DISK PLOWS

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DISK PLOWS

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Disk plows are of two types—the standard and the vertical. Both have concave disk blades for working the soil. These disks may be 18 to 32 inches or more in diameter.

The standard disk plow (fig. 1) usually has one to six disks. Each disk is independently mounted at an angle from the perpendicular. This angle can be adjusted to adapt the plow to different soil conditions.

The vertical disk plow (fig. 2) has a series of disks mounted on a common axle, or gangbolt. They are in a vertical position and spaced a fixed distance apart. The disks and the axle rotate as a unit at an angle of 35° to 60° with the line of travel. This plow is known also as the one-way disk plow, disk tiller, harrow plow, wheatland plow, and cylinder plow.

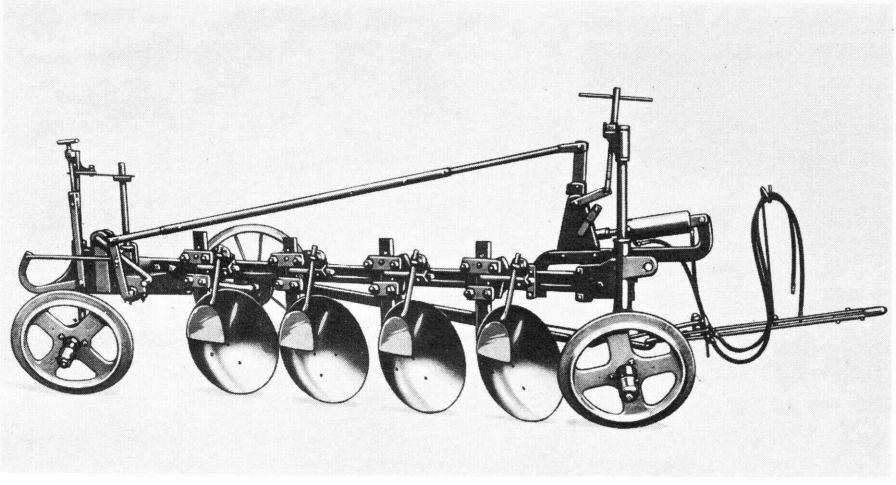

Figure 1.—Standard disk plow. (Courtesy of J. I. Case Co.)

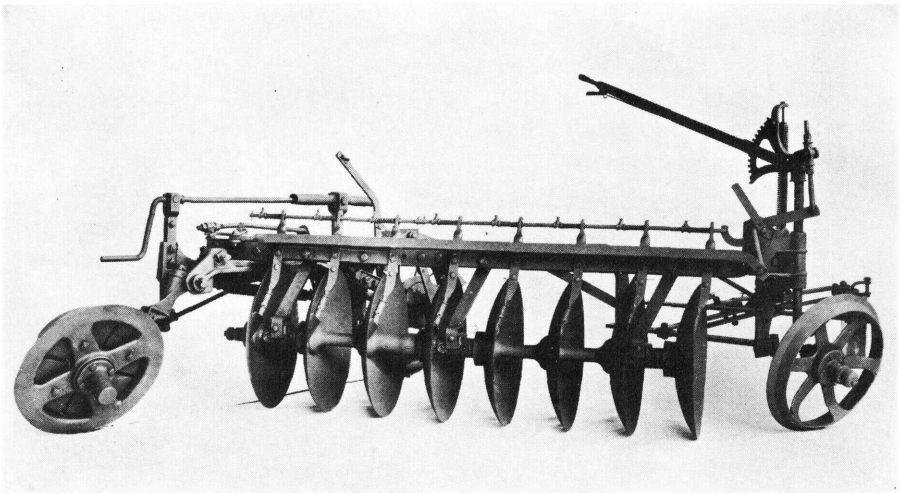

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Figure 2.—Vertical disk plow.

COMPARISON WITH MOLDBOARD PLOW

The disk plow does satisfactory work in certain soil conditions where the moldboard plow is not effective. It penetrates soil that is too hard and dry for the moldboard plow. It handles sticky soils in which the moldboard plow will not scour.

The disk plow can be operated in stony or stumpy land with less danger of breakage. It rolls over stones and stumps; the moldboard plow hooks under or into them.

Disk plows will operate effectively even after a considerable part of the disk blades have worn off, provided the blades are kept sharp and sufficient weight is available to cause them to penetrate to the desired depth. Thus they can be used effectively in hard and extremely abrasive soils. The cost of sharpening or replacing shares may prohibit the use of moldboard plows in these conditions.

Since a disk plow is very sensitive to minor adjustments, and may be harder to keep in adjustment than a moldboard plow, it does its best work only when skillfully operated. However, skillful operation is not necessary to make it *function*. It will function even when it is carelessly operated and out of adjustment, but the quality of the work will be poor. The moldboard plow under similar conditions becomes clogged or runs out of the ground.

The disk plow can be operated in loose soils, such as peat, without clogging. It is more adaptable for deep plowing than the moldboard plow.

The disk plow does not turn over

or pulverize the furrow slice as completely as does the moldboard plow. Therefore, it is less effective in covering surface trash and weeds. Additional tillage is necessary to completely cover surface debris.

The disk plow leaves the soil in a rougher, more cloddy condition than does the moldboard plow. Additional tillage is necessary to put the soil in condition for uniform depth of planting, effective application of herbicides, and cultivation to control weeds. This rough surface may be an advantage, however, if the land is to lie fallow. It will aid in increasing water infiltration, holding snow on the land, and retarding wind erosion.

Disk-plow equipment is much heavier than moldboard-plow equipment of equal capacity. A disk plow requires weight to penetrate the soil; a moldboard plow penetrates by suction.

Tests show that in soils where the moldboard plow works satisfactorily, its draft is less than that of the disk plow turning an equal amount of soil.

STANDARD DISK PLOW

Standard disk plows may be tractor or horse drawn. Since tractor-drawn plows are more numerous, most of the following discussion applies specifically to them. General adjustment and operation features, however, apply to both types.

There are three types of tractor-drawn standard disk plows—trailing, semimounted, and direct-connected. The trailing type is attached to the tractor at one point with a flexible hitch. The weight of the unit is on its own wheels, both when the plow is raised and when it is in the soil. The front of the semimounted type attaches to the tractor at two points so that it is carried and controlled by the rear wheels of the tractor. The rear furrow wheel carries the back of the plow, both when raised and when in the soil. The entire weight of the direct-connected type is carried on the tractor when the plow is raised, but this type usually has a rear wheel that controls the rear of the plow when in the soil.

Direct-connected plows (fig. 3) are being used increasingly. They are easier to handle and transport than the trailing type. However, they have special hitches and must be pulled by a tractor equipped with the same type hitch.

The backbone of the standard disk plow assembly is a stiff framework sufficiently strong and well braced to resist the twisting and bending stress on the disks as they cut through the soil. The disk-blade assemblies, hitch bar, and wheel-bracket units are attached to this frame. Two furrow wheels and a land wheel support the frame of the trailing-type plow. The hitch and a single furrow wheel support the frame of the direct-connected and semimounted types.

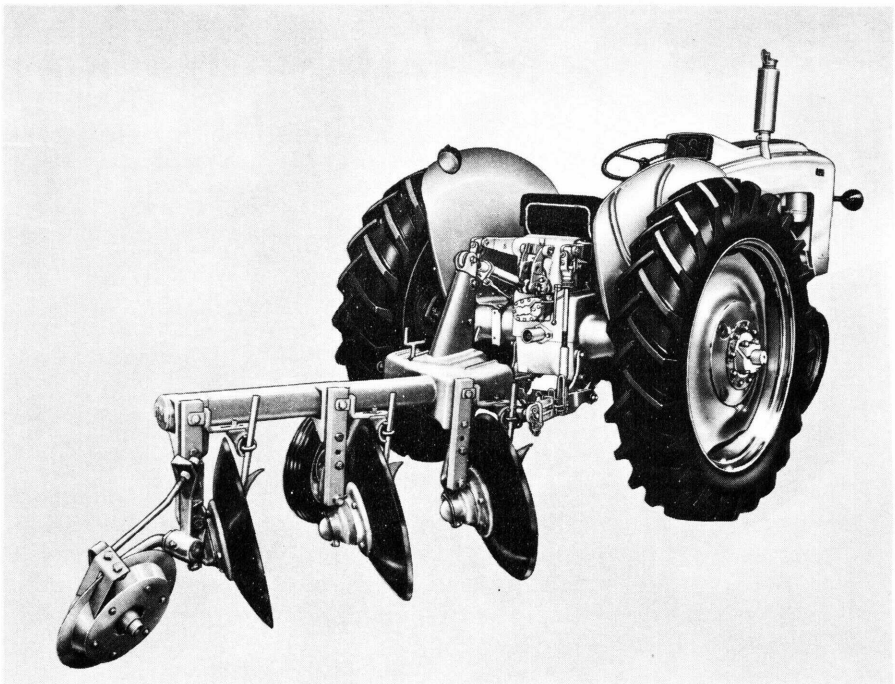

Figure 3.—Direct-connected standard disk plow. (Courtesy of Minneapolis Moline Co.)

General Adjustment and Operation

Soil conditions vary widely from one locality to another and even within the individual field. Therefore, it is not practical to give detailed instructions to fit all operating conditions. If you understand the most important general adjustments, you can alter them to suit specific conditions.

Most standard disk plows are flexible in operation. The trailing-type plow usually has more possible adjustments than the direct-connected or the semimounted type.

Following are some general adjustment and operating instructions for standard disk plows:

The plow frame is adjusted vertically and laterally by means of linkages, levers, and pivots.

The width of cut of most standard disk plows can be changed within limits to adapt the plow to different power units and soil conditions. This may be done by adding or removing one or more disks. Diagrams in the manufacturers' instruction manuals show the proper procedure.

The spacing between disks can be changed on many makes of plows.

Wide spacing is needed for deep plowing, better coverage of surface debris, and plowing in muck soils. Closely spaced disks pulverize stiff and gravelly soils better. On some standard disk plows the spacing between disks can be changed by relocating the disk standards on the frame. The same overall width of cut can be maintained on these plows by adding or removing disk units as required. On other types the spacing between disks can be changed only by changing the angle the frame makes with the direction of travel. This changes the disk angle also. Manufacturers' instruction manuals show the method of spacing and the proper procedure.

Weight holds a disk plow in the ground. If the soil is so hard and dry that penetration is difficult, add more weight to the plow. If the soil is so loose that the wheels sink too deep, use extension rims, or "sand bands," on the wheels.

Hitches and Hitching

The methods of adjusting the hitch to control depth and width of cut for tractor-mounted and semimounted disk plows vary with the type and make of plow. The principles are the same as for trailing-type units. The width of cut for the front disk is usually controlled by the spacing or location of the rear tractor wheels on the axle. Manufacturers' instruction manuals give the plow adjustments and locations of the rear wheels for the tractors with which the plow is designed to operate.

Horizontal

The horizontal hitch on a trailing-type disk plow is adjusted to control the width of cut for the first disk and to balance sidedraft between the tractor and plow where necessary.

Width of cut.—To adjust for width of cut on the trailing-type disk plow, proceed as follows:

Plow one round. Make certain the rear disk cuts a good furrow. At the start of the second round, stop with the front furrow wheel in the open furrow regardless of the position of the tractor.

Unhitch the tractor and drive it into position in front of the plow. The tractor may be entirely on the unplowed ground, or its right drive wheel or track may be in the furrow. This depends on the type of tractor and the size of the plow. For general-purpose tractors and the smaller plows, the right drive wheel of the tractor usually runs in the furrow. Next, attach hitch near the center point of the tractor drawbar and adjust hitch horizontally on the front of the plow (at *a* in fig. 4) so that the front disk cuts its proper width. Finally, adjust the steering arm of the front wheel (at *c* in fig. 4) so that the wheel is parallel to or has a slight lead away from the furrow wall.

Balancing sidedraft.—Hitching a four- or five-disk plow behind a four-wheel tractor of conventional width may put the line of draft of the plow near the line of pull of the tractor. The line of pull for

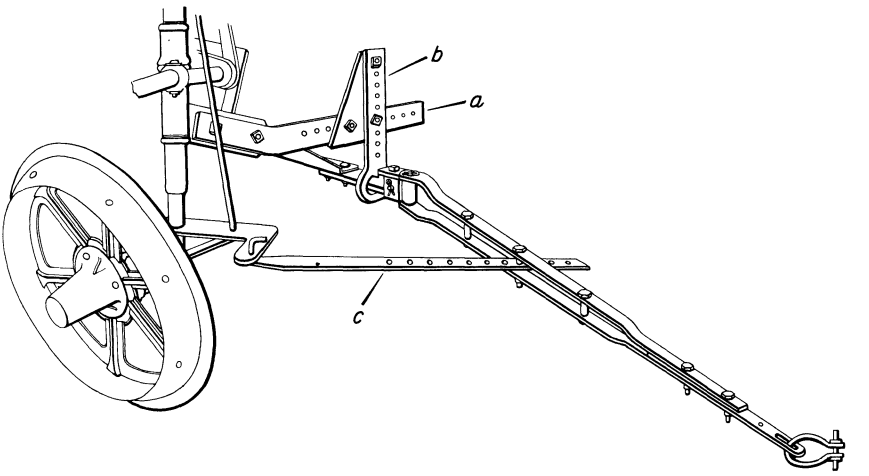

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Figure 4.—Typical hitch arrangement on trailing-type standard disk plow: *a*, Horizontal hitch; *b*, vertical hitch; *c*, steering arm.

a tractor is in the direction of travel and is located halfway between the drive wheels. It passes through the center point in the hitch if the drive wheels are set equal distances from the center line of the tractor.

For hitching purposes, the line of draft of a disk may be considered to be approximately in the center of the furrow cut by the disk. Thus the line of draft for any disk-plow unit is approximately on the center line of the width of area cut. When a wide-tread general-purpose tractor is used, set the tractor wheels as close together as *safely* practicable. (CAUTION: *Do not set the wheels too close together or the tractor may become unstable and tip over during operation.*) Even with the wheels as close together as permissible, the line of draft of the plow may be decidedly off center with reference to the tractor. This causes sidedraft and may cause the rear end of the plow to swing toward the unplowed ground.

To relieve the plow of sidedraft, move the hitch point on the tractor toward the open furrow. However, in relieving the plow of sidedraft, you may cause the tractor to pull sidewise as the plow did when the hitch was in the center of the drawbar. The proper procedure is to divide the sidedraft between the plow and the tractor. You may have to change this adjustment on trial. If the rear of the plow tends to swing out of the furrow toward the left, move the hitch on the tractor drawbar to the right. If necessary, add weights to the rear furrow wheel to assist in holding the plow in its proper position.

Vertical

Make the vertical hitch (at *b* in fig. 4) as low as the depth of plowing permits. A low hitch on the front of the plow increases the downward force on the rear wheel and helps to hold it in the furrow. Raising the hitch on the tractor has the same effect. Raising the hitch on the front of the plow or lowering it on the tractor decreases the weight on the rear wheel and increases the weight on the front disks or wheels.

For most plowing conditions, set the rear and front furrow wheels so that they have a slight lead away from the furrow wall. If the land wheel is set for the desired disk angle, adjust the hitch so that the wheel goes straight forward and the front disk cuts its correct width. When properly adjusted, the standard disk plow should run level and all disks should cut the same depth and width. The land wheel should run straight forward, parallel to the line of travel. Depth of plowing and leveling of the plow are adjusted by means of hand levers or screws attached to the wheel mounting brackets.

Disk Adjustments

Disk Angle

Disk angle is the angle the face of the disk makes with the line of travel (fig. 5). On many trailing-

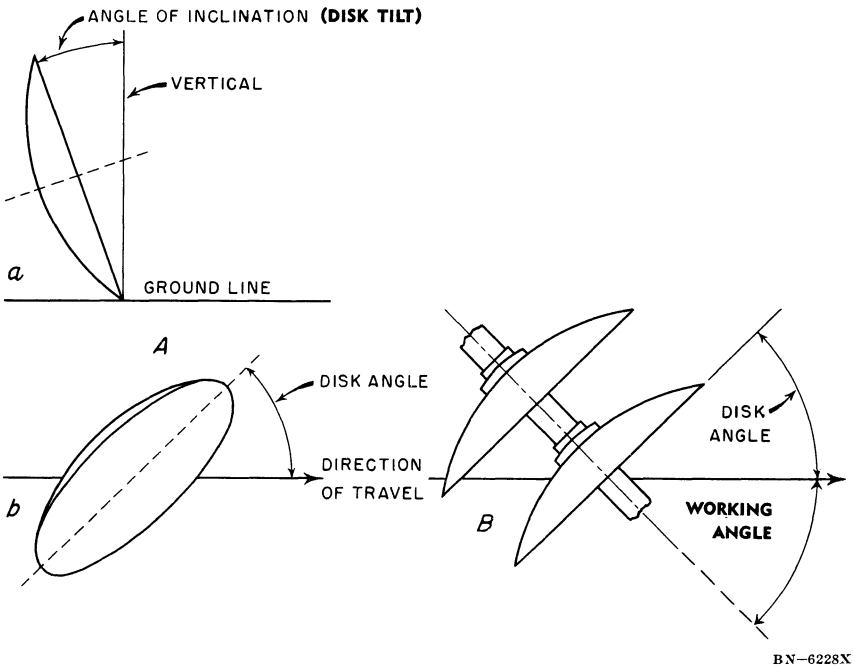

Figure 5.—Disk Adjustments. A. Standard disk plow blade: *a*, Disk tilt, or angle of inclination, from vertical; *b*, disk angle in relation to direction of travel, viewed from directly above. *B*, Vertical disk plow blades showing working angle.

type disk plows it can be changed only by adjusting the land-wheel bracket in relation to the plow frame. As the angle increases, the width of cut of the disk gang decreases. As the angle decreases, the width of cut increases. When plowing hard ground, use the narrow cut at the greater disk angle.

Some plows have wedges or other means of adjusting built into each bearing mounting. This arrangement permits individual adjustment of the disks. When the disks are adjusted individually, the width of cut of the disk gang remains approximately the same.

Adjustments are built into the mounting arms for mounted and semimounted plows. Your instruction manual gives the correct procedure for making adjustments.

It should be noted that the width of cut per individual disk and the disk angle affect the amount of uncut soil between individual furrow bottoms. The amount is increased as the width per disk is increased or the disk angle is decreased (fig. 6).

Disk Tilt

The disk tilt is the angle of inclination from the vertical (fig. 5). This is adjustable on many standard disk plows. Some plows have

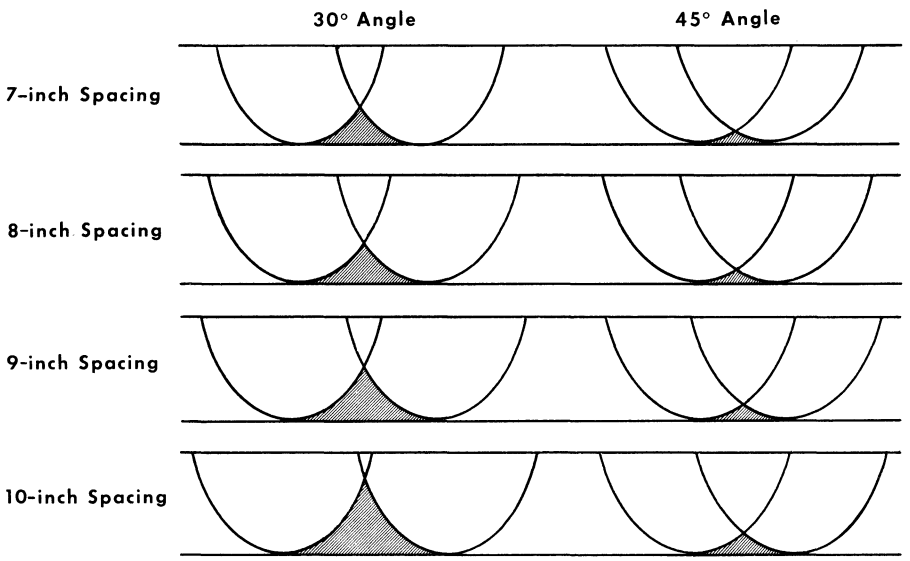

Figure 6.—How disk angle and width of cut determine amount of uncut soil between disk furrows. Shaded areas show uncut soil between furrows made by 24-inch disks when the disk angle is 30° or 45° and the spacing between disks is 7, 8, 9, or 10 inches.

wedges or eccentric washers in the bearing support. Others have a special arrangement of holes for the bolts connecting the bearing standard to the frame. On others, the bearing support is pivoted.

Increase the tilt of the disk when plowing sticky, waxy soils. Decrease the tilt when plowing loose, sandy soil or hard, dry soil.

When plowing soil so hard that penetration is difficult, set the plow at its narrow width and the disks in their most nearly vertical position. If the desired depth is not obtained, add weights to the plow.

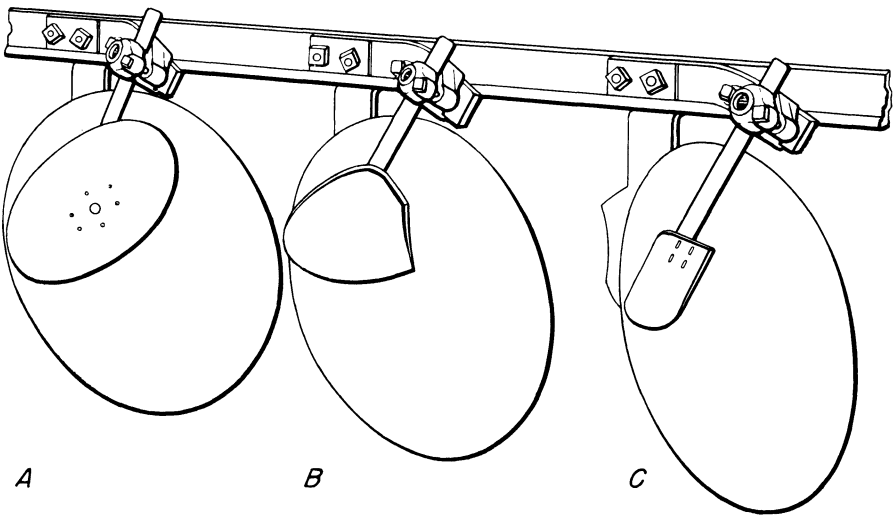

Figure 7.—Disk scrapers: *A*, Rotating; *B*, moldboard; *C*, hoe.

Disk Scrapers

Scrapers with brackets are regular equipment on most standard disk plows. The three most common types are the moldboard or universal, the hoe, and the rotating (fig. 7). The brackets are designed to give a wide range of adjustment for the scrapers.

The moldboard scraper works best in soils that cause no scouring difficulties. When properly adjusted, it helps to cover trash and vegetation.

The rotating and the hoe scrapers are used in sticky soils where the moldboard scraper will not scour.

Adjust any type scraper so that the scraping edge is close to the disk face. Leave enough clearance to avoid friction if the disk does not run true.

VERTICAL DISK PLOW

The vertical disk plow (fig. 8) is similar in general construction to the standard disk plow. An important difference between the two is the mounting of the disks. On the standard plow, they are independently mounted. On the vertical plow, they are securely fastened to a common gang bolt. The entire unit is mounted in bearings on the main frame.

Vertical disk plows may be the trailing, the semimounted, or the direct-connected type. Direct-connected plows are being used increasingly, especially in the four- to eight-disk sizes.

Some of the larger plows have several disk gangs. Each gang is mounted on its own gang bolt, and these are joined by couplings.

End thrust of the disk gang is heavy on the vertical plow. It is usually absorbed by a single antifriction thrust bearing or by a well-constructed plain thrust bearing. Plain radial bearings take the radial load of the disk gang.

The furrow wheels usually are of heavy construction and have flanged or ribbed tires. They are so constructed as to assist in holding the plow in position and in taking side thrust.

Most trailing-type plows are equipped with a power lift that is operated by the land wheel or a hydraulic cylinder.

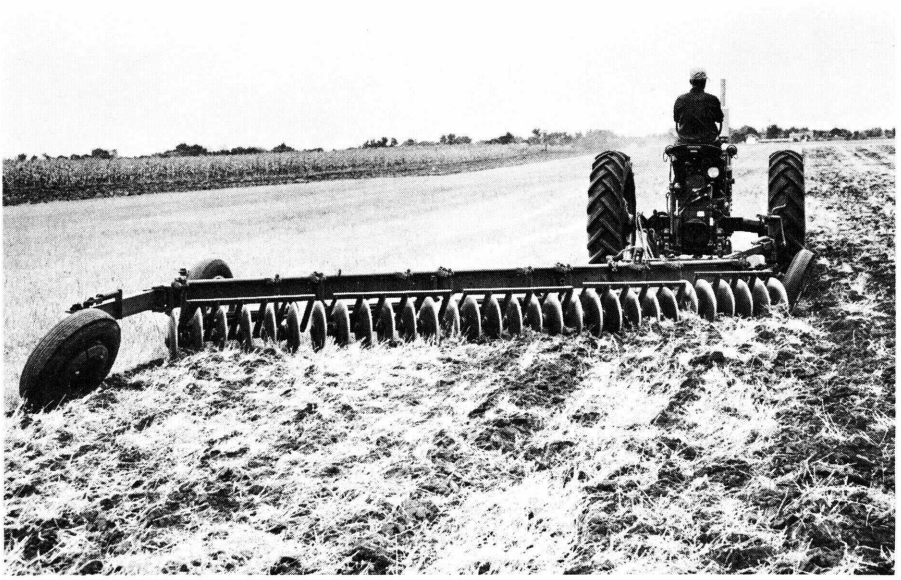

Figure 8—Trailing-type, multiple gang, vertical disk plow. (Courtesy of International Harvester Co.)

Scrapers and the attaching brackets are available for use with the vertical plow when working wet and sticky soils. Some plows are equipped with trash guards. Wheel weights may be added where necessary to get the desired depth of plowing or where needed to help stabilize the plow.

Adjustments

Following are adjustments that can be made on the trailing-type vertical disk plow:

The disk gang is raised or lowered by means of hand levers, screws, or hydraulic cylinder. Depth of plowing and leveling of the plow are controlled by these adjustments.

The working angle of the disk gang—the angle the gang bolt makes with the line of travel (fig. 5, *B*)—can be changed. The usual working angle is 45° to 50°, but it may be set from 30° to 55°. Change the angle by shifting the land wheel with respect to the main frame. Then adjust the front and rear furrow wheels and the hitch to correspond with the land-wheel adjustment. When the working angle of the disk gang is increased, the width of cut of the plow increases; when it is decreased, the width of cut decreases. Decrease the working angle when plowing hard ground.

Many of the larger plows composed of several gangs are so arranged that a gang may be removed and the wheels, frames, and connections rearranged for a smaller unit.

Hitches and Hitching

The hitching principles and procedures for trailing-type vertical disk plows are the same as for standard disk plows. Instructions for hitching and adjusting mounted and semimounted units are given in your instruction manual.

CARE OF DISK PLOWS

Standard and vertical disk plows are sturdy, but they must have good care if they are to operate satisfactorily.

To maintain proper alinement, keep all nuts tight and promptly straighten or repair bent or broken braces, hitch parts, and levers.

For ease of adjustment, oil regularly all screw adjustments, axle sleeves, and other moving parts.

Keep all wheel bearings and the thrust bearing on the vertical plow well lubricated and properly adjusted. Oil or grease the radial bearings on the vertical plow if they are made of metal. Maple wood radial bearings often do not need lubrication. However, follow the manufacturer's recommendations for the particular bearing design used on your plow.

Lubricate individual disk bearings on the standard plow at least twice a day when the plow is in use. Keep these bearings properly adjusted. Take them apart and clean

them at least once a season. Clean or replace the dust seals at the same time.

Keep the disk blades sharp by grinding or rolling. Grind them on the same side as the original bevel. Rolling is an effective method of sharpening if suitable equipment is available. (CAUTION: *Cracking in the edge area may occur if modern, hard, heat-treated disks are rolled at too heavy or rapid a rate of metal deformation.*) If the metal deformation rate is light enough, effective rolling can be done on all commercial disks. Do not work to an edge that is too fine or sharp. The thin edge will chip off or bend.

Keep disks coated with rust preventative or grease when they are not in use.

DRAFT AND PENETRATION

The operator can control several factors that influence the draft and penetration of the disk plow. They are: Operating speed, disk setting, size of disks, and use of scrapers.

The normal variations in working speed of horses and mules do not materially affect draft and penetration. The higher speeds of tractors do affect them.

Tests show that the draft of a single disk may double when the speed is increased from 2½ to 5 miles per hour. When draft and speed are doubled, power requirements increase four times. Increased speed also results in greater side thrust.

The effect of speed on penetration appears to be governed by the tilt of the disk. Penetration of a vertical disk, as on the vertical disk plow, decreases as the speed increases. Penetration of a tilted disk, as on the standard disk plow, increases in many soils at higher speeds.

The tilt of the disk is adjustable on many standard plows. Most disk plows are designed to operate in a range from 15° to 25°. On plows where the angle is not adjustable, the disks usually are set at an angle of 18° to 20°. In heavy, sticky soils, increase the tilt of the disk for better penetration. To avoid clogging, set the disk almost vertical. Where there is considerable surface material to be plowed under and penetration is not difficult, increase the blade tilt in order to turn the furrow slice better.

The angle of the disk in relation to the direction of travel affects draft and penetration. The usual operating angle is 42° to 45° for moderately deep concavity disks and slightly more for disks of greater concavity. Draft increases as the angle is decreased from this setting. Also, more weight is required to hold the disk in the ground. Draft also increases, especially in the heavier soils, as the angle is increased from the usual setting.

The size of the disks affects draft and penetration. The trend is to use disks of larger diameter. They take a wider cut, tend to cut through surface debris better, penetrate the soil more easily, have less side thrust, and wear longer.

The use of scrapers on the disks when working heavy, sticky soils prevents the buildup of soil on the disks and thus may reduce draft and eliminate the need for additional weight to keep the disks in the ground.

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Store gasoline and other flammables in approved containers and locations.

Remove fire hazards from storage areas.

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