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Terminology and Definitions for Agricultural Tillage Implements

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ASABE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA ph. 269-429-0300, fax 269-429-3852, hq@asabe.org

Terminology and Definitions for Agricultural Tillage Implements

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1 Purpose and scope

1.1 The purpose of this Standard is to provide uniform terminology and definitions for tillage implements designed primarily for use in the production of food and fiber. It does not include implements designed primarily for earth movement and transport.

1.2 Dimensions, spacings, depths of operations, widths or velocities may be used as a part of the implement specifications. These should not be considered as performance specifications for any type of design or publication.

1.3 This Standard is intended to be consistent with terminology in other ASABE Standards including ASABE Standard EP291 Terminology and Definitions for Soil Tillage and Soil-Tool Relationships, and ASABE Standard S477, Terminology for Soil-Engaging Components for Conservation-Tillage Planters, Drills and Seeders.

2 Tillage implement categories

2.1 Primary tillage. Primary tillage implements displace and shatter soil to reduce soil strength and to bury or mix plant materials, pesticides, and fertilizers in the tillage layer. Primary tillage is more aggressive, deeper, and leaves a rougher soil surface relative to secondary tillage.

2.1.1 Examples of primary tillage implements

Plows
- Moldboard
- Chisel
- Combination chisel with cutting blades
- Wide-sweep
- Disk
- Bedder

Moldboard listers
Disk bedders
Subsoilers
Disk harrows
- Offset disk
- Heavy tandem disk

Powered rotary tillers

2.2 Secondary tillage. Secondary tillage implements till the soil to a shallower depth than primary tillage implements, provide additional pulverization, mix pesticides and fertilizers into the soil, level and firm the soil, close air pockets, and eradicate weeds. Seedbed preparation is the final secondary tillage operation.

2.2.1 Examples of secondary tillage implements

Harrows
- Disk
- Spring, spike, coil, or tine tooth
- Knife
- Powered oscillatory spike tooth
- Packer
- Ridger
- Leveler
- Rotary ground-driven

Cultivators
- Field or field conditioner

Rod weeders
Rollers
Powered rotary tillers
Bed shapers
Rotary hoes

2.3 Cultivating tillage. Cultivating tillage implements perform shallow post-plant tillage to aid the crop by loosening the soil and/or by mechanical eradication of undesired vegetation.

2.3.1 Examples of cultivating implements

Row crop cultivators
- Rotary ground-driven
- Spring tooth
- Shank Tooth

Rotary hoes
Rotary tillers—strip type, power driven

2.4 Combination primary tillage. Combination primary tillage implements perform primary tillage functions and utilize two or more dissimilar tillage components as integral parts of the implement (not as attachments).

2.4.1 Examples of combinations of components used in primary tillage

Coulter blades, subsoiler shanks, and chisel plow shanks
Chisel plow shanks and disc blades

2.5 Combination secondary tillage. Combination secondary tillage implements perform secondary tillage functions and utilize two or more dissimilar tillage components as integral parts of the implement (not as attachments).

2.5.1 Examples of combinations of components used in secondary tillage

'S' tines, spike teeth, and disc blades
Packer rollers and spring teeth

2.6 Combination primary, secondary tillage. Combination primary and secondary tillage implements perform primary, secondary and seedbed preparation functions, utilizing two or more dissimilar tillage and seedbed preparation components as integral parts of the implement leaving the field ready to be seeded at the end of the operation.

2.6.1 Examples of combinations of components used in combination primary, secondary tillage

Coulter blades, subsoiler shanks and rolling baskets
Coulter blades, chisel shanks and rolling spikes

3 Implement hitch classification

3.1 Pull

3.1.1 Wheel-mounted

3.1.2 Drag

3.1.3 Squadron

3.2 Semi-mounted (semi-integral)

3.3 Rear-mounted (three-point integral)

3.4 Front-mounted

3.5 Center-mounted

4 Implement frame configurations

4.1 Rigid

4.2 Rigid with rigid wings

4.3 Single folding wing

4.4 Dual folding wings

4.5 Multiple folding wings

4.6 Hinged

4.7 Sectional

4.8 Endways transported

4.9 Winged styles may have mechanical, hydraulic, or no folding assistance.

5 Definitions and illustrations

5.1 Disk harrow: A primary or secondary tillage implement consisting of two or four gangs of concave disks. Adjustment of gang angle controls cutting aggressiveness. Disk harrow hitches are either rear-mounted or pull type. Types of disk harrows are shown in Figs. 1–7 .

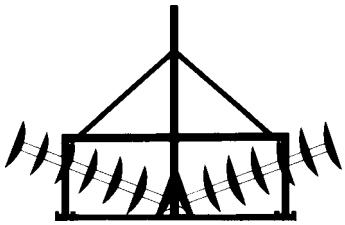


Figure 1 – Single disk harrow—Two gangs of disks set to oppose each other—Drag-type pull hitch

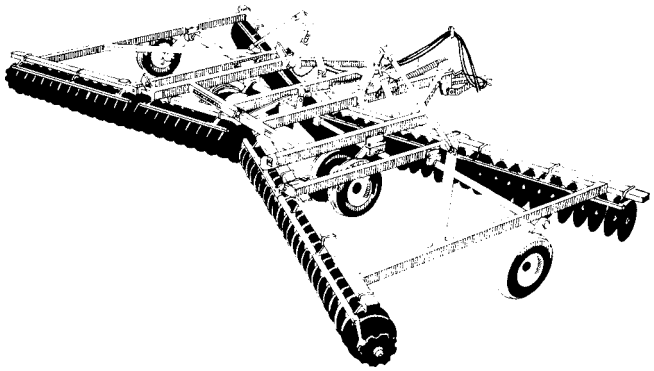


Figure 2 – Tandem disk harrow—In line—Four gangs of disks with the two front gangs set as a single disk harrow and the two rear gangs in tandem to those in front—The rear gangs throw soil in the opposite direction to that from the front gangs—Wheel-mounted pull hitch

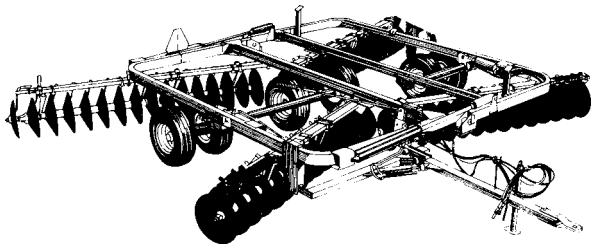


Figure 3 – Tandem disk harrow—Front gangs offset—The inner end of one front gang travels behind the inner end of the other front gang—Wheel-mounted pull hitch

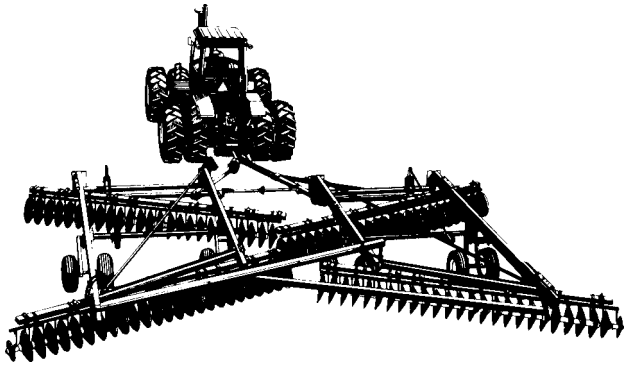


Figure 4 – Tandem disk harrow—Double offset—The inner end of one gang travels behind the inner end of the other gang in the same rank—Wheel-mounted pull hitch

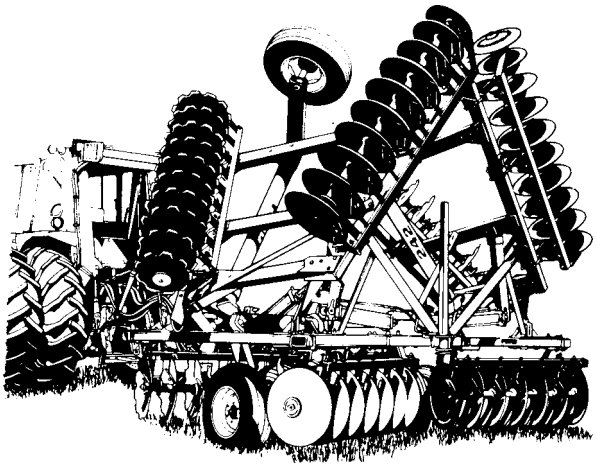


Figure 5 – Tandem disk harrow—Dual folding wings—Wheel-mounted pull hitch

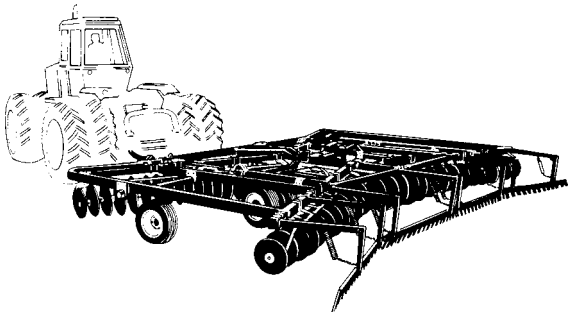


Figure 6 – Tandem disk harrow—Tooth drag harrow attachment—Wheel-mounted pull hitch

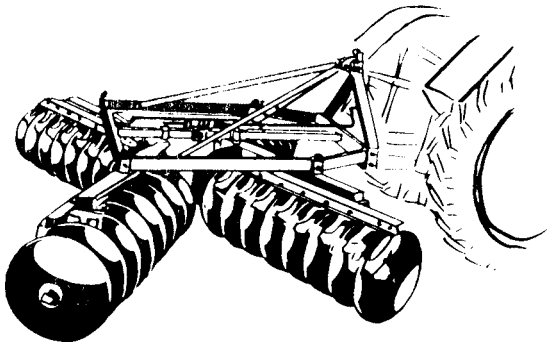


Figure 7 – Tandem disk harrow—Rear-mounted hitch

5.2 Offset disk harrow: A primary or secondary tillage implement consisting of two gangs of concave disks in tandem. The gangs cut and throw soil in opposite directions. Types of offset disk harrows are shown in Figs. 8–10.

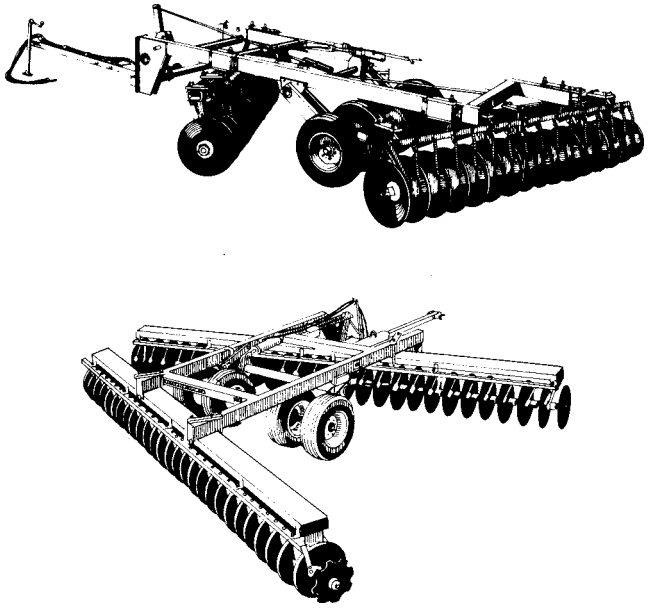


Figure 8 – Offset disk harrow—Wheel-mounted pull hitch

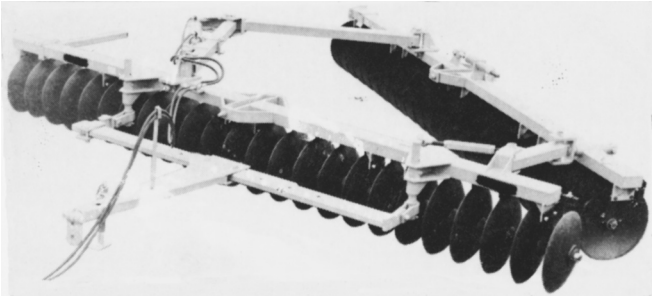


Figure 9 – Offset disk harrow—Drag-type pull hitch

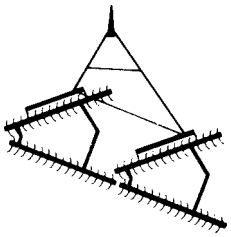


Figure 10 – Offset disk harrow—Squadron, drag-type pull hitch

5.3 One-way disk harrow: A tillage implement equipped with one gang of concave disks. When mounted in short flexible gang units, the harrow conforms to uneven soil surfaces. Types of one-way disk harrows are shown in Figs. 11 and 12.

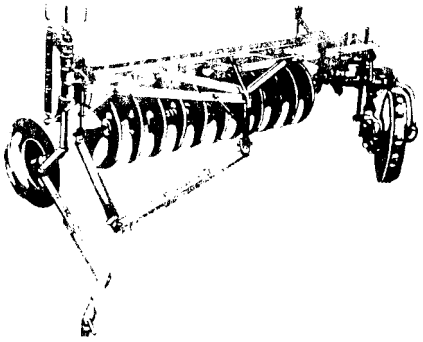


Figure 11 – One-way disk harrow—Rigid frame—Wheel-mounted pull hitch

Figure 12 – One-way disk harrow—Equipped with seeder attachment—Squadron, wheel-mounted pull hitch

5.4 Moldboard plow: A primary tillage implement which cuts, partially or completely inverts a layer of soil to bury surface materials, and pulverizes the soil. The part of the plow that cuts the soil is called the bottom or base. The moldboard is the curved plate above the bottom which receives the slice of soil and inverts it. Moldboard plows are equipped with one or more bottoms of various cutting widths. Bottoms are commonly right-hand that turn all slices to the right. Two-way moldboard plows are equipped with right-hand and left-hand bottoms that are alternately used to turn all slices in the same direction as the plow is operated back and forth across the field. Types of moldboard plows are shown in Figs. 13–16.

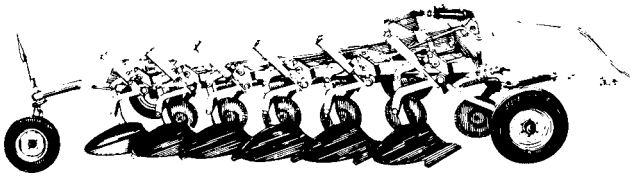


Figure 13 – Moldboard plow—Six bottom—Wheel-mounted pull hitch

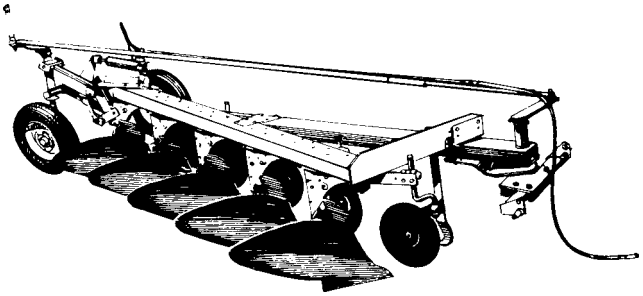


Figure 14 – Moldboard plow—Five bottom—Semi-mounted hitch

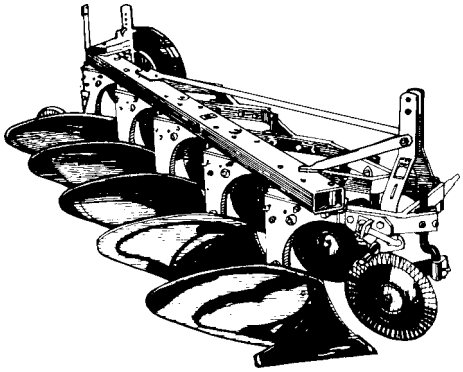


Figure 15 – Moldboard plow—Five bottom—Rear-mounted

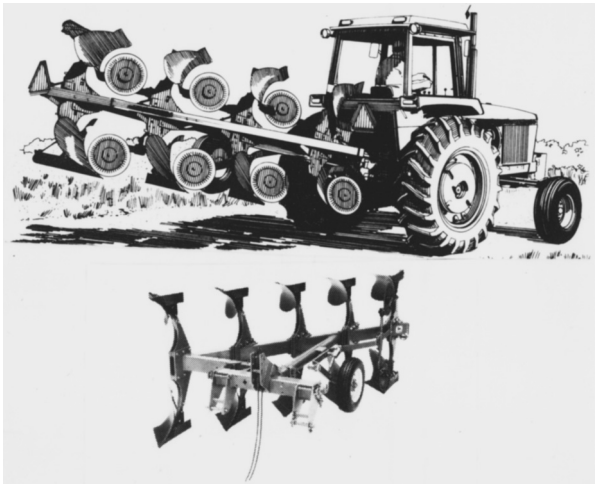


Figure 16 – Moldboard plow—Two-way—Rear-mounted

5.5 Chisel plow: A primary or secondary tillage implement which shatters the soil without complete burial or mixing of surface materials. Multiple rows of staggered curved shanks are mounted either rigidly, with spring-cushions, or with spring resets. Interchangeable sweep, chisel, spike, or shovel tools are attached to each shank. Working width is increased by adding folding wings to the main unit. Combination implements consist of chisel plows with gangs of flat or concave disks or individual rolling coulters preceding the shanks to cut surface residue and vegetation. Chisel plows differ from cultivators by being constructed stronger with wider spaced shanks for primary tillage (see Field cultivators, paragraph 5.9). Types of chisel plows are shown in Figs. 17–21).

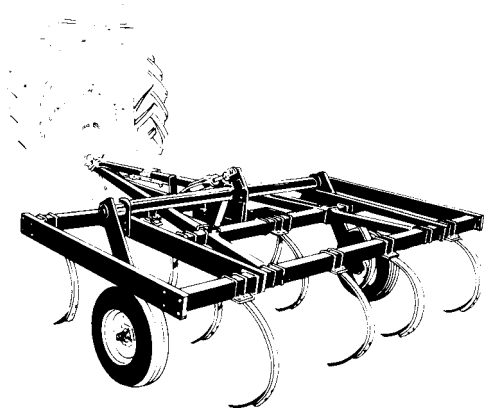


Figure 17 – Chisel plow—Rigidly mounted shanks—Wheel-mounted pull hitch

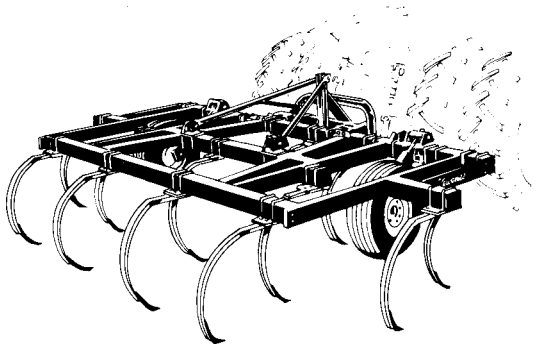


Figure 18 – Chisel plow—Wheels are for depth control—Rear-mounted

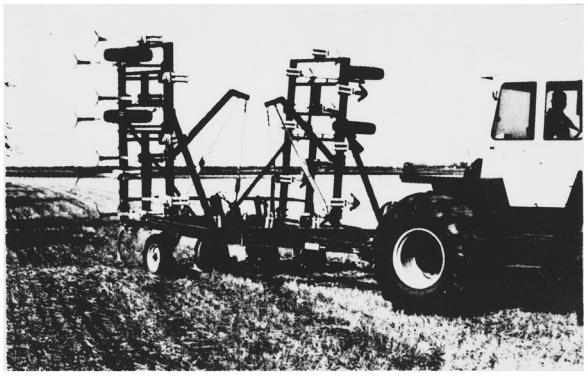


Figure 19 – Chisel plow—Dual folding wings—Wheel-mounted pull hitch

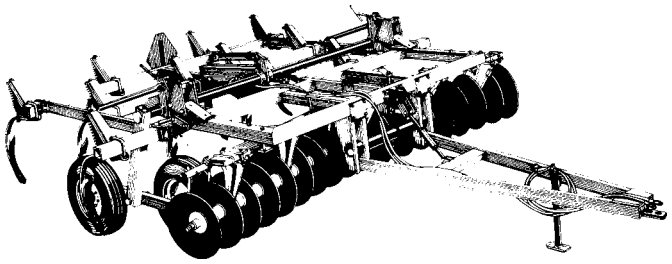


Figure 20 – Combination chisel plow—Two opposing gangs of concave disks, spring-cushioned shank mounts—Wheel-mounted pull hitch

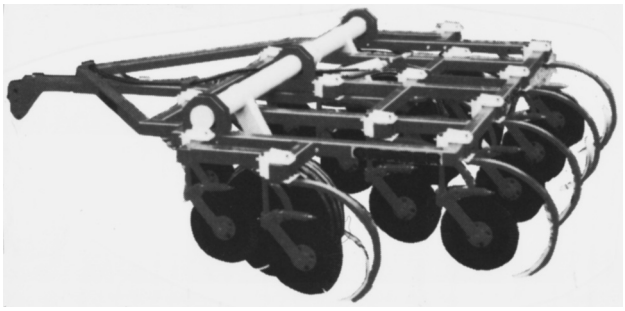


Figure 21 – Combination chisel plow—Individual rolling coulters preceding each shank—Wheel-mounted pull hitch

5.6 Disk plow: A primary tillage implement with individually mounted concave disk blades which cut, partially or completely invert a layer of soil to bury surface material, and pulverize the soil. Blades are attached to the frame in a tilted position relative to the frame and to the direction of travel for proper penetration and soil displacement. Penetration is increased by the addition of ballast weight. Disk plows are equipped with one or more blades of diameter corresponding to intended working depth. Disk plows are commonly right-hand, but two-way plows are equipped with right-hand and left-hand blades. Types of disk plows are shown in Figs. 22–24.

5.7 Subsoiler: A primary tillage implement for intermittent tillage at depths sufficient to shatter compacted subsurface layers. Subsoilers are equipped with widely spaced shanks either in-line or staggered on a V-shaped frame. Subsoiling is commonly conducted with the shank paths corresponding to subsequent crop rows. Strong frame and shanks are required for deep operation. Types of subsoilers are shown in Figs. 25 and 26.

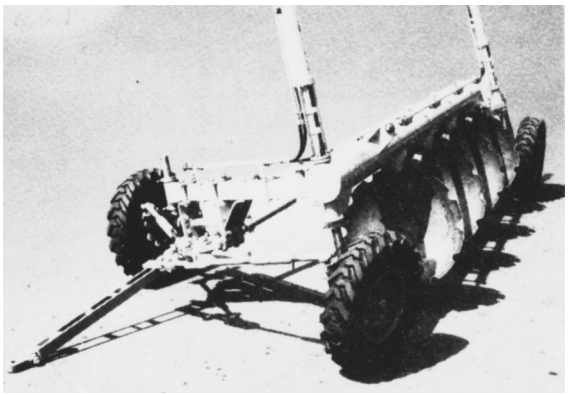


Figure 22 – Disk plow—Two-way—Wheel-mounted pull hitch

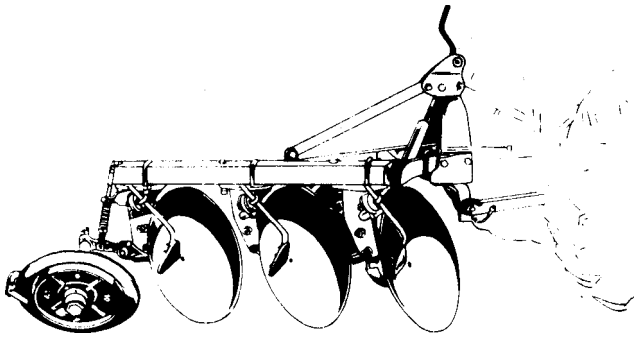


Figure 23 – Disk plow—Three blade—Rear-mounted

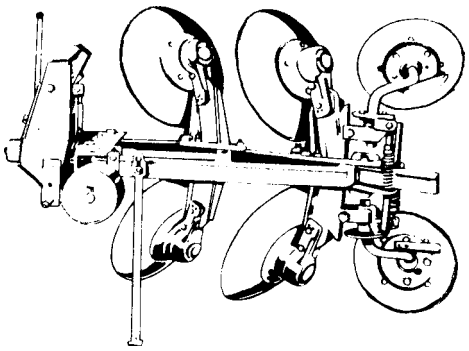


Figure 24 – Disk plow—Two-way, two blade—Rear-mounted

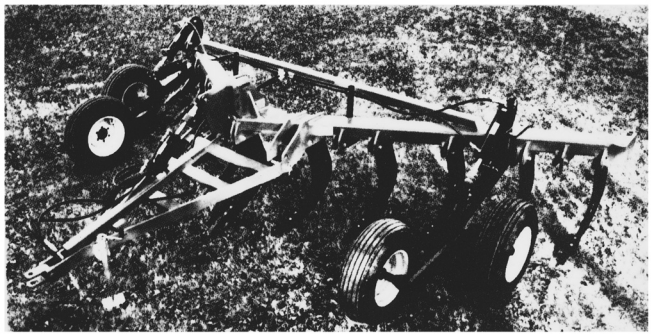
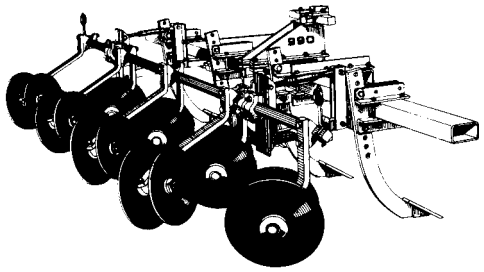


Figure 25 – Subsoiler—V-frame—Wheel-mounted pull hitch

Figure 26 – Subsoiler—V-frame—Rear-mounted

5.8 Bedder-ridger: A primary tillage implement or a secondary tillage implement for seedbed forming. Bedder tools are either moldboard lister bottoms which simultaneously throw soil in both right-hand and left-hand directions or short disk gangs with two or more disks of equal or varying diameters. Each disk gang throws soil in one direction and is followed by another disk gang throwing soil in the opposite direction to form a furrow. Planting attachments are sometimes added behind a bedder for planting either on top of the beds or in the furrows. Types of bedder-ridgers are shown in Figs. 27–31.



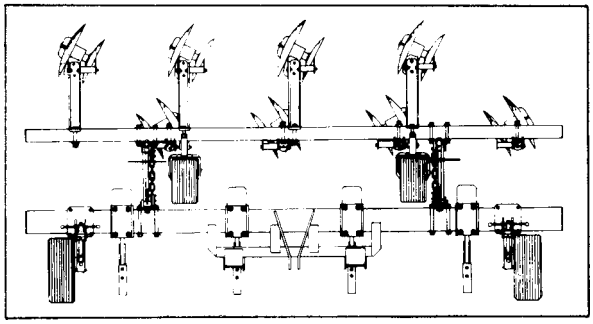


Figure 27 – Subsoil bedder—In-line shanks, disk bedder with two disks per individually mounted gang unit—Disk gangs are staggered—Rear-mounted

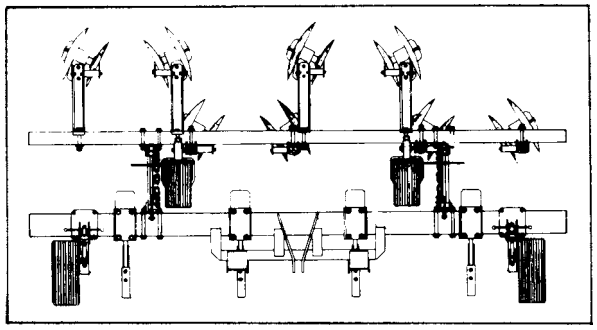


Figure 28 – Subsoil bedder—Same as Fig. 27 except that disk gangs are opposed

Figure 29 – Row bedder—Disk bedder, gauge wheels for depth control—Rear-mounted

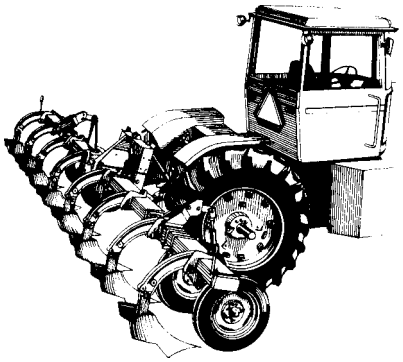


Figure 30 – Row bedder—Moldboard lister bottoms, gauge wheels for depth control—Rear-mounted

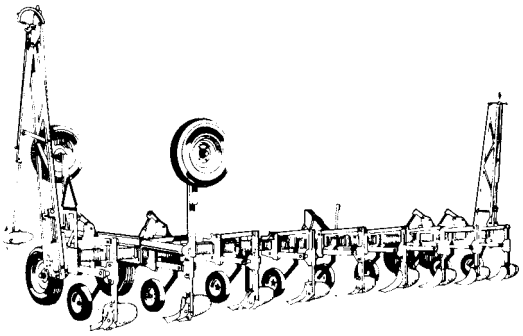


Figure 31 – Row bedder—Lister bottoms mounted on parallel linkage with individual depth control—Rear-mounted, endways transport hitch

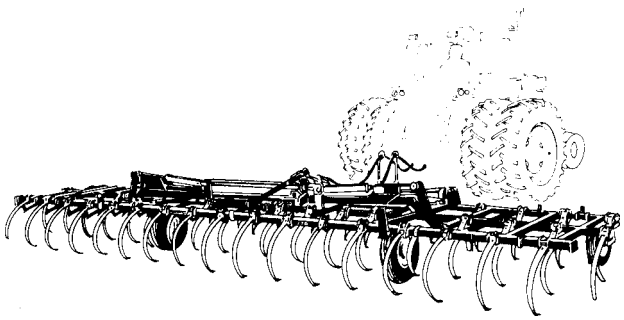


Figure 32 – Field cultivator—Dual folding wings—Wheel-mounted pull hitch

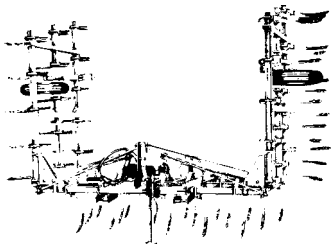


Figure 33 – Field cultivator—Dual wings folded for transport—Rear-mounted

5.9 Field cultivators: A secondary tillage implement for seedbed preparation, weed eradication, or fallow cultivation subsequent to some form of primary tillage. Field cultivators are equipped with spring steel shanks or teeth which have an integral forged point or mounting holes for replaceable shovel or sweep tools. Teeth are generally spaced 15–23 cm (6–9 in.) in a staggered pattern. Frame sections are folded upwards or backwards for transport. Types of field cultivators are shown in Figs. 32 and 33.

5.10 Rod weeder: A secondary tillage implement for seedbed preparation, weed eradication, fallow cultivation and/or soil moisture conservation subsequent to some form of primary tillage. Rod weeders are equipped with a rod whose leading edge spins upward as it travels below the soil surface, uprooting weeds and depositing them on the soil surface. The implement reduces soil moisture loss by stopping capillary action and sealing in moisture below the rods' operating depth. Rods are powered by a reversing chain on ground-driven systems, or by hydraulics or the PTO on powered systems. Most rod weeders have field cultivator sweeps running ahead of the rod to loosen the soil profile. Types of rod weeders are shown in Figs. 34 and 35.

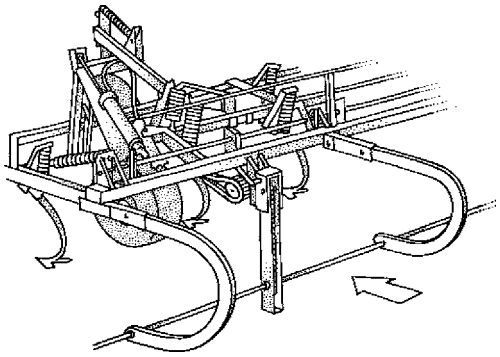


Figure 34 – Rod weeder—Ground driven—Sweep attachment

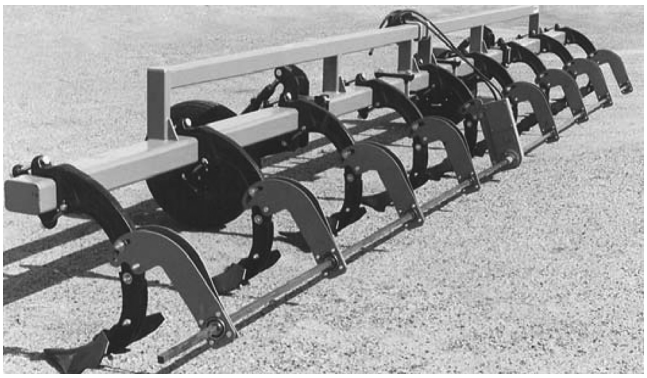


Figure 35 – Rod weeder—Hydraulically driven—Sweep attachment

5.11 Row crop cultivator: A secondary tillage implement for tilling between crop rows. The frame and cultivating tools are designed to adequately pass through standing crop rows without crop damage.

Gangs of shanks are often independently suspended on parallel linkages with depth-controlling wheels to provide flotation with the soil surface. Tool options are shanks with shovels or sweeps, spring teeth, and ground-driven rotary finger wheels. Types of row crop cultivators are shown in Figs. 36–42.

5.12 Harrows: Tillage implements used for seedbed preparation and in some cases light surface cultivation after the seed is planted and before or after the crop emerges. Harrows level the soil surface, enhance moisture retention, pulverize surface clods, and disturb the germination of small weeds. Harrows have staggered teeth of either rigid spikes, coil-spring round wires, flat-spring bars, or S-shaped spring bars. Types of harrows are shown in Figs. 43–48.

5.13 Rotary hoe: A secondary tillage implement for dislodging small weeds and grasses and for breaking soil crust. Rotary hoes are used for fast, shallow cultivation before or soon after crop plants emerge. Rigid

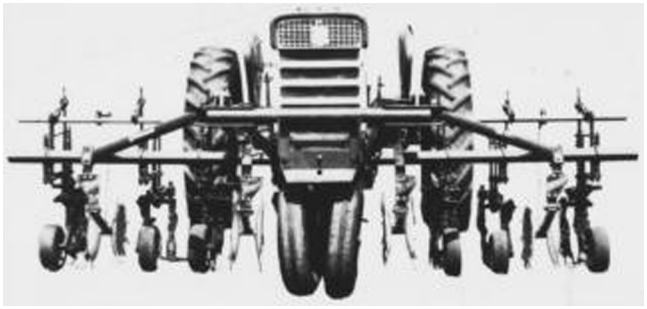


Figure 36 – Row crop cultivator—Four-row, shanks on parallel linkages with gauge wheels, rotary crop shields—Front-mounted

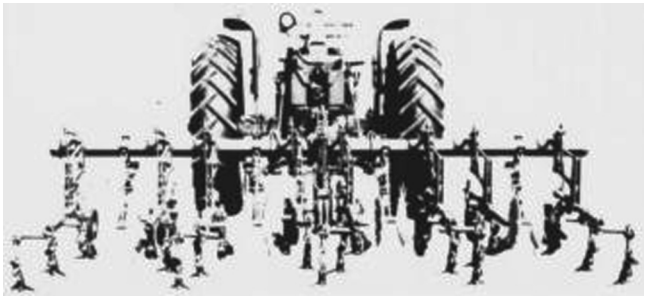


Figure 37 – Row crop cultivator—Four-row—Rear-mounted

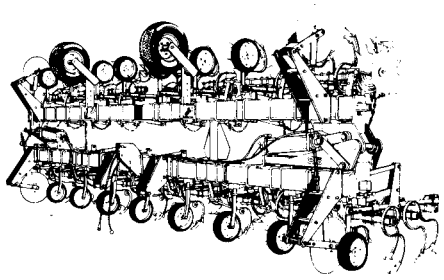


Figure 38 – Row crop cultivator—Spring teeth, dual wings folded for transport—Rear-mounted

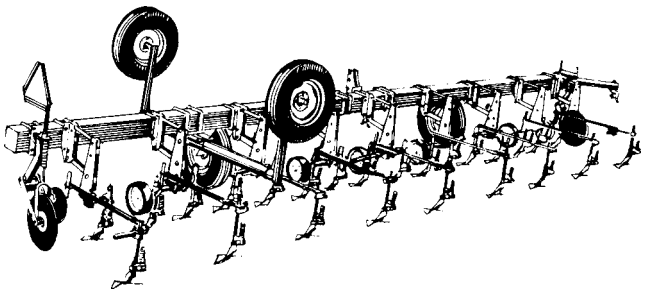


Figure 39 – Row crop cultivator—Sweep tools are shanks ganged on parallel linkages—Rear-mounted, endways transport hitch

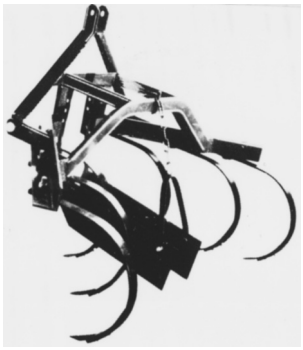


Figure 40 – Row crop cultivator—One-row, spring teeth, crop shields—Rear-mounted

Figure 41 – Row crop cultivator—Same as Fig. 40 except two-row, rolling coulter for lateral stability

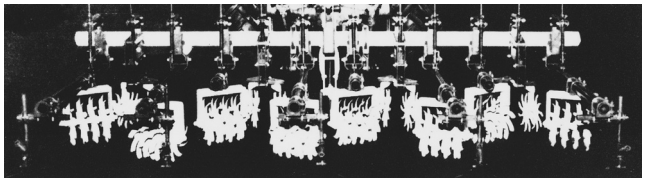


Figure 42 – Row crop cultivator—Rotary ground-driven gangs of finger wheels—Rear-mounted

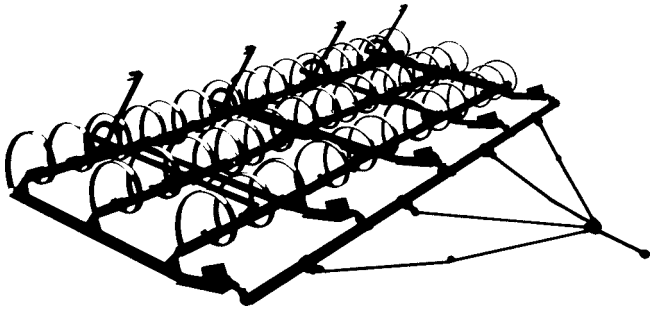


Figure 43 – Harrow—Spring teeth, hinged frame sections—Drag-type pull hitch

Figure 44 – Harrow—Section, round-wire teeth

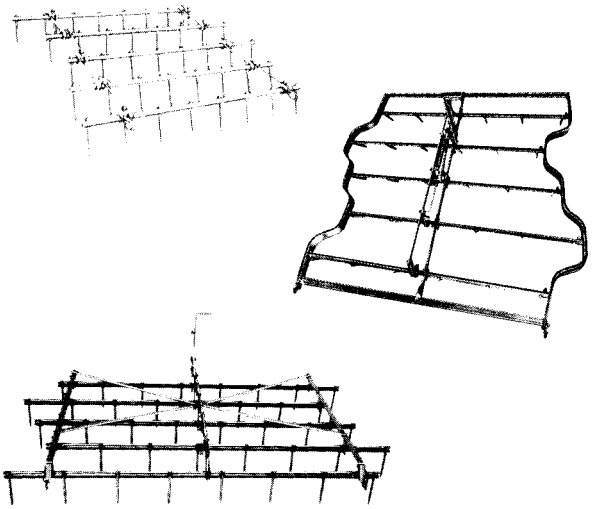


Figure 45 – Harrow—Sections, spike teeth

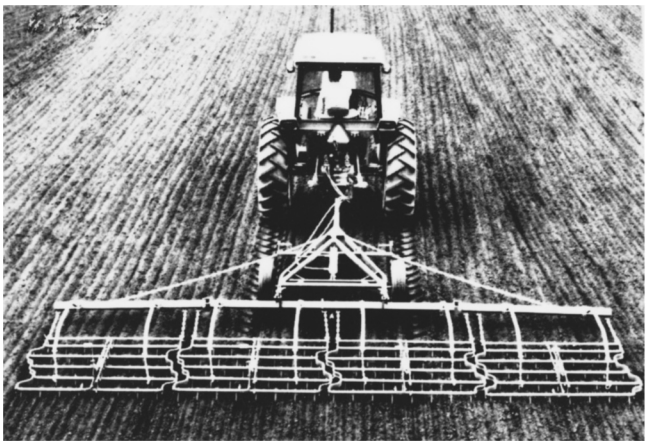


Figure 46 – Harrow—Four sections, spike teeth—Squadron hitch

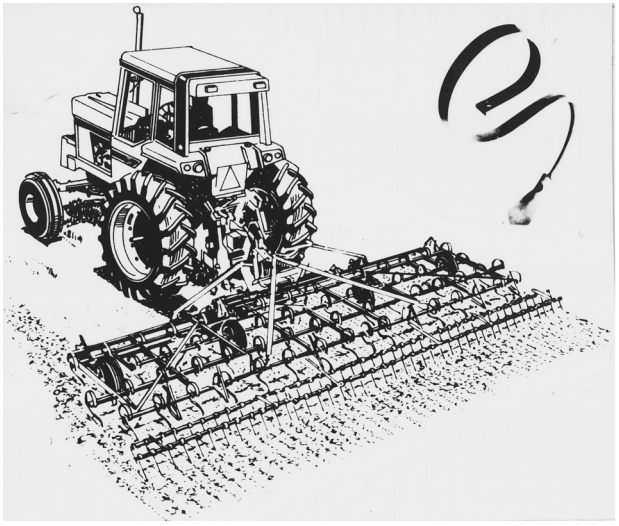


Figure 47 – Harrow—Wheels control depth: S-shaped spring teeth followed by coil-spring wire teeth—Rear-mounted

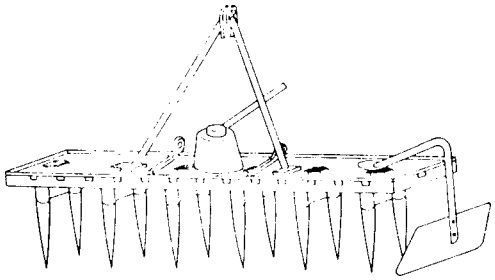


Figure 48 – Harrow—Power-oscillated spike teeth—Rear-mounted

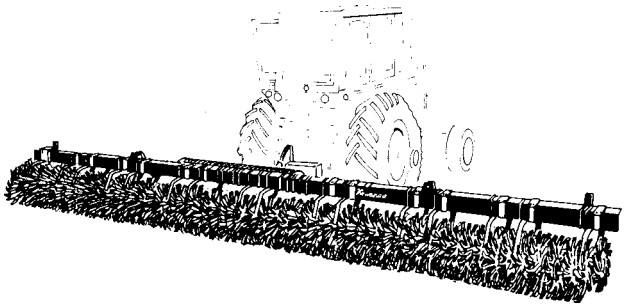


Figure 49 – Rotary hoe—In-line sections on spring loaded arms—Rear-mounted

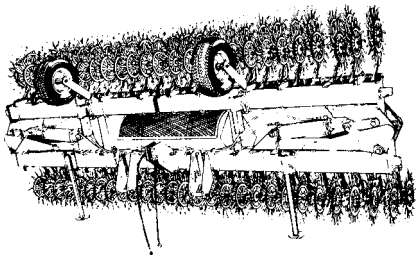


Figure 50 – Rotary hoe—Dual folding wings for transport—Rear-mounted

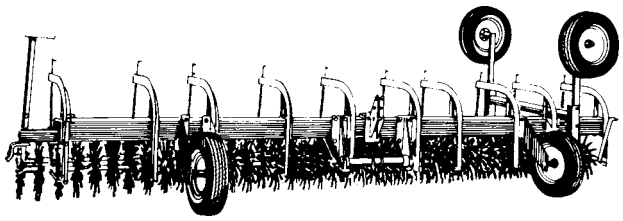


Figure 51 – Rotary hoe—Rear-mounted, endways transport hitch

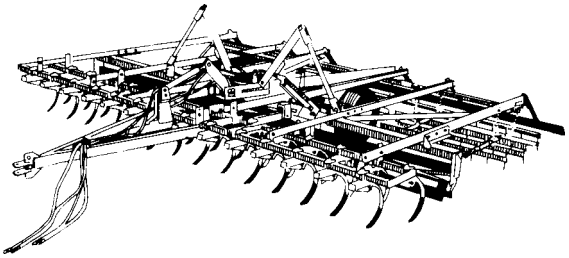


Figure 52 – Seedbed conditioner—Comprised of field cultivator teeth, rolling cutter-mixer blades, spike tooth harrow sections, and a drag bar—Wheel-mounted pull hitch

curved teeth mounted on wheels roll over the soil, penetrating almost straight down and lifting soil as they rotate. Hoe wheels may be mounted in multiple gangs or as short gangs on spring loaded arms suspended from the main frame. Types of rotary hoes are shown in Figs. 49–51.

5.14 Seedbed conditioner: A combination secondary tillage implement for final seedbed preparation. Typical purpose is to smooth and firm the soil surface for flat-planting. A seedbed conditioner is shown in Fig. 52.

5.15 Roller harrow: A secondary tillage implement for seedbed preparation which crushes soil clods and smooths and firms the soil surface. It consists of an in-line gang of ridged rollers, followed by one or more rows of staggered spring cultivator teeth, followed by a second in-line gang of ridged rollers. Types of roller harrows are shown in Figs. 53–54.

5.16 Packer: A secondary tillage implement for crushing soil clods and compacting the soil. Packers consist of one or two in-line gangs of rollers. Roller sections may be lugged wheels or any one of various shaped ridged wheels. Types of packers are shown in Figs. 55–58.

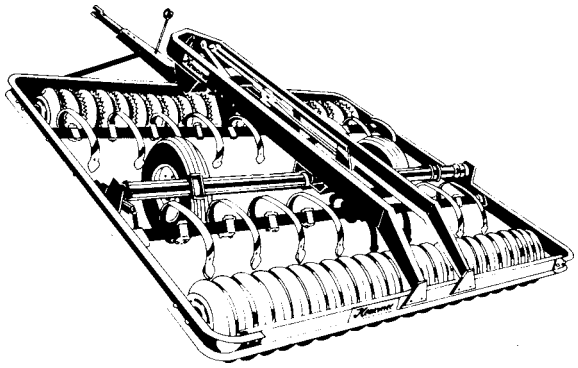


Figure 53 – Roller harrow—Wheel-mounted pull hitch

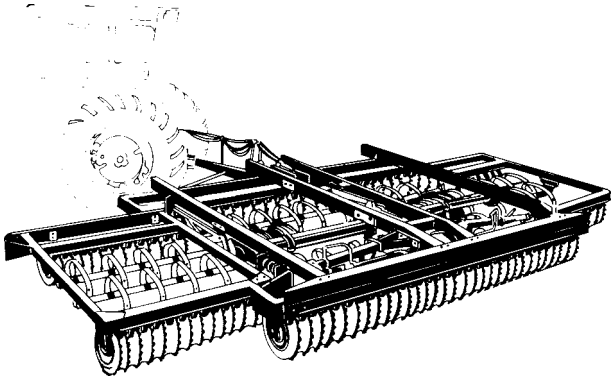


Figure 54 – Roller harrow—With dual folding wings—Wheel-mounted pull hitch

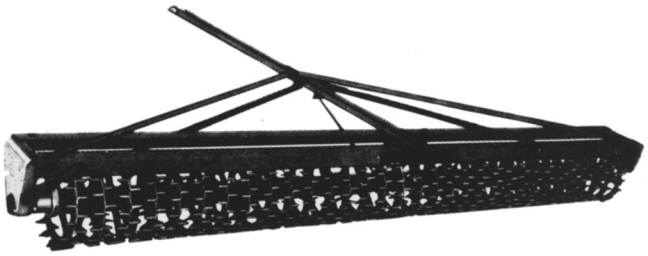


Figure 55 – Single packer roller—In-line roller gang—Drag-type pull hitch

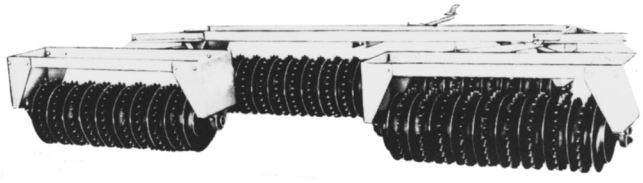


Figure 56 – Single packer roller—Offset roller gangs—Drag-type pull hitch

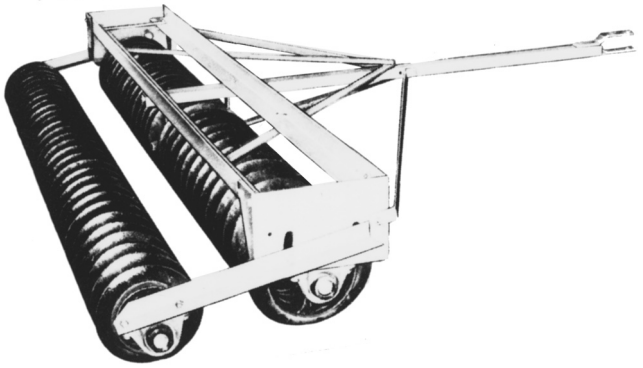


Figure 57 – Tandem packer roller—Leading roller wheels are larger diameter than trailing roller wheels—Drag-type pull hitch

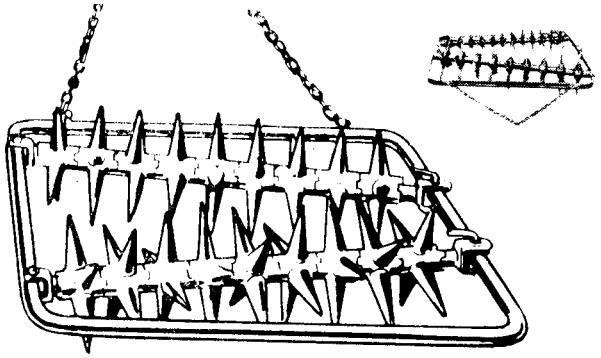


Figure 58 – Clod buster roller—Two angled gangs of spiked roller wheels, typically pulled behind a plow—Drag-type pull hitch

5.17 Rotary tiller: A primary or secondary tillage implement used for broadcast or strip tillage. Rotary tillers are also used as chemical incorporators prior to planting and as row crop cultivators. They consist of a power-driven shaft, transverse to the direction of travel, equipped with curved knives that slice through the soil, chop surface residue, and mix all materials in the disturbed layer. Types of rotary tillers are shown in Figs. 59 and 60.

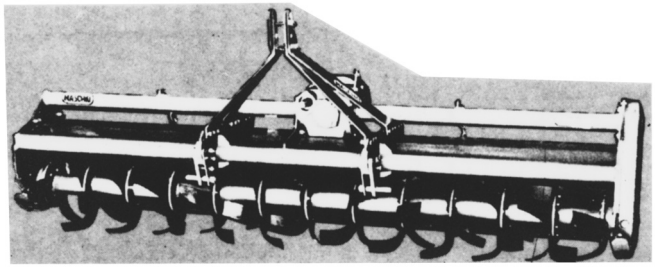


Figure 59 – Rotary tiller—Broadcast full width tilling—Rear-mounted

Figure 60 – Rotary tiller—Strip tiller with crop shields for row crop cultivation—Rear-mounted

5.18 Combination tillage implement for strip tillage: A combination of primary and secondary tillage components that leaves the field ready to be planted. Also known as "zone tillage" in some areas, strip-tillage is a one-pass operation that tills narrow strips precisely where rows of seeds will be planted, either immediately or up to several months later. The tilled row area is generally free of residue, and the space between rows is undisturbed. Fertilizer (dry, liquid or anhydrous ammonia) is often placed in the strip.

For strip-tillage in the fall, tillage depth is usually 6 to 12 in. (15 to 30 cm). Strip-tillage in the spring is limited to soils that are dry to tillage depth.

Components of a strip-tillage unit include a coulter, a tillage shank, and a pair of disks or coulters immediately behind the shank. Optional items include row cleaners, rolling basket and a means of controlling depth. Row markers or precise auto-steering are required.

In humid regions, the pair of disks roll on the soil surface and serve to confine the loosened soil to the narrow strip. In dry regions the pair of coulters runs nearly as deep as the shank, and are angled to squeeze the soil together to eliminate large voids. A type of combination implement for strip tillage is shown in Fig. 61.

5.19 Tillage components: Soil-engaging components of tillage implements designed to perform primary or secondary tillage functions. Components are shown in Figs. 62–81.

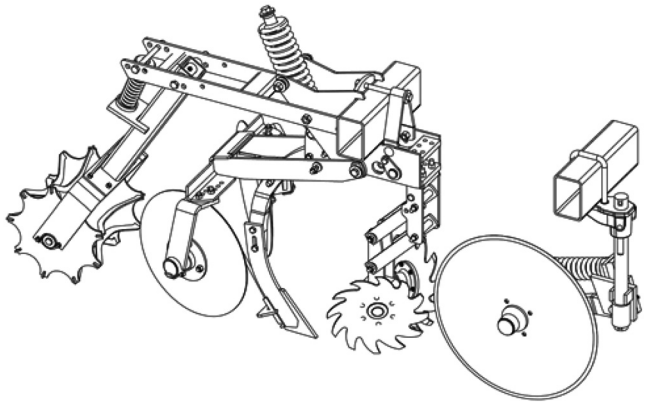


Figure 61 – Strip tillage machine combining components of both primary and secondary tillage. The functions of this machine are to cut surface residue; move surface residue away from the seed row; loosen the soil below the row to be planted; and leave the surface ready for planting. Soil and residue are disturbed only in a band centered on the row to be planted. Tillage depths are adjustable. This type of machine can also be equipped to incorporate herbicide in a zone over the row area; and the planter can be attached to the rear of the machine for a one-pass tillage/planting operation.

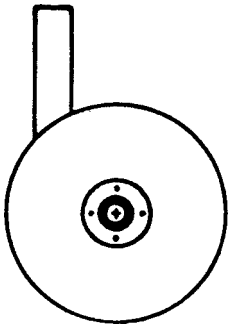


Figure 62 – Coulter blade—Smooth—A flat circular blade, sharpened at the circumference

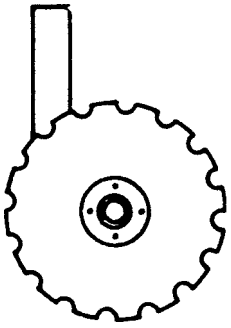


Figure 63 – Coulter blade—Notched—A flat circular blade with equally spaced notches around the circumference—The blade edges and notch surfaces are sharpened

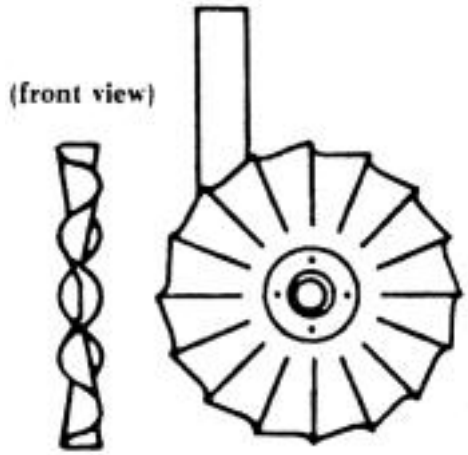


Figure 64 – Coulter blade—Fluted—A circular blade with formed flutes radiating from the outer periphery toward the center

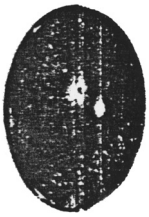


Figure 65 – Disc blade—Plain—A concave circular blade, sharpened at the circumference

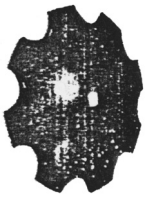


Figure 66 – Disc blade—Notched—A concave circular blade with equally spaced notches around the circumference—The blade edges and notch surfaces are sharpened

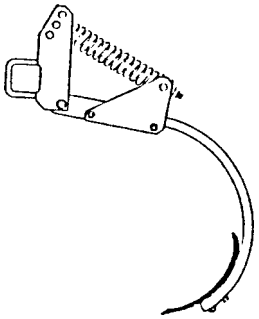


Figure 67 – Chisel plow shank—Medium duty—50 mm wide × 25 mm thick (2 in. wide × 1in. thick) or smaller cross section of material

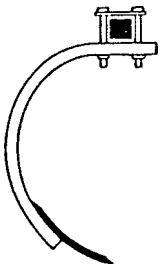


Figure 68 – Chisel plow shank—Heavy duty—50 mm wide × 32 mm thick (2 in. wide × 1 1/4 in. thick) or greater cross section of material

Figure 69 – Field cultivator shank—Material cross sections are usually less than 19 mm (0.75 in.) thick and of various widths—Shapes are described as 'C' shape, 'S' tines, 'K' tines, and spring tooth

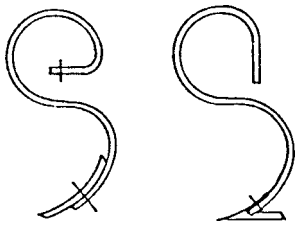


Figure 70 – 'S' tine—An 'S'-shaped tine used for secondary tillage operations as well as row crop cultivation—Tool bar attachment can be either horizontal or vertical—Material cross sections range from 32 mm wide × 10 mm thick (1.25 in. wide × 0.394 in. thick) to 45 mm wide × 14 mm thick. (1.75 in. wide × 0.562 in. thick)

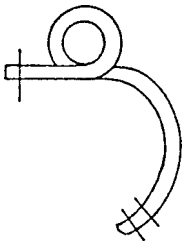


Figure 71 – Coil shank—A shank of round or square cross section that has a circular coil of material as an integral part of the shank's shape—The coiled section provides a 'Spring' effect when encountering obstructions

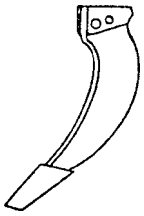


Figure 72 – Subsoiler (ripper) shank—Material section and shape that permit working depths greater than that of heavy duty chisel shanks or other primary tillage implements

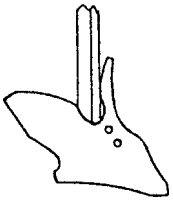


Figure 73 – Furrowers—A formed 'V'-shape cutting blade with wings shaped to deflect the soil upward and away from the center point of the 'V'—Furrowers are used to form ridges or furrows

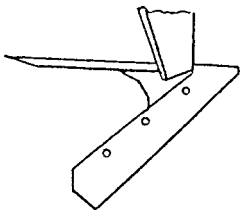


Figure 74 – Sweep blade—A 'V'-shaped blade designed to operate at shallow depths, to destroy weed growth, and to loosen the soil surface without covering residue—Cutting width of 'V' greater than 600 mm (24 in.).

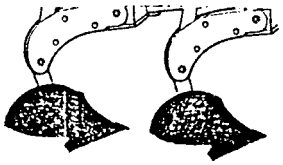


Figure 75 – Moldboard plow—A shear blade and moldboard combination that provides for cutting and turning of the furrow slice

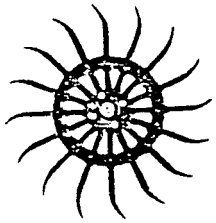


Figure 76 – Rotary hoe wheel—Tine-like projections equally spaced, in a circular 'Wheel' configuration about a central hub assembly—The hoe wheels are ground-driven to provide shallow surface tillage

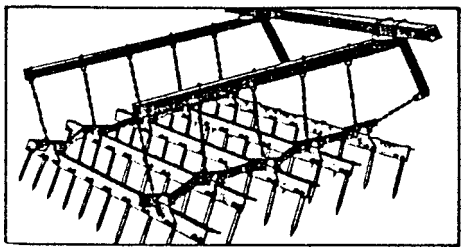


Figure 77 – Spike teeth—A round, square, or diamond-shaped cross section of material—Teeth are laterally spaced on frame bars and used as a tillage component to mix and level the soil surface

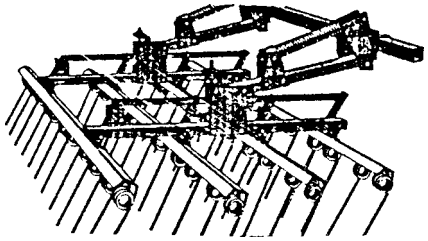


Figure 78 – Spring teeth—A circular material cross section coiled in the mounting area to provide flexibility to the shank end of the tine, used as a tillage component to mix and level the soil surface

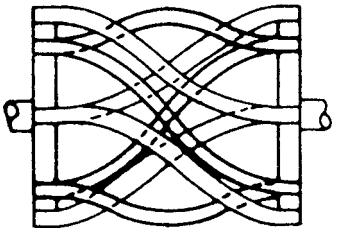


Figure 79 – Basket roller—Cylindrical, reel-type assemblies or baskets made with wire rods, bars, or blades, used to mix and level the soil surface. Implement is also used for weed eradication between rows

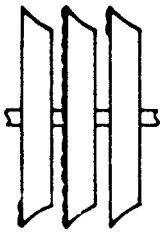


Figure 80 – Packer roller wheel—Cast iron wheels of various diameters and circumferential shapes used to firm the soil and break up clods

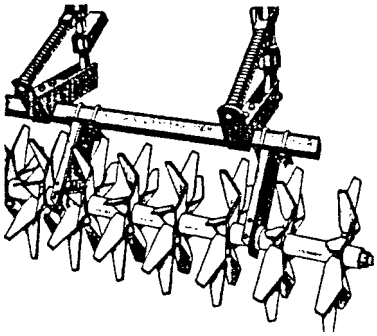


Figure 81 – Treader wheel—Paddle-like projections spaced in a circular wheel configuration about a central hub and axle—The treader wheels are ground-driven to uproot small vegetation and break up cloddy soil surfaces