June 3, 1947. J. W. HARDING 2,421,379

SHAFT MUCKING MACHINE

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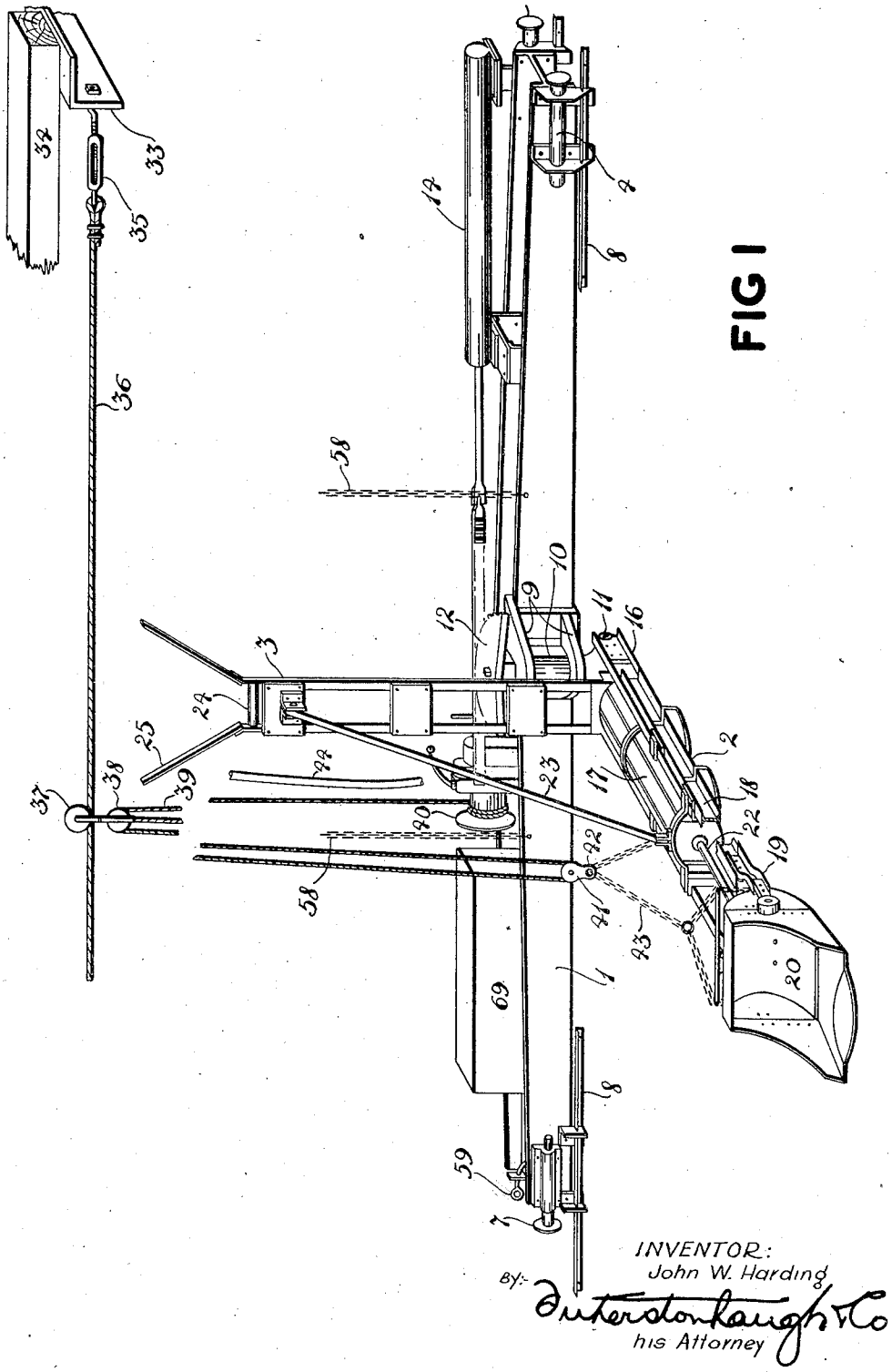


FIG 1

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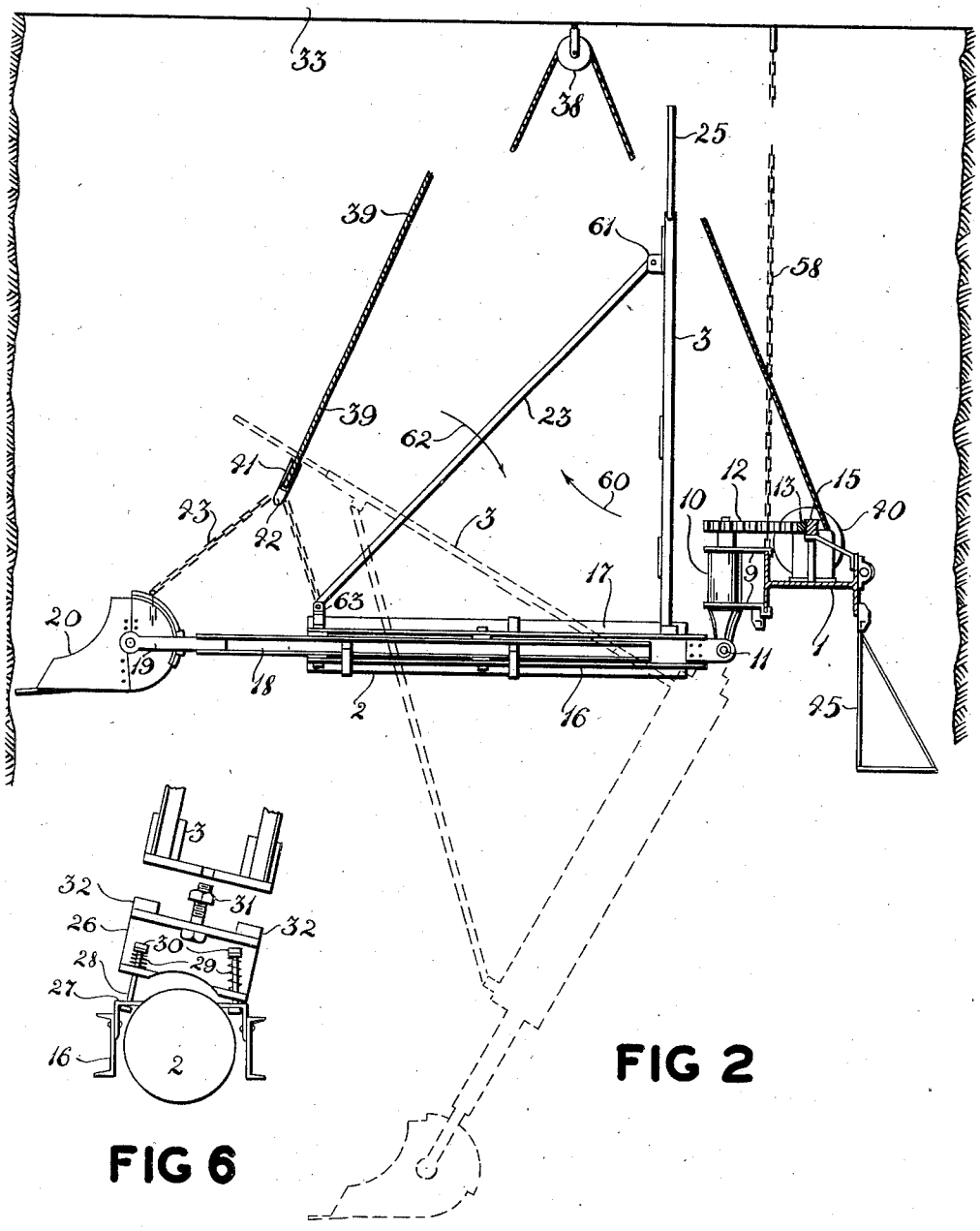


FIG 2

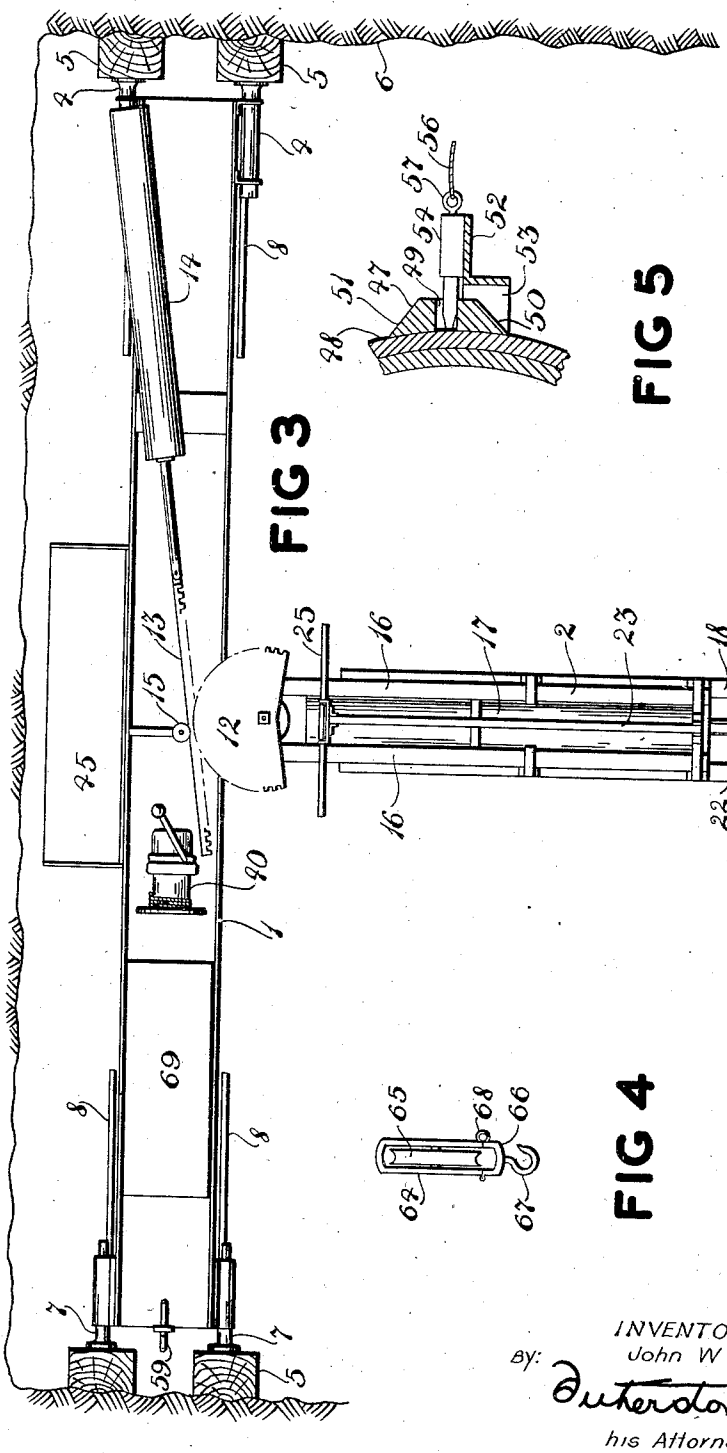
FIG 6

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SHAFT MUCKING MACHINE

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SHAFT MUCKING MACHINE

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Application December 6, 1944, Serial No. 566,899

8 Claims. (Cl. 214—134)

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My invention relates to shaft mucking machines, an object of the invention being to provide equipment of the character herewithin described by means of which two miners should be able to fill buckets in the operation of sinking a mine shaft, as fast as ten miners can fill when mucking by hand.

A further object of my invention is to provide equipment of the character herewithin described by the use of which all members of a sinking crew except for an operator and helper manipulating my machine, should be able to timber above the blasting set while a round is being mucked out.

A further object of my invention is to provide equipment of the character herewithin described which is foldable into a compass of small girth so that it may be hoisted up the sinking compartment while drilling and blasting is being carried on.

A further object of my invention is to provide equipment of the character herewithin described, the necessary skill in the manipulation of which may be rapidly acquired, and by means of which all parts of a shaft round may be mucked out by the shovel forming a part of my invention.

With the above more important objects in view and such other minor objects as may appear as the specification proceeds, my invention consists essentially in the arrangement and construction of parts all as hereinafter more particularly described, reference being had to the accompanying drawings, in which:

Figure 1 is a perspective illustration of my shaft mucking machine in operative position beneath a blasting set.

Figure 2 is an end elevation viewed from one end of my shaft mucking machine.

Figure 3 is a plan view of my shaft mucking machine.

Figure 4 is a detail illustrating the snatch block associated with my hoisting cable.

Figure 5 is a sectional detail illustrating my shovel lock.

Figure 6 is a fragmentary detail illustrating the shock absorbing springs associated with my derrick arm.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding first to describe the structural components of my machine, these consist of a stationary, jack-sustained gantry beam 1 preferably of H or I cross-section, upon which is journalled an extensible shovel boom 2 having secured thereto a derrick arm 3 in rigid right angular relationship excepting for the provision of shock absorbing springs to be hereinafter described.

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Proceeding now to describe the foregoing main components and other minor components in detail, it is to be understood that my gantry beam 1 is sustained in horizontal position (in the case of a vertical shaft) by virtue of the pressure exerted by a pair of jack screws 4 at one end of the beam, these members bearing against blocks 5 interposed between the buffer ends of the jack screws and the shaft space 6. Similar jack screws may be provided at the opposite end of the beam if desired. Alternatively, a pair of dead or spring-loaded buffers 7 may be provided, also bearable against blocks interposed between them and the adjacent shaft space. The blocks aforesaid are supported on pairs of parallel rails 8 to sustain the same in position when setting up the machine.

Intermedially of the beam 1 and projecting therefrom is a pair of spaced bearings 9 through which extends a massive journal 10. Projecting in diametrically opposite directions from the lower end of the journal are trunnions 11. Upon these trunnions my shovel boom 2 is journalled, the region thereof which is adjacent to the said trunnions being referred to in the accompanying claims as the root of the boom.

The boom is rotated in a horizontal plane through the medium of a spur-toothed sector plate 12 which is keyed to the upper end of the journal 10, a rack 13 being in mesh with the sector plate, the latter being end-shiftable to right or left under the influence of a compressed air operated piston assembly 14 bolted to the beam 1 in the manner clearly illustrated in the accompanying Figures 1 and 3. The rack 13 is sustained in contact with the toothed perimeter of my sector plate 12 by means of the roller 15.

My shovel boom 2 is of extensible construction and consists essentially of a pair of parallel main channels 16 between which and secured to which is a piston and cylinder assembly 17. Slidable within the channels 16 are secondary I beams 18 to the outer ends of which are bolted the shovel arms 19, these arms terminating in bearings between which my shovel 20 is mounted via a pair of conventional trunnions.

Spanning the arms 19 to the rear of the bucket 20 is a crosshead 21 to the centre of which a piston rod 22 is secured by means of which the ex-

tensible portion of my boom including the bucket, may be operated under air pressure.

Secured in right angular relationship to the root of the boom 2 is my derrick arm 3 aforesaid, the same being maintained rigidly in such position by means of the brace 23 an idling roller 24 is positioned at the apex of the derrick arm, and above the roller I provide a pair of divergent guides 25 for vertically aligning or centering a boom operating cable when the latter is dipped at steep angles as will hereinafter become apparent.

At this point attention is directed to the accompanying Figure 6 wherein I have illustrated the structural details by means of which my derrick arm is connected to the boom, and in this figure it will be seen that I provide an intermediate piece of channel section 26 which is secured to a pair of inwardly directed angle brackets 27 fastened to the channels 16, the piece 26 being secured to the angle brackets by the sway bolts 28. These bolts pass through drillings in the lower flange of the piece 26 and are encircled by the heavy coil springs 29 the ends of which bear against the flange aforesaid and the nuts 30. These springs act as shock absorbers allowing the arm 3 to yield as clearly illustrated should it strike the beam 1 when the boom is swung parallel therewith.

The derrick arm 3 is secured to the piece 26 simply by the heavy duty chuck bolt 31 for ready removal in dismantling, and is prevented from rotation with respect to the piece 26 by the pair of lugs 32. The details illustrated in the accompanying Figure 6 and described hereinabove have not been illustrated in Figures 1 and 3 in view of the necessarily reduced scale thereof.

Stretched between a pair of angle bars 33 secured to the opposite ends of the conventional blasting set 34 and held taut by turn-buckles 35 or the like is a cable 36, which may if desired take the form of a rigid rail, and since functioning as such, has been referred to as a rail in the accompanying claims. Upon this rail travels snatch block 37 from which is suspended in swivelling relationship a conventional cable pulley block 38. One end of a hoisting cable 39 is anchored to the block 38, the other end being wound upon an air drum hoist 40 of any conventional construction as widely used in mining operation.

The cable 39 also passes around a pulley block 41 provided with an eye-piece 42 through which extends a shovel chain 43, this chain being secured at the rear end to any suitable point upon the boom 2, and at the front ends thereof to the bucket arms 19. By these means, it is obvious that I am able to raise and lower the boom 2 and shovel 20 in vertical planes.

Having now described my machine in terms of its structure, the operation thereof will be explained in association with certain remaining structural details more suitably introduced in an operational description.

Compressed air for the operation of the piston assemblies 14 and 17 and the air drum hoist 40 is supplied through the bull hose 44 which branches off at the lower end thereof to supply these assemblies, and extends to an air header above the blasting set. The operator of my machine stands upon a platform 45 intended to be readily attachable and removable at the time of setting up or dismantling.

When the cable 39 is unwound, the shovel boom 2 will rotate vertically and counterclockwise with respect to the accompanying Figure 2, carrying

with it the derrick arm 3. Obviously, the snatch block will travel along the cable 36 so that it is always in approximately the vertical plane of the boom axis, the cable 39 being engaged by the roller 24 and angulated thereby when the boom has fallen as illustrated in phantom lines in Figure 2. In this way I am able to obtain sufficient purchase on the cable in all positions of the boom, and it is obvious that the members 25 will act satisfactorily to guide the cable onto the roller and maintain it there if it happens to be initially somewhat misaligned.

My gantry beam 1 will preferably be positioned approximately seven feet above the muck, and by virtue of the outflare of the shovel arms 19 as well as the cross-sectional configuration of the shovel 20 it will be apparent that I am able to remove muck from all corners of a rectangular mine shaft. In this connection however it is to be understood that my shovel 20 is preferably lip heavy when loaded and bowl heavy when empty, the same being provided with the locking or latching means which I have illustrated in the accompanying Figure 5.

In that figure it will be seen that I have secured a plate portion 47 to the rear part of the bowl 48, the plate being provided with a central aperture 49 and bevelled surfaces 50 and 51 upon either side thereof. To an angle bracket 52 secured between end plates 53 to the bowl 48 is a sleeve 54 through which extends a spring loaded latch bolt 55 projectionable into the aperture 49 and withdrawable therefrom by means of a cable 56 anchored to an eye-piece 57 on the opposite end of the latch bolt.

When the shovel is empty, it tends to rotate clockwise with respect to the accompanying Figure 2 and when it has rotated to the extent such that it bears the relationship to the boom which I have illustrated in phantom lines, then it is to be understood the latch bolt will have ridden over the bevelled surface portion 50 and engage the aperture 49 so that the shovel is locked. This is the most satisfactory position for the greater part of the mucking operation. In certain positions however, as for example when it is desired to scrape muck from regions immediately below or somewhat to the rear of the gantry beam 1, the more desirable position for the shovel is that shown in full lines in the accompanying Figure 2. Accordingly, I may if desired provide an additional plate 47 further round the bowl into the aperture of which the latch bolt 55 may also be projected to maintain the shovel in the relationship last mentioned.

When the shovel is loaded and in either of the positions relative to the boom illustrated in Figure 2, and the boom substantially horizontal, it will be obvious that upon the retraction of the latch bolt 55 by pulling upon the cable 56, the shovel will rotate counterclockwise being lip heavy when loaded and deposit its contents into a hoistable bucket. When empty, it will rotate in the reverse direction until locked whereupon the next shovelful of muck may be loaded.

It will be seen that the gantry beam 1 is suspended from a pair of chains 58 anchored to the blasting set and when it is desired to muck out a new round, the operating schedule would be somewhat as follows.

As soon after blasting as the bottom is clear of smoke, the crew goes down, blows off the blasting set, and lowers it enough to erect a set of timbers after which the muck is wetted.

My mucking machine is then lowered vertically

or endwise through the hoisting aperture in the blasting set, and in order that it may be lowered in this way, it is to be understood that the beam 1 will be suspended from a chain via the hook or eye 59 in the ends thereof. In this position the boom will hang parallel with the beam and alongside it as will also the derrick arm 3 after the chuck bolt 31 has been removed. Following such removal, the derrick arm may be rotated counterclockwise with respect to the accompanying Figure 2 in the direction of the arrow 60 about the hinge 61, whereafter the brace 23 is free to rotate in the direction of the arrow 62 about the hinge point 63. When the parts 3 and 23 are folded as aforesaid, they are suitably piled and the device as-a-whole may then be raised or lowered through a four foot aperture.

After the machine has been lowered through the hoisting aperture in the blasting set, it is swung into the horizontal by means of the chains 58, one of which is anchored steady while the other is paid out from any suitable winch above the blasting set until the beam is horizontal after which the end-jacks are tightened.

The derrick arm is next unfolded and secured by means of the chuck bolt as aforesaid and the operator's platform 45 is attached. The snatch block 37 is mounted on the cable or rail 36 after the latter has been tensioned, and in this connection reference is made to the accompanying Figure 4 wherein I have illustrated this snatch block in detail from which the same will be seen to consist of a yoke 64 in which the pulley 65 is journalled. Hingedly connected to one of the ends of the yoke 64 is a portion 66 depending from which is a hook 67. Opposite the hinge point of the portion 66 and projecting from the other end of the yoke 64 are two spaced and aligned rings 68 between which a similar ring projecting from the swinging side of the portion 66 may be introduced. A conventional pin may be passed through all three of the aligned rings 68 to lock the portion 66 to the yoke, after which the swivelling pulley block 38 is attached. From the foregoing it will be clear that the pulley 65 may now ride on the cable 36, although a variety of modifications alternative to the snatch block of Figure 4 may be resorted to if desired within the scope of this invention.

If desired my machine may be used in an inclined shaft in which case the gantry beam 1 would be positioned perpendicular to the angle of inclination of the shaft. In such case the shovel boom, and associated parts would require little or no change.

In conclusion, it is to be noted that numeral 69 designates a tool chest and I would explain that if desired, a conventional vibrating assembly may be installed in association with the shovel 20 to facilitate penetration thereof into heavy material.

Since many modifications can be made in the invention herein described and since the accompanying drawings have been prepared only to illustrate the relative arrangement and interaction of parts and not with regard to accuracy of dimensions for manufacturing purposes which in view of this disclosure I consider to entail merely mechanical skill together with the skill of the mechanical drafsman, and since many apparently widely different embodiments of this invention may be made within the scope of the accompanying claims without departing from the spirit and scope of the same it is intended that all matter contained in the accompanying specification shall

be interpreted as illustrative only and not in a limiting sense and I desire only such limitations placed thereon as justice dictates.

What I claim as my invention is:

1. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam, a horizontally rotatable shovel boom secured to said vertical journal, a derrick arm secured to the root of said boom for rotation therewith in a horizontal plane, a cable drum upon said machine, and a cable wound upon said drum, extending over said derrick arm and being secured to said boom for raising the same.

2. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam, an extensible and horizontally rotatable shovel boom secured to said vertical journal, a derrick arm secured to the root of said boom for rotation therewith in a horizontal plane, a cable drum upon said machine, and a cable wound upon said drum, extending over said derrick arm and being secured to said boom for raising the same.

3. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, an extensible and rotatable shovel boom journalled thereon, a derrick arm secured to the root of said boom for rotation therewith in a vertical plane, a cable drum mounted upon said machine, and a cable wound upon said drum, extending over said derrick arm, and being secured to said boom for raising the same.

4. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam, horizontal trunnions projecting from said journal, a shovel boom mounted for vertical rotation on said trunnions, and being horizontally rotatable with said journal, and means for rotating said boom.

5. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam, trunnions projecting from said journal, an extensible shovel boom mounted for vertical rotation on said trunnions, and being horizontally rotatable with said journal, a derrick arm, a cable drum, said derrick arm and said cable drum being mounted upon said machine, and a cable wound upon said drum and secured to said boom for raising the same.

6. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam for horizontal rotation, trunnions projecting from said journal, a shovel boom mounted on said trunnions for vertical rotation, and being horizontally rotatable upon said journal, a derrick arm secured to the root of said boom for rotation therewith in a vertical plane, a cable drum mounted upon said machine, a cable wound upon said drum extending over said derrick arm, and being secured to said boom for raising the same.

7. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertical journal mounted in bearings on said gantry beam for horizontal rotation, trunnions projecting from said journal, an extensible shovel boom mounted upon said trunnions for vertical rotation and being horizontally rotatable with said journal, a derrick arm secured to the root of said boom for rotation therewith in a ver-

tical plane, a cable drum mounted upon said machine, and a cable wound upon said drum extending over said derrick arm, and being secured to said boom for raising the same.

8. A shaft mucking machine comprising in combination a stationary wall-engaging gantry beam, a vertically rotatable shovel boom journalled thereon and projecting from one side thereof, and means for rotating said boom comprising a drum mounted upon said machine, a rail above said beam being spaced therefrom and parallel therewith, and a cable windable upon said drum, suspended from said rail, and being secured to said boom.

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