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COOPERATIVE EXTENSION WORK
IN AGRICULTURE AND HOME ECONOMICS

U. of N. Agr. College & U. S. Dept. of Agr. Cooperating
W. H. Brokaw, Director, Lincoln

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740

SIMPLE HITCHES FOR FARM USE
by

Paul R. Hoff and O. J. Trenary

Side draft is probably the thing which causes the most difficulty in the operation of some farm machinery, provided the machinery itself is in good condition and proper adjustment.

There are some cases where side draft cannot be eliminated entirely but many times it can be reduced greatly and occasionally can be avoided completely. A careful study of the factors which cause side draft and the means of evading it will be of benefit to those using animal power in farming operations.

Side draft causes an increase in resistance of the implement and the loss of power in the team due to the true line of pull of the team not falling on the true line of draft of the implement being used. Side draft also causes sore shoulders, due to the horses pulling at an angle to the direction of travel, and usually a poor job of plowing. The good farmer naturally wants to get the most work done for the horse power expended and get it done properly with the least hardship on his horses.

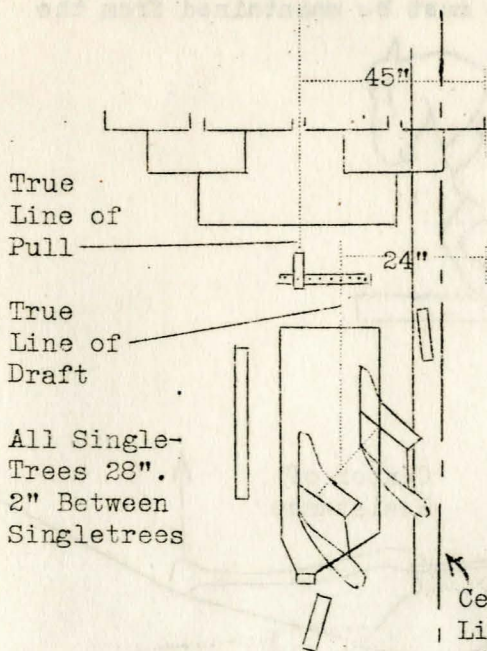
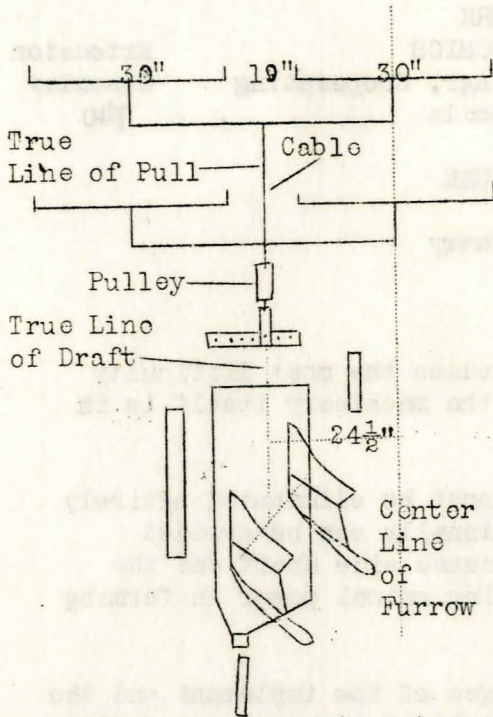


Figure 1

Figure 1 shows a hitch which is commonly used but which has many faults. The true line of pull does not fall on the true line of draft and consequently considerable side draft will result. The true line of pull and the true line of draft can never be made to fall on top of each other in abreast hitches of this sort where the right hand horse walks in the open furrow. Of course, the side draft could be eliminated with this hitch if one horse walked on the plowed ground. However, this is a great hardship and it wears out the horse needlessly.

A simple remedy in this case is to hitch the four horses tandem as shown in Figure 2. Here the true line of pull falls on the true line of draft and consequently all the side draft is eliminated. In this way the horses work straight ahead, thereby exerting

FIGURE 2



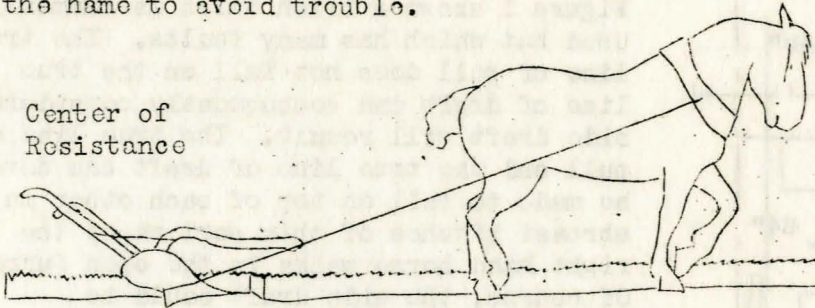
all of their energy in pulling the plow instead of only part of it while they fight side draft with the remainder.

The elimination of side draft is not the only advantage of hitching horses tandem instead of abreast. Tandem hitching gives each horse more room which in turn allows much greater air circulation, a factor especially desirable in hot weather; more freedom of movement, thus lessening the danger from trampling of feet, especially at corners, and a greater simplicity when hitching the horses.

There are two objections which are sometimes raised in connection with tandem hitching. The first is that difficulty is experienced in plowing corners and along fence lines. As soon as a few rounds are made the plow and horses are far enough away from the corner to cause no difficulty. To get into the corner itself it will be necessary to use a single team on the plow. This is not a large job and could be done very easily and in a short time. Horses hitched tandem can plow

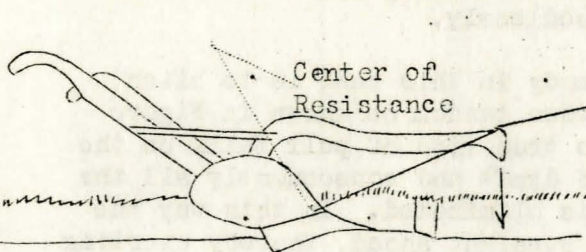
much closer to a fence line than when they are hitched abreast. A second objection to the tandem hitches, which is occasionally raised by some men is a belief that the greater the distance between the horses and the implement the greater the pull needed to move it. This is not true if the proper angle of draft is kept on all of the traces. The same angle must be maintained from the plow to the hame to avoid trouble.

Center of Resistance



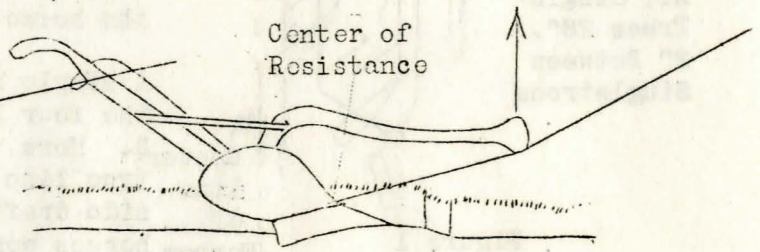
A

Center of Resistance



B

Center of Resistance



C

FIGURE 3

In A, Figure 3, the correct angle is shown for a walking plow and the same principal applies for a riding plow. The line made by the trace from the hame carries straight through the clevis to the plow. In B the hitch is too high. A broken line of hitch always tends to straighten and in this case it forces the point of the plow into the ground. In C the hitch is too low and the point of the plow is lifted. Either B or C will increase the draft while no increase will result if the line is kept straight as in A.

In riding plows incorrect hitching has a tendency to put more load on the wheels thus increasing the wear on the wheel boxings as well as increasing the draft.

A handy method of checking the angle of draft is to step to the side of the plow and sight along the trace. If this is a straight line from the hames, through the point of hitch down to the center of resistance of the plow it is correct. If it is not a straight line, raise or lower the hitch on the vertical clevis of the plow until it is a straight line. The center of resistance of all plows is located at approximately the height shown in Figure 3.

Another method of checking is sometimes used. After laying out the land and traveling down the field for a ways, slip off of the seat of the plow, grab the front furrow wheel and notice the force needed to slide it along the ground. Then grab the rear furrow wheel and see if approximately the same force is needed to slide it. If so the vertical line of hitch is correct.

Tests have proved that four horses hitched tandem can do as much work as five horses hitched abreast and more than a four abreast outfit. In addition to this they work more quietly and keep cooler.

In cases where direct comparisons have been made on the same ground it has been found that the four tandem outfit plowed one acre more per day than the four abreast outfit. About twenty per cent of the energy of the four abreast outfit was consumed by side draft. The work done by the tandem outfit was of better quality than that done by the abreast outfit. The side draft was eliminated in the case of tandem hitching and the tendency, which the abreast outfit had, to raise up and carry part of the load on their necks was avoided. Therefore, the plow sucked into the ground in better shape.

In designing hitches of any sort there are three main points which should be kept in mind.

1. Eliminate as much side draft as possible.
2. Equalize the load so that no horse can either loaf or pull more than his share.
3. Do not crowd. Allow each horse as much room as possible.

Any farmer can make satisfactory eveners for almost any hitch he wants to use. Ordinary farm eveners are used for the lead team and the single trees and double trees may all be standard equipment. The different parts are connected by clevises and links found on any farm. A log chain or $\frac{1}{2}$ inch cable is used to extend to the lead team while a simple double lever evener or a pulley is used at the back. If a cable and pulley are available they may be used to good advantage. If not, the chain may be used with a double lever evener which is easy to make. The chain has an advantage in that its construction allows convenient places where the buck ropes may be snapped. The cable and pulley

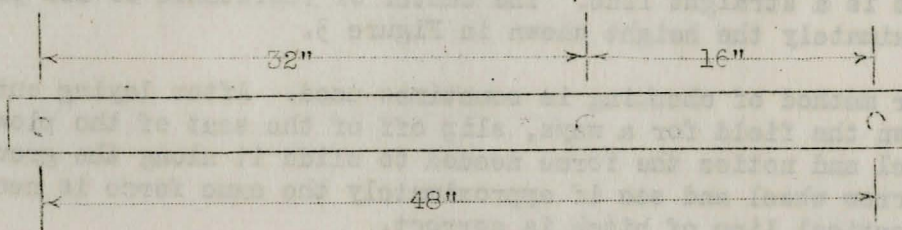
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method has an advantage of being self equalizing. If one team starts to shirk they do not get a lighter load as the pulley immediately transfers their share to them.

When constructing hitches always start with the evener used for the lead team and work back to the implement.

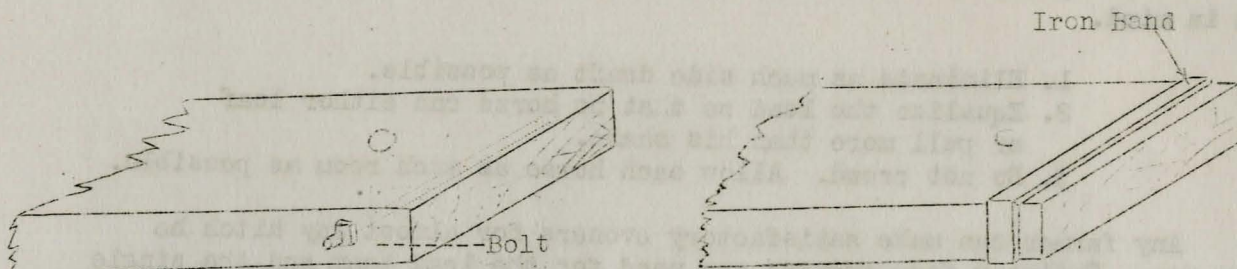
All measurements should be from the center of one hole to the center of another. A 48 inch evener means the measurement as shown in Figure 4. IT IS NOT THE OVERALL LENGTH OF THE PIECE. The piece itself usually extends two inches beyond the holes. Therefore, a 52 inch piece would be needed for a 48 inch evener.

FIGURE 4



Only hard wood should be used for eveners and this should be of good quality. This may be either 2" x 6" or 2" x 8" material although 2" x 8" is preferred. This is especially true if clear pieces are not available. The single tree holes should be at least two inches from the ends of the piece although some farmers prefer to leave three inches. In either case it is a good plan to reinforce the ends of the plank. Two methods for doing this are shown in Figure 5. Either way is satisfactory.

FIGURE 5



The holes for the single trees and the clevis should not be in a straight line or the piece is apt to be weakened. The two single tree holes should not be less than 1-1/2 inches from one edge and the clevis holes should be not less than 1 1/2 inches from the other edge. The arrangement is shown in

Figures 15, 16, 17 and 18 on Pages 11 and 12.

Clevises and connecting links should be of sufficient length to keep all horses of front and rear teams in line in their respective places. The chain or cable should be strong enough to hold up under heavy work and of sufficient length that the rear horses will not bump their knees on the lead eveners.

The following pages show a number of hitches of different sizes for various conditions. Two of these, for a wagon and one for a mower show three horses abreast. The rest of them are for tandem hitching and vary according to the number of horses used and the position in which they are placed.

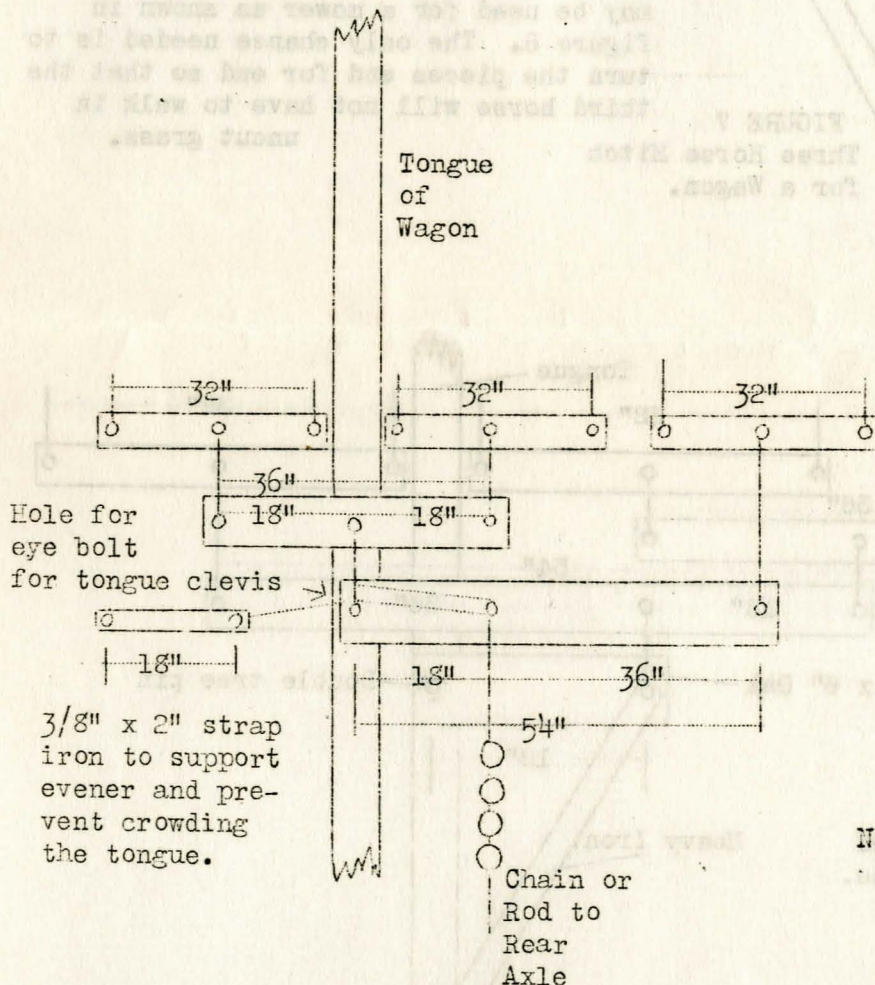


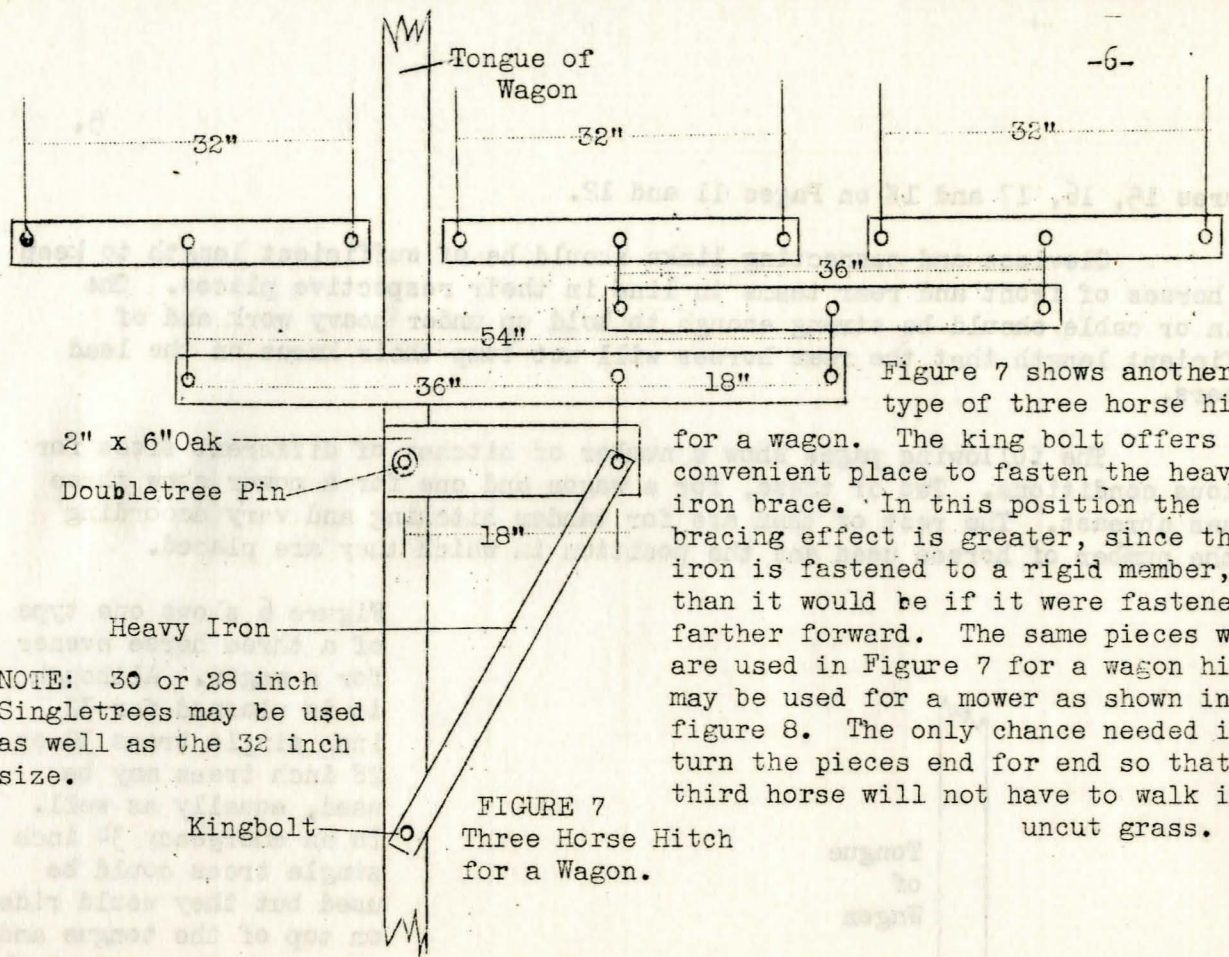
Figure 6 shows one type of a three horse evener for a wagon. Although it is planned for 32 inch single trees 30 or 28 inch trees may be used, equally as well. In an emergency 34 inch single trees could be used but they would ride on top of the tongue and this is rather undesirable. A chain extends from the 54 inch piece to the rear axle. This tends to counteract any side draft caused by the turning of the tongue.

NOTE: 30 or 28 inch single-trees may be used as well as the 32" size.

FIGURE 6

Three Horse Hitch for a Wagon

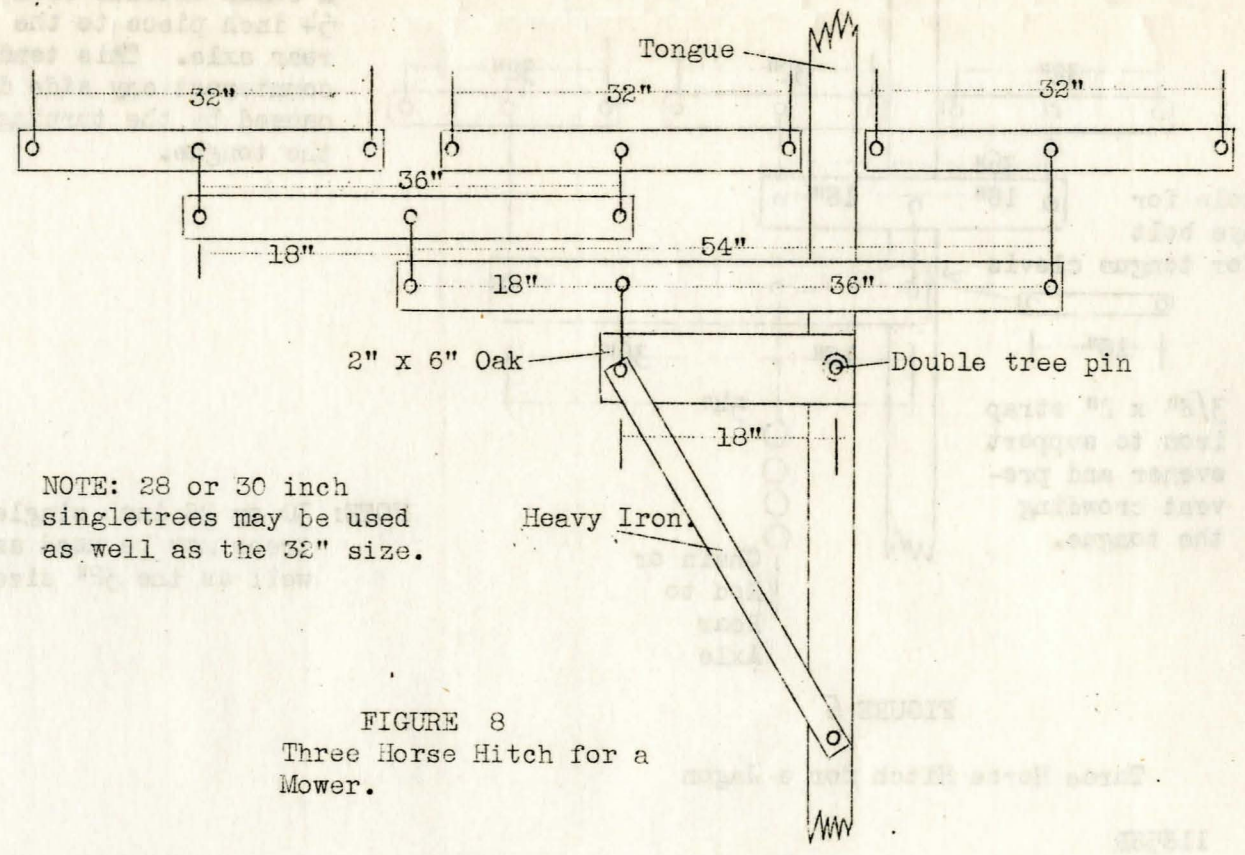
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2" x 6" Oak
 Doubletree Pin
 Heavy Iron
 NOTE: 30 or 28 inch Singletrees may be used as well as the 32 inch size.

FIGURE 7
 Three Horse Hitch for a Wagon.

Figure 7 shows another type of three horse hitch for a wagon. The king bolt offers a convenient place to fasten the heavy iron brace. In this position the bracing effect is greater, since the iron is fastened to a rigid member, than it would be if it were fastened farther forward. The same pieces which are used in Figure 7 for a wagon hitch may be used for a mower as shown in figure 8. The only change needed is to turn the pieces end for end so that the third horse will not have to walk in uncut grass.



NOTE: 28 or 30 inch singletrees may be used as well as the 32" size.

FIGURE 8
 Three Horse Hitch for a Mower.

Attention is called to the fact that in the hitches shown in figures 6,7,8 the 36 inch pieces and the 54 inch pieces are exactly the same. This allows their use in first one hitch and then the other.

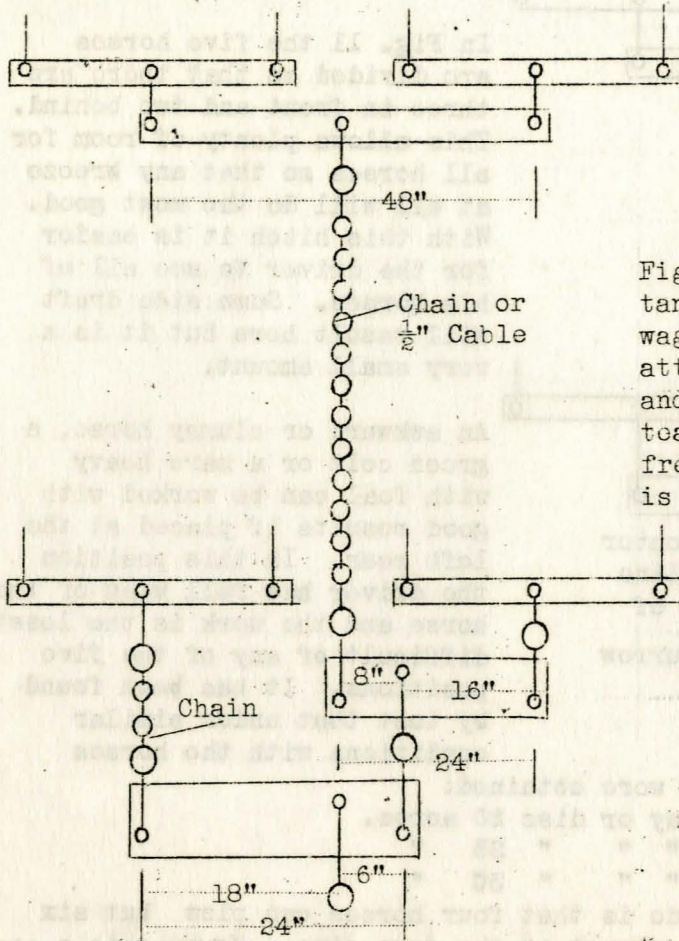


Figure 9 illustrates a four horse tandem hitch for a sulky or a heavy wagon load. A chain or cable attached to a 48 inch piece in front and a double lever evener for the rear team is used here. Plenty of room for freedom of movement and air circulation is available for both teams.

FIGURE 9

In figure 10 the use of a cable and pulley is shown. This method has an advantage over the one shown in figure 9 in that it equalizes the pull. Neither team can loaf as the pulley immediately adjusts the load in case one pair of horses slows down. Two precautions must be taken in the use of this arrangement. The end of the cable which comes from the lead team must come under the pulley, pass around it and out on top of the rear team. The pulley itself should be as close as possible to the rear team.

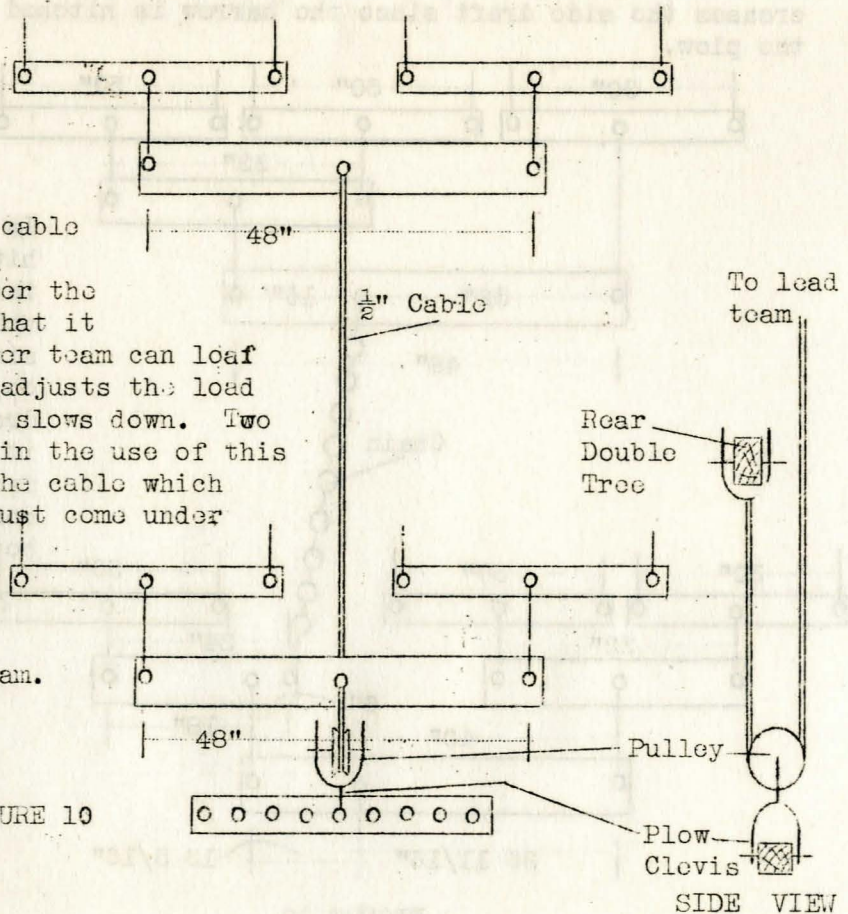
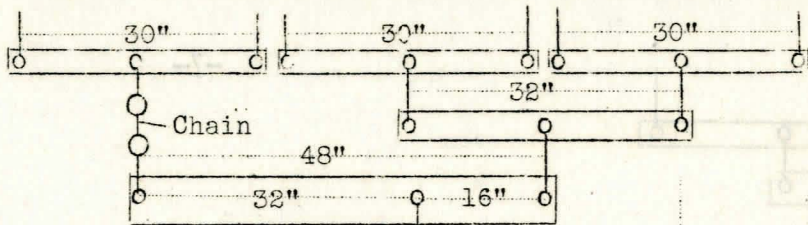


FIGURE 10



NOTE: 28" singletrees may be used in place of the 30" singletrees.

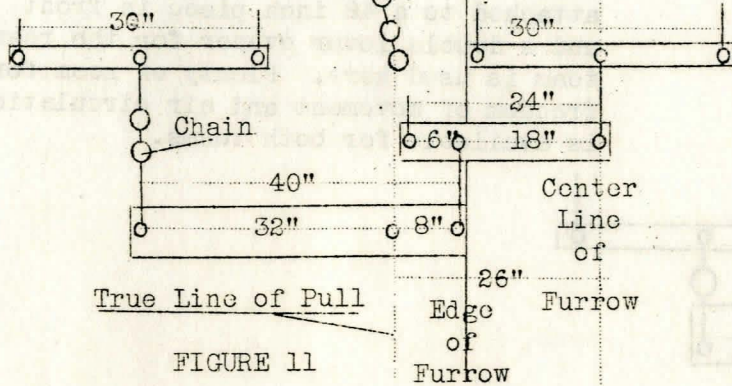


FIGURE 11

In Fig. 11 the five horses are divided so that there are three in front and two behind. This allows plenty of room for all horses so that any breeze at all will do the most good. With this hitch it is easier for the driver to see all of his horses. Some side draft will result here but it is a very small amount.

An awkward or clumsy horse, a green colt or a mare heavy with foal can be worked with good results if placed at the left rear. In this position the driver has full view of the horse and the work is the least difficult of any of the five positions. It has been found by test that under similar conditions with the horses

hitched tandem the following results were obtained:

4	horses	will	plow	4	acres	a	day	or	disc	20	acres.
5	"	"	"	5	"	"	"	"	"	25	"
6	"	"	"	6	"	"	"	"	"	30	"

Another comparison which has been made is that four horses can plow but six horses can plow and harrow the same amount in the same time. However this increases the side draft since the harrow is hitched to the rear and right of the plow.

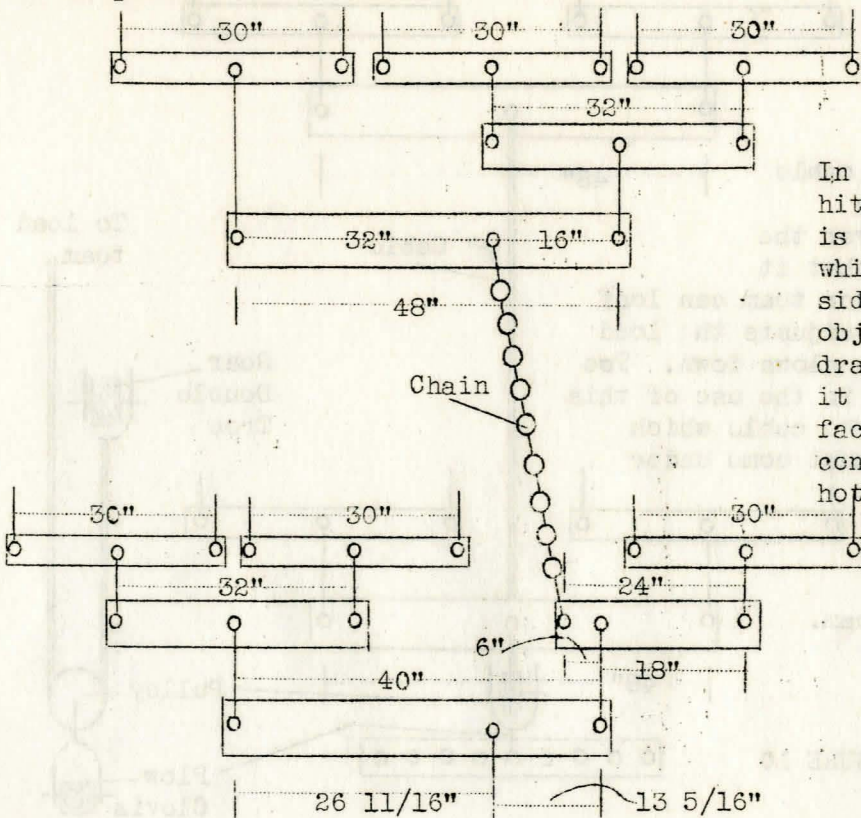
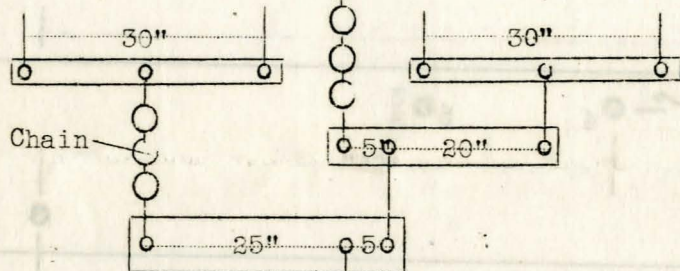
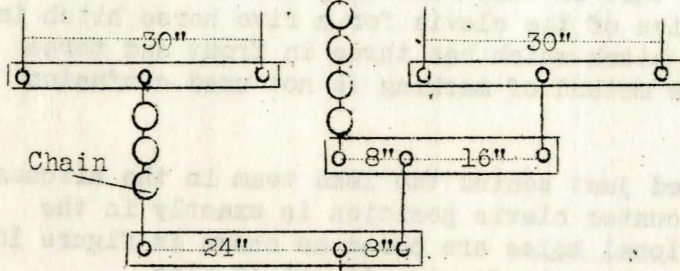
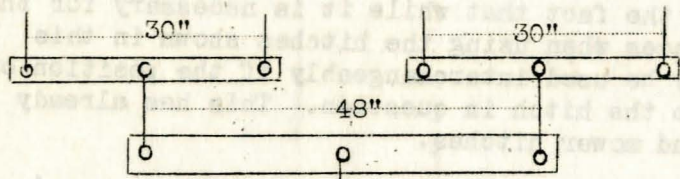


FIGURE 12

In figure 12 six horses are hitched tandem 3 and 3. This is a popular hitch and one which will accomplish considerable work. The two objections to it are the side draft which develops, although it is not very great, and the fact that in hot weather the center rear horse will become hot. There is little chance for air circulation and consequently it will be necessary to allow the horses to rest more often. This in turn lessens the amount of work done in a day.

FIGURE 13



In figure 13 the horses are hitched 2 and 2 and 2. This hitch has no side draft, all the horses have the same amount of freedom, trampling of feet and crowding at the turns is eliminated, and each horse receives as much breeze as possible.

An eight horse hitch as shown in figure 14 is a good arrangement for small disks hitched tandem or a large single disk. It also works satisfactorily on a three bottom gang plow. Combinations of implements such as a disk and a harrow can be used with ease when 8 horses are hitched 4 and 4. 40 acres can be disked in one day with 8 horses hitched tandem pulling two single disks spaced apart with a plank.

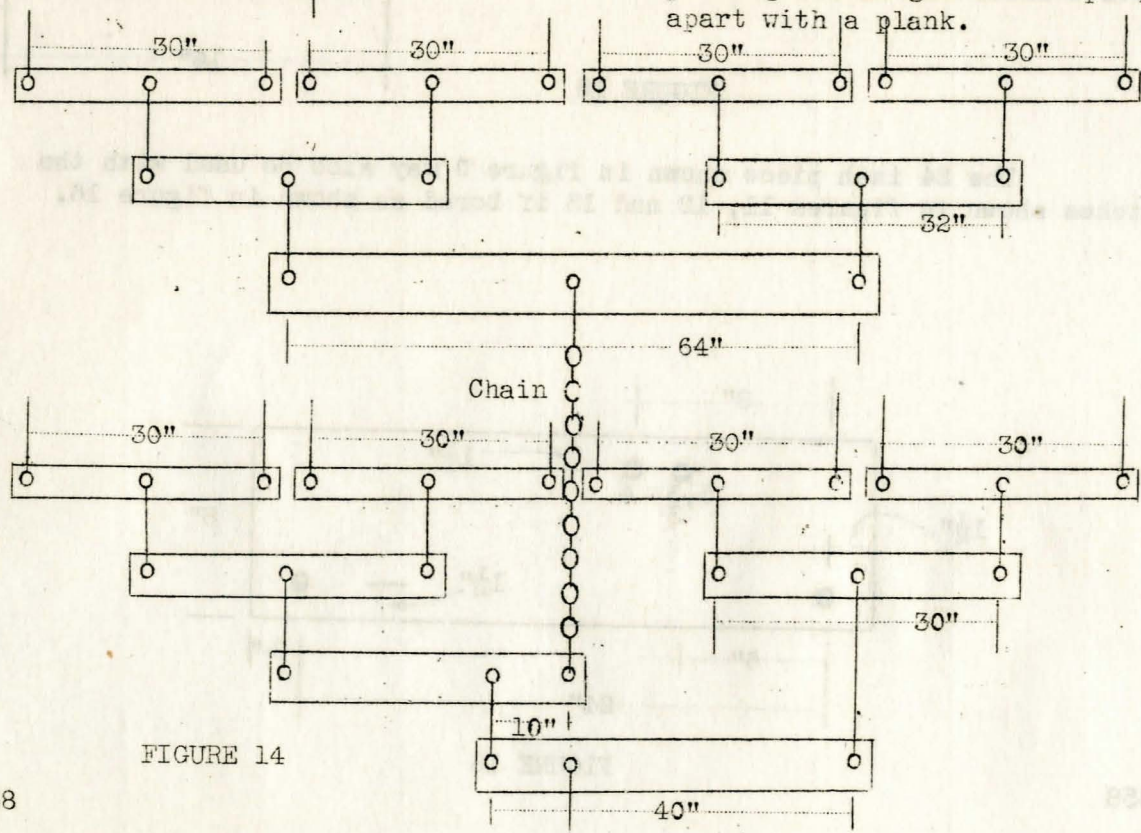
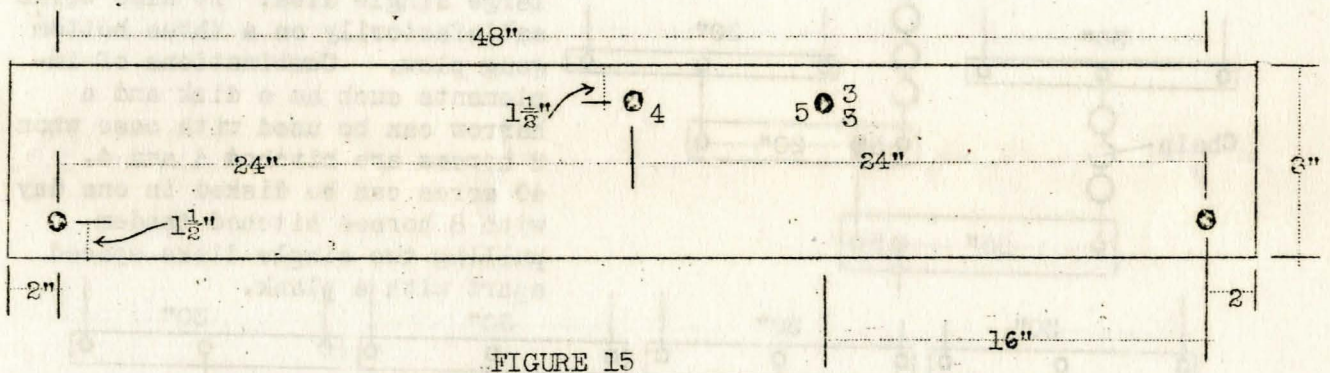


FIGURE 14

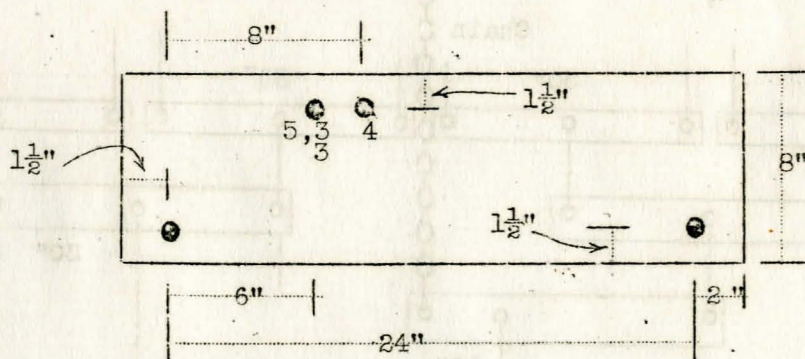
Attention is called to the fact that while it is necessary for the farmer to make or buy special pieces when using the hitches shown in this bulletin many of these pieces may be used interchangeably if the position of the clevis is varied according to the hitch in question. This has already been pointed out for the wagon and mower hitches.

In boring a piece so that it can be used for more than one hitch it would be well to mark each clevis hole so that one could tell at a glance to which hitch it belonged. A method of doing this is shown in figures 15, 16 and 17. The numbers represent the number of horses in the hitch and their relative positions in the case of the six horse hitches. For example, the clevis position for a 4 horse hitch is marked "4". Since all the hitches concerned are tandem it is plain that in this case they are hitched two in front and two behind. The position of the clevis for a five horse hitch is marked "5" but for the six horse hitch which has three in front and three behind the marking is $\frac{5}{3}$. If some method of marking is not used confusion may result.

A 48 inch evener is used just behind the lead team in the hitches shown in figures 9 and 10. The center clevis position is exactly in the middle in these cases. If additional holes are bored as shown in figure 15 the piece may be used for hitches shown in figures 11 and 12 also.



The 24 inch piece shown in figure 9 may also be used with the hitches shown in figures 11, 12 and 13 if bored as shown in figure 16.



The 40 inch piece used in figure 11 could also be used in figure 12 and 14 if bored as shown in figure 17.

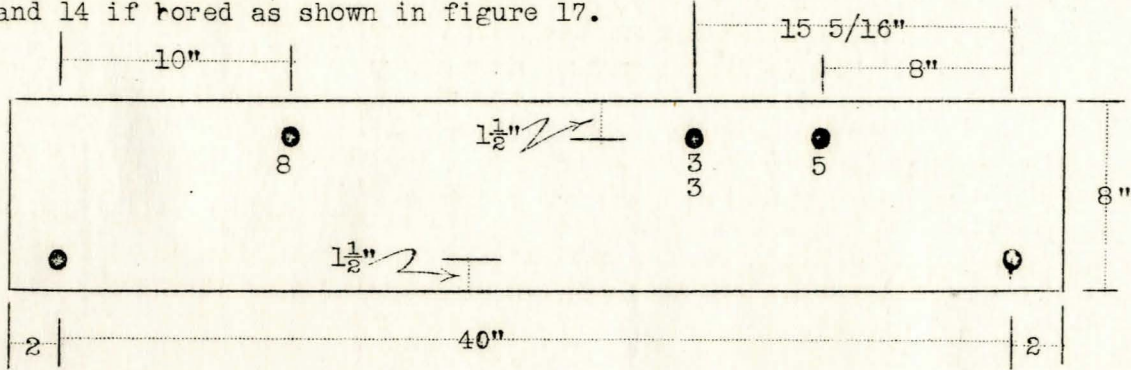


FIGURE 17

For good operation of tandem hitches it is best to use the tying in and bucking back system of lines. When using this system the operator drives with but two lines. The other horses are tied in and bucked back so that they must go forward at the same time and at no greater speed than the lead horses which are being driven. Additional information concerning this method will be furnished upon request.

The driver should be in a position to watch all of his horses at all times. With the larger hitches it may be necessary to use an elevated seat.

Tandem hitches eliminate side draft and thereby allow the horses to exert all of their energy on straight pulling, lessen the danger of trampling and crowding, keep the horses cooler in hot weather and cover more ground per day than is possible with an equal number of horses hitched abreast. The time required for hitching and unhitching is lessened considerably with the tandem system.

Occasionally it may seem a little awkward to drive horses hitched tandem but in the majority of cases farmers never go back to the abreast method after they have tried tandem hitches. A little practice soon enables the driver to show as much skill with tandem teams as he originally had with abreast teams.