

(No Model.)

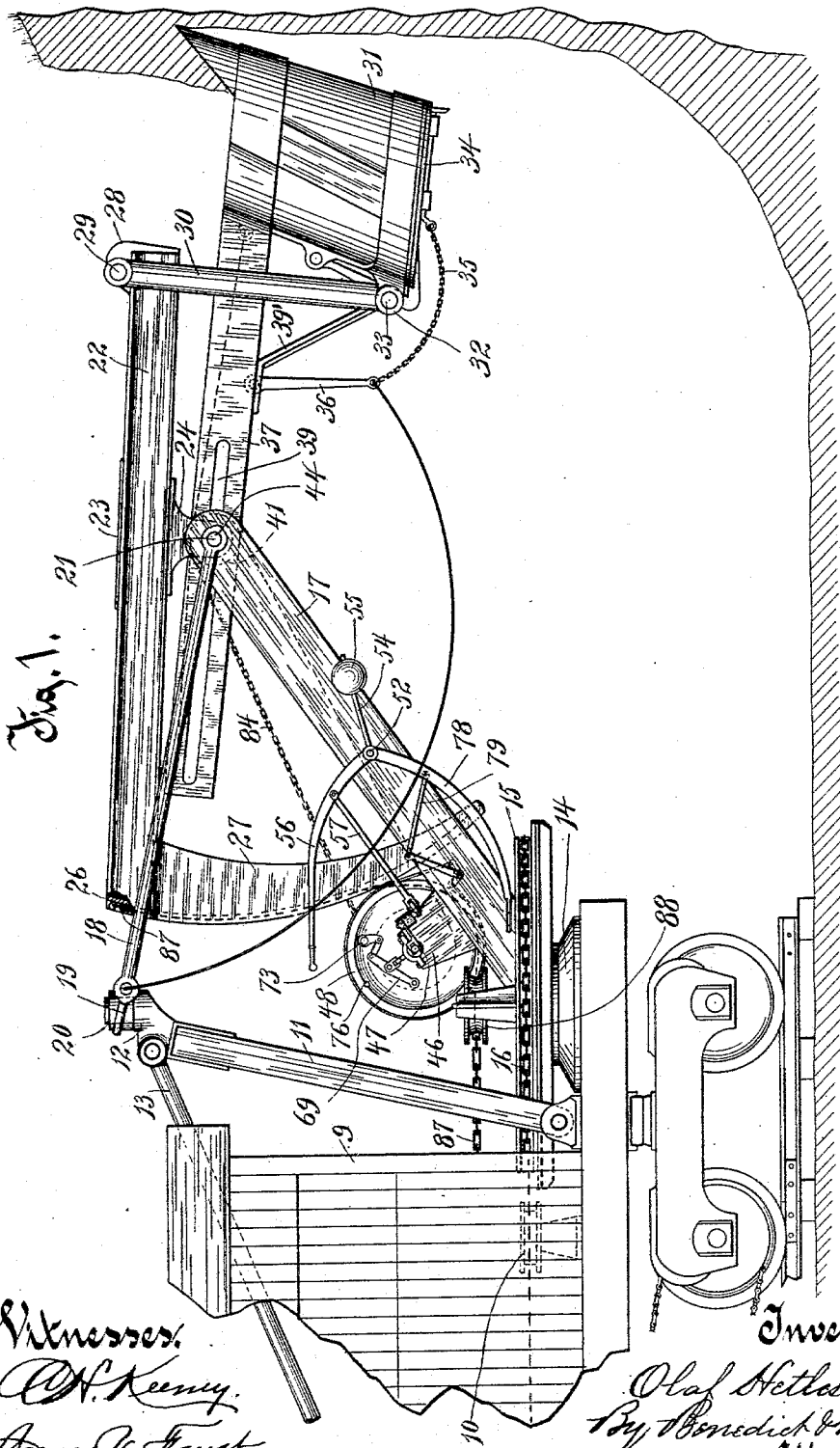
4 Sheets—Sheet 1.

O. HETLESAETER.

STEAM SHOVEL, DITCHING MACHINE, AND DREDGE.

No. 563,857.

Patented July 14, 1896.



Witnesses:

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(No Model.)

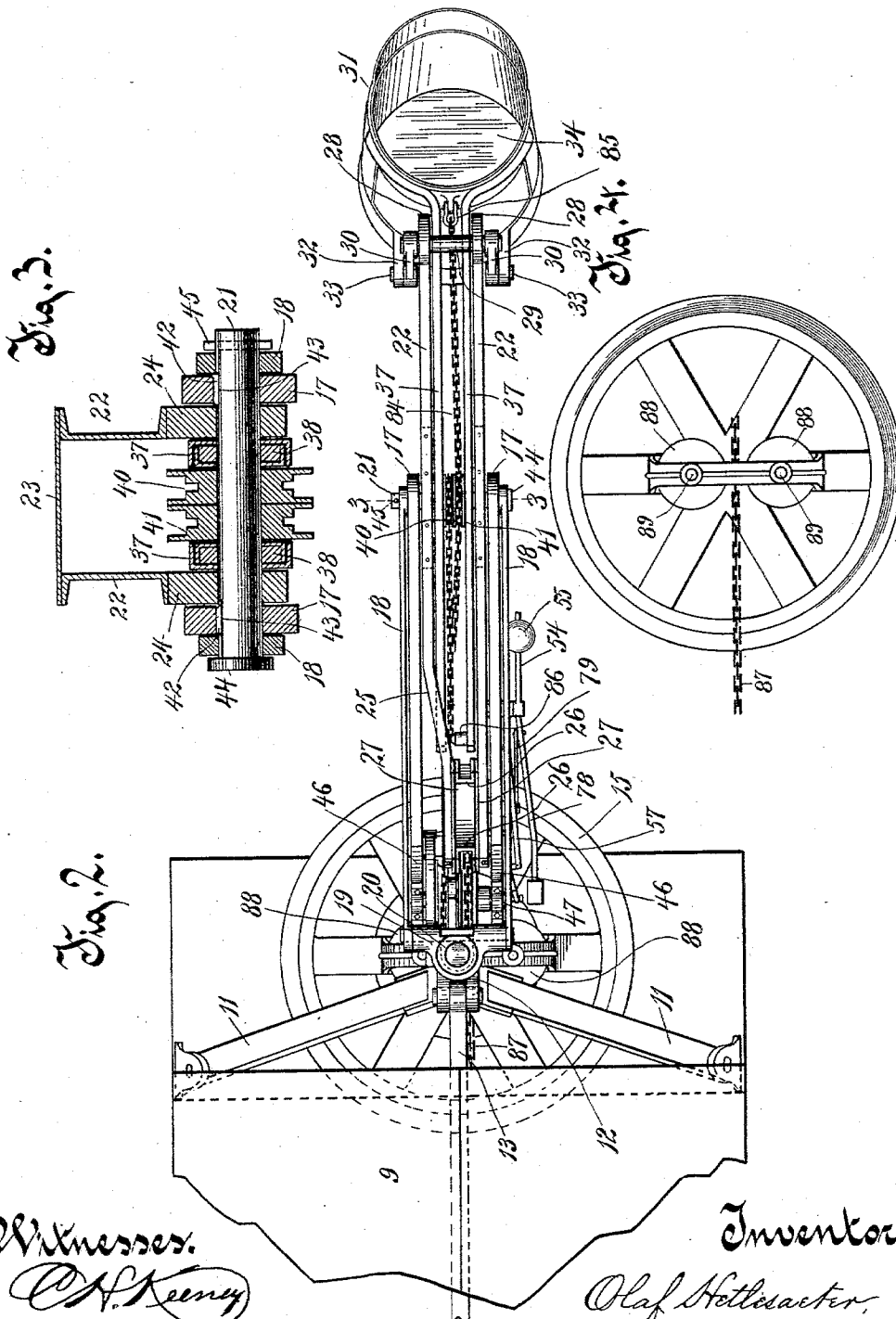
4 Sheets—Sheet 2.

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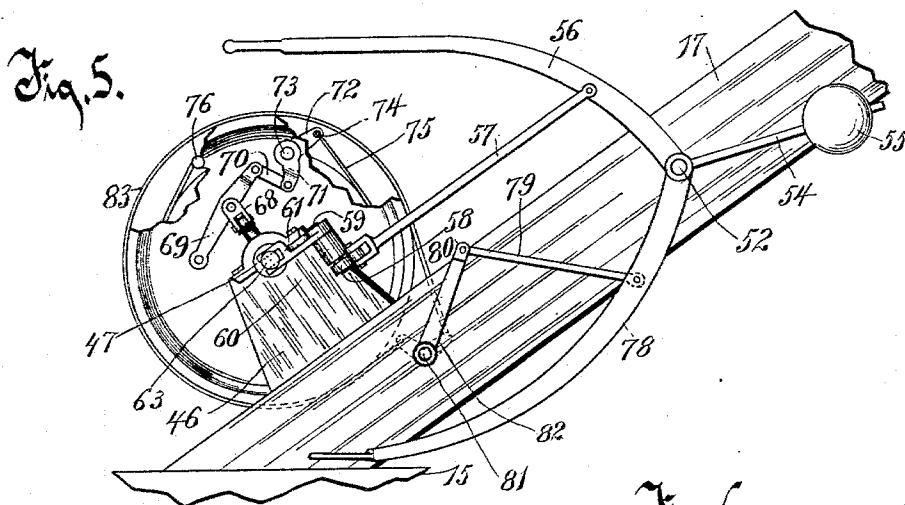


Fig. 6.

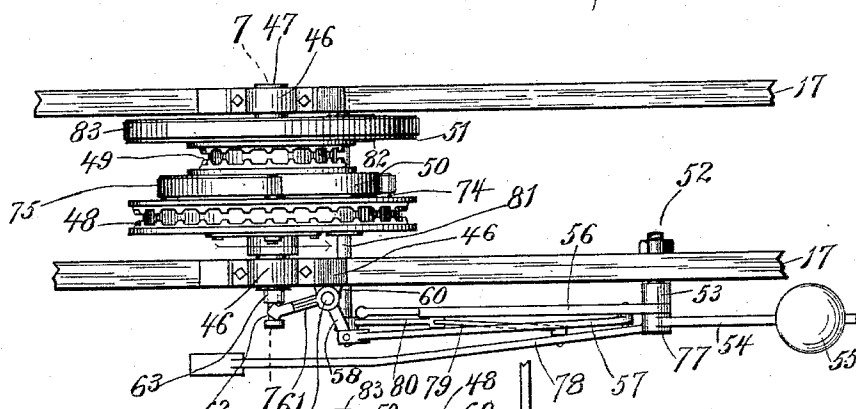
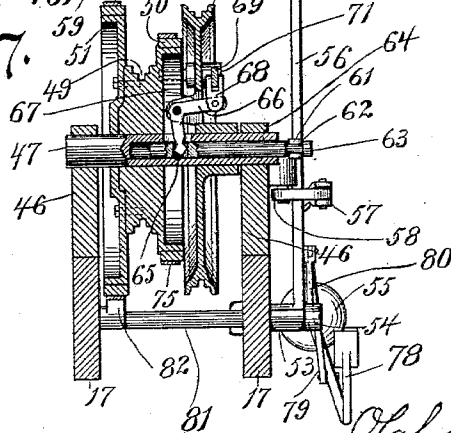


Fig. 7.



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(No Model.)

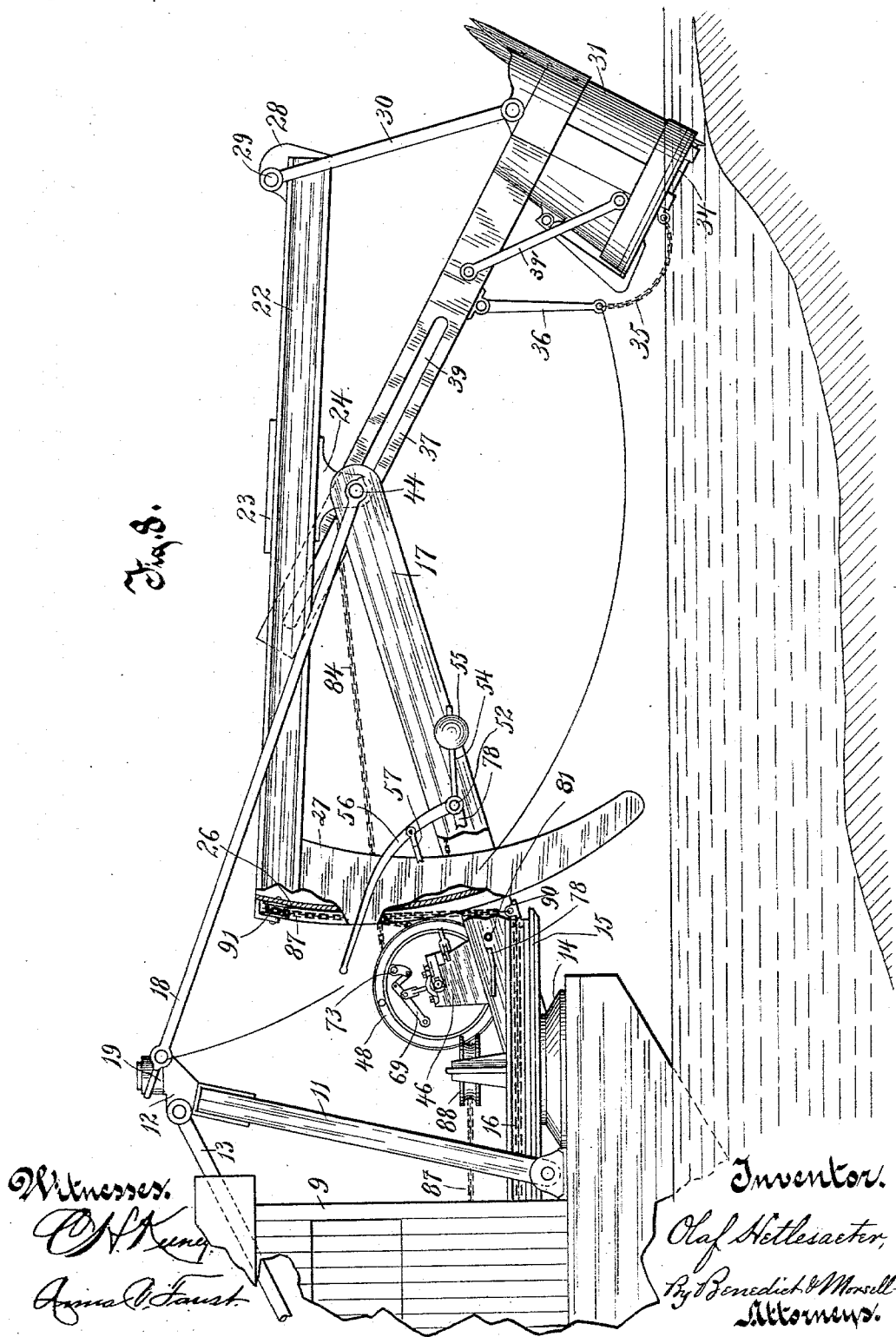
4 Sheets—Sheet 4.

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Patented July 14, 1896.



UNITED STATES PATENT OFFICE.

OLAF HETLESAETER, OF MILWAUKEE, WISCONSIN.

STEAM SHOVEL, DITCHING-MACHINE, AND DREDGE.

SPECIFICATION forming part of Letters Patent No. 563,857, dated July 14, 1896.

Application filed December 21, 1893. Renewed May 21, 1896. Serial No. 592,487. (No model.)

To all whom it may concern:

Be it known that I, OLAF HETLESAETER, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Steam Shovels, Ditching-Machines, and Dredges, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention has relation to improvements in steam shovels, ditching-machines, and dredges. It has for its primary object to provide a machine wherein, through improved means for raising the dipper, suspending, and thrusting the same, the greatest possible power, speed, and durability are obtained, dead strains are entirely avoided, and the full power of the hoisting-engines, less friction, is made available at each and every part of the dipper travel. From the improved construction also arises other incidental objects, among which may be mentioned, first, the certainty with which the dipper may be placed where it is wanted at the start of the cut, due to the positive hanging of the dipper by stiff links instead of loose chains, and also to the balancing of the dipper-handle and connecting parts, as well as the hoisting-chain, on a central pivot or shaft, thus allowing the dipper itself, part of its weight being extra and overbalancing, to drop freely and rapidly to any desired point, and also to the reduction of the friction caused by the hoisting-chain to the minimum.

Another incidental object is due to the form of construction of the machine, whereby no part of the machine is over fourteen feet six inches above the rails, thus allowing the shipping of same completely mounted or erected.

With the above and other objects in view the invention consists of the devices and parts as hereinafter described and claimed or their equivalents.

In the accompanying drawings, Figure 1 is a side elevation of my machine in connection with a fragment of a car. Fig. 2 is a plan view with the top plate of the oscillating lever removed. Fig. 3 is a transverse section on the line 3 3 of Fig. 2. Fig. 4 is a plan view of the turn-table and the guide-rollers carried thereby, showing a fragment of the hoisting-chain passing between said rollers. Fig. 5 is

a side elevation of the pocket-sheave for the hoisting-chain and the mounting thereof on the boom, showing the mechanism for operating the friction and brake bands, a portion of said roller being broken away for clearer illustration of certain parts. Fig. 6 is a plan view of Fig. 5, looking down upon the same at right angles to the upper edge of the boom. Fig. 7 is a transverse section on the line 7 7 of Fig. 6, and Fig. 8 is a side elevation of my device as applied to a float for dredging purposes, also showing a modification in the connection between the oscillating lever and the bucket, and also a modification in the arrangement of the hoisting-chain.

Like numerals of reference denote like parts throughout the several views.

In the drawings, the numeral 9 indicates a car (shown in Figs. 1 and 2) to which my improvements are applied. On this car is mounted an engine provided with friction-drums of any approved type, a boiler, and a water-tank for supplying steam to the engine. As all the parts just mentioned, however, are common in steam-shovels as ordinarily constructed, it is not deemed necessary to specifically describe or show the same herein. In the front end of the car are also provided two guide-pulleys 10 10, and forward of these pulleys are pivoted, at opposite edges of the car, two legs 11 11, which are converged so that their upper adjacent ends will be in a line over the center of the turn-table 15. These upper ends of the legs are united by a casting 12. The frame formed by the inclined legs is held to the position shown in the drawings by means of a third leg 13, which runs back to the rear of the car (not shown) and is secured to the floor in any desirable manner directly over the rear truck center.

On the extreme forward end of the car is thoroughly bolted to the floor-beams a pivot 14, and resting and swinging horizontally on this pivot is a turn-table 15, on which the forward overhanging machinery is swung and supported. This turn-table is operated by means of a chain or cable 16, which has its two ends fastened thereto at opposite points, and is then extended back between the guide-pulleys 10 10 to its operating-drum. (Not shown.)

The numerals 17 17 indicate two parallel

inclined beams, which constitute the boom of the machine. The lower ends of these beams are secured to the turn-table, one at each side of the center thereof, preferably entering and secured in recesses formed in said turn-table.

The numerals 18 18 indicate two guy-rods, which, at their rear ends, are connected by means of a collar 19, provided with an aperture 20, which receives the casting 12, uniting the upper ends of the legs 11 11, whereby the rods are permitted to swing horizontally on the casting 12. The forward ends of these rods are apertured to form bearings for a transverse shaft 21, which shaft also passes through eyes or apertures in the upper ends of the boom-beams.

Above the upper end of the boom is an oscillating lever, which consists of beams 22 22, preferably of heavy channel-irons, having their top flanges united at the center by a short plate 23, which prevents the beam from buckling or spreading out. Secured to and depending from the center of the under flanges are bearing-castings 24 24, which are provided with eyes to receive the shaft 21. The lever 22 22 is made of such width as to fit inside of the top of the boom ends 17 17, the bearings 24 24 being located on the shaft 21 inside of said boom ends.

About medially one of the beams 22, forming part of the oscillating lever, is inclined inward, as indicated at 25, for a short distance, and then runs rearward to its terminus parallel with the other beam, whereby the space between the two beams at the rear ends thereof is diminished. This permits of the passage of the channeled chain-guide past the thrusting-chain. This chain-guide consists of two channels 26 26, connected together by means of two plates 27 27, one on each side, one of said channels being curved to the form of a segment of a circle, and the other merely serving to strengthen the former. The upper ends of these plates and channels pass into the contracted space at the rear of the oscillating lever and are securely attached to the beams composing said lever.

At the forward end of the oscillating lever are provided two eyed castings 28 28, secured, respectively, to the beams 22 22, composing said lever. In these castings a pin 29 is fitted. From opposite ends of this pin are hung stiff suspension links or rods 30 30, preferably composed of heavy wrought-iron.

The numeral 31 indicates a bucket, from the lower rim of which project rearwardly two lugs 32 32, provided each with an inward-extending trunnion 33, which receive the lower ends of the links 30 30. This bucket is provided with the usual hinged bottom 34, controlled by means of a chain 35, passing through the eye of a guide-arm 36 and extending rearward for convenient manipulation in the customary manner.

The dipper-handle consists of two arms 37 37, each preferably constructed of double

channel-irons, the outer, in practice, being twelve inches wide and the inner ten inches wide. They are so placed together that the flange of the smaller channel-iron fits within the flange of the outer, while a cast-iron filler 38 is placed in the longitudinal space. By thus constructing the arms composing the dipper-handle, they are strengthened to such a degree as to make them capable of withstanding the greatest possible strain. The channel-iron and the fillers composing each arm 37 are provided with registering elongated slots 39 39, through which the shaft 21 passes. The arms 37, therefore, respectively are arranged on the shaft so as to lie adjacent to the inner sides of the bearing-castings 24 24. The outer ends of the arms of the dipper-handle are rigidly secured to the upper rim of the circumference of the bucket, as clearly shown in the drawings, and a brace 39' is secured at its upper end to the dipper-handle, and extends down obliquely and is secured at its lower end to the bottom rim of the bucket, thereby forming an additional means of firmly uniting the dipper-handle to the bucket.

On the shaft 21, between the dipper-arms 37 37, are two loose sheaves 40 and 41. Shaft 21 is held against rotation by means of feathers or keys 42 42, arranged in the apertures of the upper ends of the beams 17 17, which feathers or keys fit into complementary grooves 43 43 in the shaft. Said shaft is also held against endwise movement by the head 44, at one end thereof, and a pin 45 intersecting the opposite end, both of which also serve to keep the guy-rods 18 18 in proper position with relation to the shaft.

Near the lower ends of the beams 17 17 constituting the boom, and secured to the upper edge of each beam, are bearings 46 46 for a transverse shaft 47. On this shaft are two sheaves 48 and 49, the former keyed or otherwise secured thereon, and the latter loose on the shaft. On each side of the central pocket portion of sheave 49, and integral with said sheave, are two rims 50 and 51. Extending laterally from one of the beams 17, the lower one with respect to Fig. 6, is a fixed pivot-pin 52. Turning freely on this pivot is a hub or collar 53. A curved arm 56, rigid with the collar, projects rearward therefrom and terminates at its free end in a suitable handle. Near the forward end of arm 56 is pivoted a connecting-link 57, the opposite end of said link articulating with one end of a crank 58, the opposite end of said crank connecting with a short vertical shaft 59, which turns in a bearing 60, secured to the beam 17 adjacent. The upper end of this shaft has projecting therefrom, and at right angles thereto, a second crank 61, which has its end forked or bifurcated to engage an annular recess 62 in a rod 63. It will be seen that the two cranks 58 and 61, rigidly connected to and extending, respectively, from opposite ends of the vertical shaft 59, form a bell-crank lever. Shaft 47

is bored out longitudinally, as indicated at 64, to receive rod 63, and said rod near its inner end is provided with an opening 65 to receive one crank of a bell-crank lever 66, which bell-crank lever is pivoted to a lug 67, projecting laterally from the sheave 48. The other crank of the lever connects with a short link 68, which in turn connects medially with a lever 69, said lever having one end pivoted to the side of the sheave, and its opposite end connected, through a link 70, with a bell-crank lever. This latter lever is composed of the two cranks 71 and 72, the former located on the outer face of the sheave and connected to the link 70, as above described, and the latter on the inner face of said sheave, the two being connected rigidly together by means of a short shaft 73 running transversely through the sheave 48. Crank 72 has extending laterally therefrom a pin 74, to which one end of a friction-band 75 is connected. This band surrounds the rim 50 of sheave 49, and is connected at its opposite end to a pin 76, projecting laterally from the inner side of sheave 48. Also turning freely on the fixed pivot-pin 52 is a second collar 77. This collar is provided with a rigid rearward-extending arm 54, having a counterbalance-weight 53, and the collar is also formed or provided with a rigid foot-operated lever 78, to which is connected medially a link 79, said link in turn having pivotally connected thereto a second link 80, the lower end of which connects rigidly with the end of a shaft 81, which shaft is journaled in the two beams 17 17 of the boom. This shaft carries thereon a bell-crank 82, the two cranks of which connect, respectively, with the two ends of a brake-band 83, which encircles the rim 51 of sheave 49.

The numeral 84 indicates the thrusting chain or cable, which is connected at one end to a loop or eye 85, secured to the upper rim of the bucket at the rear thereof. This chain is then extended back between the arms of the dipper-handle to and over sheave 40, thence down to sheave 49, and around and underneath the same, and thence up again and around sheave 41, and thence extended back to the rear of the dipper-handle, where it is connected to a transverse pin 86.

The hoisting chain or cable is indicated by the numeral 87, and is fastened at its extreme end in the end of the rear channel of the chain-guide farthest from the hoisting-drum. The chain is then extended along this channel and around sheave 48, and thence back between guide-pulleys 88 88, mounted horizontally on pins 89 89, projecting up from the turn-table, the chain finally extending back to the drum (not shown) for winding the same.

In the operation of my machine after the engine is started the hoisting-drum is caused to revolve in the usual manner. As the hoisting-chain 87 is wound around said drum, power is applied to the inner end of the oscillating lever, which will be forced to re-

volve on shaft 21. As the oscillating lever is actuated by means of power applied to the hoisting-chain lying in a curved chain-guide of the form of the segment of a circle whose center is the pivotal shaft 21, it is evident that the pull is always tangential to this circle and at right angles to the dipper-handle, which is a normal to said circle. The movement of the hoisting-chain causes the pocket-sheave 48 to revolve, thus making it possible to transmit power to the thrusting-chain by means of the friction-gearing, whose operation is next described. The cranesman, who takes his position on the turn-table, now depresses the operating arm or handle 56. This has the effect of operating crank 61, which in turn exerts a lateral pull on rod 63, the latter operating the bell-crank lever 66, which in turn, through intermediate connections, operates the crank 72, to which one end of the friction-band 75 is attached, thus tightly clamping said band around the rim 50 of sheave 49, and thereby causing said sheave to rotate with its companion pocket-sheave 48, which is rotated by the hoisting-chain passing under it. As sheave 49 is rotated, it will cause the thrusting-chain 84 to pay out or slacken at one end and haul in at the other.

In regard to sheave 48 it will be seen that said sheave, by hoisting in on chain 87, will be rotated in the direction of the arrow, Fig. 6, and thereby through the chain exert a pull on the end of the operating-lever and rotate the same on the shaft 21 and cause the uplifting of the bucket or dipper. Now if the force of the friction-band 75 is insufficient to hold the dipper to the bank, the brake-band 82 is applied to the rim 51 by operating the foot-lever 78, as will be readily understood by reference to the drawings. When the dipper or bucket has been filled, the swinging chain 16 is put in operation by the appropriate winding drum or drums therefor, and the dipper thus swung around to either side of the car on which it is desired to dump into cars run on parallel side tracks.

In the ordinary form of steam-shovels the dipper-handle works on the boom through a rack-and-pinion mechanism. It is evident that that portion of my improvement relating to the oscillating lever actuated by means of power applied to the hoisting-chain lying in a circular chain-guide may be used in connection with a dipper having its handle operated by said rack-and-pinion mechanism, and I therefore do not wish to be understood as limiting myself to the application of the portion of my invention referred to to a dipper having its handle mounted on the end of the boom, as shown in the accompanying drawings.

In Fig. 8 of the drawings my improvements are shown as applied to a float for dredging purposes, the arrangement and disposition of the parts being such as to afford a deeper thrust of the dipper, which, of course, is necessary in dredging-machines. In this form

a slight modification in the hoisting-chain is provided, consisting in attaching one end of the chain to one of the beams 17 by means of an eyed lug 90 or equivalent device and then extending said chain upward over a pulley 91 at the upper end of the channel of the chain-guide and thence downward around and beneath the sheave 48, and finally back to the winding-drum. By this arrangement double the purchase or power for raising the oscillating lever is secured over the construction shown in the other form with the same-sized engine and gearing. In Fig. 8 is also shown a slight modification in the manner of connecting the bucket or dipper to the forward end of the oscillating lever. The suspension-links 30 30, instead of extending down from the forward end of the oscillating lever to connect to the bucket at the lower and rear portion thereof, merely extend to the upper rim of said bucket.

From the foregoing description the operation, advantages, and construction of my improved steam-shovel, it is thought, will be readily understood.

It will be seen that by this construction the effective power is the same at the lowest point of digging as at any other point, or, in other words, the machine will dig to the full power of the engines, less the friction, at each and every part of the dipper travel. In other forms of machines the greatest loss of power occurs at the commencement of the digging operation, due to the great angularity (small angle) formed by the hoisting-chain with the dipper-handle at the commencement of the digging, while, as above stated, in my machine the full power of the engine, less friction, is effectively exerted at the start, as well as at all other points of the dipper travel, owing to the fact that the power is always applied at right angles to the dipper-handle, as explained more fully before. It combines rapidity to the maximum, owing to the method of suspending the dipper by stiff links and to the ease with which the dipper and connected parts oscillate around the fixed central shaft. It possesses greater reach of movement, being capable of being raised higher, thrust deeper, and extended farther horizontally than other machines now in common use.

Owing to the shortness of the boom and to the fact that the dipper, when freely suspended by its links, constantly approaches nearer to the central shaft 21 as the outer end of the oscillating lever is raised above the horizontal, the dipper can be dumped closer to the machine than in other shovels, whereby tracks may be laid on each side of the track of the shovel and in closer proximity thereto, thereby providing for loading cars on both sides in very narrow excavations.

Another important advantage is the fact that an unnecessary length of chains and number of sheaves and shafts are dispensed with, resulting in a saving in this respect and also decreasing the liability of stoppage of the

work through breakages. By decreasing the number of chains and sheaves also a freer drop of the bucket is secured and a more positive underreach attained. In fact, the machine has a positive movement throughout. The machine also provides for decreasing the length of the boom to about one-third of that of the present existing machines of the same capacity, with the result that the strain on the whole machine is reduced to the minimum, and at the same time it can be shipped completely mounted or erected, as no part of the machine or boom is over fourteen feet six inches above the rail. Furthermore, in the ordinary form of shovels a man is compelled to stand in a dangerous position on a platform, located on the side of the boom, whereas in my construction he can stand directly on the turn-table in a protected position and still be in convenient position to manipulate and observe the working parts.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-shovel, the combination of a boom, a bucket provided with a handle working on the boom, a pivoted chain-guide in the form of a segment of a circle, connections between the guide and the bucket, a hoisting-chain held at the upper end of, and lying in, the circular chain-guide, and means for applying power to said chain, whereby the pull is always exerted tangential to the circle, substantially as set forth.

2. In a steam-shovel, the combination, of a boom, a bucket provided with a handle working on the boom, a pivoted circular chain-guide, connections between the guide and the bucket, and a hoisting-chain lying in the circle of the chain-guide, and connected thereto in such manner that when power is applied to said chain, the pull will always be exerted tangentially to the circle, substantially as set forth.

3. In a steam-shovel, the combination, of a boom, a dipper having its handle longitudinally movable on the end of the boom, a lever pivotally connected at a medial point to the upper end of the boom, and adapted to rock or oscillate thereon, said lever provided at its rear end with a chain-guide curved to the arc of a circle, links connecting the forward end of the lever with the dipper, and a hoisting-chain held at the upper end of the circular chain-guide, and arranged along the length of said guide, substantially as set forth.

4. In a steam-shovel, the combination, of a boom, a dipper having its handle pivoted to the end of the boom, a lever pivotally connected at a medial point to the upper end of the boom, and adapted to rock or oscillate thereon, connections between the forward end of the lever and the dipper, and a hoisting-chain operated on the end of the oscillating lever, substantially as set forth.

5. In a steam-shovel, the combination, of a boom, a dipper longitudinally movable on the boom, an oscillating lever provided with bear-

ings at a medial point to receive the transverse shaft, and formed or provided at its rear end with a partly-circular chain-guide, and having connection at its forward end with the dipper, a chain having one end attached to the end of the dipper-handle, and adapted to be operated for imparting a thrust movement to the dipper, and a hoisting-chain lying in the circle of the chain-guide, and constructed to exert a pull at the upper end of said chain-guide, whereby an oscillating or rocking movement is imparted to the lever, substantially as set forth.

6. In a steam-shovel, the combination, of a boom, a dipper having its handle working on the boom, a lever rocking or oscillating on the upper end of the boom, said lever provided at its rear end with a partly-circular chain-guide, and having connection at its forward end with the dipper, a sheave journaled in bearings at the lower end of the boom, a chain held at the upper end of the circular chain-guide, and arranged along the length of said guide, and passed beneath the sheave at the lower end of the boom, and extended rearward for operation, substantially as set forth.

7. In a steam-shovel, the combination, of a turn-table, a boom projecting therefrom, a dipper having its handle working on the boom, a lever rocking or oscillating on the upper end of the boom, said lever provided at its rear end with a partly-circular chain-guide, and having connection at its forward end with the dipper, a sheave journaled in bearings at the lower end of the boom, pins projecting vertically from the turn-table, and having sheaves mounted horizontally thereon, and a chain held at the upper end of the circular chain-guide, and arranged along the length of said guide, and passed beneath the sheave at the lower end of the boom, and then extended rearward between the horizontally-mounted sheaves, substantially as set forth.

8. In a steam-shovel, the combination, of a boom, a dipper having its handle working on the boom, a lever rocking or oscillating on the upper end of the boom, said lever provided at its rear end with a partly-circular chain-guide, and having connection at its forward end with the dipper, a sheave journaled in bearings at the lower end of the boom, and a chain having one end attached to the swinging framework, and then extended up over a pulley located at the upper end of the chain-guide, then around said pulley and down and beneath the sheave at the lower end of the boom, and then extended rearward for operation, substantially as set forth.

9. In a steam-shovel, the combination, of a boom, consisting of parallel inclined beams, a fixed shaft connecting the upper ends of said beams, a dipper the handle thereof composed of two parallel beams, each constructed of two channel-irons, the flanges of one iron fitting within the flanges of the other, filling strips or blocks for the spaces formed by the registering channel-irons, said filling-blocks

and the channel-irons provided with registering elongated slots through which the shaft passes, and a chain connecting with the dipper-handle for imparting a thrusting movement thereto, substantially as set forth.

10. In a steam-shovel, the combination, of a truck, a frame secured thereto, a turn-table, a boom projecting forward from the turn-table, said boom consisting of parallel inclined beams united at their upper ends by a transverse shaft, a dipper having its handle provided with an elongated slot to receive the shaft at the end of the boom, rods connected at their ends by a collar, said collar receiving the upper end of the frame, and adapted to swing on the latter horizontally, and the forward ends of the rods provided with eyes to receive the extremities of the shaft, an oscillating lever provided centrally with depending bearings through which the transverse shaft passes, connections between the forward end of said lever and the dipper, a hoisting-chain for operating the oscillating lever, and a chain connected to the end of the dipper-handle, and adapted to impart a thrusting movement to the dipper, substantially as set forth.

11. In a steam-shovel, the combination of a boom consisting of two parallel beams united at their upper ends by a transverse shaft, a bucket having its handle pivoted on the shaft, a lever consisting of two parallel channel-irons having their flanges extending outward, the upper flanges connected by a plate, and the lower flanges having bearings depending centrally therefrom through which bearings the transverse shaft passes, a chain for operating the oscillating lever, and a chain connecting with the dipper-handle, for imparting a thrusting movement to the dipper, substantially as set forth.

12. In a steam-shovel, the combination, of a truck, a frame secured thereto, a turn-table on the forward end of the truck, means for revolving said turn-table, a boom consisting of parallel inclined beams projecting forward from the turn-table, and connected at their upper ends by a transverse shaft, rods connected at their rear ends by a collar receiving the upper end of the frame, whereby said rods are free to swing horizontally on the frame, and the forward ends of the rods apertured to receive opposite ends of the transverse shaft which extend laterally beyond the ends of the boom-beams, an oscillating lever comprising two parallel beams having bearings through which the shaft passes, and which are located on said shaft adjacent to the inner sides of the boom ends, said lever provided at its rear end with a partly-circular chain-guide, a dipper having its handle consisting of two arms which are provided with registering elongated slots through which the shaft passes, said arms located on the shaft adjacent to the bearings of the lever, loose sheaves carried centrally on the shaft between the arms of the dipper-handle, a transverse shaft

turning in bearings at the lower end of the boom, said shaft carrying two sheaves one loose and the other fixed, a chain having one end attached to the dipper, then extended rearward over one of the loose sheaves of the shaft at the upper end of the boom, thence down and around the loose sheave at the lower end of the boom, thence up and around the other loose sheave at the upper end of the boom, and finally back to the rear end of the dipper-handle for attachment thereto, and a second chain held at the upper end of the circular chain-guide, and then extended down to and around the fixed sheave of the shaft at the lower end of the boom, and clutch mechanism for throwing the loose sheave on the shaft at the lower end of the boom into and out of clutch with said shaft, substantially as set forth.

13. In a steam-shovel, the combination, of a boom, a dipper provided with arms pivoted to the boom, a pivoted chain-guide in the form of a segment of a circle, connections between the chain-guide and the bucket, a shaft journaled in bearings at the lower end of the boom said shaft carrying a fixed and a loose sheave, the latter provided with an integral laterally-disposed rim, a friction-band surrounding said rim, and having one end secured thereto, a bell-crank lever, having one of its cranks disposed on the side of the fixed sheave adjacent to the rim of the loose sheave and having the other end of the band attached to said crank and having the other crank disposed on the opposite side of said sheave, a second bell-crank lever having one of its cranks extending into a longitudinal recess in the shaft carrying the sheaves, connections between the other crank of this lever and the adjacent crank of the first-named lever, a rod entering the longitudinal recess of the shaft, and provided with an opening to receive the arm of the bell-crank, means for moving this rod longitudinally, a chain having one end attached to the dipper and then extended rearward over one of the loose sheaves of the shaft at the upper end of the boom, thence down and around the loose sheave at the lower end of the boom, thence up and around the other loose sheave at the upper end of the boom, and finally back to the rear end of the dipper-handle for attachment thereto, and a second chain held at the upper end of, and lying in, the circular chain-guide, said chain, when power is applied thereto, exerting a pull tangential to the circle, substantially as set forth.

14. In a steam-shovel, the combination, of a boom, a dipper provided with arms pivoted to the boom, a pivoted chain-guide in the form of a segment of a circle, connections between the chain-guide and the bucket, a shaft jour-

naled in the bearings at the lower end of the boom said shaft carrying a fixed and a loose sheave, the latter provided with two integral rims, a friction-band surrounding one of the rims, and having one end secured thereto, a bell-crank lever, having one of its cranks disposed on the side of the fixed sheave adjacent to the rim of the loose sheave, and having the other end of the band attached to said crank, and having the other crank disposed on the opposite side of said sheave, a second bell-crank lever having one of its cranks extending into a longitudinal recess in the shaft carrying the sheaves, connections between the other crank of this lever and the adjacent crank of the first-named lever, a rod entering the longitudinal recess of the shaft, and provided with an opening to receive the arm of the bell-crank, means for moving this rod longitudinally, a brake-band surrounding the other rim of the loose sheave, a pivoted bell-crank lever having opposite ends of this band secured to the cranks thereof, means for operating the bell-crank lever, a chain having one end attached to the dipper and then extended rearward over one of the loose sheaves of the shaft at the upper end of the boom, thence down and around the loose sheave at the lower end of the boom, thence up and around the other loose sheave at the upper end of the boom, and finally back to the rear end of the dipper-handle for attachment thereto, and a second chain held at the upper end of, and lying in, the circular chain-guide, said chain, when power is applied thereto, exerting a pull tangential to the circle, substantially as set forth.

15. In a steam-shovel, the combination, of a boom, a dipper provided with arms working on the boom, a pivoted chain-guide, in the form of a segment of a circle, connections between the chain-guide and the bucket, a shaft journaled in the bearings at the lower end of the boom, said shaft carrying a fixed and a loose sheave, a chain having one end attached to the dipper, and then extended to and around the loose sheave of the shaft, and then up and back for attachment to the rear end of the dipper-arms, a second chain held at the upper end of the circular chain-guide, and then extended down to and around the fixed sheave of the shaft, and clutch mechanism for throwing the loose sheave on the shaft into and out of clutch with said shaft, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

OLAF HETLESAETER.

Witnesses:

ARTHUR L. MORSELL,
WM. J. KNOX.