Sept. 24, 1940. H. N. EKBOM ET AL 2,216,070

DIPPER STICK FOR POWER SHOVELS OR THE LIKE

Filed Sept. 13, 1939 2 Sheets-Sheet 1

Fig. 1.

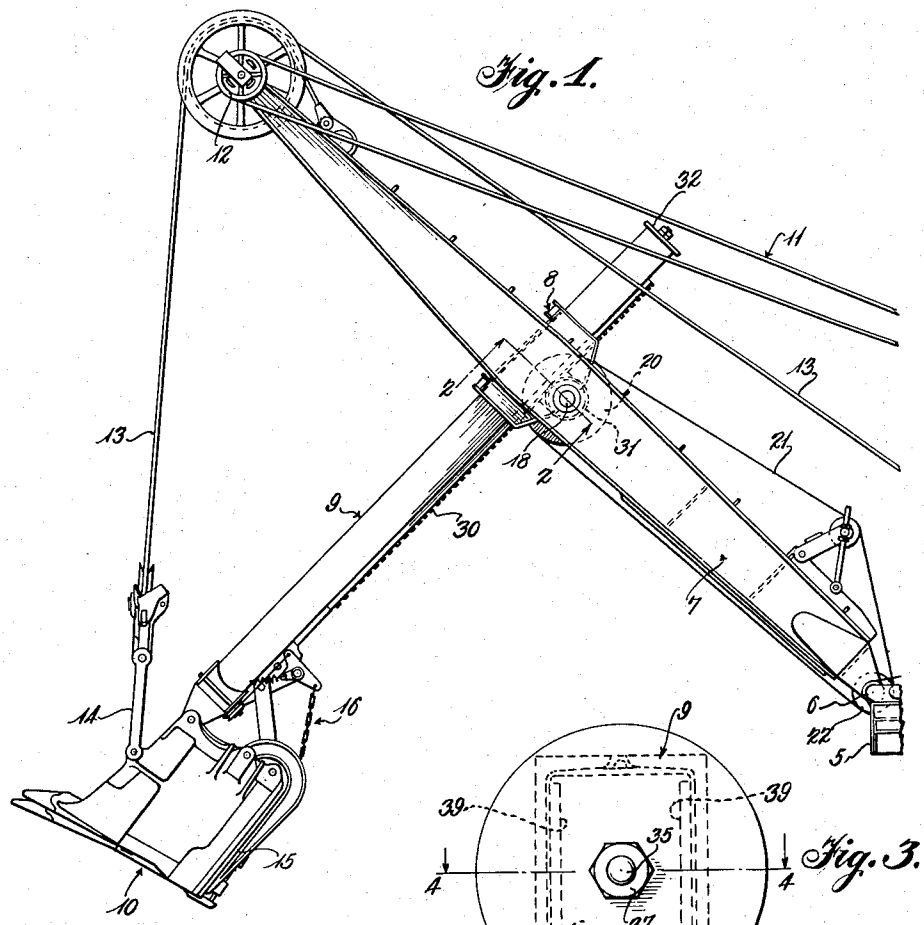
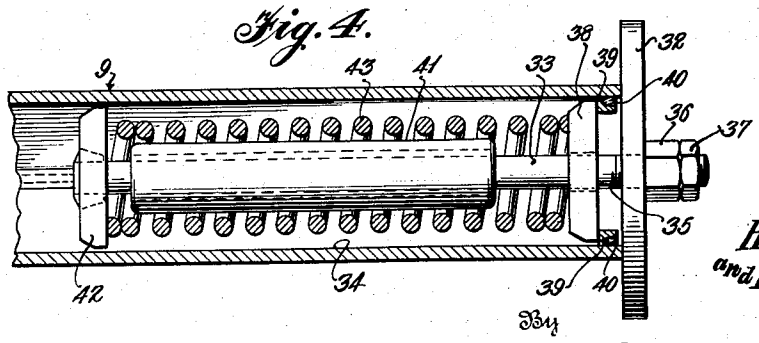


Fig. 3.

Fig. 4.



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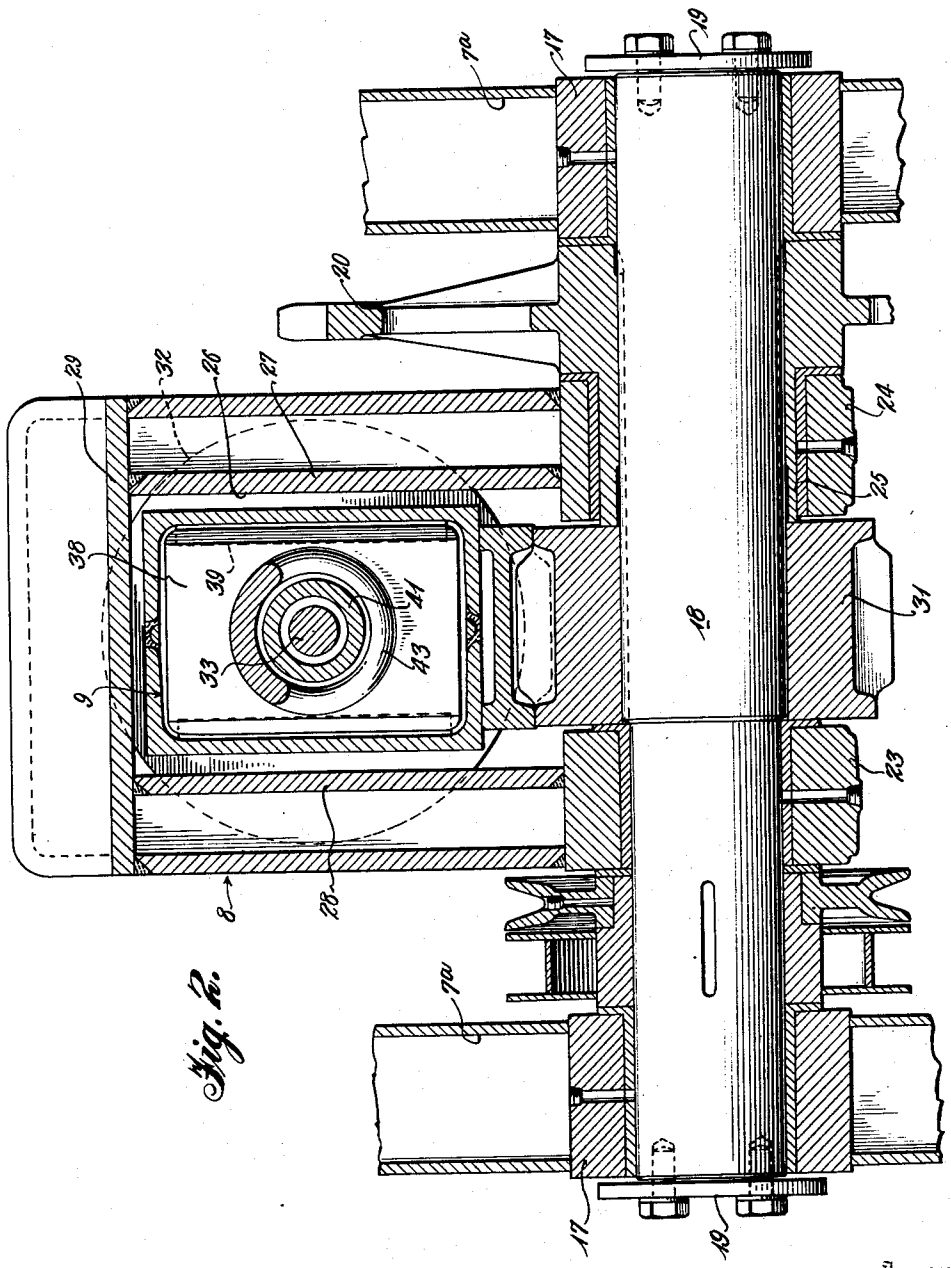


Fig. 2.

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Patented Sept. 24, 1940 2,216,070

UNITED STATES PATENT OFFICE

2,216,070

DIPPER STICK FOR POWER SHOVELS OR THE LIKE

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Application September 13, 1939, Serial No. 294,746

14 Claims. (Cl. 214—145)

This invention relates to new and useful improvements in dipper sticks for power shovels, or the like, and deals more particularly with means for limiting the outward or lowering movement of the dipper stick relative to its supporting boom.

Power shovels, of the type which includes an upper base which is rotatably supported on a lower frame or chassis, a boom pivoted to the upper base for vertical raising and lowering movement, a dipper stick connected to the boom for swinging and raising and lowering movements, and an excavating dipper or bucket, having its bottom formed by a hinged door, carried by the outer or lower end of the dipper stick, are primarily employed for digging ditches, pits, or other types of excavations and discharging the removed material onto an adjacent pile or truck. Many of the desired movements of the excavating dipper or bucket are obtained by moving the dipper stick outwardly of its boom and the extent of outward movement of the dipper stick, which, of course, depends on the length of the stick, plus the permissible angle of the boom, determine the operating area of the shovel for any given position of the same.

The dipper stick is moved in and out by means of a rack attached to the stick and a reversibly driven pinion mounted on the boom, or by other appropriate means. To prevent the dipper stick from being unintentionally run entirely out of the saddle block, which swingably mounts and guides the dipper stick on the boom and holds the dipper stick rack teeth in proper mesh with the teeth of the reversibly driven pinion, it is necessary to provide a stop on the upper or inner end of the dipper stick which will engage some part of the operating or supporting mechanism of the dipper stick and positively prevent further outward movement of the latter.

It is the present practice to employ a rigid stop or abutment which is positioned at the upper or inner end of the rack on the dipper stick and which engages the reversible pinion when the dipper stick has reached the limit of its permissible outward movement. Such a rigid stop is only intended to be used as a safety device and is not supposed to be intentionally employed by the operator of the shovel, in the normal operation of the dipper stick, as a means for stopping the outward movement of the stick.

However, because of carelessness, lack of proper attention, or thoughtless attempts on the part of the operator to reach a point beyond the permissible operating range of his shovel, the dipper stick occasionally will be moved too far or the stick and bucket will be allowed to drop with the result that the rigid stop will engage the pinion with considerable force and will instantly stop outward movement of the dipper stick. The shocks developed by such engagement cause damage to the pinion, the shipper shaft which supports the pinion, the saddle block, and other associated parts of the assembly.

It is the primary object of this invention to provide a stop or buffer for the upper or inner end portion of the dipper stick which will not deliver damaging shocks or blows to the supporting and/or operating mechanism of the stick when the stop or buffer is called upon to perform its intended function.

A further object of the invention is to provide a stop or buffer for a dipper stick which will absorb shocks, resulting from engagement of the same with a rigid part of the dipper stick supporting or operating mechanism, and thereby avoid possible damage to any associated parts of the shovel.

Another object of the invention is to provide a shock absorbing stop or buffer for dipper sticks which may be applied just as readily to existing as to new equipment.

Still another object of the invention is to provide means for limiting the extent of outward or lowering movement of a dipper stick relative to its supporting boom which will not instantly stop such movement of the dipper stick but will yieldably check its outward movement.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevational view of the boom, dipper stick, and excavating dipper or bucket of a power shovel with the manipulating cables, and the like, for these elements,

Figure 2 is a detail sectional view taken on line 2—2 of Fig. 1,

Figure 3 is an end elevational view of the upper or inner end of the dipper stick with the improved stop or buffer embodying this invention properly associated therewith, and

Figure 4 is a detail, longitudinal sectional view of the dipper stick and its associated buffer or stop, taken on line 4—4 of Fig. 3.

In the drawings, wherein for the purpose of illustration is shown the preferred embodiment of this invention, and particularly referring to Fig. 1, the reference character 5 designates the upper,

rotatable base of a power shovel, or the like, which, although not shown, is carried by a lower, traveling frame or chassis and which carries the necessary prime mover, cable operating drums, controls, and the like, by means of which the boom, the dipper stick, etc., are manipulated.

Pivoted at 6 to the rotatable upper frame 5 is a boom 7. A saddle block 8 is employed for mounting a dipper stick 9 on the boom 7 for conventional inward and outward movement and raising and lowering movement. Although Figs. 1 and 2 illustrate the boom and dipper stick to be of the type where the dipper stick passes between spaced members of the boom, it is to be understood that this invention is just as readily applicable to boom and dipper stick assemblies where the dipper stick straddles the supporting boom. An excavating dipper or bucket 10 is illustrated as being connected to the outer or lower end of the dipper stick 9 for movement with the stick.

The desired raising and lowering movements of the pivotally mounted boom 7 are obtained by means of the boom hoist cable 11 which passes over the sheave 12, carried at the outer end of the boom, and which has one end suitably anchored to an A-frame, or the like, carried by the upper rotatable base 5 and has the other end portion wrapped around a boom hoist drum. The end portions of the boom hoist cable 11 with their associated anchorage and hoist drum are not illustrated as these elements are of conventional form.

The excavating dipper or bucket 10, with its manipulating dipper stick 9, may be swung about an axis which intersects the boom 7, by means of a bucket hoisting and lowering line or cable 13 which is reeved through or attached at one end to the dipper or dipper bail 14 and has its other end portion properly wrapped around a bucket hoisting drum, not shown, which is conventionally mounted on the upper rotatable frame 5.

The bottom of the excavating bucket or dipper 10 is closed by a dipper door 15 which is allowed to open and close as a result of proper manipulation of the door trip mechanism, designated in its entirety by the reference character 16. This door trip mechanism may be operated either automatically or in response to manipulations of a suitable control by the shovel operator.

By specifically referring to Figs. 1 and 2, it will be seen that the spaced boom side members 7a carry suitable bearing blocks 17 in which are journaled the opposite end portions of a shipper shaft 18. This shipper shaft is retained against undesired axial movements relative to the boom members 7a by means of the demountable end plates 19.

Suitably keyed to the shipper shaft 18 is a sprocket wheel 20. This sprocket wheel is employed for rotating the shipper shaft in opposite directions. A proper drive of the sprocket 20 is obtained by means of the sprocket chain 21 which is additionally trained over a sprocket 22 of driving means which is reversibly driven from the power source through chains, sprockets, gears, clutches, etc., or other suitable means, and which will function to reversibly drive the shipper shaft 18. It is to be understood that this type of drive for a shipper shaft is merely conventional and other approved types of drives readily may be substituted for the same.

Further referring to Figs. 1 and 2, it will be noted that the saddle block 8 is interposed between the spaced side members 7a and is journaled by means of the bearing portions 23 and 24, respectively, on the shipper shaft 18 and on the hub extension 25 of the sprocket wheel 20. These saddle block bearing members 23 and 24 are not keyed to the shipper shaft 18 or to the sprocket wheel hub extension 25 and for that reason the saddle block is free to partake of pivotal or angular movement relative to the shipper shaft and the sprocket wheel. The saddle block may vary considerably insofar as structural details are concerned. However, as its principal function is to guide the dipper stick 9 and to hold the said stick in driving relation with respect to the shipper shaft 18, the saddle block is formed with a guideway 26 which is defined by the spaced sides 27 and 28 and the top 29. The sides 27 and 28 carry the aforementioned bearing members 24 and 23, respectively.

Inward and outward movement of the dipper stick 9 is obtained by means of a rack 30, carried by the dipper stick, and a pinion 31 which is keyed to the shipper shaft 18. The saddle block 8 maintains the teeth of the rack 30 properly meshing with the teeth of the pinion 31. It will be appreciated that by rotating the shipper shaft 18 in opposite directions the dipper stick 9 may be moved inwardly and outwardly through the saddle block 8 and relative to the boom 7.

As has been pointed out above, many normal manipulations of the excavating bucket or dipper 10 result from outward or downward movement of the dipper stick 9 relative to the boom 7 and the saddle block 8. Such downward or outward movements of the dipper stick are accomplished by rotating the shipper shaft 18 and its pinion 31 in a counter-clockwise direction, as viewed in Fig. 1. Outward or downward movement of the dipper stick must be stopped at a desired point relative to the length of the dipper stick, or the said stick will be moved entirely out of the saddle block 8. It has been the practice to employ a rigid abutment or stop to limit this outward or downward movement of the dipper stick. This conventional, rigid stop has been located at the upper end of the rack bar carried by the dipper stick. Due to this positioning of the rigid stop, it performs its intended function when it engages the pinion carried by the shipper shaft. It is not difficult to visualize the damage which will result from the forceful engagement of such a rigid stop with the pinion on the shipper shaft. Yet this type of stop has been used by all power shovels, and the like, for a considerable number of years.

The improved form of stop or buffer embodying this invention is clearly illustrated with reference to its location in Figs. 1 and 2 and is disclosed in detail in Figs. 3 and 4.

First referring to Fig. 1, it will be seen that a plate 32 is arranged to overlie the upper or inner end of the dipper stick 9. As is clearly illustrated in Fig. 2, this plate 32 is of circular form in plan and is of proper size to span the guideway 26 of the saddle block and to overlap the upper end surfaces of the sides 27 and 28 and the top 29 of the saddle block. When the dipper stick 9 is moved downwardly or outwardly substantially to its permissible limit, the plate 32 will flatly engage the upper surfaces of the sides and top of the saddle block. This stop plate 32, therefore, engages the saddle block rather than the pinion driven by the shipper shaft 18.

Referring now specifically to Figs. 3 and 4, it

will be seen that the stop plate 32 has a rod 33 extending therethrough and into the hollow end portion 34 of the dipper stick 9. This rod is adjustably connected to the stop plate 32 by means of the threads 35 and the nut 36. A lock nut 37 is employed for preventing unintentional adjustment of the holding nut 36. The portion of the rod 33 which extends into the hollow end portion 34 of the dipper stick passes through an aperture formed in a block 38 which bears against shoulders or bars 39 that are welded, or otherwise secured, as at 40 to opposite sides of the dipper stick. This block 38 acts as a guide for inward and outward movement of the rod 33 relative to the open end of the dipper stick 9.

The portion of the rod 33 which projects inwardly of the guide block 38 has loosely mounted thereon a sleeve 41. Beyond the sleeve, the end of the rod 33 has secured thereto an abutment block 42. Between this abutment block 42 and the guide block 38, the rod 33 has threaded on the same the compression spring 33 which loosely surrounds or encircles the sleeve 41. This sleeve, therefore, acts as a support for the convolutions of the spring 43 to maintain these convolutions substantially in alignment when the spring is compressed. In other words, the sleeve 41 prevents excessive buckling of the spring 43 when the latter is compressed.

Returning again to Fig. 1, it will be appreciated from the structure disclosed in Figs. 3 and 4 that when the stop plate 32 engages the upper faces of the sides and top of the saddle block the rod 33 will be moved outwardly of the upper or inner end of the dipper stick 9 if the said stick is moved to a further extent downwardly or outwardly relative to the saddle block. This outward movement of the rod 33 will cause the spring 43 to be compressed between the guide block 38, at one end of the spring, and the abutment block 42, at the other end of the spring, which moves outwardly with the rod 33. The load of this spring 43, therefore, will act to retard outward movement of the dipper stick relative to the saddle block. It will be appreciated, however, that the engagement of the stop plate 32 with the saddle block 8 will not positively, instantly stop outward movement of the dipper stick. The dipper stick will be permitted to continue its outward movement until the various convolutions of the spring 43 have all been placed in contact with each other or until the sleeve 41 engages both the guide block 38 and the abutment block 42. This permissible continued movement affords ample time for the operator to bring the dipper stick to a stop through his control of the same by means of the power mechanism which is employed for driving the shipper shaft 18. It readily will be seen, therefore, that this yieldable or resilient connection between the stop plate 32 and the upper or inner end of the dipper stick will not result in bringing the dipper stick to a sudden stop, which must necessarily result in damage to associated parts of the shovel, and will absorb and dampen all shocks which result from a forceful engagement of the stop plate 32 with the saddle block 8.

As has been pointed out above, although Figs. 1 and 2 illustrate a boom and dipper stick assembly of the type where the dipper stick lies between the spaced side members of the boom, it readily will be appreciated that the shock absorbing stop or buffer mechanism disclosed and described herein may be just as readily applied to either one or both of the spaced side members of a dipper stick of the type which straddles its boom. It further will be appreciated that a mere reversal of the arrangement disclosed in the several figures of the drawings would be to substitute for the rigid stop afforded by the saddle block 8 a laterally projecting plate rigidly connected to the upper or inner end of the dipper stick and substitute for the resiliently yieldable stop plate 32 a yieldable stop plate, or stop plates, on the upper face of the saddle block with either tension or compression springs housed within the hollow sides 27 and 28 of the saddle block and functioning to resist movement of the yieldable plate or plates toward the upper face of the saddle block.

It is to be understood that the form of this invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to, or the invention may be applied to an assembly of boom and dipper stick differing from the construction herewith portrayed, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, we claim:

1. In a power shovel, or the like, a boom, a dipper stick, a saddle block for guiding the dipper stick carried by the boom, shock absorbing means enclosed within the dipper stick and including an operating member having a portion projecting beyond the upper end of the stick, and a stop attached to the projecting portion of the operating member and engageable with the saddle block for causing the shock absorbing means to limit the outward movement of the dipper stick relative to the saddle block.

2. In a power shovel, or the like, a boom, a dipper stick, a saddle block for guiding the dipper stick carried by said boom, shock absorbing means enclosed within the dipper stick and including a spring and an operating member connected to the spring and having a portion projecting beyond the upper end of the stick, and a stop attached to the projected portion of the operating member and engageable with the saddle block for causing the shock absorbing means to limit the outward movement of the dipper stick relative to the saddle block.

3. In a power shovel, or the like, a boom, a dipper stick, a saddle block for guiding the dipper stick carried by said boom, shock absorbing means enclosed within the dipper stick and including an operating member having a portion projecting beyond the upper end of the stick, and a stop plate attached to the projecting portion of the operating member and projecting laterally of the dipper stick for engagement with the saddle block to cause the shock absorbing means to limit outward movement of the dipper stick relative to the saddle block.

4. In a power shovel, or the like, a boom, a dipper stick, a saddle block for guiding the dipper stick carried by said boom, shock absorbing means enclosed within the dipper stick and including a spring and an operating member connected to the spring and having a portion projecting beyond the upper end of the dipper stick, and a stop plate attached to the projecting portion of the operating member and projecting laterally in opposite directions from the dipper stick for engagement with opposed parts of the saddle block for causing the shock absorbing means to limit outward movement of the dipper stick relative to the saddle block.

5. In a power shovel, or the like, a pivoted boom, a saddle block journaled on the boom for pivotal movement, a dipper stick having a hollow end portion guided for longitudinal movement in the saddle block, a plate overlying the inner or upper end of the dipper stick and projecting laterally thereof so as to engage the saddle block, and resilient means in the hollow end portion of the dipper stick for connecting the said plate to the stick.

6. In a power shovel, or the like, a pivoted boom, a saddle block journaled on the boom for pivotal movement, a dipper stick having a hollow end portion guided for longitudinal movement in the saddle block, a plate overlying the inner or upper end of the dipper stick and projecting laterally thereof so as to engage the saddle block, a rod connected to the plate and extending into the hollow end portion of the dipper stick, and resilient means in said hollow end portion for connecting the rod to the stick.

7. In a power shovel, or the like, a pivoted boom, a saddle block journaled on the boom for pivotal movement, a dipper stick having a hollow end portion guided for longitudinal movement in the saddle block, a plate overlying the inner or upper end of the dipper stick and projecting laterally thereof so as to engage the saddle block, a rod connected to the plate and extending into the hollow end portion of the dipper stick, a guide block for the rod fixed in the said end portion of the stick, and resilient means interposed between the rod and the guide block for yieldably resisting withdrawal of the rod through the guide block.

8. In a power shovel, or the like, a pivoted boom, a saddle block journaled on the boom for pivotal movement, a dipper stick having a hollow end portion guided for longitudinal movement in the saddle block, a plate overlying the inner or upper end of the dipper stick and projecting laterally thereof so as to engage the saddle block, a rod connected to the plate and extending into the hollow end portion of the dipper stick, a guide block for the rod fixed in the said end portion of the dipper stick, an abutment on the inner end portion of the rod, and resilient means interposed between the guide block and the rod abutment for yieldably resisting withdrawal of the rod through the guide block.

9. In a power shovel, or the like, a pivoted boom, a saddle block journaled on the boom for pivotal movement, a dipper stick having a hollow end portion guided for longitudinal movement in the saddle block, a plate overlying the inner or upper end of the dipper stick and projecting laterally thereof so as to engage the saddle block, a rod connected to the plate and extending into the hollow end portion of the dipper stick, a guide block for the rod fixed in the said end portion of the stick, an abutment on the inner end portion of the rod, a sleeve loose on said rod, and a coil spring threaded on the rod outwardly of the sleeve and abutting at its ends against the guide block and the rod abutment for yieldably resisting withdrawal of the rod through the guide block.

10. In a dipper stick for a power shovel, or the like, a dipper stick body having a hollow inner end portion, a buffer plate adapted to normally close the hollow inner end of the dipper stick and projecting laterally thereof, and resilient means positioned within the hollow inner end portion of the dipper stick for connecting the said buffer to the stick.

11. In a dipper stick for a power shovel, or the like, a dipper stick body having a hollow inner end portion, a plate adapted to bridge the inner end of the dipper stick and projecting laterally thereof, a rod connected to the plate and extending longitudinally within the hollow end portion of the dipper stick, and resilient means positioned within the hollow inner end portion of the dipper stick for connecting the rod to said stick.

12. In a dipper stick for a power shovel, or the like, a dipper stick body having a hollow inner end portion, a circular plate overlying and normally closing the inner end of the dipper stick body and projecting laterally thereof, a rod connected to the plate and extending longitudinally within the hollow end portion of the dipper stick body, a guide for the rod located in the hollow end portion of the dipper stick body, and means interposed between the rod and the guide within the hollow end portion of the dipper stick body for yieldably resisting withdrawal of the rod through the guide.

13. In a dipper stick for a power shovel, or the like, a dipper stick body having a hollow inner end portion, a plate bridging the hollow inner end of the dipper stick body and projecting laterally thereof, a rod connected to the plate and extending longitudinally within the hollow end portion of the dipper stick body, a guide for the rod located in the hollow end portion of the dipper stick body, an abutment on the inner end portion of the rod, and resilient means located within the hollow end portion of the dipper stick and interposed between the guide and the rod abutment for yieldably resisting withdrawal of the rod through the guide.

14. In a dipper stick for a power shovel, or the like, a dipper stick body, a plate associated with the inner end of the dipper stick body and projecting laterally thereof, a rod connected to the plate and extending longitudinally of the end portion of the dipper stick body, a guide for the rod fixed on the end portion of the dipper stick body, an abutment on the inner end of the rod, a sleeve loose on said rod, and a coil spring threaded on the rod outwardly of the sleeve and abutting at its ends against the guide and the rod abutment for yieldably resisting withdrawal of the rod through the guide.

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