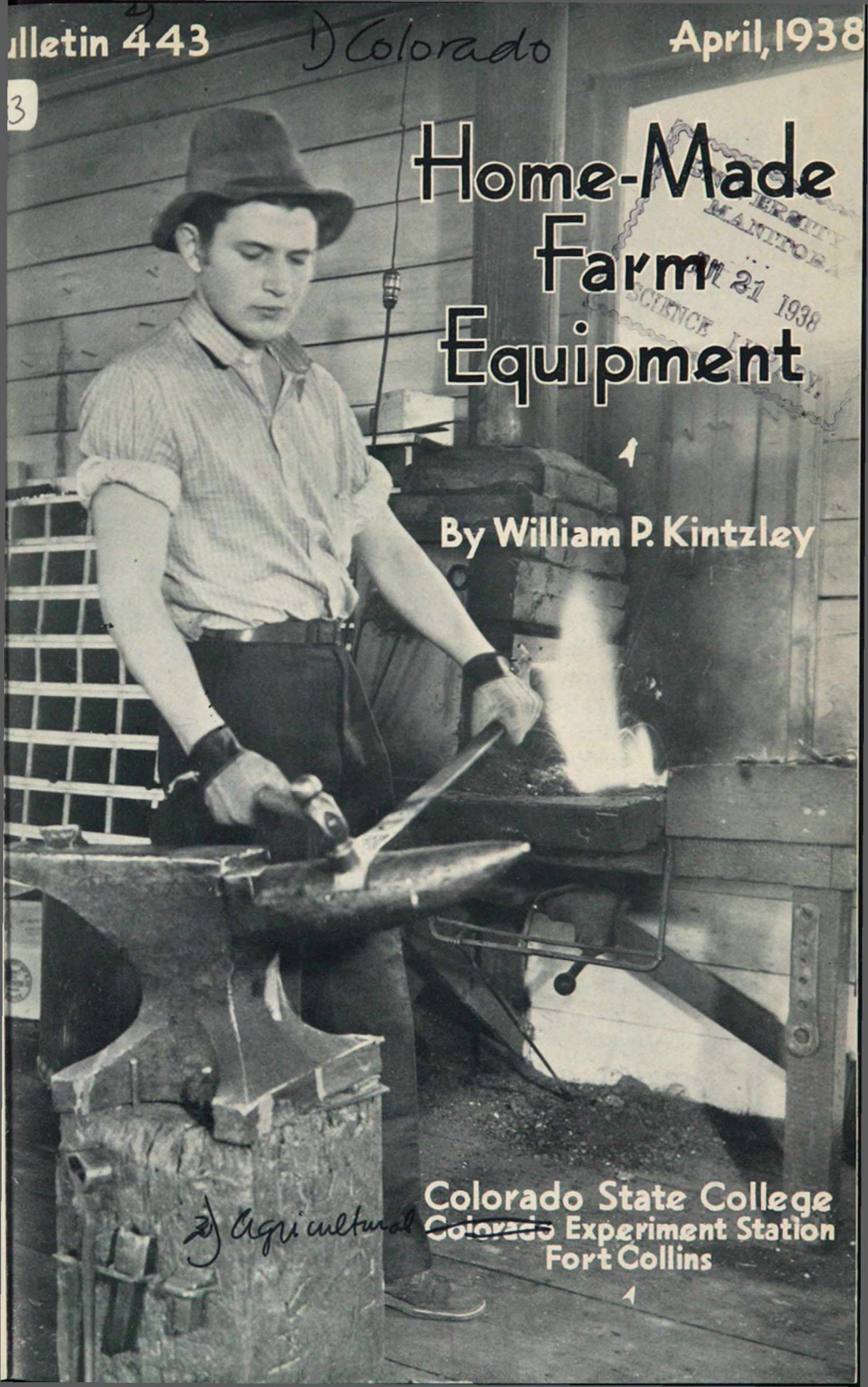


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# Home-Made Farm Equipment

By William P. Kintzley



*Agricultural*

Colorado State College  
Colorado Experiment Station  
Fort Collins

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**“STRIKE WHILE the iron is hot”**—  
and the weather cold. In the Rocky Mountain region many cold and stormy winter days, as well as occasional rainy days throughout the year, give the farmer opportunity to employ some of his time in the farm shop. Repairing and constructing farm equipment at such times is both interesting and profitable.

This bulletin tells how to construct the following equipment: Motor-driven hay buck, page 3; low platform wagon, page 8; hayrack, page 14; fence brace, page 18; harrow platform, page 19; gate latch and gate rest, page 20.

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# Home-Made Farm Equipment

WILLIAM P. KINTZLEY

Farm Manager, Colorado Experiment Station

**E**VERY FARMER has occasion to exercise his own ingenuity and his inventive talents in the making of handy equipment and devices for use on the farm. Some of these are designed to lighten his work and others merely to afford greater convenience in his tasks.

The author of this bulletin, in his work as farm manager for the Colorado Experiment Station, located at the Colorado State College of Agriculture and Mechanic Arts at Fort Collins, is no exception to this rule. Equipment described in the bulletin has been designed largely as the need for it became apparent in the course of work on College Farm. This equipment has been constructed at the farm shop during occasional slack periods when time could be spared from the routine work of the farm, just as might be the case upon any other farm. In many instances, scrap materials have been utilized, making the cost of equipment low.

The equipment described has passed the experimental stage after having been in use for some time on this farm. It has been designed to meet a practical need not filled by manufacturers of

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## **Equipment Has Proved Practical**

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farm equipment. The need for such equipment, indicated by the numerous inquiries received at this station from Colorado farmers, led to the decision to make available in printed form the essential points regarding its construction. Most of the construction can be done by a farmer of ordinary mechanical ability in a farm repair shop equipped with the usual blacksmith tools. Where shop facilities are not available, costs of having the work done by a blacksmith are not prohibitive.

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## **Motor-Driven Hay Buck**

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**T**HE MOTOR-DRIVEN hay buck (fig. 1) is a comparatively simple but efficient piece of equipment that appeals strongly to the practical farmer. In Colorado, where hay is one of the major farm and ranch crops and where that crop is practically all stacked in the field, it is necessary to use the hay buck—known also as sweep rake, bull rake, buck rake, and hay sweep. Colorado conditions create the need for this fast-moving, economical piece of hay-harvesting machinery. Time is an extremely important factor

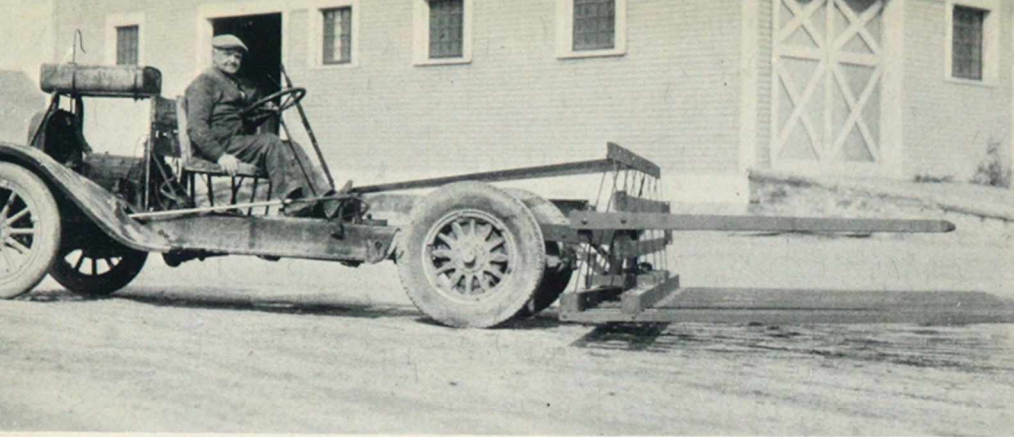


Figure 1.—This motorized hay buck is ready to swing into fast action in the hayfields.

in this region when hay is ready to stack, especially if the weather is hot or rain is threatening. A few hours' delay in the time of stacking often means a great loss in feed value if hay becomes too dry. Danger of loss resulting from rain upon cured hay provides additional incentive to reduce the stacking time as much as possible.

Having available the services of a motor-driven hay buck depends largely upon the ingenuity of the individual farmer, since manufacturers of farm equipment are unable to produce such

#### **Old Automobiles Are Cheap Power**

equipment at prices sufficiently low to create a market. A chassis with motor designed for this purpose would cost several hundred dollars, which would make the machine prohibitive to the majority of users. By way of contrast, there is available to the farmers of almost every Colorado community an almost unlimited supply of old automobiles in the hands of used-car dealers. These cars have passed their period of usefulness on the highway, yet many of them are too valuable to be wrecked merely to provide "parts," most of them being still capable of operation. Cars of this class usually can be purchased for from \$20 to \$35. In most cases the motors can be put into good, serviceable condition by replacing the piston rings and spark plugs, grinding the valves, and tightening the bearings. The price of the old car and of parts and materials for the buck will approximately equal the investment that would be required for a new horse-drawn buck, with labor costs for construction additional.

In some cases it may be desirable to use an old horse-drawn buck. Where this can be done, it will save the expense of materials for the buck. Converting the old buck for use with motor power is a simple matter. Figure 2 illustrates the parts of the buck to be used; merely remove the other parts and put on the hitch.

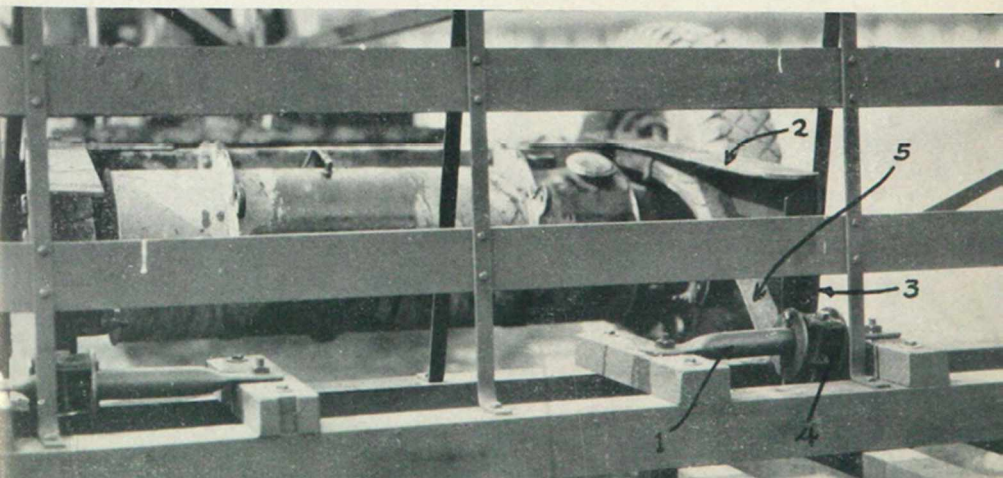
Referring to figure 2 and to the numbered arrows, the essential points to which attention is directed are the following: 1, a piece of 2-inch pipe, flattened at both ends for convenience in bolting it down; 2, a 4-inch angle iron bolted to the frame at the back of the spring and extending forward a sufficient distance to give the back part of the buck clearance ahead of the wheels; 3, a 3-inch angle iron bolted to angle iron 2 and extending downward below the hitch; 4, a U-clamp fastened to angle iron 3 at the back, slipping over pipe 1, and held in position by the bolt in front of pipe 1; 5, a brace from the bottom of angle iron 3 to the side of angle iron 2. Provision for adjusting the height of the buck may be made by boring extra holes in angle iron 3 and raising or lowering the U-clamp, 4, by changing the bolt in back of the U.

Although the motor of an ordinary passenger car has sufficient power for the standard-sized buck in the ordinary hayfield, the recommendations in this bulletin should not be interpreted as excluding the use of old motor trucks. There are conditions where larger bucks are desired and where ground conditions are unfavorable for lighter machines. In such cases the use of trucks to give additional weight and strength may be advisable.

As is apparent from figure 1, the car used for driving a hay buck is run backward. The object of this manner of operation is twofold: to permit turning the buck with the least sidewise sliding of the teeth; and to give additional traction as the load increases, since the entire weight of the buck and its load is carried on the drive wheels.

Speeds can be reversed on most cars by turning over the rear end. There are so many makes and models of automobiles that it is

Figure 2.—Few parts of the hay buck are involved in the changes necessary in motorizing the machine.



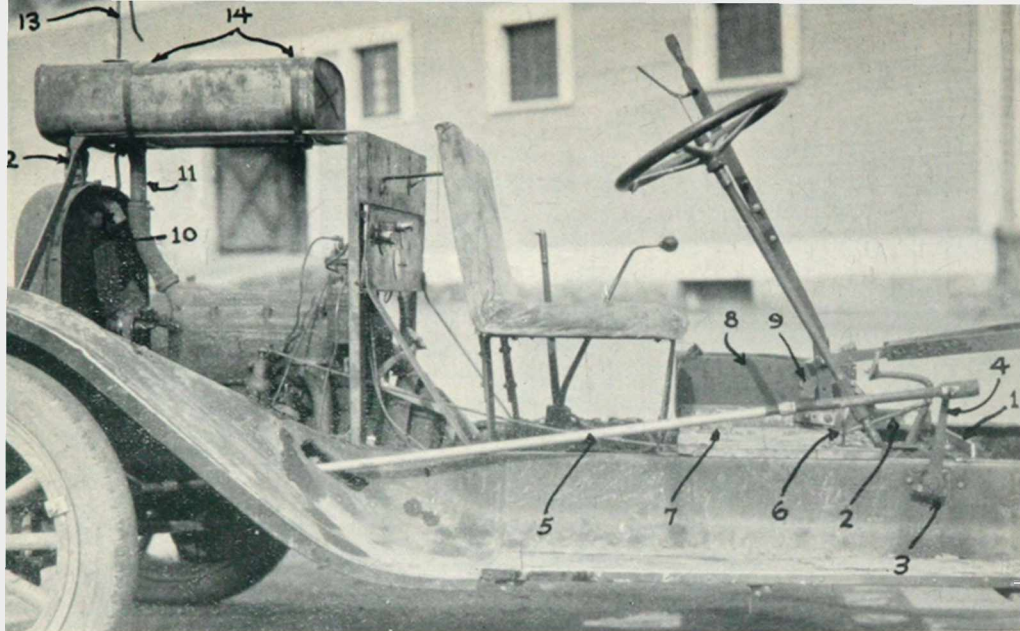


Figure 3.—Motor controls are reversed, and the cooling system is enlarged, in adapting the old automobile to use with a hay buck.

impossible to outline a definite procedure for this change that will be

### How to Reverse Your Car Speeds

applicable to all. In general, the following fundamental principles applied to any automobile design should accomplish the reversal of speeds without difficulty: Release the springs from the rear axle, disconnect the differential housing from the drive-shaft housing, and release the brake rods and the side braces if the car is so equipped. Pull out the complete rear end, turn it upside down, and place it back in position. The speeds will then be reversed. If the car is underslung, with the springs under the axles, it will be necessary to take off the spring shackles in order to remove the rear end.

Figure 3 shows the reversed controls and the cooling system. The entire body of the car, including the dash, has been removed. Wiring has been installed on a home-made dash that gives support to one end of the water tank and to a back brace for the seat.

The points indicated by the arrows in figure 3 are the following: 1, an angle iron bolted across the frame, with two other angle irons extending backward under the floor boards to support the clutch pedal; 2, the rod from the pedal to the clutch arm on the transmission housing; 3, the steering gear bolted to the frame, with the shaft extending through a hole cut in the frame; 4, the steering arm placed in position to permit the machine turning the same direction as the steering wheel, as is the case in ordinary forward driving; 5, an extension of the steering rod to leave the end fasten-

ing intact (note hole cut in fender to give desired position to rod); 6, the gasoline feed (the small rod extends back to the carburetor, and the foot feed is held in position by a spring under the floor boards); 7, the starter, conveniently placed on the floor boards (the brake pedal, the shifting lever, and the emergency brake lever are in their original positions; the brake pedal is not needed, as the emergency pedal is sufficient for all the braking required; if necessary, the brake pedal can be placed beside the clutch pedal, an arrangement that would probably be advisable if the machine is to be moved considerable distances upon roads); 8, tool box; 9, the lever ratchet with notches ground out on the front portion to permit the lever to lock back when the teeth are raised and to float forward when the teeth are down.

Since the car providing the motive power for the hay buck runs backward, the force of the air drawn through the radiator is diminished and may cause overheating of the motor. To overcome

### **Enlarging Capacity Of Cooling System**

this difficulty an old automobile gasoline tank has been installed to provide an increased volume of water as indicated in figure 3. It is very important to have the tank fastened securely and to have a short piece of flexible hose leading from the top of the radiator to the tank. This will largely absorb any vibration or movement between the two. It is quite possible that this extra tank for additional water supply might not be necessary if a larger radiator were used and if the fan blades were so turned as to pull more air.

Study of the cooling system as shown in figure 3 directs particular attention to the following points: 10, the old hose connection that has been closed; 11, a pipe soldered to the bottom of the tank; 12, the radiator connection made by removing the radiator cap and sealing the overflow pipe (a short piece of pipe is welded or soldered to the top of the radiator, and a hole is cut in the bottom of the tank and a like piece of pipe soldered to it, the two pipes being connected by a short rubber hose); 13, a piece of gas line to permit relieving the pressure, this line being soldered to the cap at the top of the tank after a small vent has been made in the cap (this pipe should extend upward to prevent the water from splashing out); 14, two metal straps used to hold the tank firmly on its support (there should be a cushion under the tank, made of some such material as split inner tubes, to prevent the support wearing through the metal of the tank as a result of vibration).

The exhaust pipe should be turned to the side or extended upward to direct the fumes away from the driver.

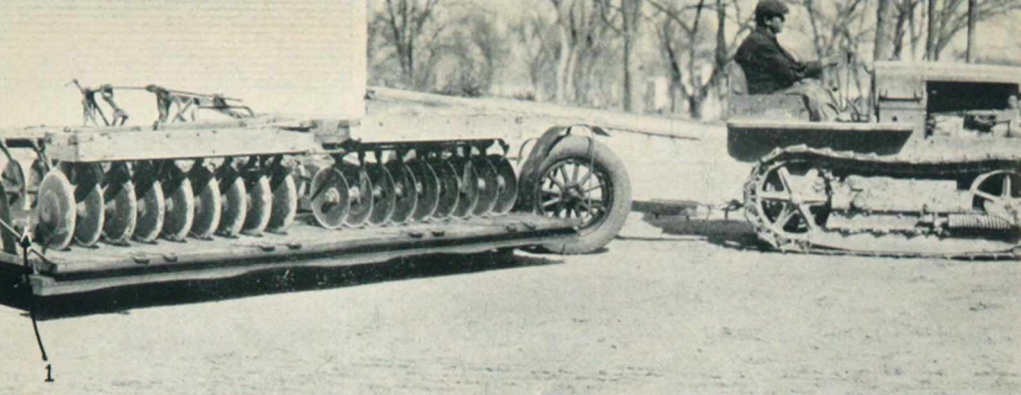


Figure 4.—Described by the farm manager as “the handiest piece of equipment on College Farm,” this low platform wagon is transporting a tandem disk to a distant field.

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## Low Platform Wagon

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**M**OST FARMERS are familiar with the old sled or stone-boat which has long been used for moving for short distances those heavy objects that are difficult to raise to the height of a farm wagon bed. Consisting of a platform bolted to a pair of pole runners, these sleds have been almost indispensable on most farms.

With the present abrasive surfaces of roads, the use of sliding runners of any description is impracticable. Yet the need for a low, portable platform upon the farm is greater than ever before, because of the injury that may be done to farm machinery by drawing it over hard road surfaces. Many other uses for such a platform will be found in the course of ordinary farm work. Sick and crippled animals that are often difficult to move may be loaded upon a low platform with a minimum of effort upon the part of the farmer and a minimum of injury to the animal. The platform may also be used to advantage in hauling corn fodder, hay, and manure, eliminating much of the lifting that is necessary when loading upon an ordinary wagon.

A platform that embodies many distinct advantages over the old sled type has been designed and built at College Farm, where it is proving convenient equipment for various purposes. This platform, figure 4, has the advantage of light draft under heavy load and may be drawn by tractor, truck, or horses. Substantially constructed of 2-inch planking, the platform is mounted upon two 5-inch I-beams (fig. 10) suspended between the front axles of an old truck. The bottoms of the I-beams are 5 inches from the ground; if a high center is encountered, the platform

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### Platform Wagon Has Advantages

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usually will slip over it without difficulty. The distance lengthwise between wheel guards is 12 feet, and the width of the platform is 8 feet.

When heavy equipment is to be transported upon the platform, hinged planks which are carried beneath the edges of the platform are let down on edge, resting upon the ground and providing support for the weight of the equipment (fig. 5). Heavy planks which will provide a driveway for a tractor to mount the platform are then placed in position, extending out 4 feet from the edge of the platform (fig. 5). The farm-made device used to hold these planks in place at the side of the platform is illustrated by figure 9.

The wheel guards shown in the illustrations are not mere refinements but are practical accessories. Especially in the hauling of such crops as hay and fodder are these guards of value, since they keep the load from rubbing against the wheels.

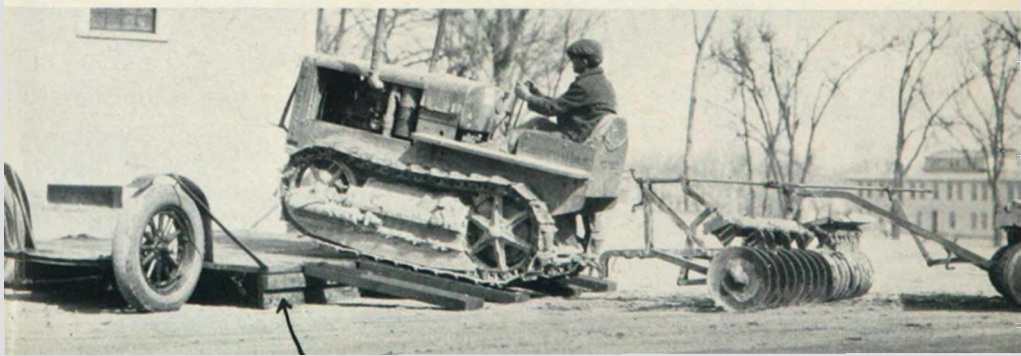
Figure 4 shows the low platform wagon in use with a tractor, after a tandem disk has been loaded upon it. Note that the gangplanks, indicated by the arrow, have been placed between the disks to prevent their rolling about while the trip is made to the field. These gangplanks and their further use are described on pages 10 and 11.

Figure 6 shows the tandem disk being loaded by driving the tractor up the gangplanks and across the platform. The arrow points to the hinged side support, which has been let down to rest upon

#### **Assuring Support In Tractor Use**

the ground and provide support as the 3-ton tractor balances over the edge; this support is necessary only when an exceptionally heavy weight is brought upon the platform. Arrow 1, figure 7, shows the device used to hold up this side support when it is not in use; it consists of a curved piece of strap iron, with a cotter key used through holes in the strap iron to keep the support

**Figure 5.—Loading a disk upon the sturdily constructed low platform wagon is almost child's play when a 3-ton tractor provides the power.**



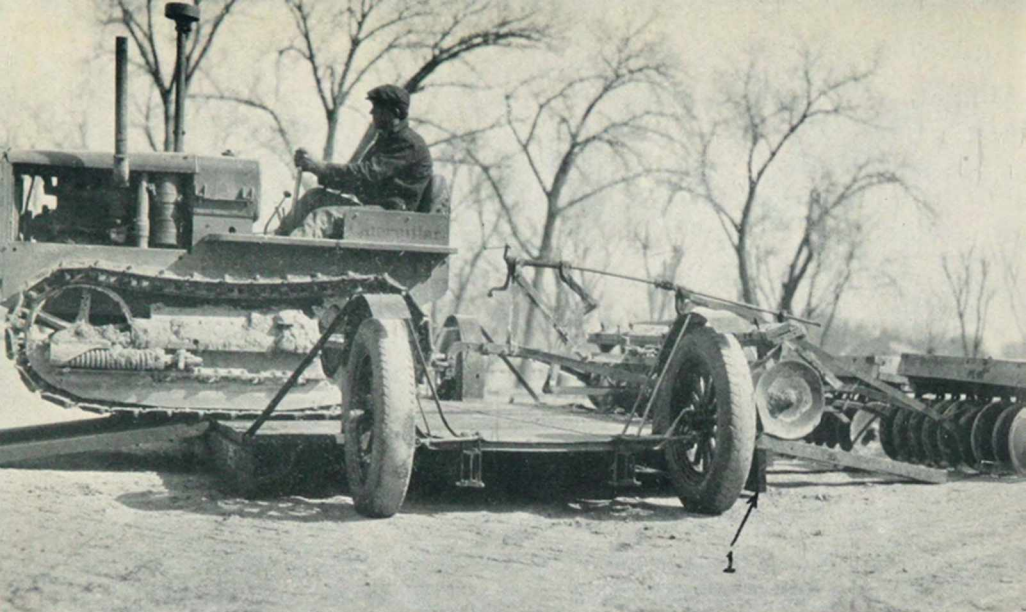


Figure 6.—“Over the top:” the tractor is leaving the platform on one pair of gangplanks as the disk approaches it on four others.

up in position. When the support is down, the cotter key is placed below the platform to keep the support from doubling under. On farms where tractors are not used, this side support may be entirely dispensed with.

Figure 6 shows the tractor crossing the platform and pulling the disk upon the gangplanks leading to the platform. The arrow points to the side support which now is clear of the ground and merely hanging when relieved of the tractor's weight; this support has about 2 inches' clearance from the ground, permitting it to swing easily for raising or lowering.

Figure 7 shows the wagon being used with horses. When horse-drawn equipment is loaded, it is not necessary to let down the side support, since the platform is so designed that it cannot tip, and horse-drawn farm equipment is not heavy enough to overload the edge of the platform. Horse-drawn machinery is pulled upon the platform by means of a rope or chain, without driving the team across the platform (fig. 8).

Construction of the hinged gangplanks is illustrated in figure 9. The one on the right is fully in place and ready for use, while the one at the left is merely resting upon the edge of the platform in order to show clearly its construction. The arrow 1 points to the hinge; it is necessary to have a flexible joint here, as the side of the platform is pressed down slightly under heavy weight. Arrow 2

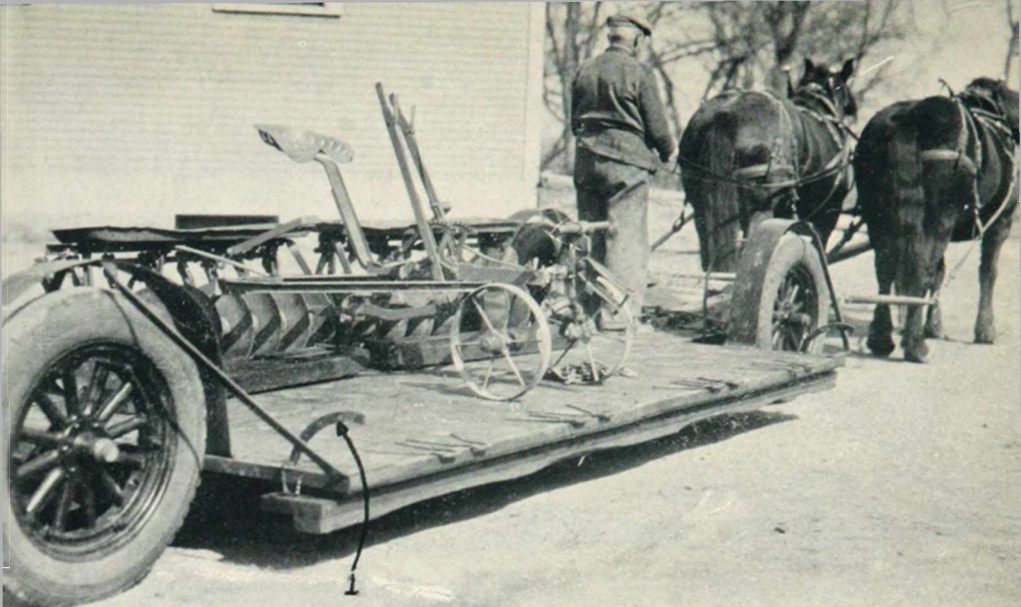


Figure 7.—This low platform wagon is well adapted to use on farms where horses provide the motive power.

gives an idea of the length of the hooks; the plank is 3 inches thick. Arrow 3 points out the angle iron which is used to protect and strengthen the edge of the platform.

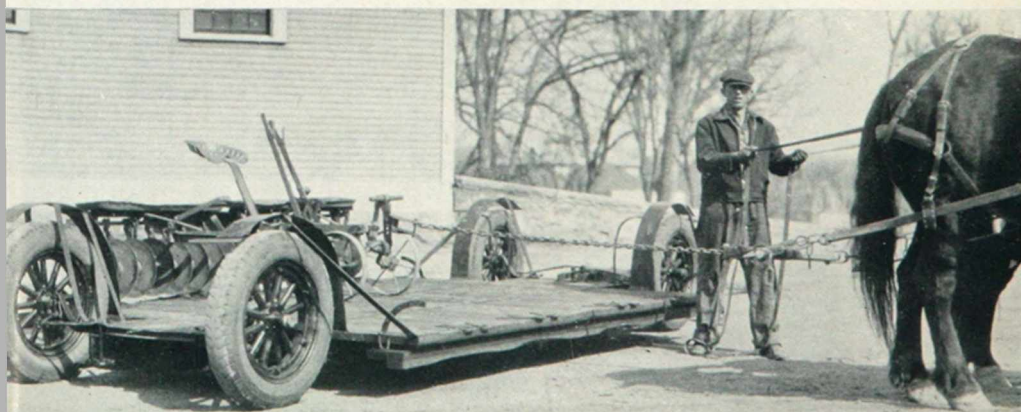
A view of the sturdy rear axle, which is made of the front axle of a 1½-ton truck, is afforded by figure 10. The arrows refer to the following points: 1, the steering rod which has been cut and flattened at one end to permit bolting to the axle, thus holding the wheel in proper alignment; 2, four ½-inch bolts supporting the I-beams (the holes in the axle, through which the bolts are placed, are the original holes through which the truck's springs were clamped to the axle); 3, strap iron bolted through the floor to

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**Rear Axle Is  
Sturdily Built**

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Figure 8.—When horses are used, machinery is loaded by pulling it upon the platform by means of a chain or a rope; only one pair of gangplanks being used; horses do not cross the platform.



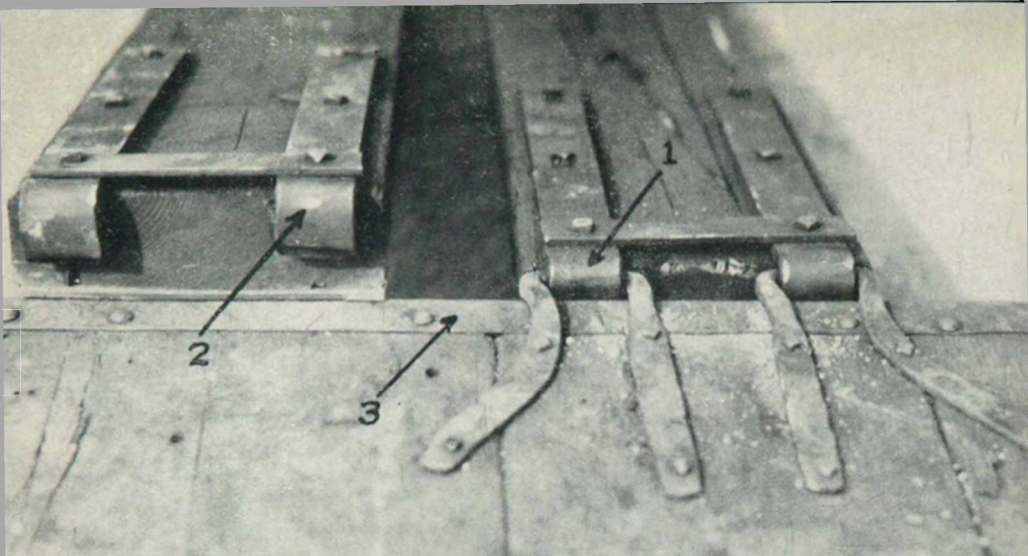
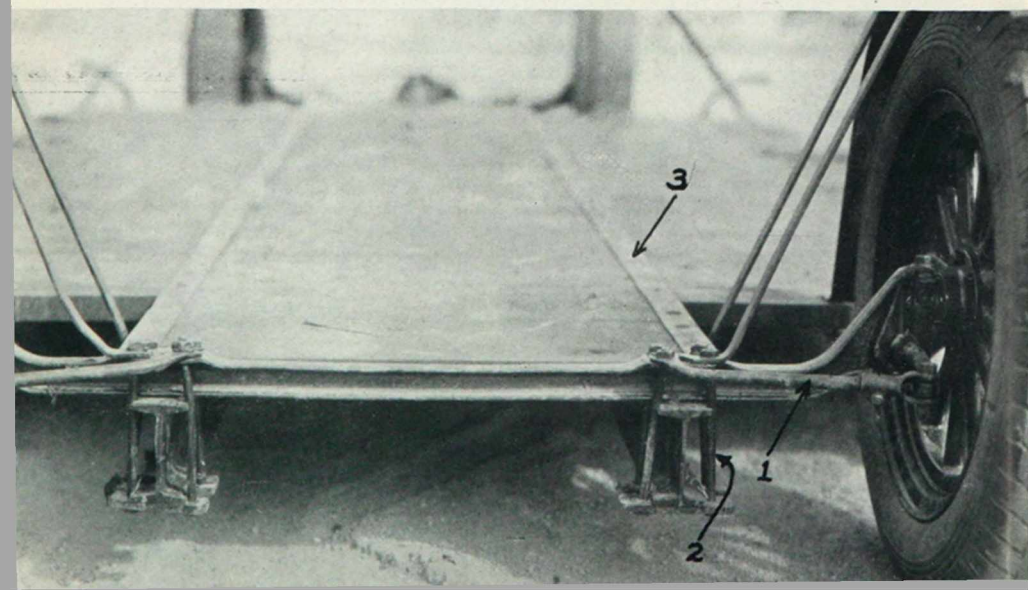


Figure 9.—Heavy gangplanks are hinged in place upon the edges of the platform by means of these flexible, farm-made joints.

the edge of the I-beam to hold the platform securely in place (holes are not bored in the beam, but another strap under the platform projects under the flange from the bolts).

The steering apparatus is illustrated in figure 11: 1, the single bolt, removal of which is all that is necessary to permit changing tongues; 2, the channel iron controlling the steering device; 3, a draft pin extending through the steel plate and the floor; 4, the steel plate bolted to the floor (the bolt heads are countersunk to leave a smooth surface upon which channel iron 2 may turn upon

Figure 10.—Rear construction of the low platform wagon, using the front axle of an old truck, is simple but strong.



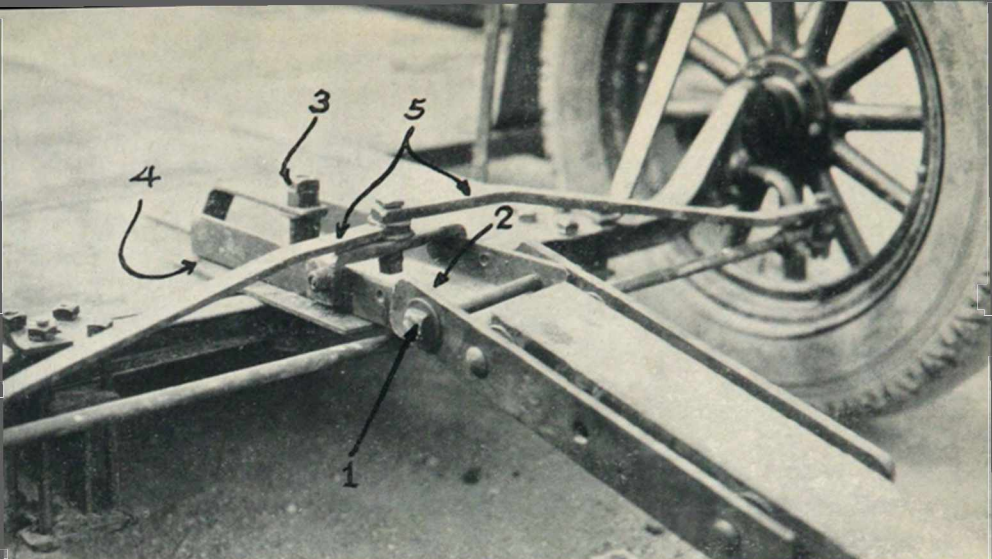


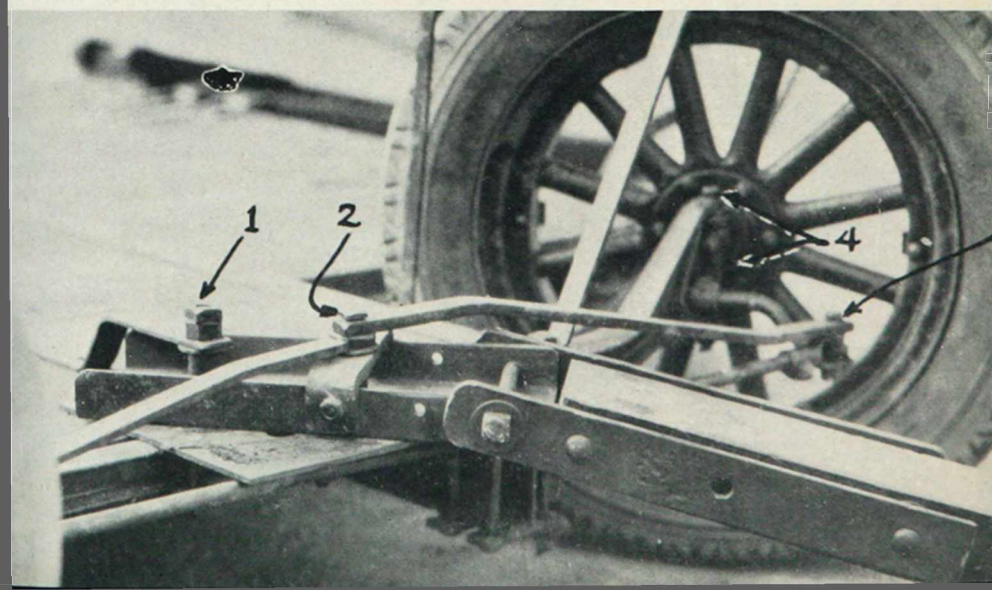
Figure 11.—Steering parts of the low platform wagon are few and easy to construct.

the draft pin); 5, steering straps controlling position of wheels.

The tongue of this platform wagon may be hitched at any of various heights. The short tongue used when the platform is pulled by tractor or truck may be removed and a longer tongue attached by changing a single bolt, if horses are to be used as motive power.

The additional front-axle view in figure 12 shows the position of the steering device when the wheels are cramped. This hitch works perfectly if the apparatus is so constructed that the distance between points 1 and 2 equals the distance between points 3 and 4.

Figure 12.—The steering apparatus operates easily when the wheels are cramped.



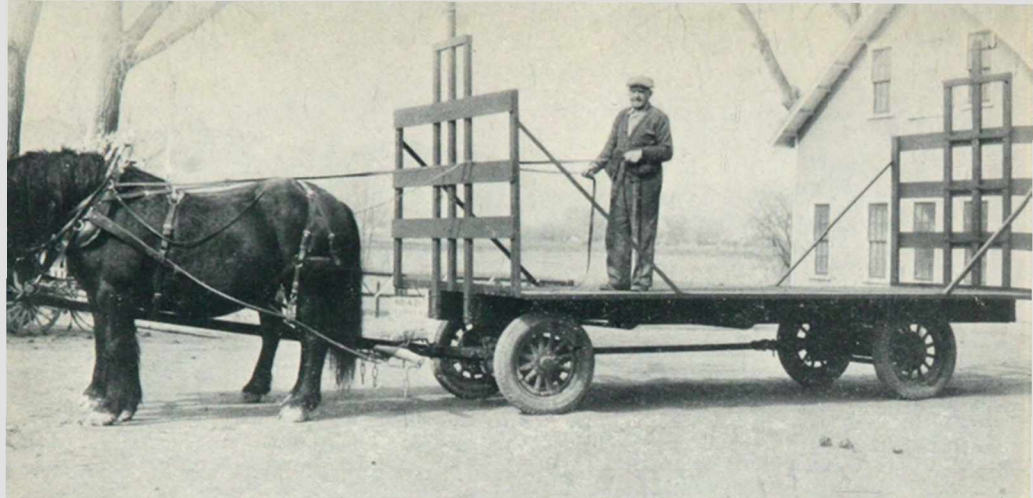


Figure 13.—This western type of hayrack combines unusual strength with maximum utility.

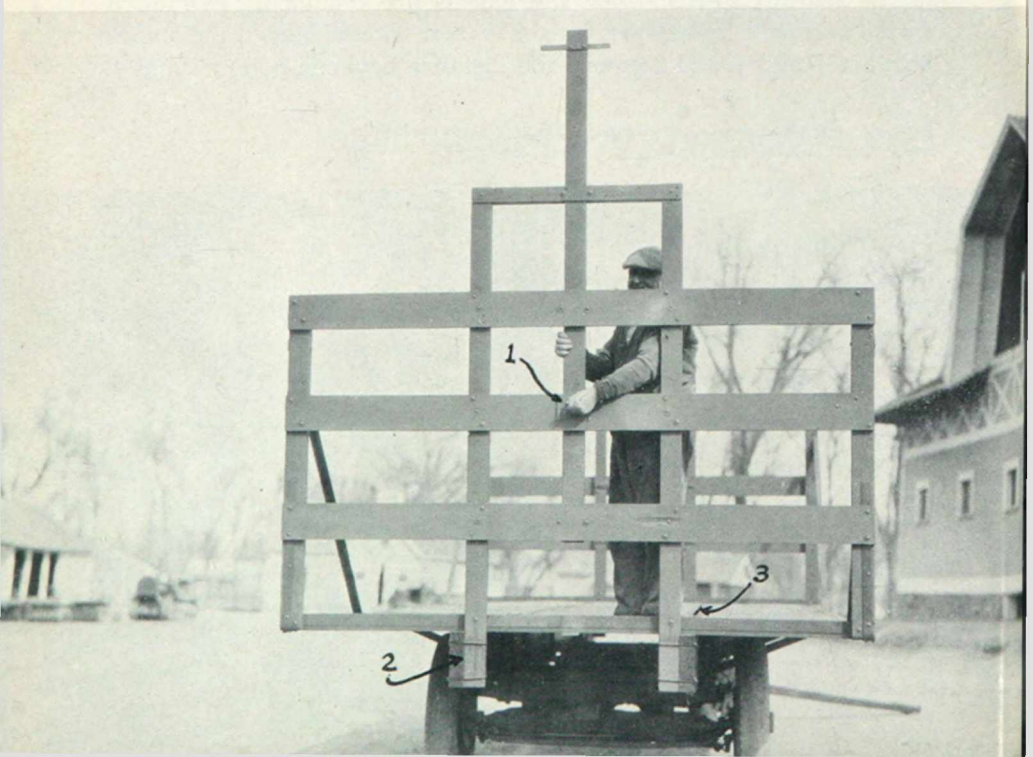
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## Hayrack

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**A** WESTERN type of hayrack designed to overcome the weaknesses and undesirable features so evident in most racks, and to add new features which will bring the type of construction upon a par with that of other modern farm equipment, has been de-

Figure 14.—Adjusting the center standard of the hayrack to the height of a load is accomplished merely by raising the standard and placing a bolt to hold it in position.



veloped at this station (fig. 13). While dimensions of the rack should be adjusted to suit the individual requirements of the farmer, this particular rack bed is 16 feet long and 8 feet wide. One important objective in the construction of this rack was to get a practical height for the bed: the floor is 34 inches from the ground. Incidentally, it will be noted that the floor is laid crosswise of the rack, thus eliminating the need of cross members over the stringers to support the floor.

The corner standards are 4½ feet high; the stringer standards are 6 feet high from the floor but extend down the width of the stringers; the center standard is 7 feet high and adjustable to the height of the load. All standards are made from 2x4's, the dimensions being the same for both the front and the rear ends of the rack.

The rack built upon these specifications combines the qualities of strength, durability, and lightness. The complete unit shown in the illustrations, including the wagon, weighs 1,470 pounds. Use of angle iron in construction of the rack is an investment that will be well repaid by the resultant increase in strength and length of service of the rack. Edges of the rack floor, in the case of the rack illustrated, are protected and strengthened by angle iron bolted to the floor boards. Other braces beneath the floor are held to the stringers by U-bolts.

Figure 15.—The farm manager inspecting the iron-reinforcement features of a hayrack at College Farm.



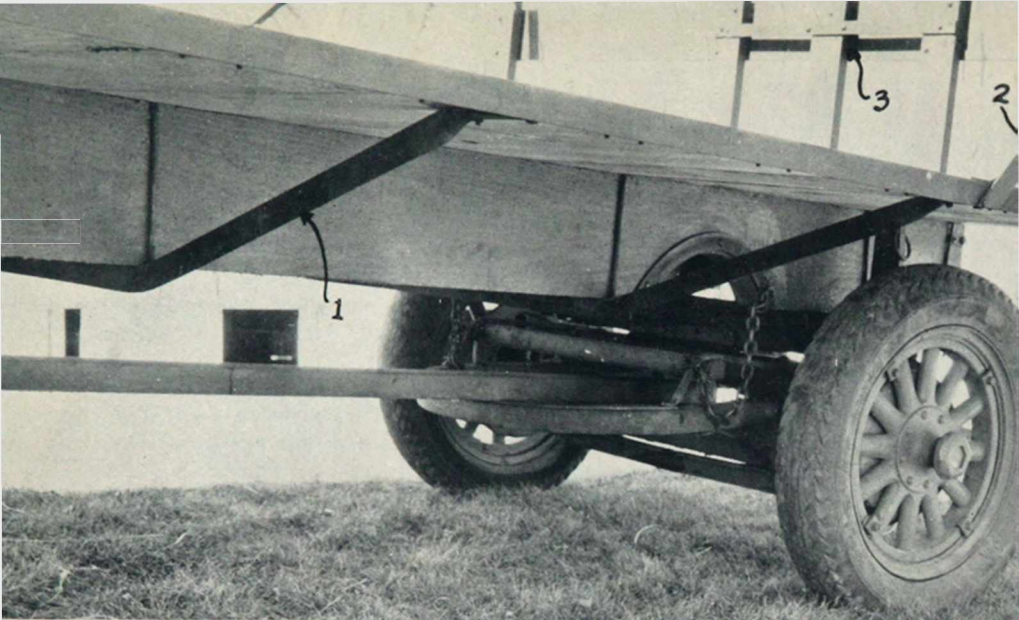


Figure 16.—Angle-iron braces, clamped to the stringers and bolted to the floor of the hayrack, add strength and contribute to long service.

All users of farm wagons have experienced the annoyance, when making a short turn, of a front wheel rubbing so hard against the stringer as to lock the wheel or raise the rack; or if the stringer was so set as to avoid contact with the wheel, the reach may have been forced to take the strain against the circle brace, a situation which often has resulted in breaking the reach. In the case of this hayrack, a short chain has been attached to lead from each stringer to the circle of the wagon hound; these chains are adjusted to take the strain without either the wheels or the reach coming in contact (fig. 17).

### **Device to Prevent Rubbing by Wheel**

In making a detailed study of the illustrations before beginning construction of the hayrack, the following points as indicated by the numbered arrows should be particularly noted:

Figure 14: 1, the adjustable center standard being raised from the floor position to a higher position such as might be necessary in accommodating it to the height of a load; 2, two U-clamps through the stringer and around the standard give full strength to the standard and hold the stringer in a rigid, upright position; 3, strap iron by which the floor is held to the stringers by 2½-inch lag screws. With the exception of the wheel arches on the stringers and the straps on the two center standards, all strap iron and angle iron is of ⅛-gauge steel. No nails are used in construction of this rack.

Figure 15: 1, strap iron from the lower end boards extending under the floor for the entire length of the rack is bolted through the edge of the floor and through angle iron 2, giving support to



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### Build Rack for Long-Time Service

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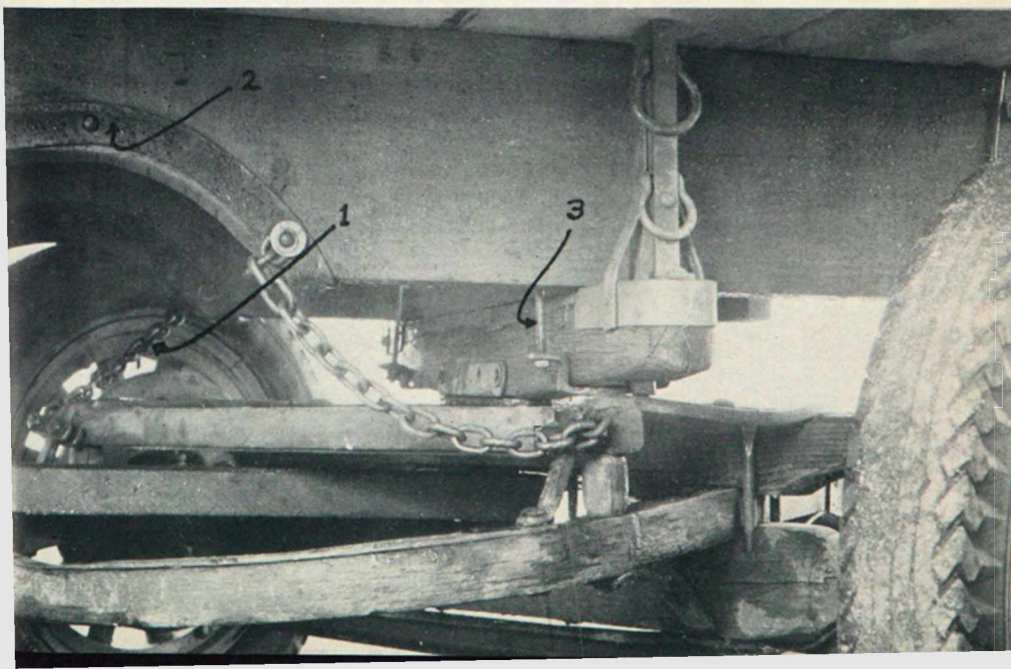
the floor and preventing loosening of the corner standard by vibration; 2, angle iron giving strength and protection to the edge of the floor; 3, angle iron bolted to floor and standards and through the end of angle iron 2; 4, strap iron rest for adjustable standard.

Figure 16: 1, an angle iron clamped to the stringers and flattened at the ends to permit bolting conveniently to the under edge of the floor (the third of these supports, at the rear of the rack, does not show in this picture); 2, an angle iron end brace (the iron is split at the floor to permit bolting both ways; the same method is used at the tops of the corner standards); 3, a small piece of pipe used over the bolt between the strap iron and the end board, keeping the tightened bolt from gripping the adjustable center standard.

Figure 17: 1, the chain under tension when the wagon is cramped, neither reach nor tire making contact; 2, the arched strap iron to strengthen the stringer where it has been cut away to allow the wheel to turn; 3, a U-clamp under the wagon bolster and over the rack stringer, a good device to use if the rack does not have to be removed from the running gear frequently, as it eliminates the necessity of any other method of keeping the rack in place and is an aid in preventing tipping.

The wagon shown under the hayrack in the illustrations is that described in Colorado Experiment Station bulletin 434. This bulletin, available upon request, tells how to convert old farm wagons into handy, rubber-tired wagons for use upon farms at low cost.

Figure 17.—When making short turns, the arched stringers and restraining chains prevent the front wheels from rubbing against the stringers and the reach from taking strain against the circle brace.



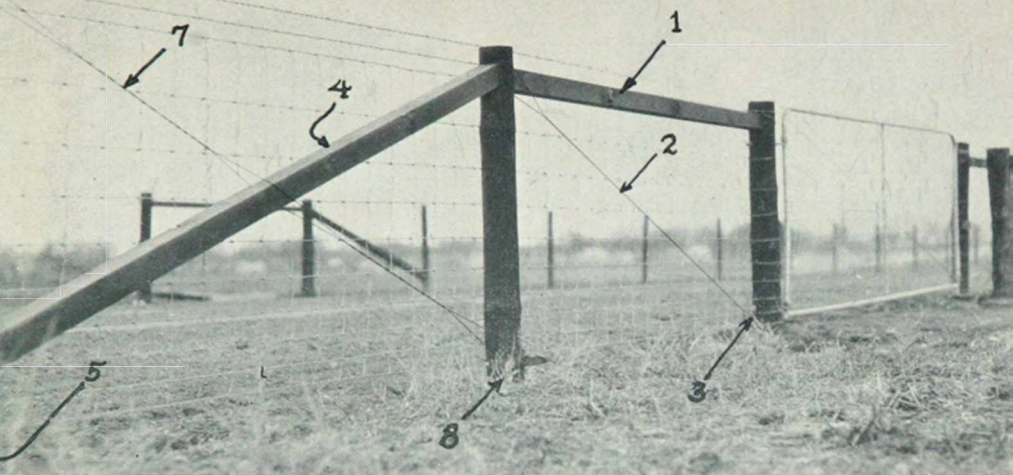


Figure 18.—Holding corner posts and gateposts in position despite stress is the function of this type of brace.

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## Fence Brace

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**H**OLDING a corner post or a gatepost in position when high woven wire is stretched to a high tension is often difficult. Success in building a good fence depends a great deal on keeping corner posts and end posts from "giving."

The double brace illustrated in figure 18 has proved its effectiveness in withstanding the strain of a heavy pull. Since the object of a brace is to hold the end post in a vertical position under pressure, it is necessary to transfer the pressure from the top of the post to some other point, which must be the ground. Diverting this pressure to three ground points gives enough distribution of stress or pressure to enable the post to withstand an unusually heavy pull.

If brace 1 were acting alone, the first brace post, 8, would receive the pressure at the top, and it would be returned by brace wire 2 to the ground line of the gatepost, 3. This one point would receive the entire load. The second brace, 4, carries the pressure to the second brace post, 6, about 18 inches from the ground line, bringing part of the pressure to the ground

at point 5. The object in keeping this brace above the ground line is to deliver part of the pressure to the top of the second brace post, 6, where it is returned by brace wire, 7, to the bottom of the first brace post, 8.

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### This Brace Divides Strain of "Pull"

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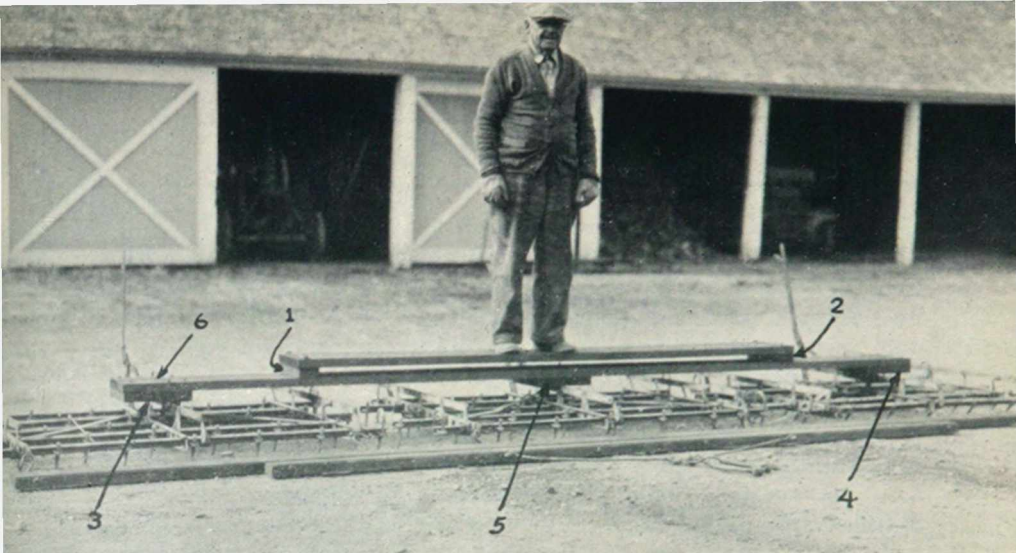


Figure 19.—Equalizing the driver's weight upon the three sections of the harrow is an advantage of this platform.

Braces should be well-fitted into shallow notches in the posts. Brace wires should be securely fastened and evenly tightened; it is important that these wires be tight. They should be twisted until the post leans slightly backward; then, when the pull comes, there will be no "give" to permit the post to lean. The entire pull should come from the end post. The wire should not be gripped to the brace posts by staples, as pulling from them would unbalance the stress.

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## Harrow Platform

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**F**OR MANY purposes the harrow does its best work when the weight of the driver is added to that of the harrow. In the case of a three-section harrow, when a plank is placed across the sections for the driver to stand upon, the plank will spring enough to place most of the weight on the middle section of the harrow. Figure 19 illustrates a simple arrangement for giving equal distribution of weight among the three sections. The driver's weight is divided between points 1 and 2. Points 3, 4, and 5 rest on the three sections of the harrow. To give equal distribution of weight, the distance between points 1 and 3 equals one-half the distance between points 1 and 5. The plank is held at the ends and prevented from slipping backward or forward by rods, 6, fastened to the harrow; it is prevented from working endwise by a cleat on the bottom, 3, 4; these devices should allow a little end play to keep the harrow from binding.

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## Gate Latch and Gate Rest

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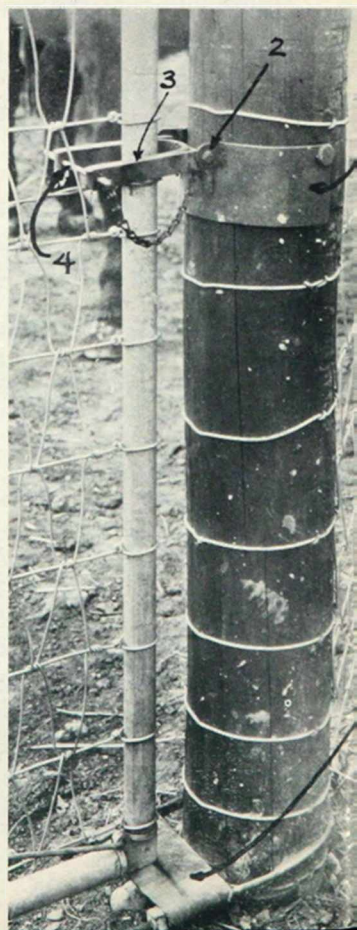
**A**N IMPORTANT feature of an enclosure for livestock is a gate equipped with a latch which is both convenient and dependable. Every stockman has experienced the trouble and damage occasioned by livestock releasing themselves from an enclosure by rubbing a gate open. To guard against this possibility, gates are often fastened by tying with a piece of rope or wire.

The latch illustrated in figure 20, in use on College Farm, will solve the problem and is not difficult to make. The  $\frac{1}{8}$ -inch band iron, indicated by the arrow numbered 1, can easily be bent to the shape of the gatepost to which it is fastened by lag screws. The band is cut at the top to permit the cut portions to be turned back to receive the bolt, 2, which holds the U-latch. The U-latch, 3, is of strap iron  $\frac{1}{4}$  inch in thickness and 1 inch wide. The

ends are pointed and turned down to rest against the post, thus keeping the latch from falling down. The strap is doubled back to make the U and should extend past the end frame of the gate to allow for a slight giving of the gatepost which sometimes occurs as a result of frost action in the ground. The pin, 4, secured by the chain is a cotter key; it prevents livestock from raising the U and allowing the gate to swing open. A cotter key is particularly desirable for this purpose, since the slight tension from its tendency to spread prevents it from working out where there is vibration from wind or other causes.

A good gate rest is an important feature. Most gates will eventually sag of their own weight; in addition, the weight of persons who may climb over a gate may spring the gate hinges and cause sagging. The gate rest shown in figure 20 and indicated by arrow 5 can be adjusted to the required height by loosening the burs and slipping the clamp up or down on the post. The ends of the  $\frac{1}{8}$ -gauge strap-iron rest are rolled under, making a grip for the clamp rod. The surface of the rest is sprung down slightly in the middle, giving the gate a tendency to stay in the proper position.

Figure 20.—Livestock cannot open the gate equipped with the safety latch; the gate rest at the bottom holds the gate in its original shape and position.



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## **Shop Notes**

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