May 18, 1937. J. H. COPE 2,080,461

EXTENSION HAY STACKER

Filed April 20, 1936 2 Sheets-Sheet 1

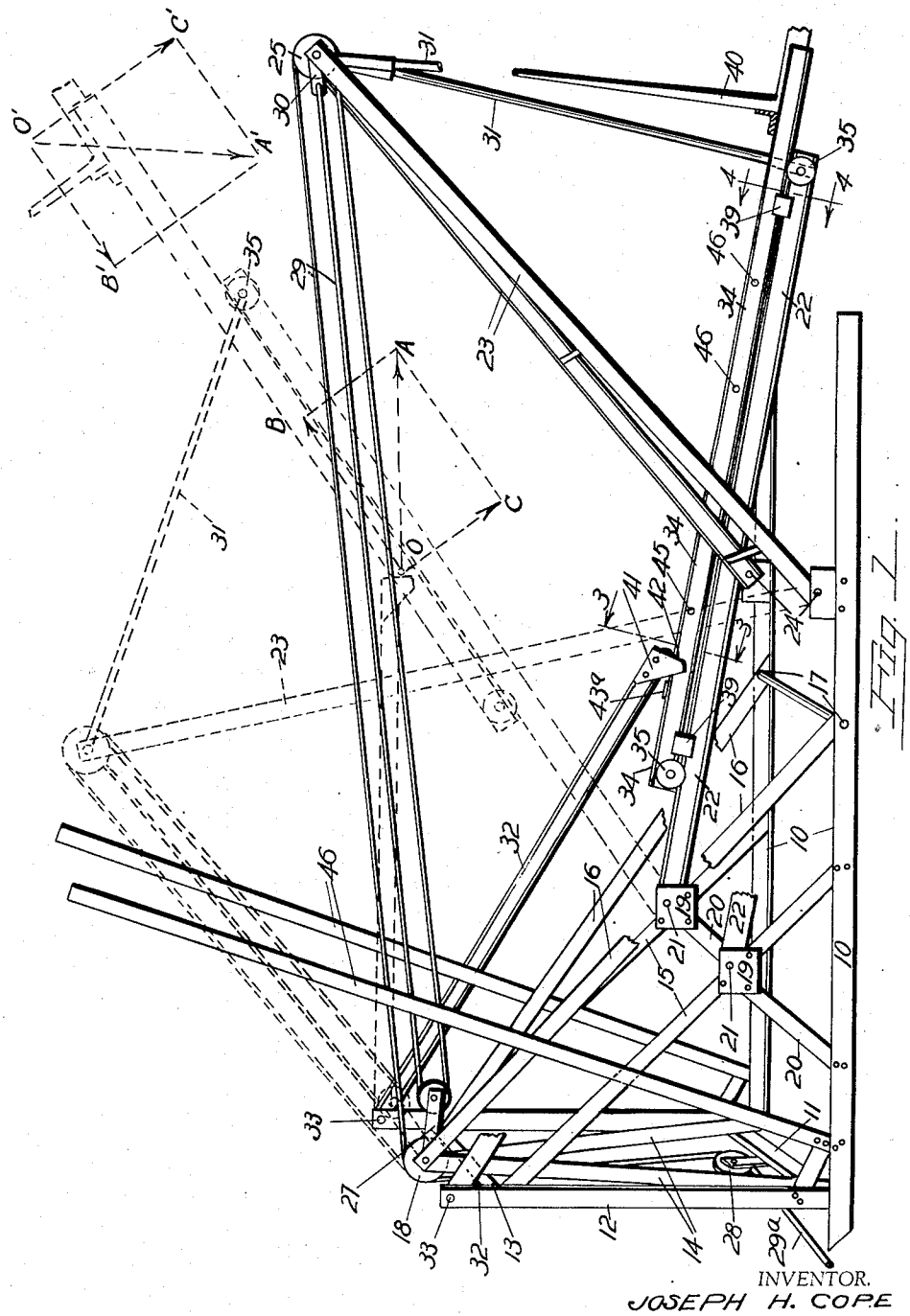


Fig. 1.

INVENTOR.
JOSEPH H. COPE

BY

ATTORNEY.

May 18, 1937. J. H. COPE 2,080,461

EXTENSION HAY STACKER

Filed April 20, 1936 2 Sheets-Sheet 2

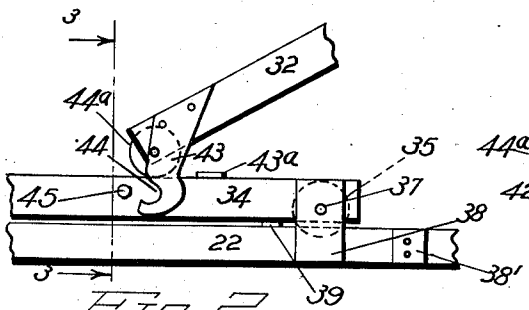


Fig. 2.

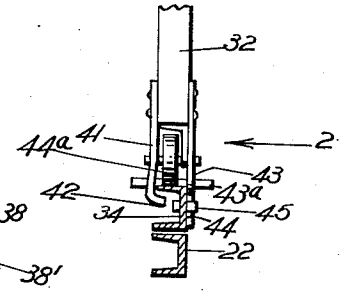


Fig. 3.

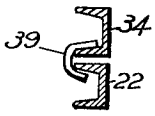


Fig. 4.

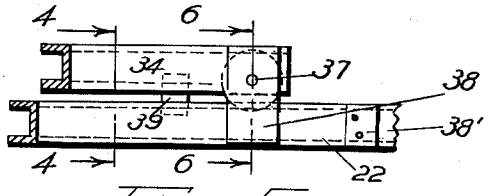


Fig. 5.

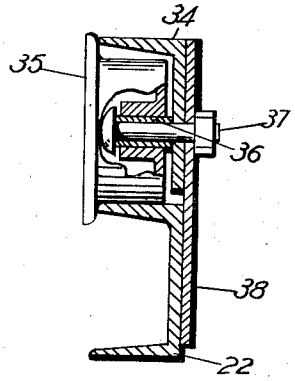


Fig. 6.

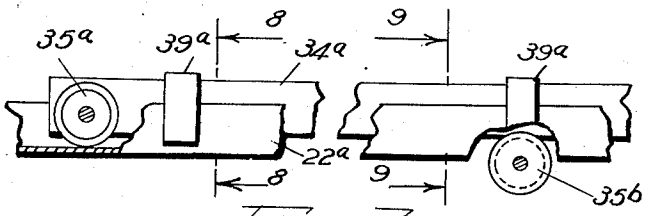


Fig. 7.

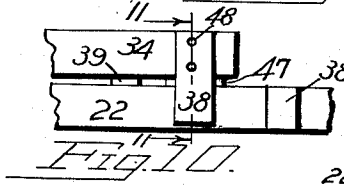


Fig. 10.



Fig. 9.

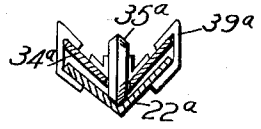


Fig. 8.

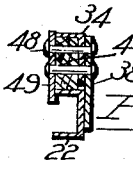


Fig. 11.

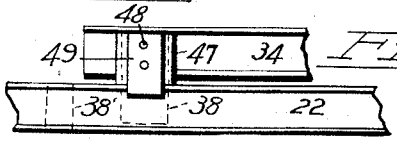


Fig. 12.

INVENTOR.
JOSEPH H. COPE
BY
ATTORNEY.

Patented May 18, 1937 2,080,461

UNITED STATES PATENT OFFICE

2,080,461

EXTENSION HAY STACKER

Joseph H. Cope, Denver, Colo.

Application April 20, 1936, Serial No. 75,369

10 Claims. (Cl. 214—141)

This invention relates to improvements in hay stackers and relates more particularly to hay stackers of the extension type.

In many parts of our country hay is raised in large quantities and stacked in the fields instead of being stored in sheds and barns. In many places the hay is elevated and deposited on the stacks by means of extension type hay stackers having a main frame, a lifting frame pivoted thereto, an extension frame carried by the lifting frame, means for simultaneously elevating the two frames by turning the lifting frame about its pivot, and means for moving the extension frame longitudinally on the lifting frame as the latter is turned about its pivots.

Stackers of the type referred to are of the general type shown in U. S. Letters Patent No. 1,774,052, granted to me August 26, 1930, and have hereto been manufactured from wood. When wood is employed for the lifting and the extension frame, the movable surfaces can be lubricated by means of a heavy grease and are then found to slide quite freely.

It has been found that stackers of the type referred to can be built of structural steel parts which resist deterioration, when exposed to the elements, more effectively than wood which soon becomes weather-beaten.

In changing from a wood to a steel construction, it has been found that the extension arm will not slide as freely on the lifting arm as when wood is employed, even when the movable surfaces are well lubricated.

It is the object of this invention to produce an extension stacker of structural steel in which anti-friction bearings are provided between the lifting and the extension frame so as to reduce the force necessary to produce relative movement.

I am aware that rollers, balls and similar means are commonly employed between relatively movable surfaces and are referred to by the broad term of anti-friction bearings.

In a stacker of the type referred to, a peculiar and unique arrangement and relationship of the parts and the applied forces exist, which make it necessary to apply the bearings in a manner quite different from any of which I am cognizant.

In the type of stacker to which this invention relates, the force for moving the extension frame is applied to the extension frame by a compression member in such a direction that it has two components, one of which tends to move the extension frame along the lifting frame and the other of which tends to force the extension frame towards the lifting frame, so that during the outward movement of the extension frame there is no tendency for it to pivot about the outer end of the lifting frame. This relationship of the forces requires a special arrangement of rollers which will be described herein.

In order to describe the invention so that it can be clearly understood, reference will now be had to the accompanying drawings in which an extension stacker, provided with the improvements that form the subject of this invention, has been illustrated and in which,

Figure 1 is a perspective view, with parts broken away, showing the improved construction; the relationship of the parts in partly elevated position has been indicated by broken lines.

Figure 2 is a side elevation of a portion of the stacker, looking in the direction of arrow 2 in Figure 3;

Figure 3 is a section taken on lines 3—3, Figures 1 and 2;

Figure 4 is a section taken on lines 4—4, Figures 1 and 5;

Figure 5 is a side elevation showing the inner end of the extension arm and a portion of the lifting arm;

Figure 6 is a section taken on lines 6—6, Figure 5;

Figure 7 is a side elevation, partly broken away, showing the lifting and extension arms constructed from angle iron;

Figure 8 is a section taken on lines 8—8, Figure 7;

Figure 9 is a section taken on lines 9—9, Figure 7;

Figure 10 is a view similar to that shown in Figure 5 and shows a slightly modified construction;

Figure 11 is a section taken on line 11—11, Figure 10; and

Figure 12 is a view looking towards the right in Figure 11.

The construction of the stacker follows quite closely that shown in my patent above identified and the old parts have therefore been shown in a more or less general way while the parts that relate more particularly to the present improvement have been shown with considerable particularity.

The main frame consists of side members 10 connected at one end by a transverse member 11. Corner posts 12 extend upwardly from the sides 10 and are connected near their tops by a transverse bar 13. Braces 14 serve to resist side-

wise movement of the corner posts. Inclined braces 15 extend from the corner posts to the sides 10 in the manner shown. Braces 16 extend from the upper ends of the braces 14 to the points 17 on the sides 10. A pulley 18 is pivoted between the upper ends of braces 14 and 16. At points near the lower ends of braces 15, plates 19 are secured and braces 20 extend downwardly and connect with the sides 10. Pivoted at points 21 are the two arms 22 of the lifting frame. The arm 22 nearest to the observer has been omitted so as to simplify the view and permit the position and construction of the anti-friction bearings to be more clearly shown. An A-frame, comprising the members 23, is pivoted to the sides 10 at points 24 and is provided at its top with a pulley 25. A pulley 26 is pivoted between the outer ends of links 27 and another pulley 28 is attached to the transverse bar 11. A suitable rope or cable 29 has one end attached to the A-frame by links 30 and passes around pulleys 26, 25, 18 and 28 in the manner shown. The movable end of the A-frame is connected with the movable end of the lifting frame arms 22 by links 31, and by applying a sufficient tension to the end 29*a* of the cable, the parts can be moved from full-line to dotted-line position.

Two pusher bars or links 32 are pivoted at 33 to the tops of the corner posts and their free ends rest on the upper surfaces of the arms 34 of the extension frame. The arms 22 of the lifting frame and the corresponding arms 34 of the extension frame have been illustrated as formed from channel irons arranged in superposed relation; this is illustrative only as other structural forms, such as angle irons, can be employed and the invention is not dependent on the specific structural form employed.

In the embodiment illustrated, a short section of the top flange of arm 22 has been cut away at the outer end thereof and a similar section of the lower flange of the inner end of arm 34. A flanged roller 35 is secured to the web of each of the arms 22 and 34 in the manner shown in Figure 6 from which it will be seen that the roller has a hub in which the tubular bearing sleeve 36 is rotatably mounted. The sleeve is slightly longer than the hub and a bolt 37 passes through the sleeve, through the web, and through the guide plate 38. Since the sleeve 36 is longer than the hub, the roller can rotate freely and the bearing sleeve can be rigidly secured in position. The guide plate 38 cooperates with the flange on the pulley to maintain arms 22 and 34 in superposed alignment.

To prevent the arms 22 and 34 from spreading apart, each is provided with a U-shaped clip 39. One clip is carried by the lifting arm near its outer end and the other by the extension arm near its inner end. These clips are preferably welded to their respective arms. The lifting arms carry a stacker head 40 on their outer ends.

The pusher arm or link 32 is provided on its inside with a guide plate 41 whose lower end is bent inwardly and projects underneath the flange of arm 34 as indicated by numeral 42 in Figure 3. On the outside of the links 32 is positioned a plate 43 (see Figures 2 and 3) that parallels the outside of arm 34 and has a notch 44 in its front edge which will move into engagement with the lug 45 in certain operative positions, to which reference will be made hereinafter. The upwardly inclined bars 46 are stops which serve to limit the counter-clockwise movement of the stacker head.

The arms 34 are provided with a plurality of openings 46, spaced along its length, so that the lugs 45 can be variously positioned. For the purpose of this explanation, the lug 45 will be considered as located in the hole nearest the inner end of the arm 34.

Referring now more particularly to Figure 1, let us consider that the parts are in the position shown in full lines and that a load of hay is on the stacker head. A horse or a tractor is hitched to the end 29*a* of the cable. When the cable is tensioned sufficiently, the A-frame will begin to turn counter-clockwise and links 31 will impart a corresponding movement to the lifting frame. As the lifting and extension frames move upwardly, the ends of links 32 slide along the upper flanges of arms 34 until the plates 43 engage the lugs 45 whereupon, on further rotation, links 32 begin to extend the extension frame, which extension continues until the stacker head reaches a position in which the hay slides off it and onto the stack.

The force exerted by the arm 32 has been indicated in direction and intensity by line OA in Figure 1; its component, in the direction of the length of arm 34 has been designated by OB while the component perpendicular to the direction of arm 34 has been indicated by the line OC. The weight of the stacker head and load can be considered as concentrated at O' in which case the line O'A' represents its weight while O'B' represents the component that opposes the force required to overcome friction. Line O'C' represents the force of the load that opposes the force CC and tends to rock the arm 34 about the roller 35 on the outer end of the lifting arm. The angles and dimensions of the parts have been so calculated and proportioned that the moment of the force O'C' is at all times substantially equal to the moment of the force OC, the latter being preferably slightly larger. When the moments of these two forces are equal the weight of the extension arm and load is supported on the roller or bearing near the end of the lifting arm, the force OA is always proportional to the load so that the balance pointed out is constantly present. If a temporary overbalanced condition should occur, it will be resisted by the clips 39.

In Figures 7, 8 and 9 the lifting and extension arms have been shown as formed from angle iron instead of channel bars. The lifting arm has been designated by reference character 22*a* while the extension arm has been designated by 34*a*; clips 39*a* correspond to clips 39 in Figures 1 and 4. The roller 35*a* is rotatably attached to the inner end of arm 34*a* and roller 35*b* corresponds to the roller 35 carried by arm 22. The peripheral surface of roller 35*a* is transversely convex and that of roller 35*b* is transversely concave.

The lifting arms 22 have secured thereto, as by welding, plates 38' which serve as stops to be engaged by plates 38 so as to limit inward movement of the extension arm.

Referring again to Figures 2 and 3, attention is called to the roller 44*a* which is positioned at the lower end of each link 32 and supports it on the upper surface of the extension arm 34. The rollers 44*a* permit the pusher arms or extension links 32 to move freely along the extension arms during the times that the extension frame is not being extended, as when the stack is still too low to require this.

Transverse bars 43*a* are welded to the extension arms and are engaged by plates 41 and 43

to retract the extension arm when the stacker frame is lowered.

Anti-friction rollers **35**, **35***a* and **35***b* are considered the preferred type of bearings but it is also possible and quite satisfactory to replace such rollers by blocks of hard wood such as maple because such blocks function in a satisfactory manner in combination with a movable metal surface.

In Figures 10, 11 and 12 a construction has been illustrated in which maple blocks **47** have been substituted for the rollers **35**. The blocks are fastened to the web of the channels by bolts or rivets **48** which also hold the two guide plates **38** and **49** in position. Plate **49** replaces the flanges of the rollers and serves to guide the extension frame and prevent lateral displacement of the arms. Similar blocks can be used to replace the rollers **35***a* and **35***b* shown in Figures 7, 8 and 9 as well as roller **44***a* on the end of the extension link **32**.

It will be seen from the above that, due to the fact that the force for extending the stacker head is applied by the link **32** it is possible to obtain a substantial balance on the bearings that cooperate with adjacent surfaces of the lifting and extension arms.

Having described the invention, what is claimed as new is:

1. In an extension stacker having a main frame, a lifting arm pivoted thereto, an extension arm slidably supported by the lifting arm, means for elevating the lifting arm by turning it about its pivot, and means for exerting a downwardly and outwardly inclined force on the extension arm for extending it, said means comprising a compression link having one end pivoted to the main frame above the lifting arm pivot, and the other connected with the extension arm, and a bearing on the lifting arm, adjacent its outer end, forming means for supporting the extension arm, the angular relation of the parts and their proportions being so related that the extension arm will be substantially balanced on the bearing during its extension, whereby the frictional resistance to movement of the extension arm will be concentrated at the bearing.

2. A device in accordance with claim 1 in which the bearing has a flange lapping the extension arm, and in which a guide bar is provided for lapping the opposite side of the extension arm.

3. In an extension stacker having a main frame, a lifting arm pivoted thereto, an extension arm supported by the lifting arm, for relative longitudinal movement, means for moving the lifting arm about its pivot, and means for moving the extension arm longitudinally relative to the lifting arm, spaced anti-friction bearings forming a supporting connection between the arms, comprising flanged rollers, the flanges of the rollers carried by one arm lapping the other arm, and means cooperating with the flanges on the rollers, spaced from the latter, for engaging the other arm, to keep the arms in lateral alignment.

4. In an extension stacker having a main frame, a lifting arm pivoted thereto, an extension arm supported by the lifting arm, for relative longitudinal movement, means for moving the lifting arm about its pivot, and means for moving the extension arm relative to the lifting arm, anti-friction bearings on the arms, forming a supporting connection between the arms, comprising flanged rollers, the flanges of the rollers carried by one arm lapping the other arm, means cooperating with the flanges on the rollers, spaced from the latter, for engaging the other arm, to keep the arms in lateral alignment, and means for resisting vertical separation of the arms.

5. In a machine of the type described, in combination, a lifting arm, an extension arm carried thereby, a bearing carried by the lifting arm, for engaging a surface of the extension arm, and a bearing carried by the extension arm for engaging a surface of the lifting arm, the bearings having flanges that form guides, means for raising the lifting arm, means operated thereby for applying an inclined force to the extension arm at a point between the bearings, one component being outwardly directed and parallel with the lifting arm and the other perpendicular thereto and downwardly directed each arm having a guide plate that slidably engages the other arm and cooperates with the flange on the bearing to maintain the arms in superposed alignment, and each arm having a means that engages the other arm and serves to resist vertical separation of the arms.

6. An extension stacker comprising a main frame, a lifting frame comprising two parallel channel iron arms pivoted at one end to the main frame, an extension frame carried by the lifting frame and longitudinally movable thereon, the extension frame comprising two parallel channel irons spaced to lie in superposed relation on the corresponding channel iron arms of the lifting frame, a roller pivotally connected with the web of each channel iron arm, adjacent the overlapping end thereof, the periphery of each roller projecting beyond the outside of each flange to provide a clearance between adjacent surfaces of cooperating arms, a guide bar connected with the outside of each arm and overlapping the corresponding cooperating arm, the rollers having flanges lapping the arm supported thereby, and means secured to each arm, adjacent the roller, embracing the cooperating arm to resist vertical separation of the arms.

7. In an extension stacker, a pivoted lifting arm of channel iron, an extension arm also of channel iron, supported thereby for longitudinal movement, a pusher bar having one end resting on the upper surface of the extension arm, a guide plate secured to the pusher bar and projecting downwardly along the web of the extension arm, another guide plate carried by the pusher bar for engagement with the edge of the upper flange of the lifting arm, the last named guide plate having its end turned inwardly to engage the under surface of the flange.

8. In a device of the class described, a lifting arm of structural steel, an extension arm supported thereby, the two arms being arranged in superposed relation with their flanges in parallel relation, rollers carried by each arm for engaging the adjacent flange of the other arm, the rollers having guide means, guide bars carried by each arm for engaging the web of the other arm, each arm having a clip that embraces the adjacent flange of the other arm to limit vertical separation, and means for effecting relative longitudinal movement of the arms.

9. In an extension stacker a pivoted lifting arm of structural iron, an extension arm of a similar structural shape, supported thereby for longitudinal movement, a pusher bar having one end resting on a surface of the extension arm, a guide plate secured to the pusher bar and projecting downwardly along a side of the extension arm, and another guide plate carried by the

pusher bar for engagement with an under surface of one arm to secure the pusher bar against upward movement relative to the extension arm.

10. In an extension stacker a pivoted lifting arm of structural iron, an extension arm of a similar structural shape, supported thereby for longitudinal movement, a pusher bar having one end resting on a surface of the extension arm, a guide plate secured to the pusher bar and projecting downwardly along a side of the extension arm, another guide plate carried by the pusher bar for engagement with an under surface of one arm to secure the pusher bar against upward movement relative to the extension arm, and means for holding the lifting arm and the extension arm in parallel relation while permitting relative longitudinal movement.

JOSEPH H. COPE.