a) Check the depth of cut of the front discs. Make sure that they are not cutting deeper than the rear discs.
   b) Check the lead of the rear furrow wheel and the land wheel. They should have a slight lead towards the worked land.
   c) Move the main hitch attachment forward (right) on the main frame, or shorten the stabilizer link.
   d) Lower the main hitch attachment on the main frame.
   e) Add weights or fluid to the rear furrow wheel or use a cast iron rear furrow wheel or coulter attachment. This should be necessary only when soil conditions vary greatly throughout the field.
   f) Reduce the depth or width of cut.

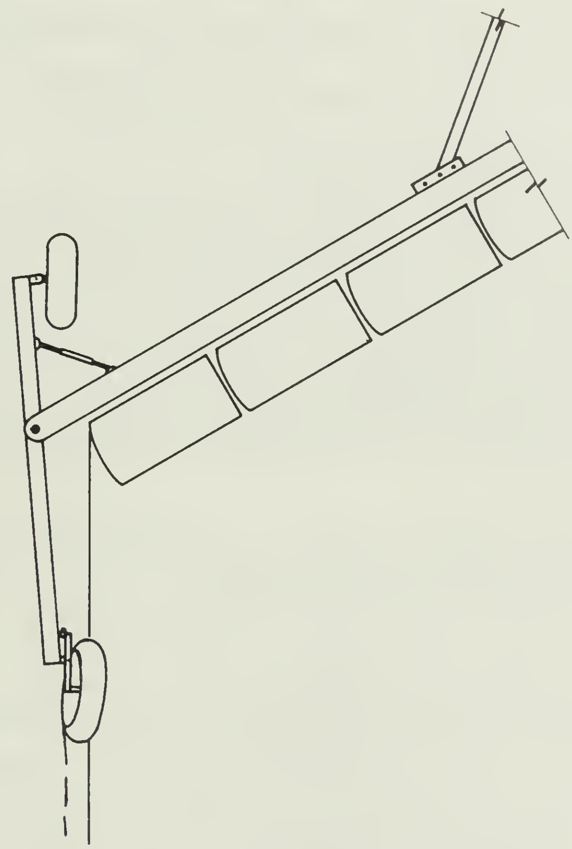


Fig. 9

5. Rear furrow wheel running on worked land (Figure 10).
   a) Check the depth of cut of the front discs. Make sure they are cutting the same depth as the rear discs.
   b) Reduce or eliminate the lead of the rear furrow wheel and the land wheel.
   c) Move the main hitch attachment backward (left) on the main frame, or lengthen the stabilizer link.
   d) Raise the main hitch attachment on the main frame.
   e) Reduce the weight on the rear furrow wheel.
   f) Check the tension on the rear furrow wheel return spring. It must be sufficient to hold the rear axle arm against the stop.

6. Ridging between adjacent rounds or gangs.
   a) Check the level of the discer frame. Make sure that the front discs do not cut deeper than the rear discs.
   b) Check the cutting width of the front disc. It should cut about two-thirds as wide as the other discs.
   c) Check the level adjustment of the individual gangs (if they are individually adjustable).

d) Check for bent gang hangers and excessive play in the gang linkage and bracket connections.
e) Check the spring pressure on the disc gangs and set them all equal.
f) Check for binding in the gang linkage pivots.

7. Broken disc blades and spools.
   a) Reduce forward speed in stony conditions. Be particularly careful with new or sharpened disc blades.
   b) Keep gang bolts tight. See the Operator's Manual for recommended torques.
   c) Remove excessive play in gang hangers and bracket connections.
   d) Use a greater width of cut in stony fields.
   e) When replacing a broken blade, install the new one at the rear of the gang.

The Operator's Manual should be studied thoroughly for additional adjustments and and recommendations.

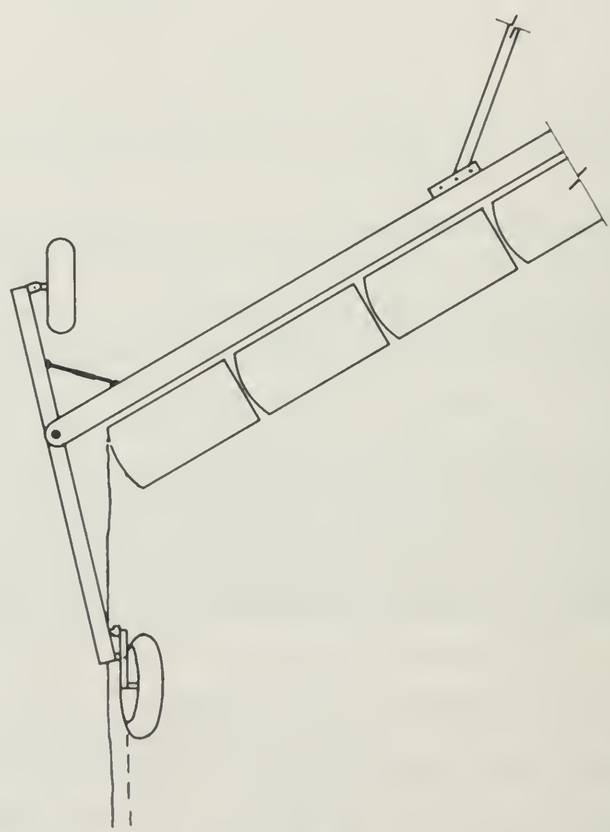


Fig. 10

SEEDING

Discers are capable of doing an excellent seeding job with many crops, if adjusted and operated properly. Tests across western Canada have shown equal or better yields with discer seeding as compared to other methods on medium and heavy soils. Discers can operate satisfactorily in a wider range of soil and trash conditions than any other seeding machines. The ability to seed and kill weeds in a once-over operation means substantial savings in time, cost and soil moisture as compared to separate tillage and seeding operations. Careful adjustment and operation of discers can result in yield increases of 5 to 10 bushels per acre (300 to 600 kg/ha). Seeding rates can be reduced substantially if all the seed is properly placed. More uniform emergence and maturity of crops can be obtained when the seed is uniformly placed.

SOIL PREPARATION

For best results, the soil should be level and firm so that the discer can operate at a uniform depth. The final tillage operation prior to seeding should be no deeper than the desired seeding depth to provide a firm subsurface for the discer. If the field is deeply ridged, it may be necessary to harrow or cultivate shallow to smooth the field before seeding. Straw and trash should be broken up and evenly spread if possible. This can often be accomplished by a high-speed harrowing on a hot, dry day. Preseeding tillage in spring often results in nonuniform germination due to drying of the surface soil.

Filling discer seed box

WIDTH OF CUT

The width of cut should be set so that the discer is cutting about 10% less than its nominal width. This allows the discs to make a clean cut at a depth of just over 2 inches (5 cm). When using the full nominal width of cut, a depth of nearly 3 inches (7.5 cm) is needed to get a complete cut at the surface (see Figure 2). The narrower cut also helps to maintain a more uniform depth through any tough spots or heavy trash in the field. With a narrow cut, a larger slot is provided behind the discs for the seed to drop into. This helps to ensure that the seed is placed into moist soil, and reduces the scatter of seed and fertilizer.

If the soil is very loose or soft, it may be necessary to increase the width of cut to prevent the discs from going too deep.

DEPTH OF SEEDING

Seeding too deeply is one of the most common mistakes when using a discer. The main reason for working deeply is to make sure the weeds are cut off. However, by using a narrower width of cut, a good weed kill can be obtained at a shallow depth. The ideal seeding depth for cereal crops is about 2 inches (5 cm). If the soil is dry to a greater depth, cereals may be seeded to a maximum depth of 3 inches, (7.5 cm) to reach the moisture. Oilseeds should be seeded at $1^1/_2$ inches (2.5 to 4 cm).

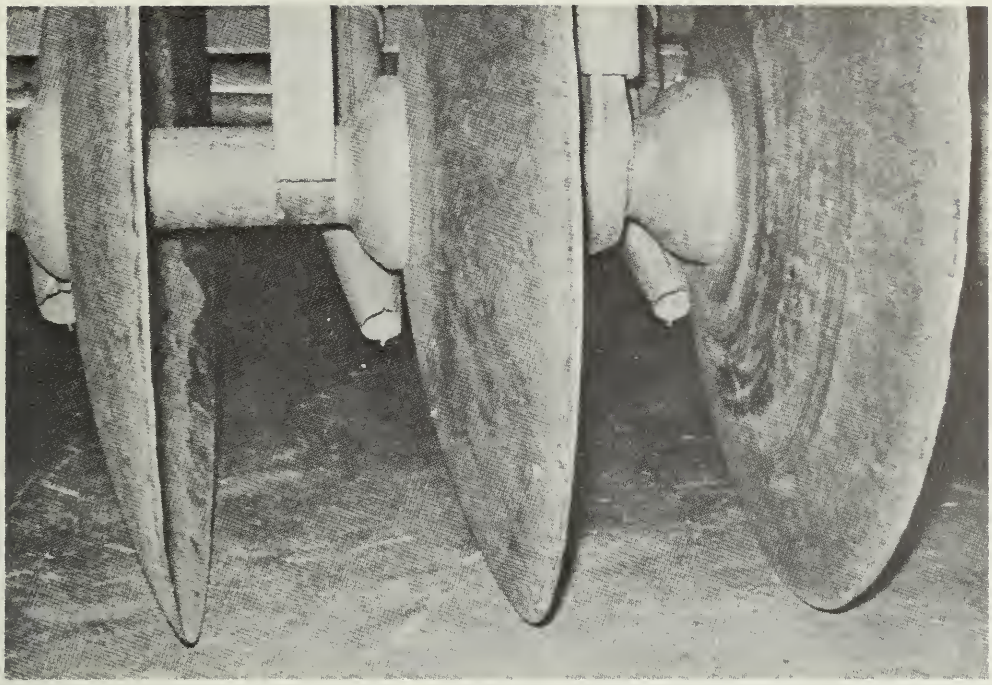
When seed is placed too deep, the result is poor, uneven emergence and weak plants producing low yields. Shallow seeding can result in poor germination if the surface soil is too dry.

The depth of seeding should be checked frequently. Careful leveling of the discer (page 19) is very important to ensure equal seeding depths at both ends of the discer. Automatic or mechanical depth controls (page 7) are particularly useful on a discer when seeding. They help to ensure a uniform seed depth in varying soil conditions, and also allow a narrower width of cut to be used, even in soft soil, thereby obtaining a better weed kill. Excessive speed may result in highly variable seeding depths.

SEED SPOUTS

Poor seed spout design and placement is another common problem with discer seeding. The seed should be delivered in a compact, uniform pattern to the bottom of the cut. Misplaced or poorly designed seed spouts can produce highly variable seeding depths, ranging from the maximum depth of cut right to the soil surface. This results in much of the seed being mixed in with dry surface soil, which may delay germination; and the varying depths produce very uneven emergence and maturity.

The design of some seed spouts prevents the seed from being placed properly. Those that are sharply tapered at the bottom produce a fan-shaped pattern which is often too wide for the slot behind the discs. This results in seed being placed at many different depths. A good seed



Proper seed spout placement

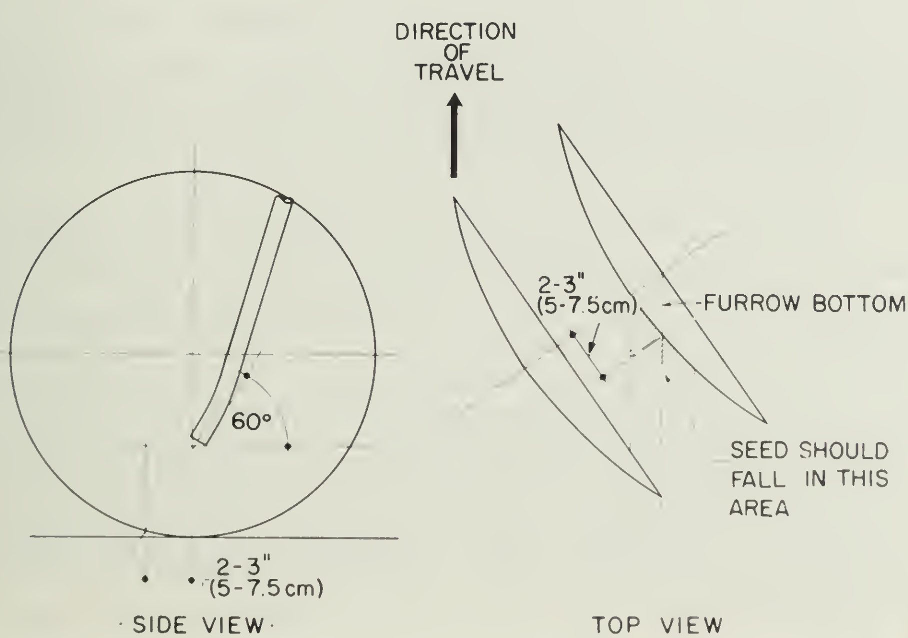


Fig. 11 RECOMMENDED SEED SPOUT PLACEMENT

spout has a long gradual taper and curves around the back of the disc to place the seed in a narrow band directly behind the disc. With proper seed spout design and placement, total variations in seeding depth can be limited to about 1/2 inch (1 cm).

The location and direction of the seed spouts is also critical for best results. They should be located as close as possible to the back side of the discs, and directed to place the seed 2 to 3 inches (5 to 7.5 cm) behind the center of the discs. The best angle for the seed spouts (measured perpendicular to the gang bolts) is 60° from the horizontal (see Figure 11). A frequent check of the seed spouts should be made during seeding to ensure that the seed is being placed at the bottom of the cut.

In selecting a discer for seeding, the position and shape of the seed spouts should be carefully evaluated. The ability of the spouts to direct all of the seed to the bottom of the cut should be observed. Spouts that are not designed or positioned properly, or are easily moved out of position, should be avoided.

SEEDING RATES AND CALIBRATION

Recommended seeding and fertilizing rates are sometimes increased when a discer is used for seeding. This is done to compensate for the scatter and depth variations that result from poorly adjusted discers. If the above adjustments and procedures are followed, the seeding rates do not need to be any higher than for a well adjusted drill. With proper seed placement and good germination, 3/4 bu/acre of wheat (50 kg/ha) is adequate for the highest yields. With seed wheat at $6.00/bu (22¢/kg) this rate would result in a saving of $3.00/acre ($7.50/ha) as compared to commonly used rates near $1^1/_4$ bu/acre (85 kg/ha).

Seeding rates of discers should be checked whenever the seed or the width of cut is changed. The indicated seed rate settings are not necessarily accurate and neither are the acremeters. When a narrower width of cut is used, a heavier seeding rate results, and the acremeter shows more acres than were actually covered. Different samples of the same seed type do not always feed at the same rate. Before the start of seeding, the individual seed cups should be checked for uniformity. By directing the spouts into containers and turning the feed shaft, the delivery from each run can be determined. The outputs should be weighed and adjustments made to any runs differing more than 5% from the average.

Field calibration is necessary to check on the actual seeding rate. The procedure is as follows:

- Determine the width and length of the area covered.
- Measure the amount of seed (or fertilizer) used on that area.
- Calculate the area covered using one of these formulas:

$$\text{acres} = \frac{\text{width in inches x length in miles}}{100}$$

$$\text{hectares} = \frac{\text{width in metres x length in metres}}{10{,}000}$$

- Divide the amount of seed used by the area covered to get the rate in lb/acre of bu/acre (or kg/ha).

PACKING AND HARROWING

Packing the soil behind the discer is highly recommended, especially when seeding stubble fields. The soil above the seed is usually quite loose behind the discer, and this can result in slow moisture transfer to the seed and rapid drying of the surface soil. To overcome this, packers should be pulled directly behind the discer except on wet, heavy clay soils. Yield increases of 3 to 5 bu/acre of wheat (200 to 350 kg/ha) are common in comparisons of packing versus no packing. On sticky clay soils a spring tine harrow may be used instead of packers. Harrowing again a few days after seeding is often useful in killing newly sprouted weeds and providing some additional leveling and packing. Soils that are subject to wind or water erosion should not be harrowed after seeding.

Improved packer hitches are now available which allow discers to be placed in transport position without unhooking the packers.

FERTILIZER ATTACHMENTS

Several features should be considered in selecting a granular fertilizer attachment. A large box is important so that it does not need to be filled more frequently than the seed box. The attachment should have:

- A simple, dependable metering arragement.
- A wide range of possible application rates.
- Good sealing against moisture.
- Easily cleaned parts.
- A durably constructed, noncorrosive composition.
- A simple, dependable drive.
- A wide opening for easy filling.
- A low tendency to plug.

The calibration of fertilizer attachments should be checked whenever the type of fertilizer is changed, since there are very significant differences in flow rates between different brands and types of fertilizer.

Liquid fertilizer attachments are easily mounted on most discers, since the pump can be mounted wherever it is convenient, and the tanks can be mounted on the discer and/or on the tractor. By mounting the fertilizer tanks on the tractor instead of the discer, the additional weight helps to provide traction and reduces sinkage of the discer wheels. The delivery hoses must extend well past the end of the seed spouts to prevent blockage of the spouts due to moisture accumulation.

SPRAYER ATTACHMENTS

The use of preemergence weed control chemicals is becoming quite common. Sprayer attachments that mount on discers can be used to apply these chemicals. The boom is mounted just behind the discs and the chemical is sprayed into the soil as it settles down behind the discs. Harrows are commonly used to assist in further incorporation. The sprayer tank can be mounted on the tractor or be trailer mounted and pulled behind the discer. These attachments can be built from regular sprayer parts or purchased as a kit from local manufacturers. Recalibration of the spray nozzles is required, since the boom is mounted at an angle to the direction of travel and each nozzle covers less than its normal width.

Applying preemergence herbicide while seeding

MULTIPLE DISCER HITCHES

Single unit discers are usually available in sizes up to 18 or 21 feet (5.5 or 6.4 m). For larger sizes, combination units are used. These are available as tandem, duplex or triplex combinations in sizes up to 36 feet (11 m). As many as five individual discers may be hitched together to form units with widths up to 75 feet (23 m).

There are three basic types of combinations used. The tandem hitch consists of two or more discers pulled one behind the other, and connected by means of a special hitch fastened to the front discer (Figure 12), or else a special chain or cable hitch (Figure 13). Duplex discers are built in two sections which may be directly in line with each other and connected by a flexible coupling (Figure 14); or two individual frames connected by a flexible coupling at the center furrow wheel (Figure 15).

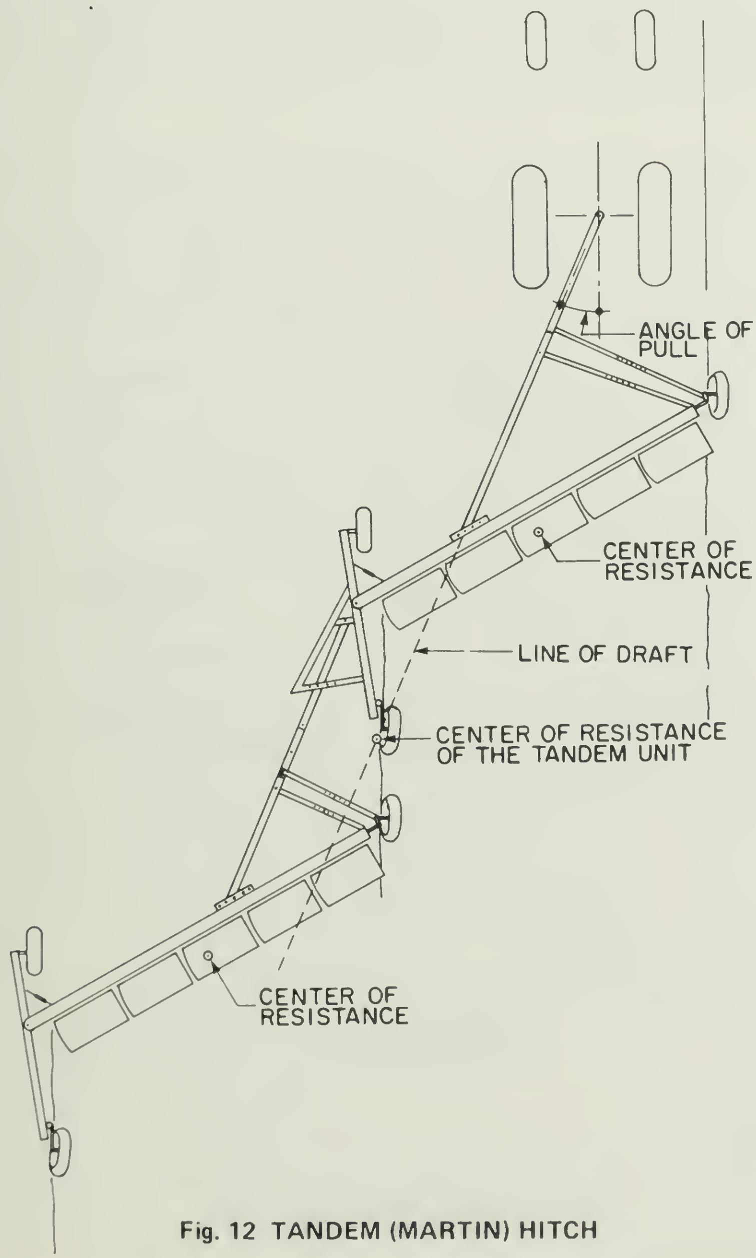


Fig. 12 TANDEM (MARTIN) HITCH

Each of the different combinations has its advantages and disadvantages. The tandem hookup has the smallest angle of pull for a given width of discer and tractor position, and will therefore produce the least side draft on the tractor. The discers can be easily separated for use with a smaller tractor, or for severe soil conditions. Each discer must be adjusted separately and it is sometimes difficult to get both of them to operate at the desired disc angle. Putting the discers into transport position may also require more time and effort than with a duplex arrangement.

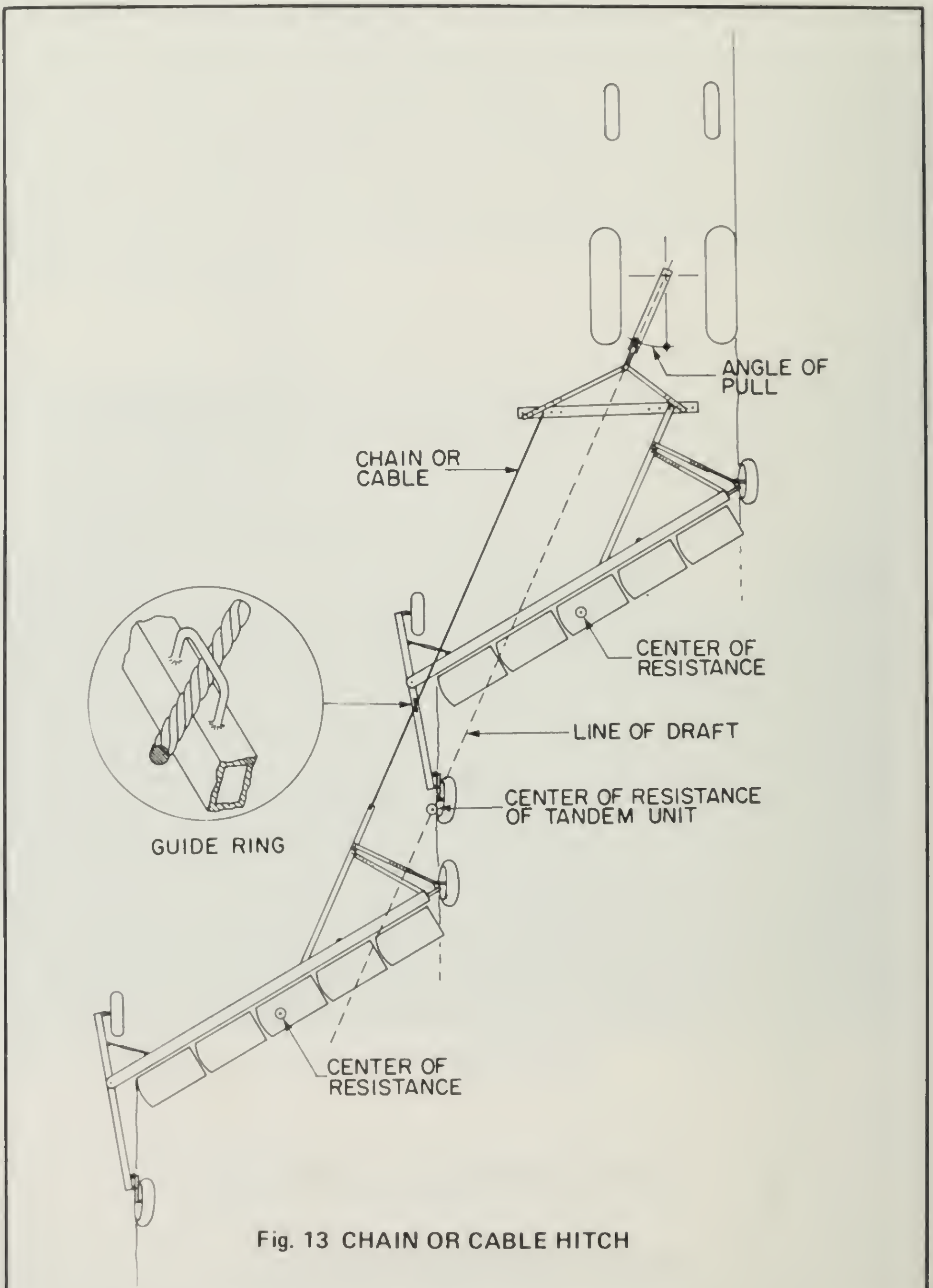


Fig. 13 CHAIN OR CABLE HITCH

Duplex discers with the two sections in line have the greatest angle of pull of the three basic types of combinations. Duplex discers do not allow for separation of the discer sections for special conditions. Adjustment of the discer is no more difficult than a single unit, since the sections are directly connected. This eliminates leveling problems between the two sections and also keeps both sections operating at the same angle. Putting the discer into transport is also a relatively simple procedure.

Duplex discers with independent frames connected at the center furrow wheel are a compromise between the other two types for angle of pull and convenience of adjustment. The discers can be separated if necessary, but not as easily as with a tandem hookup. The discers must be separately leveled and adjusted, but the combination is somewhat more stable than two discers in tandem. A special ball and socket coupling is available to convert certain discers to a duplex arrangement.

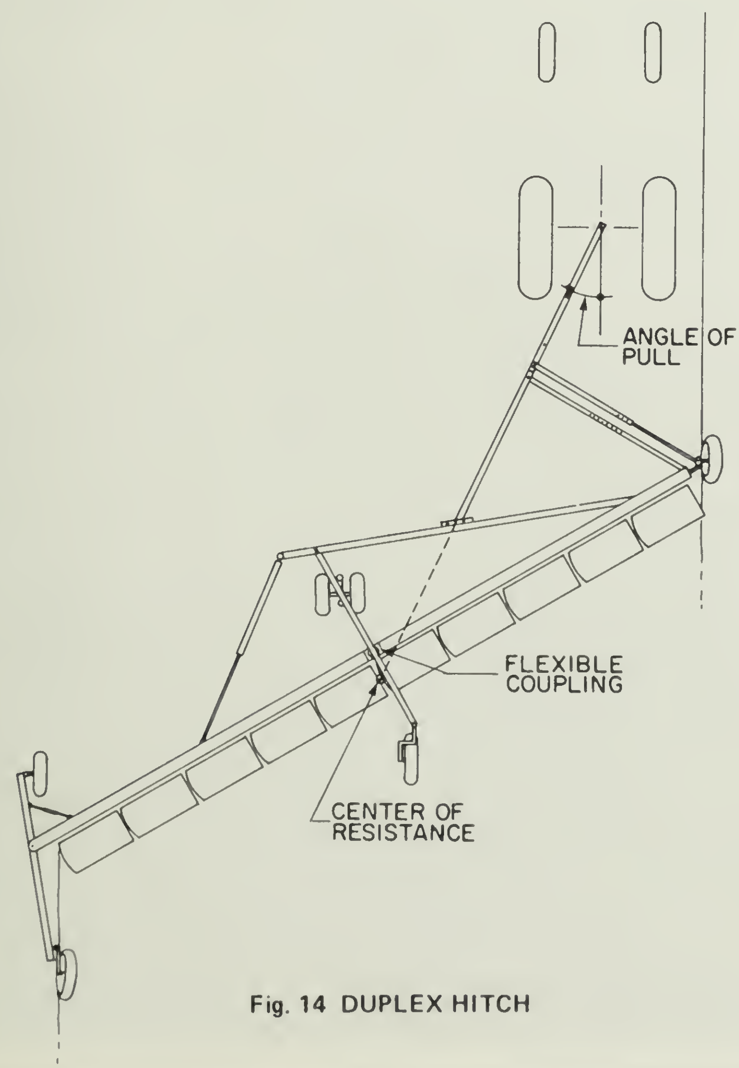


Fig. 14 DUPLEX HITCH

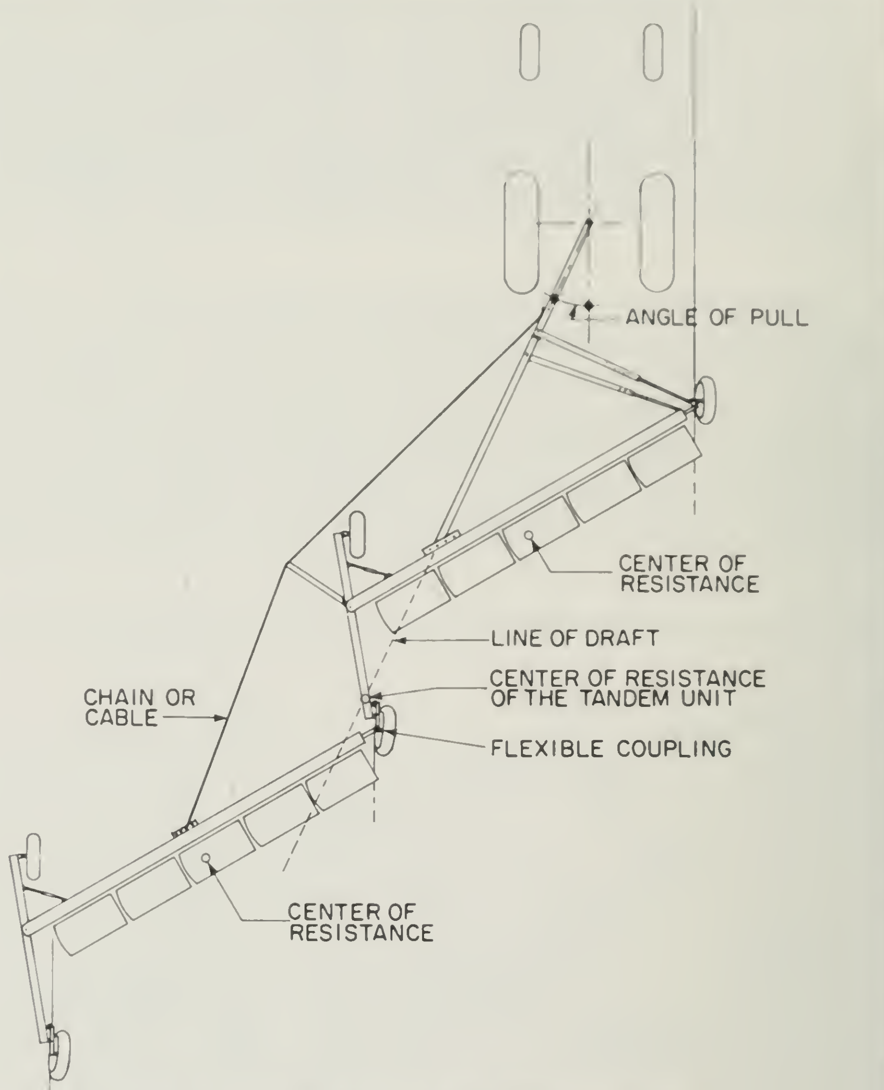


Fig. 15 FLEXIBLE COUPLING (SWEET) HITCH

Tandem discer hitch (Martin)

Flexible coupling hitch (Sweet)

Duplex discer hitch

HITCHING

The same principles of hitching apply to multiple hookups as to single discers. However, in most cases (whenever the total width is 24 feet (7.3 m) or more) the right tractor wheels are run on the land instead of in the furrow. Tractors used to pull multiple discers usually have dual rear wheels or very large single tires which do not fit into the furrow. Also, the angle of pull is often too large when the tractor is positioned in the furrow. This results in excessive side draft on the tractor, and in loose soil conditions the discers may be pulled too far to the right. If the tractor drawbar is held against the left stop, this is an indication that a drawbar offset should be used, or that the tractor should be moved over to the left, out of the furrow. A marker on the front of the tractor, consisting of a horizontal bar and a drop chain, can be used to indicate the proper tractor position relative to the furrow. Longer hitch members are usually required when operating the tractor on the land.

The center of resistance of a two-discer hookup is midway between the centers of resistance of the individual sections if both sections are the same size. The center of pull, the hitch pivot pin and the center of resistance should be aligned as previously indicated on page 16. On a triplex unit, the center of resistance is at the center of resistance of the middle discer, if all three are the same size. Some of the manufacturers of multiple discers have specific hitching information which should be studied by the operator before going to the field. The problems and solutions for multiple discer hookups are basically the same as outlined for single discers on pages 20 to 24.

Tractor with drawbar offset pulling a multiple discer hookup

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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	millimetre	(mm)
foot	x 30	centimetre	(cm)
yard	x 0.9	metre	(m)
mile	x 1.6	kilometre	(km)
AREA			
square inch	x 6.5	square centimetre	(cm^2)
square foot	x 0.09	square metre	(m^2)
acre	x 0.40	hectare	(ha)
VOLUME			
cubic inch	x 16	cubic centimetre	(cm^3)
cubic foot	x 28	cubic decimetre	(dm^3)
cubic yard	x 0.8	cubic metre	(m^3)
fluid ounce	x 28	millilitre	(ml)
pint	x 0.57	litre	(ℓ)
quart	x 1.1	litre	(ℓ)
gallon	x 4.5	litre	(ℓ)
WEIGHT			
ounce	x 28	gram	(g)
pound	x 0.45	kilogram	(kg)
short ton (2000 lb)	x 0.9	tonne	(t)
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	degrees Celsius	(°C)
PRESSURE			
pounds per square inch	x 6.9	kilopascal	(kPa)
POWER			
horsepower	x 746	watt	(W)
	x 0.75	kilowatt	(kW)
SPEED			
feet per second	x 0.30	metres per second	(m/s)
miles per hour	x 1.6	kilometres per hour	(km/h)
AGRICULTURE			
gallons per acre	x 11.23	litres per hectare	(ℓ/ha)
quarts per acre	x 2.8	litres per hectare	(ℓ/ha)
pints per acre	x 1.4	litres per hectare	(ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare	(ml/ha)
tons per acre	x 2.24	tonnes per hectare	(t/ha)
pounds per acre	x 1.12	kilograms per hectare	(kg/ha)
ounces per acre	x 70	grams per hectare	(g/ha)
plants per acre	x 2.47	plants per hectare	(plants/ha)