

ASAE S414.1 FEB04
Terminology and Definitions for Agricultural Tillage
Implements



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Terminology and Definitions for Agricultural Tillage Implements

Developed by the ASAE Cultural Practices Equipment Committee in cooperation with the Tillage Equipment Council of the Farm and Industrial Equipment Institute; approved by the Power and Machinery Division Standards Committee; adopted by ASAE March 1982; reconfirmed December 1986; revised December 1990; reaffirmed December 1995, December 1996, December 1997, December 1998, February 2004.

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 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 of publication.

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

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

3.6 Not all tillage tools are produced with each hitch classification.

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.

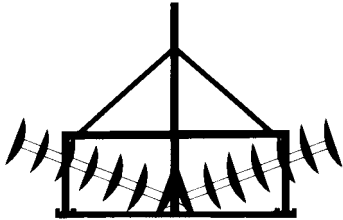


Figure 1 – Single disk harrow—Two gangs of disks set to oppose each other—Drag-type pull hitch

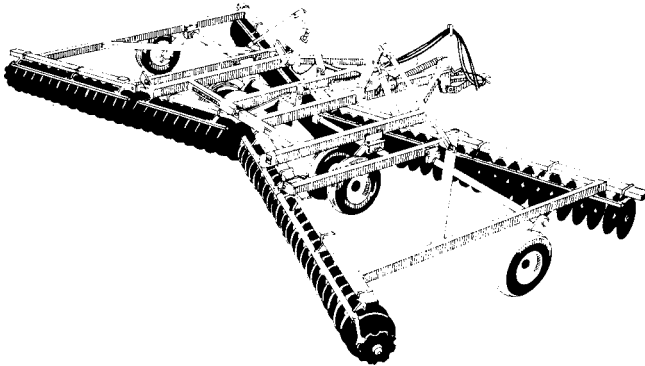


Figure 2 – Tandem disk harrow—In line—Four gangs of disks with the two front gangs set as a single disk harrow and the two rear gangs in tandem to those in front—The rear gangs throw soil in the opposite direction to that from the front gangs—Wheel-mounted pull hitch

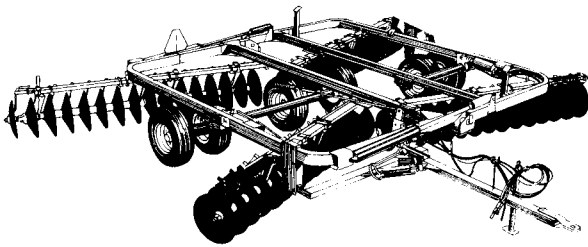


Figure 3 – Tandem disk harrow—Front gangs offset—The inner end of one front gang travels behind the inner end of the other front gang—Wheel-mounted pull hitch

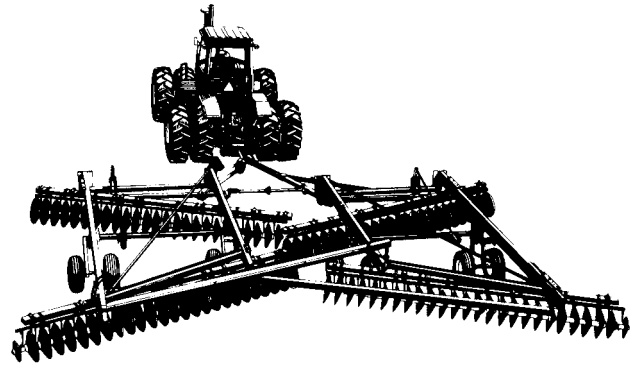


Figure 4 – Tandem disk harrow—Double offset—The inner end of one gang travels behind the inner end of the other gang in the same rank—Wheel-mounted pull hitch

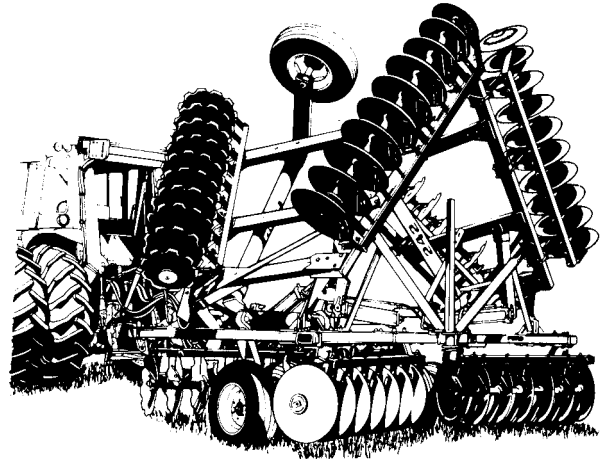


Figure 5 – Tandem disk harrow—Dual folding wings—Wheel-mounted pull hitch

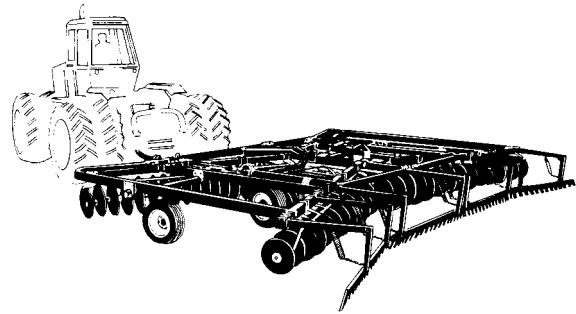


Figure 6 – Tandem disk harrow—Tooth drag harrow attachment—Wheel-mounted pull hitch

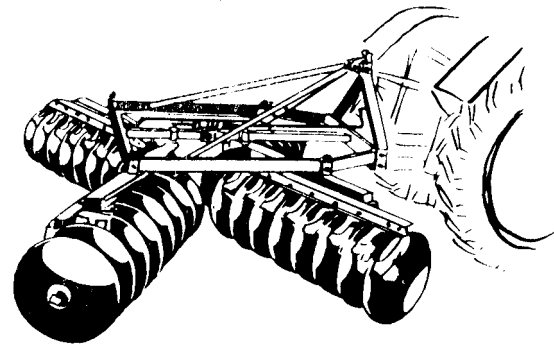


Figure 7 – Tandem disk harrow—Rear-mounted hitch

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.

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. 11–12.

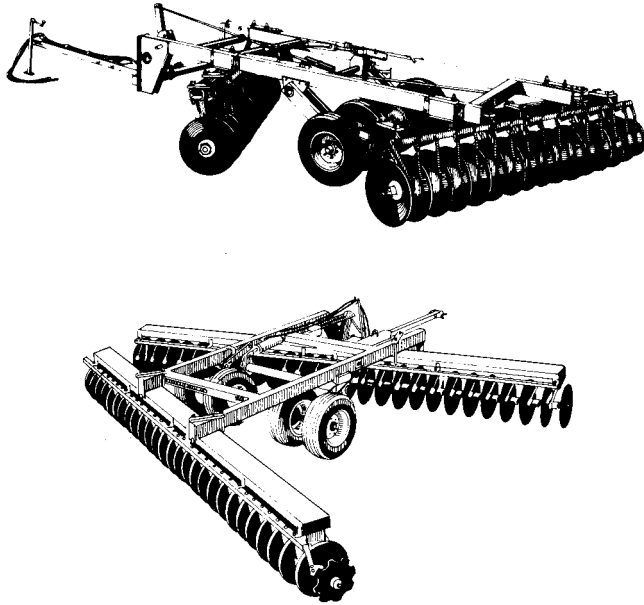


Figure 8 – Offset disk harrow—Wheel-mounted pull hitch

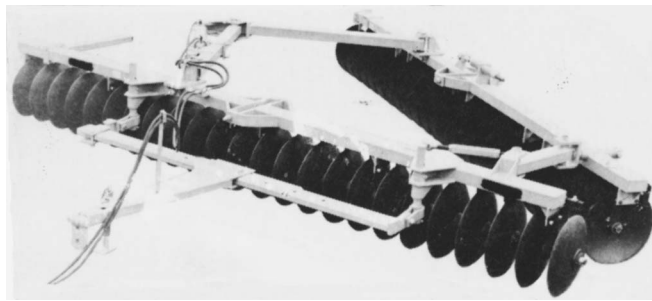


Figure 9 – Offset disk harrow—Drag-type pull hitch

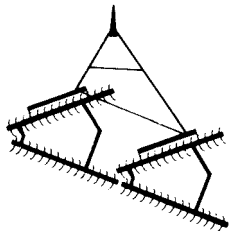


Figure 10 – Offset disk harrow—Squadron, drag-type pull hitch

5.4 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.

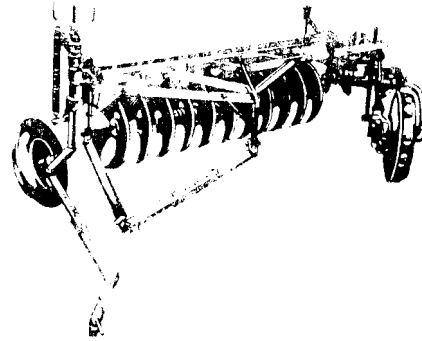


Figure 11 – One-way disk harrow—Rigid frame—Wheel-mounted pull hitch



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

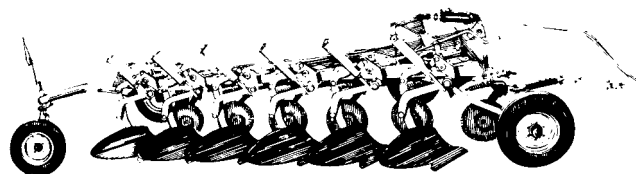


Figure 13 – Moldboard plow—Six bottom—Wheel-mounted pull hitch

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).

5.6 Disk plow: A primary tillage implement with individually mounted concave disk blades which cut, partially or completely invert a layer of

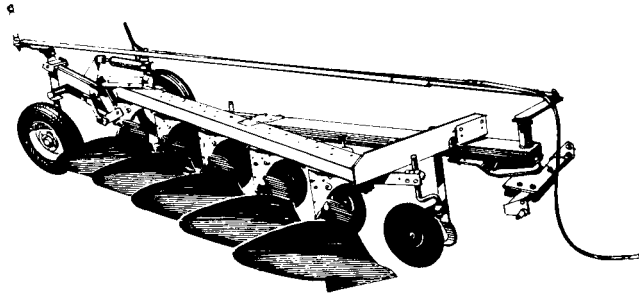


Figure 14 – Moldboard plow—Five bottom—Semi-mounted hitch

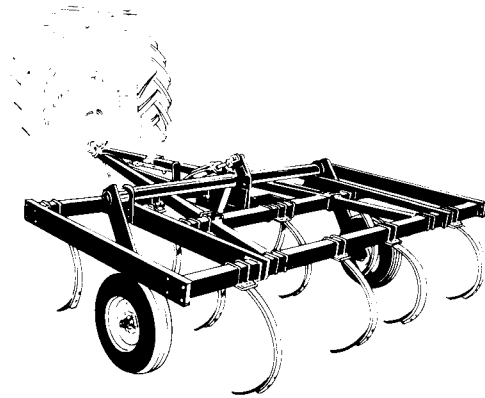


Figure 17 – Chisel plow—Rigidly mounted shanks—Wheel-mounted pull hitch

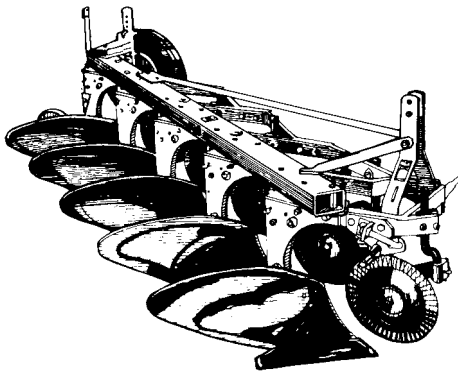


Figure 15 – Moldboard plow—Five bottom—Rear-mounted

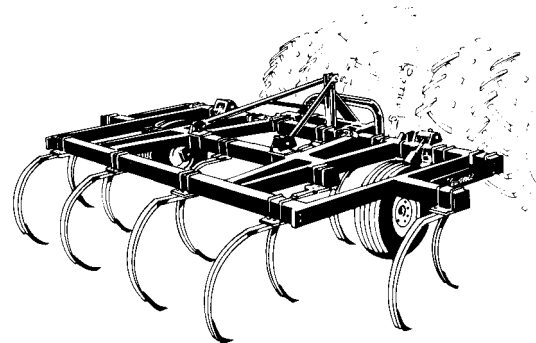


Figure 18 – Chisel plow—Wheels are for depth control—Rear-mounted

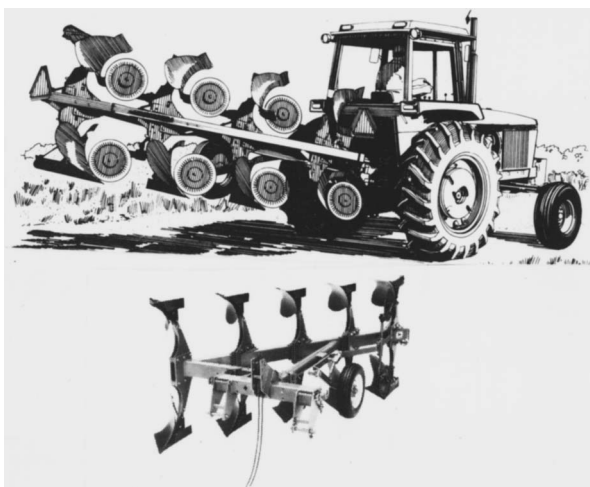


Figure 16 – Moldboard plow—Two-way—Rear-mounted



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

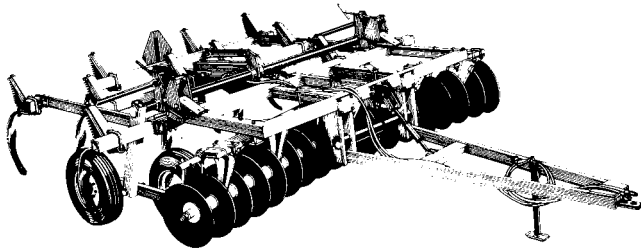


Figure 20 – Combination chisel plow—Two opposing gangs of concave disks, spring-cushioned shank mounts—Wheel-mounted pull hitch

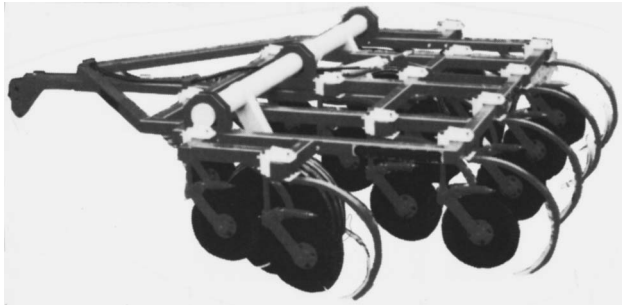


Figure 21 – Combination chisel plow—Individual rolling coulters preceding each shank—Wheel-mounted pull hitch

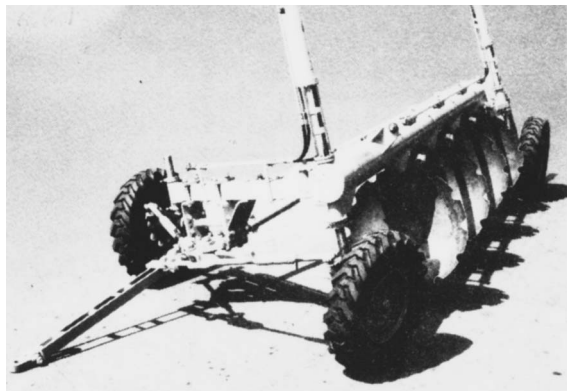


Figure 22 – Disk plow—Two-way—Wheel-mounted pull hitch

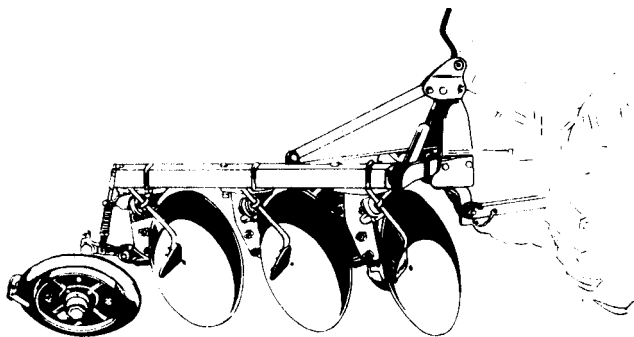


Figure 23 – Disk plow—Three blade—Rear-mounted

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. 25–26.

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

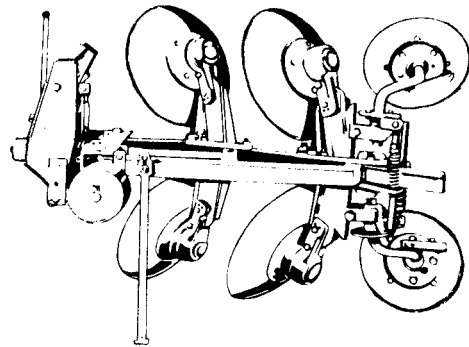


Figure 24 – Disk plow—Two-way, two blade—Rear-mounted

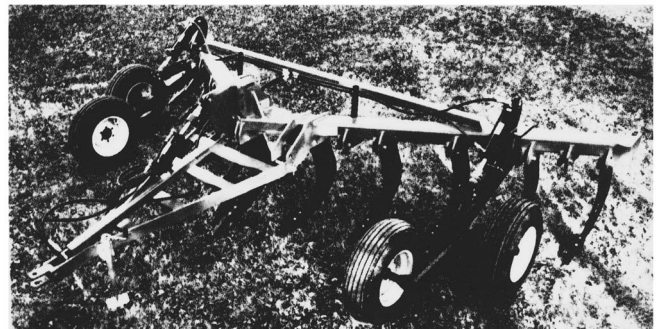


Figure 25 – Subsoiler—V-frame—Wheel-mounted pull hitch



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

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.

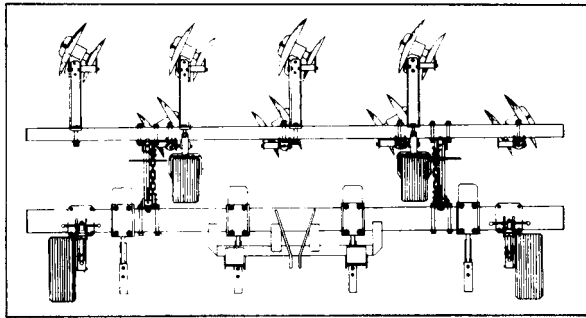
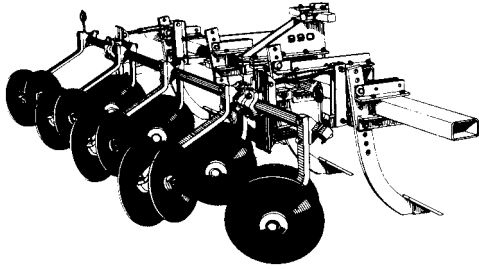


Figure 27 – Subsoil bedder—In-line shanks, disk bedder with two disks per individually mounted gang unit—Disk gangs are staggered—Rear-mounted

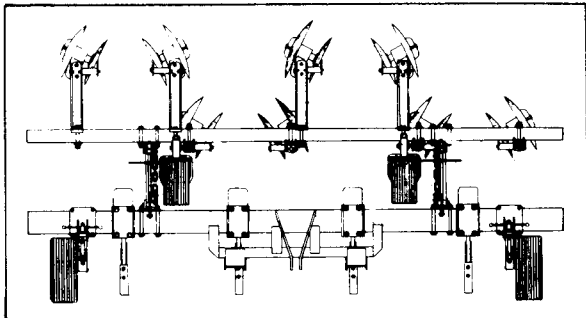


Figure 28 – Subsoil bedder—Same as Fig. 27 except that disk gangs are opposed



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

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. 32–33.

5.10 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.

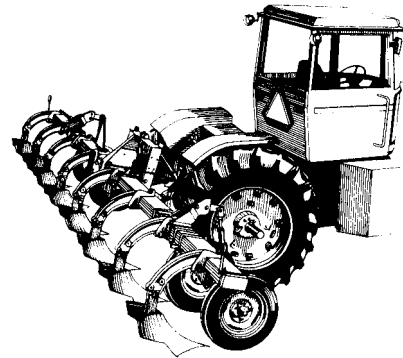


Figure 30 – Row bedder—Moldboard lister bottoms, gauge wheels for depth control—Rear-mounted

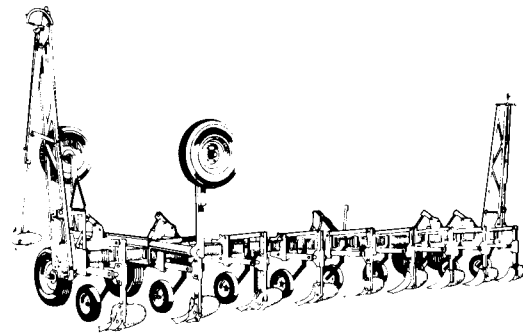


Figure 31 – Row bedder—Lister bottoms mounted on parallel linkage with individual depth control—Rear-mounted, endways transport hitch

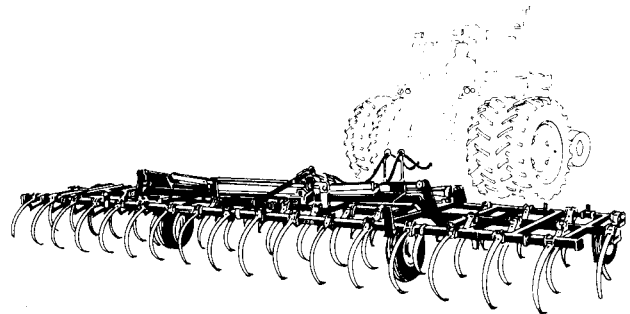


Figure 32 – Field cultivator—Dual folding wings—Wheel-mounted pull hitch

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. 34–40.

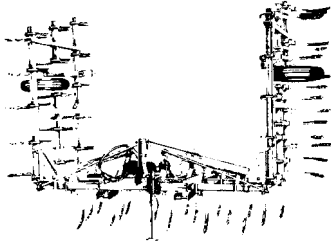


Figure 33 – Field cultivator—Dual wings folded for transport—Rear-mounted

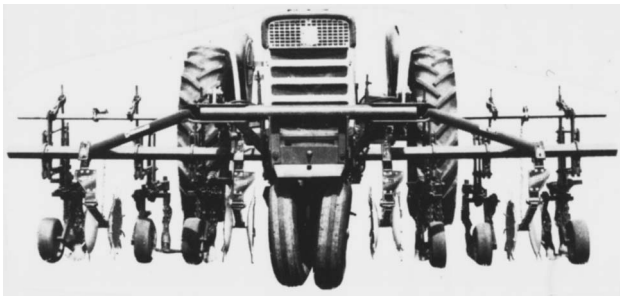


Figure 34 – Row crop cultivator—Four-row, shanks on parallel linkages with gauge wheels, rotary crop shields—Front-mounted

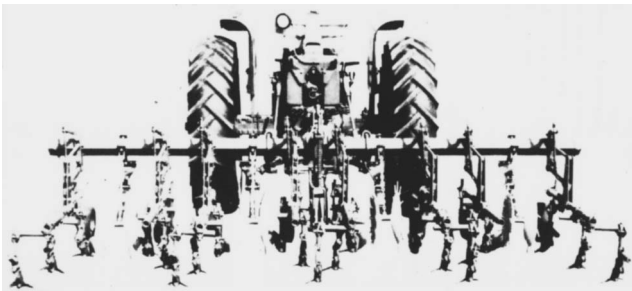


Figure 35 – Row crop cultivator—Four-row—Rear-mounted

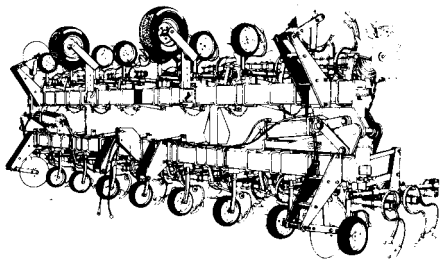


Figure 36 – Row crop cultivator—Spring teeth, dual wings folded for transport—Rear-mounted

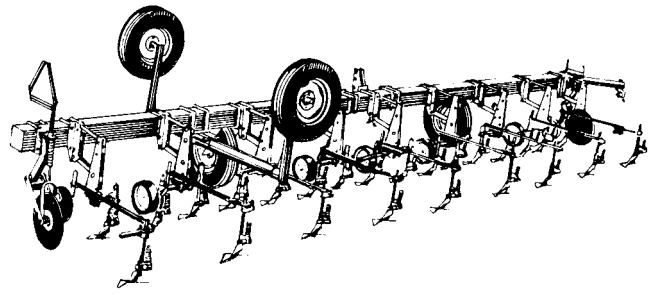


Figure 37 – Row crop cultivator—Sweep tools are shanks ganged on parallel linkages—Rear-mounted, endways transport hitch

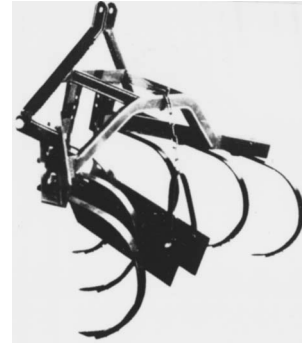


Figure 38 – Row crop cultivator—One-row, spring teeth, crop shields—Rear-mounted



Figure 39 – Row crop cultivator—Same as Fig. 38 except two-row, rolling coulter for lateral stability

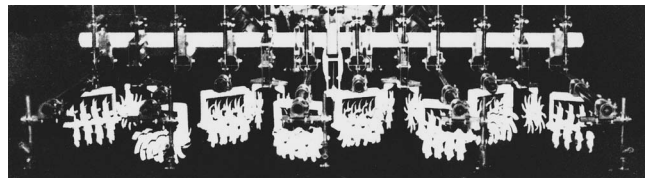


Figure 40 – Row crop cultivator—Rotary ground-driven gangs of finger wheels—Rear-mounted

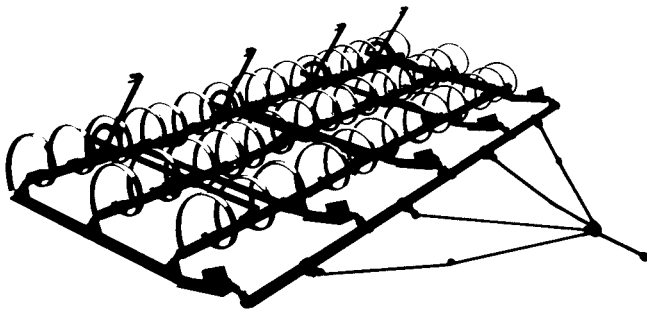


Figure 41 – Harrow—Spring teeth, hinged frame sections—Drag-type pull hitch



Figure 42 – Harrow—Section, round-wire teeth

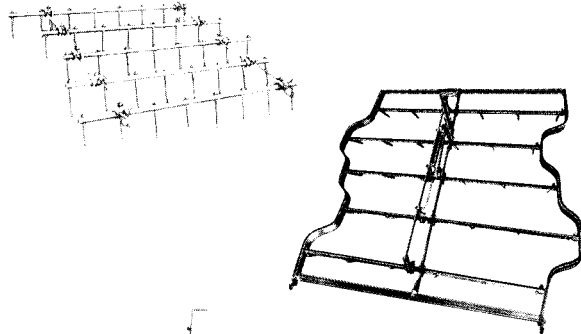


Figure 43 – Harrow—Sections, spike teeth

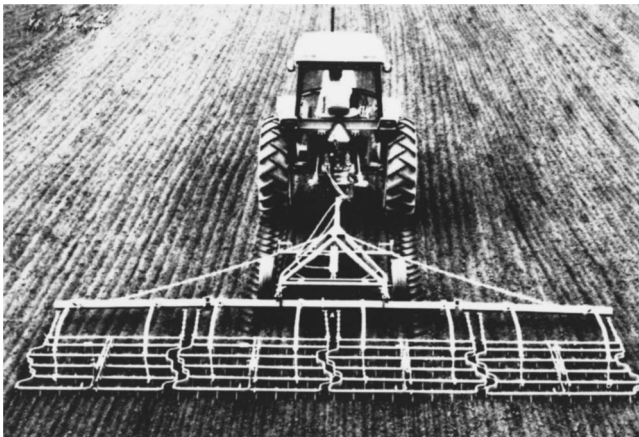


Figure 44 – Harrow—Four sections, spike teeth—Squadron hitch

5.11 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. 41–46.

5.12 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 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. 47–49.

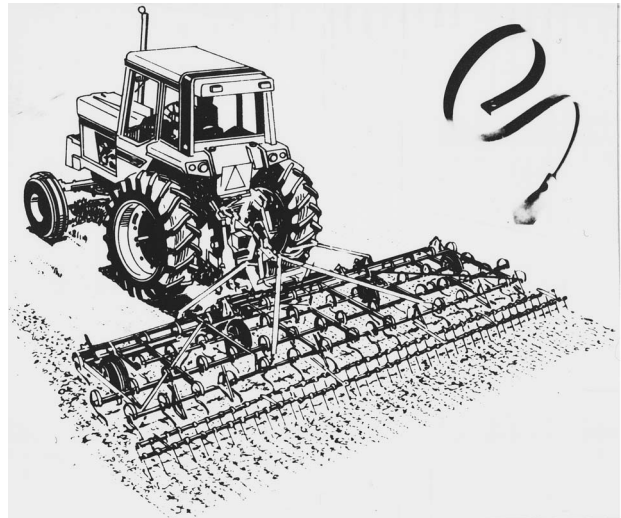


Figure 45 – Harrow—Wheels control depth: S-shaped spring teeth followed by coil-spring wire teeth—Rear-mounted

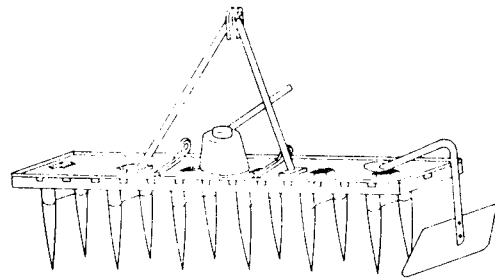


Figure 46 – Harrow—Power-oscillated spike teeth—Rear-mounted

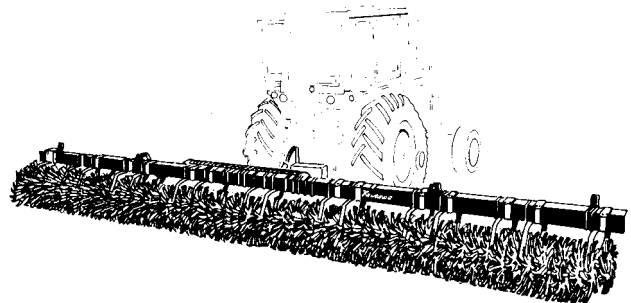


Figure 47 – Rotary hoe—In-line sections on spring loaded arms—Rear-mounted

5.13 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. 50.

5.14 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. 51–52.

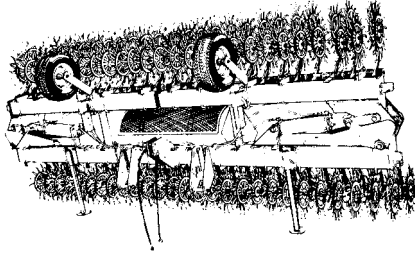


Figure 48 – Rotary hoe—Dual folding wings for transport—Rear-mounted

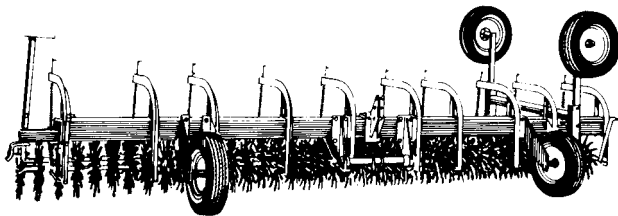


Figure 49 – Rotary hoe—Rear-mounted, endways transport hitch

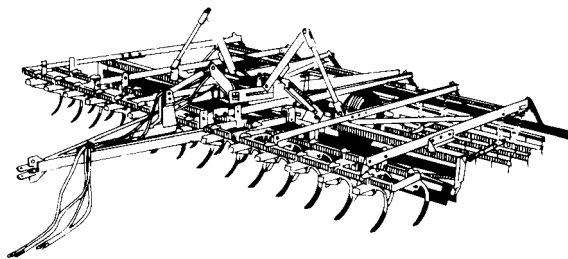


Figure 50 – Seedbed conditioner—Comprised of field cultivator teeth, rolling cutter-mixer blades, spike tooth harrow sections, and a drag bar—Wheel-mounted pull hitch

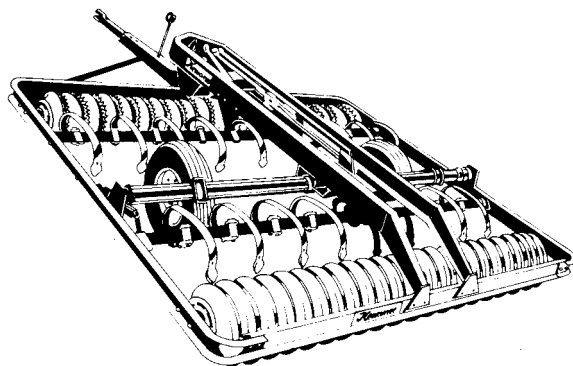


Figure 51 – Roller harrow—Wheel-mounted pull hitch

5.15 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. 53–56.

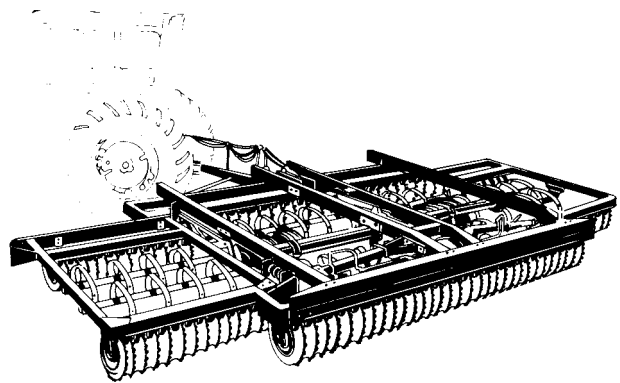


Figure 52 – Roller harrow—With dual folding wings—Wheel-mounted pull hitch

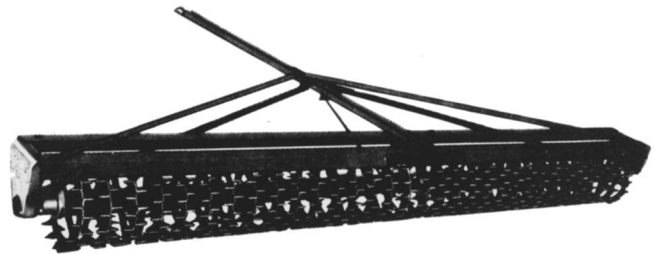


Figure 53 – Single packer roller—In-line roller gang—Drag-type pull hitch

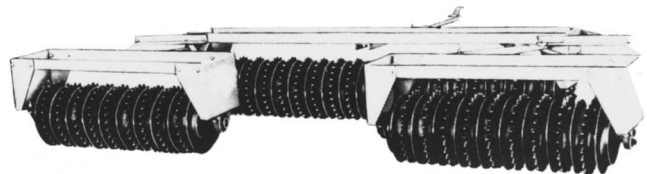


Figure 54 – Single packer roller—Offset roller gangs—Drag-type pull hitch

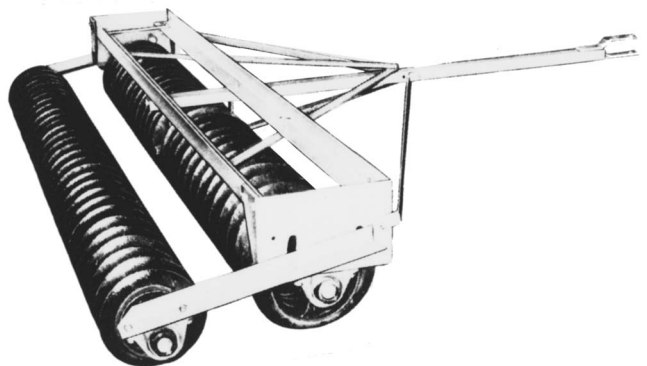


Figure 55 – Tandem packer roller—Leading roller wheels are larger diameter than trailing roller wheels—Drag-type pull hitch

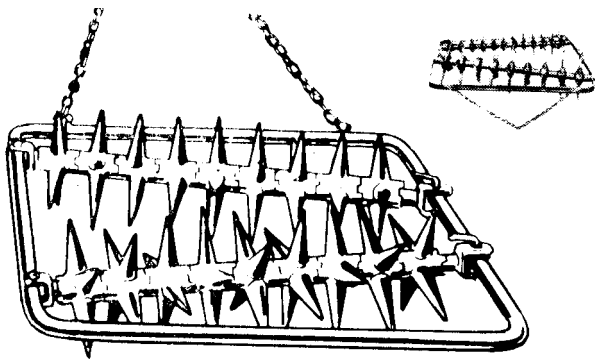


Figure 56 – Clod buster roller—Two angled gangs of spiked roller wheels, typically pulled behind a plow—Drag-type pull hitch

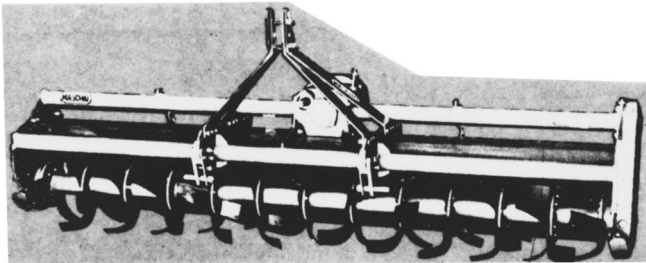


Figure 57 – Rotary tiller—Broadcast full width tilling—Rear-mounted

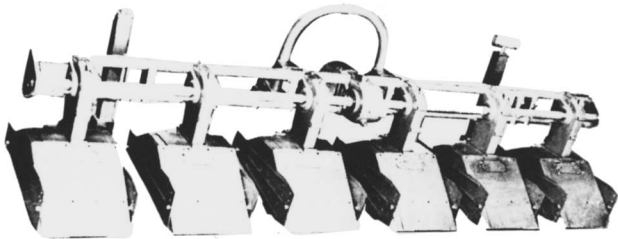


Figure 58 – Rotary tiller—Strip tiller with crop shields for row crop cultivation—Rear-mounted

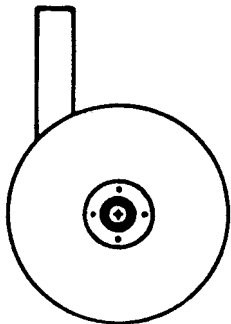


Figure 59 – Coulter blade—Smooth—A flat circular blade, sharpened at the circumference

5.16 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. 57–58.

5.17 Tillage components: Soil-engaging components of tillage implements designed to perform primary or secondary tillage functions. Components are shown in Figs. 59–78.

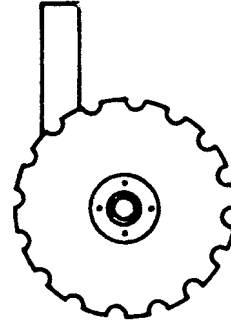


Figure 60 – Coulter blade—Notched—A flat circular blade with equally spaced notches around the circumference—The blade edges and notch surfaces are sharpened

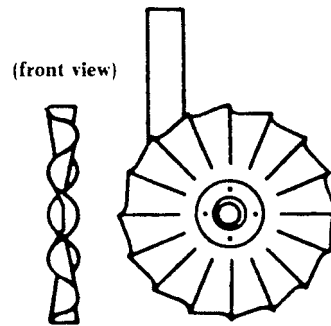


Figure 61 – Coulter blade—Fluted—A circular blade with formed flutes radiating from the outer periphery toward the center

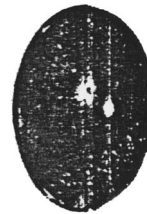


Figure 62 – Disc blade—Plain—A concave circular blade, sharpened at the circumference

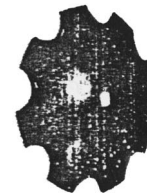


Figure 63 – Disc blade—Notched—A concave circular blade with equally spaced notches around the circumference—The blade edges and notch surfaces are sharpened

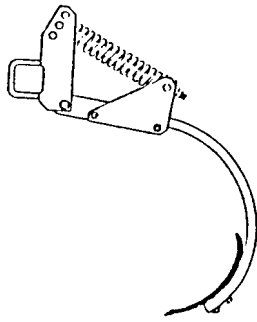


Figure 64 – Chisel plow shank—Medium duty—50 mm wide × 25 mm thick (2 in. wide × 1 in. thick) or smaller cross section of material

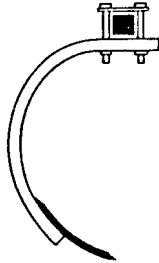


Figure 65 – Chisel plow shank—Heavy duty—50 mm wide × 32 mm thick (2 in. wide × 1 1/4 in. thick) or greater cross section of material

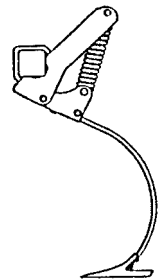


Figure 66 – Field cultivator shank—Material cross sections are usually less than 19 mm (0.75 in.) thick and of various widths—Shapes are described as ‘C’ shape, ‘S’ tines, ‘K’ tines, and spring tooth

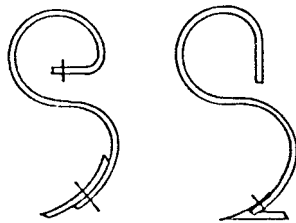


Figure 67 – ‘S’ tine—An ‘S’-shaped tine used for secondary tillage operations as well as row crop cultivation—Tool bar attachment can be either horizontal or vertical—Material cross sections range from 32 mm wide × 10 mm thick (1.25 in. wide × 0.394 in. thick) to 45 mm wide × 14 mm thick (1.75 in. wide × 0.562 in. thick)

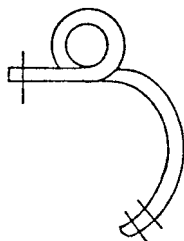


Figure 68 – Coil shank—A shank of round or square cross section that has a circular coil of material as an integral part of the shank’s shape—The coiled section provides a ‘Spring’ effect when encountering obstructions



Figure 69 – Subsoiler (ripper) shank—Material section and shape that permit working depths greater than that of heavy duty chisel shanks or other primary tillage implements

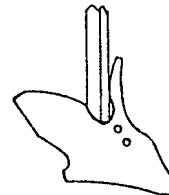


Figure 70 – Furrowers—A formed ‘V’-shape cutting blade with wings shaped to deflect the soil upward and away from the center point of the ‘V’—Furrowers are used to form ridges or furrows

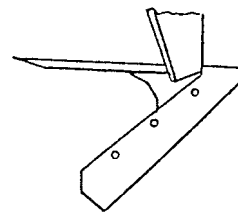


Figure 71 – Sweep blade—A ‘V’-shaped blade designed to operate at shallow depths, to destroy weed growth, and to loosen the soil surface without covering residue—Cutting width of ‘V’ greater than 600 mm (24 in.)

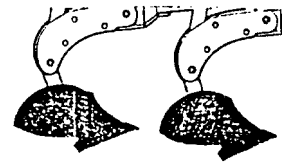


Figure 72 – Moldboard plow—A shear blade and moldboard combination that provides for cutting and turning of the furrow slice

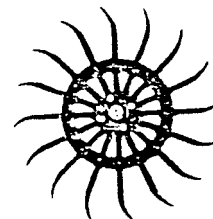


Figure 73 – Rotary hoe wheel—Tine-like projections equally spaced, in a circular ‘Wheel’ configuration about a central hub assembly—The hoe wheels are ground-driven to provide shallow surface tillage

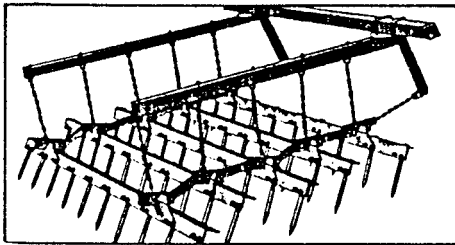


Figure 74 – Spike teeth—A round, square, or diamond-shaped cross section of material—Teeth are laterally spaced on frame bars and used as a tillage component to mix and level the soil surface

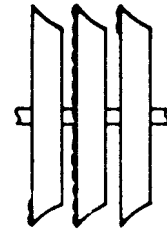


Figure 77 – Packer roller wheel—Cast iron wheels of various diameters and circumferential shapes used to firm the soil and break up clods

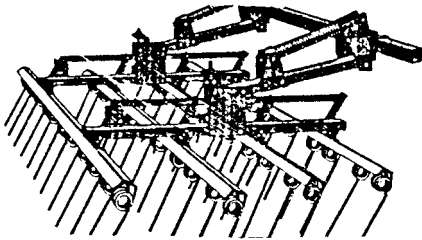


Figure 75 – Spring teeth—A circular material cross section coiled in the mounting area to provide flexibility to the shank end of the tine, used as a tillage component to mix and level the soil surface

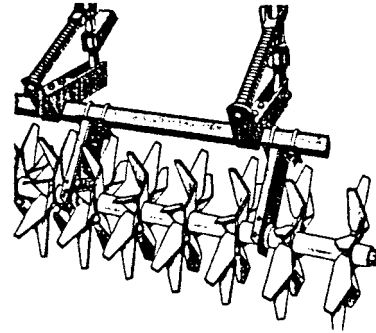


Figure 78 – Treader wheel—Paddle-like projections spaced in a circular wheel configuration about a central hub and axle—The treader wheels are ground-driven to uproot small vegetation and break up cloddy soil surfaces

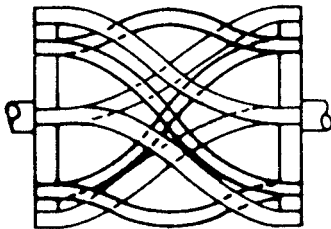


Figure 76 – Basket roller—Cylindrical, reel-type assemblies or baskets made with wire rods, bars, or blades, used to mix and level the soil surface