Jan. 9, 1923. 1,441,700.

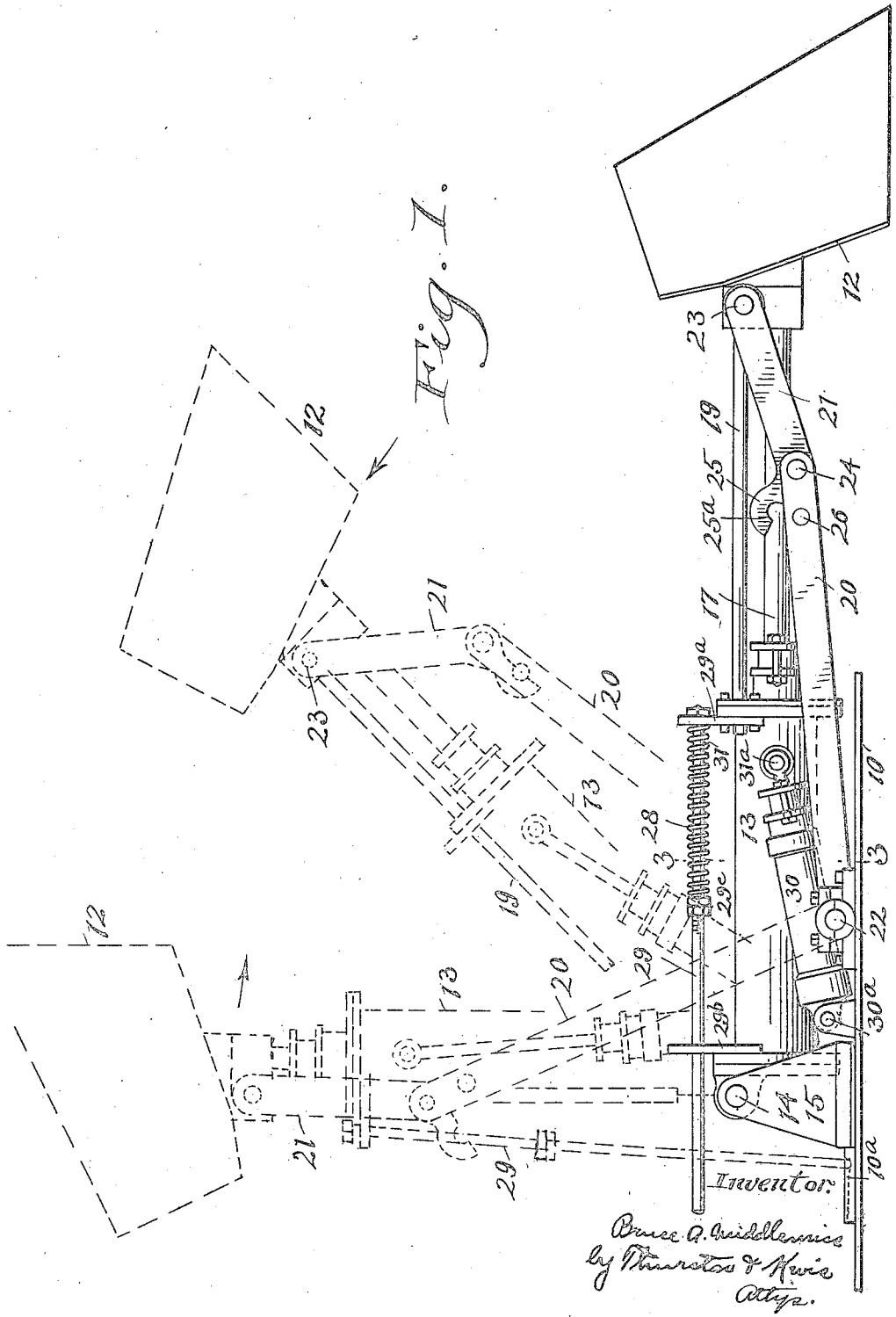
B. A. MIDDLEMISS.

LOADING MACHINE.

FILED JAN. 18, 1917.

2 SHEETS—SHEET 1.

Fig. 1.



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B. A. MIDDLEMISS.

LOADING MACHINE.

FILED JAN. 18, 1917. 2 SHEETS—SHEET 2.

Fig. 2.

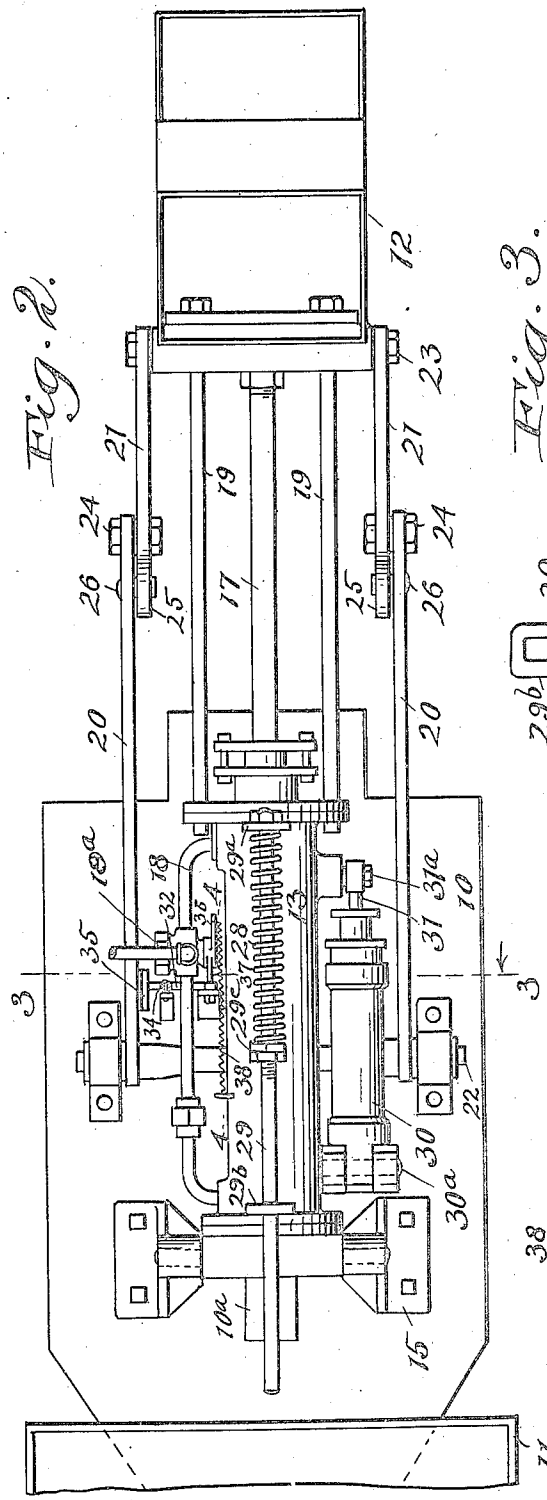


Fig. 3.

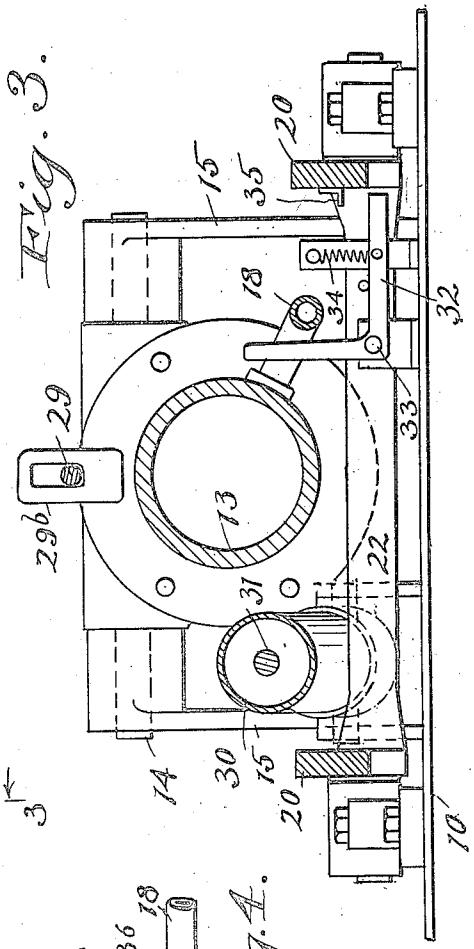
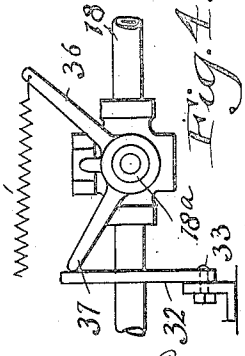


Fig. 4.



Inventor:

Bruce A. Middlemiss

by Thurston & Kwis

Attys

Patented Jan. 9, 1923. 1,441,700

UNITED STATES PATENT OFFICE.

BRUCE A. MIDDLEMISS, OF HIBBING, MINNESOTA, ASSIGNOR TO MIDDLEMISS AND BRACKETT, OF MILWAUKEE, WISCONSIN, A COPARTNERSHIP COMPOSED OF BRUCE A. MIDDLEMISS AND JOHN C. BRACKETT.

LOADING MACHINE.

Application filed January 18, 1917. Serial No. 143,116.

To all whom it may concern:

Be it known that I, BRUCE A. MIDDLEMISS, a citizen of the United States, residing at Hibbing, in the county of St. Louis and State of Minnesota, have invented a certain new and useful Improvement in Loading Machines, of which the following is a full, clear, and exact description.

This invention relates to loading machines designed to shovel loose material into cars or other receiving apparatus.

In so far as I am informed, all loading machines have been modifications of the steam shovel, dredge, and heavy loading machine types, designed to effect a relatively slow movement of the load carrying element, followed by a relatively slow movement to deliver material. This slowness is caused by the relatively large quantities which it has been the custom to handle in each operation.

While these types have been standard for surface and unrestricted underground excavations, their size and weight has precluded their use in underground workings where their space is limited. It has been possible to use existing machines underground only by adapting the size of the drifts and the radii of turnouts to suit the machine. In bad ground this is impracticable.

My invention has for its general object to produce a compact, light machine overcoming these objections, working on the principles, first, of handling small quantities per cycle, second, of attacking materials with a light element, given high kinetic energy by the power and quickness of its thrust, third, of transferring small individual loads by fast and relatively very powerful means, giving a very rapid speed of transfer. This combination with automatic means for continuous operation, furnishes a machine of unique usefulness in underground mining, where it is necessary to handle quickly detached masses of material, individually small, but of enormous aggregate tonnage.

In carrying out my invention I make use preferably of a peculiarly designed two surfaced shovel, one face being adapted to receive and the other to transfer the load. I also prefer to terminate the transfer stroke suddenly, by the action of a yielding element, the recoil of which may be used to assist reversal of the mechanism. Preferably in securing high shovel energy, I mount the shovel directly on a powerful reciprocating element. In the particular machine illustrated, this reciprocating element is further utilized as a transferring means.

It is obvious that the common type of drop bottom bucket may be employed, that a conveying apparatus may be added to the transferring means, that motors of the rotary type may be substituted for the pistons shown, and that, if required for heavy work, an auxiliary scraper may be employed to carry material into reach of the shovel. The type shown is designed for certain conditions, and to meet conditions in other mining districts any or all of the obvious modifications of design may be added without affecting the essentials of the invention.

In the accompanying sheets of drawings wherein I have shown one embodiment of my invention which operates with high efficiency, Fig. 1 is a side view of the machine, the parts being shown in full lines with the shovel approximately at the end of its outward or material receiving stroke, and by dotted lines in other different positions; Fig. 2 is a top plan view of the same; Fig. 3 is an enlarged transverse sectional view substantially along the line 3—3 of Fig. 1; and Fig. 4 is a detail view of the valve mechanism, this view being taken from the line 4—4 looking in the direction indicated by the arrows.

The machine here illustrated and described, and embodying my invention includes a base 10, which is designed to be held stationary during the loading operation and to be moved forwardly in any desired manner as the material in front of the machine is loaded into a car, a portion of which is indicated at 11 in Fig. 2 at the rear of the machine, or in any other suitable material receiving element. The material is loaded, that is to say, it is scooped up from a point in front of the machine, and is then elevated and moved rearwardly over the machine and discharged into the receiving ele-

ment 11 by a swinging unit including a reciprocating bucket or shovel 12, which is open at the front so that a load will be received as the shovel is moved forwardly into the material and is open at its upper end so that material can be discharged from the bucket at the rear of the machine.

The bucket is given the movements necessary for this purpose by a single motor or motive device which is a part of the swinging unit and which preferably consists of a reciprocating air or other fluid pressure motor having a cylinder 13, which at its rear end, and preferably at its upper rear end is pivoted on a horizontal shaft 14 mounted in bearing brackets 15 on the base 10. The motor includes also a piston to which is connected a reciprocating plunger 17, which is directly and rigidly connected at its forward end to the bucket 12. Air or other motive fluid is supplied first to one end and then to the opposite end of the cylinder 13 by means of a pipe 18 connected to the cylinder near the ends thereof and a four-way valve 18^a, the motive fluid being designed to be supplied to the pipe 18 by a flexible tube or pipe adapted to be connected to the valve chamber by means of the connection indicated at 18^a. To guide the shovel during its forward and rearward reciprocating movements, the shovel is provided with two parallel guide rods 19 which are parallel to the plunger 17 and slide through two openings in the forward head of the cylinder 13.

Although a motor such as here indicated, would normally give only a forward and rearward reciprocating movement to the shovel, by my invention this motor gives the shovel not only the necessary reciprocating movements but also gives to the unit including the shovel and motor the upward and rearward swinging movement, and this is accomplished by the provision of two sets or pairs of bars or arms 20 and 21, the two sets or pairs being located on opposite sides of the motor. Each rear arm 20, which is somewhat longer than the companion forward arm, is pivoted at 22 to the base 10, forward of and below the pivotal axis of the cylinder 13, and also below the line of movement of the plunger 17 when in horizontal of substantialy horizontal position. The forward and shorter arm of each pair is pivotally connected at 23 to the rear part of the bucket, and preferably as here shown, slightly above the plunger 17. Additionally the two arms 20 and 21 of each pair are pivotally connected together at 24, and the arm 21 is provided with a tail like extension 25 having a notch 25^a which is designed to engage a pin or other projection 26 on the arm 20 when the arms 20 and 21 are swung to a certain position.

The parts are so arranged that at or near the end of the outward stroke of the piston and shovel, the arms 20 and 21 of each pair drop downward so that the pivotal axis of connection 24, passes below the dead center, that is, below a line connecting the axes 22 and 23, with the result that when the shovel is retracted, the tail 25 engages the pin 26 locking the two arms 20 and 21 so as to form them into a rigid brace or strut. In view of the fact that the inward pull of the motor is substantially horizontal, and inasmuch as this brace is at an angle, or is downwardly inclined with respect to the line of pull, when the piston of the motor moves rearward there is imparted to the shovel, motor, and in fact, the entire swinging material moving mechanism or unit, a vertical component which swings said mechanism as a unit around the axis of shaft 14 to substantially the vertical position indicated by dotted lines.

During the upward and rearward swinging movement the shovel is being drawn inwardly, the piston then moving toward the rear end of the cylinder, and when the cylinder reaches substantially the vertical position the piston is at the end of its inward stroke. However, the cylinder and in fact the swinging unit move slightly beyond the vertical position, this continued movement beyond the vertical being due to momentum. The final swinging movement is checked gradually, and then stopped by a yieldable buffer or shock absorbing checking device which not only stops and cushions the rearward swinging movement, but immediately starts the unit to swing back to its normal horizontal position. This device consists preferably of a coil spring 28 surrounding a rod 29 which is mounted on the top of the cylinder 13 and extends lengthwise thereof, the upper or forward part of the rod passing freely through a hole of a supporting bracket 29^a at the front head of the cylinder, and the lower or rear part fitting loosely in a slot of a bracket 29^b at the rear head of the cylinder. The rod 29 extends far enough beyond the rear end of the cylinder 13 that when the swinging unit reaches subsantially the vertical position the lower or rear end of the rod engages a plate 10^a on base 10, and in consequence the rod moves through the brackets 29^a and 29^b and compresses the spring 28 which is located between the forward bracket 29^a and an adjustable abutment 29^c on the rod, this being preferably in the form of a nut. The parts are so arranged that the spring 28 begins to be compressed at or about the time the unit reaches the vertical position, and brings the unit to a stop without material shock, and then the compressed spring throws the unit back beyond the vertical in the opposite direction and into a position from which it drops by gravity again to the horizontal

position. The arms 20 and 21 do not prevent this return movement of the unit because at or about the end of the upward and rearward swinging movement the two arms of each pair straighten out and they pass by gravity and by momentum rearwardly beyond the dead center, this taking place just as the buffer spring 28 starts the return forward and downward movement.

When the swinging unit reaches its upper or near vertical position, the spring buffer stops it without destructive shock but suddenly enough to cause the material or load in the shovel to be thrown therefrom or completely discharged out of the rear end of the shovel into the car or receiving member 11.

As before stated, the swinging unit drops by gravity again to the horizontal position. To check this movement just before the unit reaches the horizontal, I provide a movement checking device consisting preferably of an oil or other fluid containing cylinder 30 which is pivoted at 30ª on the base 10, this cylinder having a piston to which is connected a plunger 31 pivoted at 31ª to the cylinder 13 near its forward end. Inasmuch as the lower pivotal axis of the oil cylinder 30 is a short distance forward of and below the pivotal axis of the power cylinder 13, when the mechanism or unit drops to horizontal position, the piston moves rearwardly in the oil cylinder so as to check the fall of the unit. This oil cylinder works in such a manner that it does not check the upward swinging movement, the piston in the cylinder 30 then passing freely along the cylinder, and it allows the unit to fall quickly to near the horizontal position where the movement is checked the last few degrees of the downward swinging movement taking place slowly.

If now motive fluid is admitted to the rear end of the power cylinder 13 so as to move the piston therein forwardly, the shovel is given its forward thrust or stroke which again fills the shovel and at the end of this forward thrust or stroke the parts will again be in the full line position indicated in Fig. 1, the arms 20 and 21 straightening out and dropping downwardly very slightly by gravity and momentum below the dead center when the shovel is at the end of its outward stroke. The arms do not, however, pass materially beyond the dead center until the return movement of the shovel is started.

Although as will be readily understood, the four-way valve 18ª could be operated manually, I prefer that this valve be operated automatically so that without any attention on the part of the operator, material will be loaded into the receiving element, the shovel passing through one complete cycle of movement after the other. This automatic throwing of the valve 18ª can be effected in various ways, but in this case I have illustrated a simple automatic mechanism which operates successfully. This includes a pivoted bell crank trip lever 32 which is pivoted at 33 on the base 10, the bell crank having a vertical arm and a substantially horizontal arm. The latter is normally pulled upwardly to a definite position by a spring 34, and is adapted to be rocked from normal position by a projection in the shape of a short angle piece 35 on one of the swinging arms 20. The four-way valve 18ª is provided with two bell crank arms 36 and 37 which swing in a plane at right angles to the plane of movement of the bell crank 32. It will be observed that the arm 36 has attached to it a spring 38 which tends to swing the valve arms 36 and 37 toward the rear end of the motor or in a counter-clockwise direction as the same would be viewed in Fig. 1. Additionally the upright arm of the bell crank 32 is normally in the path of movement of the valve arm 37, so that as the mechanism swings downwardly after discharging the shovel load, the upright bell crank arm 32 engages the arm 37 and shifts the valve. This shifting of the valve 18ª which takes place at or about the instant the cylinder reaches horizontal position, admits the motive fluid to the rear end of the cylinder causing the forward or loading stroke to be imparted to the shovel. At or about the time the shovel reaches the end of its forward stroke, the arms 20 and 21 drop downwardly below the dead center, as previously described, and in so doing, the angle 35 hits the laterally or horizontally extending arm of the bell crank 32, swinging the upright arm of the bell crank away from the valve arm 37, and permitting the spring 38 which is connected to the valve arm 36 to shift the four-way valve to its opposite position and so that motive fluid is admitted to the forward end of the cylinder, whereupon there is caused the rearward stroke of the piston and the upward and rearward swinging movement of the loading mechanism. This movement is then followed by the downward swinging drop to horizontal position, the fall being checked by the oil cylinder as previously explained, and just before the parts reach horizontal position the valve arm 37 again engages the upright arm of bell crank 32, shifting the valve and causing the forward stroke of the plunger and shovel previously explained.

These movements take place rapidly, and material is thus, with this simple mechanism, picked up shovelful after shovelful and carried upwardly and rearwardly and thrown or discharged into the receiving element 11. This mechanism is well adapted for certain uses such as for loading ore or coal, especially by reason of its extremely

simple construction. Additionally the material can be loaded while the operator is giving attention to other parts or to other work. When the material is consumed or picked up within reach of the shovel, the machine as a whole will be moved forwardly to additional material to be loaded.

Having thus described my invention, what I claim is:

1. In a loading machine, a material digging and shifting device comprising a shovel mounted to reciprocate, means for imparting thereto a thrust movement and a withdrawing movement, and means whereby said withdrawing movement is automatically converted into a swinging movement through a curve of constantly decreasing radius.

2. In a loading machine, material carrying means, motive means operatively associated therewith to successively impart thrust and withdrawing movements to the same to effect loading thereof and means for automatically converting the withdrawing movement into a swinging delivery movement through a curve of constantly decreasing radius.

3. In a loading machine, material carrying means, motive means operatively associated therewith to reciprocate the same to effect loading thereof and withdrawal from the pile and thereafter cause the same to effect a swinging delivery movement through a curve of constantly decreasing radius, said means including means whereby the said carrying means swings back to normal position through an arc differing from that which it describes in moving to delivery position.

4. In a loading machine, material carrying means, motive means operatively associated therewith to reciprocate the same to effect loading thereof and withdrawal from the pile and thereafter cause the same to effect a swinging delivery movement through a curve of constantly varying radius.

5. In a loading machine, a material digging and shifting device comprising a shovel mounted to reciprocate to project the same into and withdraw it from the pile and to thereafter swing the same for effecting delivery of a load received during reciprocation thereof, and means whereby said swinging movement effects forced projection of the load from the shovel, said means including motive means for imparting the several aforesaid successive movements to the shovel.

6. A loading machine comprising motive means, a shovel adapted to be reciprocated to project the same into and withdraw it from the pile, and swing thereby to deliver a load, and means associated with said shovel and motive means for effecting forcible projection of the load from the shovel.

7. A loading machine comprising motive means, a shovel adapted to be reciprocated to project the same into and withdraw it from the pile and swing thereby to deliver a load, and means associated with said shovel and motive means for effecting forcible projection of the load from the shovel, and return the latter to its normal position during an interval of idleness of the motive means.

8. A loading machine comprising motive means, a shovel adapted to be reciprocated to project the same into and withdraw it from the pile and swing thereby to deliver a load, and a stop for arresting the swinging movement of the shovel and effecting forcible projection of the load therefrom.

9. A loading machine comprising motive means, a shovel adapted to be reciprocated to project the same into and withdraw it from the pile and swing thereby to deliver a load, and a stop for arresting the swinging movement of the shovel and effecting projection of the load therefrom and effect initial return movement of said shovel to its normal position.

10. A loading machine comprising motive means, a shovel adapted to be reciprocated to project the same into and withdraw it from the pile and swing thereby to deliver a load, a stop for arresting the swinging movement of the shovel and effecting forcible projection of the load therefrom and effect initial return movement of said shovel to its normal position, and means for maintaining said motive means idle during return movement of said shovel to normal position.

11. A loading machine comprising a shovel, motive means associated therewith for effecting reciprocation of said shovel into a pile to load the same and then to withdraw it from the pile, and swing it to a point of discharge, a yielding stop element disposed to arrest the swinging movement of said shovel to effect forced projection of the load therefrom and effect rebound of said shovel in its return swing to normal position, a source of power for said motive means, and means controlling the connection between said source of power and said motive means for maintaining the latter idle during the return movement of said shovel.

12. A loading machine comprising a shovel, motive means associated therewith for effecting reciprocation of said shovel to load the same and thereupon swing said shovel to a point of discharge through an arc of constantly decreasing radius, a yielding stop element disposed to arrest the swinging movement of said shovel to effect forced projection of the load therefrom and effect rebound of said shovel in its return swing to normal position, a source of power for said motive means, and means control-

ling the connection between said source of power and said motive means for maintaining the latter idle during the return movement of said shovel, the said return movement of the latter being through a substantially constant arc.

13. In a loading machine, a base, a swinging material receiving and conveying unit mounted to swing about a horizontal axis, said swinging unit including a shovel and a motor connected to the shovel to reciprocate the same, and means whereby said motor is caused to move the shovel outwardly to receive a load, then inwardly and to simultaneously swing the unit upwardly and rearwardly through an arc of substantially ninety degrees to dumping position.

14. In a loading machine, a base, a swinging material receiving and conveying unit mounted to swing about a horizontal axis, said swinging unit including a shovel and a motor connected to the shovel to reciprocate the same, and means whereby said motor is caused to move the shovel outwardly to receive a load, then inwardly and to simultaneously swing the unit upwardly and rearwardly through an arc of substantially ninety degrees to dumping position, said means including bracing arms between the unit and the base.

15. In a loading machine, a base, a material receiving and conveying unit mounted to swing about a horizontal axis and including a shovel and a motor connected to the shovel to reciprocate the same, and means whereby said motor is caused to move the shovel outwardly to receive a load, then inwardly and to simultaneously swing the unit upwardly and rearwardly through an arc or substantially ninety degrees to dumping position, said means comprising a brace including a pair of arms pivoted together and pivoted to the unit and to the base.

16. In a loading machine, a base, a swinging material receiving and coveying unit mounted to swing in a vertical plane, said swinging unit including a shovel and a motor for reciprocating the same, and means whereby said motor causes the shovel to be moved outwardly to receive a load, then to be moved inwardly and at the same time causes the unit to swing upwardly to a position at which the load is discharged and from which the unit may automatically return to substantially horizontal position.

17. In a loading machine, a base, a material receiving and conveying unit mounted to swing in a vertical plane and including a shovel and a motor for reciprocating the same, and means whereby said motor causes the shovel to be moved outwardly to receive a load, then to be moved inwardly and at the same time causes the unit to swing upwardly to a position at which the load is discharged and from which the unit may return to substantially horizontal position, and means for checking the swinging movements of the unit.

18. In a loading machine, a base, a material receiving and conveying unit mounted to swing in a vertical plane and including a shovel and a motor for reciprocating the same, and means whereby said motor causes the shovel to be moved outwardly to receive a load, then to be moved inwardly and at the same time causes the unit to swing upwardly to a position at which the load is discharged and from which the unit may return to substantially horizontal position, said means including motor controlling means which automatically reverses the motor at predetermined points in the cycle of movement.

19. In a loading machine, a base, a material receiving and conveying unit mounted to swing in a vertical plane and including a shovel and a motor for reciprocating the same, and means whereby said motor causes the shovel to be moved outwardly to receive a load, then to be moved inwardly and at the same time causes the unit to swing upwardly to a position at which the load is discharged and from which the unit may return to substantially horizontal position, said means comprising pivoted arms connected to the unit and to the base, a valve for the motor, and means whereby the valve is automatically actuated to reverse the motor at predetermined points in the cycle of movement.

20. In a loading machine, a base, a shovel, a reciprocating motor including a cylinder pivoted to the base, a plunger connected to the shovel, and means whereby a swinging component is given by the motor to the motor and shovel when the shovel is moved inwardly by the motor.

21. In a loading machine, a base, a shovel, a reciprocating motor including a cylinder pivoted to the base, a plunger connected to the shovel, and means whereby a swinging component is given to the motor when the shovel is moved inwardly by the motor, said means including a brace or strut connected to the shovel and base and composed of two pivoted members which in a certain position are locked together.

22. In a loading machine, a base, a shovel, a reciprocating motor including a cylinder pivoted to the base, a plunger connected to the shovel, and means whereby a swinging component is given by the motor to the motor and shovel when the shovel is moved inwardly by the motor, and valve mechanism for controlling the motor.

23. In a loading machine, a base, a shovel, a reciprocating motor including a cylinder pivoted to the base, a plunger connected to the shovel, and means whereby a swinging component of the power of the motor is

given to the motor and shovel when the shovel is moved inwardly by the motor, and means automatically reversing the motor.

24. In a loading machine, a base, a shovel, a reciprocating motor including a cylinder pivoted to the base, a plunger connected to the shovel, and means whereby a swinging component of the power of the motor is given to the motor and shovel when the shovel is moved inwardly by the motor, a four-way valve for the motor, and means for automatically reversing the valve at given points in the cycle of movement imparted to the shovel.

25. In a loading machine, a shovel, a motive element for reciprocating the same to project it into and withdraw it from material to be transferred, means associated with said shovel and said motive element whereby the withdrawing stroke of the shovel is converted into a swinging movement thereof through an arc of constantly decreasing radius to the point of discharge for the load.

26. In a loading machine, a shovel, a motive element for reciprocating the same to project it into and withdraw it from material to be transferred, and means associated with said shovel and said motive element whereby the withdrawing stroke of the shovel is converted into a swinging movement thereof through an arc of constantly decreasing radius to the point of discharge for the load, and a stop for arresting said swinging movement for effecting forced projection of the load from the shovel.

27. In a loading machine, a shovel, a motive element for reciprocating the same to project it into and withdraw it from material to be transferred, and means associated with said shovel and said motive element whereby the withdrawing stroke of the shovel is converted into a swinging movement thereof through an arc of constantly decreasing radius to the point of discharge for the load, and a yielding stop for arresting the swinging movement of said shovel to effect forcible projection of the load therefrom and effect rebound thereof toward its initial position.

28. In a loading machine, a shovel, a motive element for reciprocating the same to project it into and withdraw it from material to be transferred, and means associated with said shovel and said motive element whereby the withdrawing stroke of the shovel is converted into a swinging movement thereof through an arc of constantly decreasing radius to the point of discharge for the load, a source of power for said motive element, means controlling the connection between said source and said motive element, a yielding stop for arresting the swinging movement of said shovel to effect forcible projection of the load therefrom and effect rebound thereof toward its initial position, and means for interrupting the connection between said motive element and said source of power during the return movement of the shovel to its initial position.

29. In a loading machine, a base, a material carrying unit comprising a motive element and a shovel carried thereby both mounted on said base to swing in unison about a common axis, said motive element adapted to reciprocate said shovel to project same into and withdraw the same from the material to be transferred, means associated with said shovel and said motive element and base for automatically converting a part of the withdrawing stroke of the shovel into a swinging movement thereof through an arc of constantly decreasing radius.

30. In a loading machine, a base, a material carrying unit comprising a motive element and a shovel carried thereby both mounted on said base to swing in unison about a common axis, said motive element adapted to reciprocate said shovel to project same into and withdraw the same from the material to be transferred, and means associated with said shovel and said motive element and base for automatically converting a part of the withdrawing stroke of the shovel into a swinging movement thereof through an arc of constantly decreasing radius, and means disposed to arrest the swinging movement of said shovel to effect forcible projection of the load therefrom.

31. In a loading machine, a base, a material carrying unit comprising a motive element and a shovel carried thereby both mounted on said base to swing in unison about a common axis, said motive element adapted to reciprocate said shovel to project same into and withdraw the same from the material to be transferred, and means associated with said shovel and said motive element and base for automatically converting a part of the withdrawing stroke of the shovel into a swinging movement thereof through an arc of constantly decreasing radius, and yielding means disposed to arrest the swinging movement of said shovel to effect forcible projection of the load therefrom and effect a rebound of said shovel to its initial position.

32. In a loading machine, a base, a material carrying unit comprising a motive element and a shovel carried thereby both mounted on said base to swing in unison about a common axis, said motive element adapted to reciprocate said shovel to project same into and withdraw the same from the material to be transferred, and means associated with said shovel and said motive element and base for automatically converting

a part of the withdrawing stroke of the shovel into a swinging movement thereof through an arc of constantly decreasing radius, and maintaining the momentum thereof to a predetermined point, and means for automatically arresting the swinging movement of said shovel and effecting return thereof to its initial position while maintaining the motive element idle.

33. In a loading machine, a base, a material carrying unit comprising a motive element and a shovel carried thereby both mounted on said base to swing in unison about a common axis, said motive element adapted to reciprocate said shovel to project same into and withdraw the same from the material to be transferred, and means associated with said shovel and said motive element and base for automatically converting a part of the withdrawing stroke of the shovel into a swinging movement thereof through an arc of constantly decreasing radius, and means associated with said motive element and its associated parts for arresting the swinging movement of said shovel to effect forcible projection of the load therefrom and effect a rebound and return by gravity of the shovel and motive element to their initial position.

34. In a shoveling machine, a shovel, a motive element for reciprocating the shovel to project it into the material and thereafter withdraw the same, a support on which the said motive element and shovel are pivotally supported, and means associated with the said support and said shovel for automatically converting a part of the withdrawing stroke of the shovel into a swinging delivery stroke thereof.

35. In a shoveling machine, a shovel, a motive element for reciprocating the shovel to project it into the material and thereafter withdraw the same, a support on which the said motive element and shovel are pivotally supported, and means associated with the said support and said shovel for automatically converting a part of the withdrawing stroke of the shovel into a swinging delivery stroke thereof, means for arresting the swinging movement of said shovel for effecting forcible projection of the load therefrom.

36. In a shoveling machine, a shovel, a motive element for reciprocating the shovel to project it into the material and thereafter withdraw the same, connection between said motive element and a source of power, means interposed in said connection for controlling the same, a support on which the said motive element and shovel are pivotally supported, means associated with the said support and said shovel for automatically converting a part of the withdrawing stroke of the shovel into a swinging delivery stroke thereof, and means for arresting the swinging movement of said shovel for effecting forcible projection of the load therefrom, and means associated with the power control and the arresting means for automatically effecting return of the shovel to initial position.

37. In a shoveling machine, a shovel, a motive element for reciprocating the shovel to project it into the material and thereafter withdraw the same, connection between said motive element and a source of power, means interposed in said connection for controlling the same, a support on which the said motive element and shovel are pivotally supported, means associated with the said support and said shovel for automatically converting a part of the withdrawing stroke of the shovel into a swinging delivery stroke thereof, means for arresting the delivery movement of said shovel to effect projection of the load therefrom, and means associated with the power control and the arresting means, whereby the power is shut off as said shovel approaches said arresting means, the latter including means for effecting rebound of the shovel for imparting thereto initial return movement to its initial position, the latter completed by gravity.

38. In a shoveling machine, a load-receiving element, a motive element associated therewith and adapted to normally impart a movement of predetermined length thereto toward the material to be transferred followed by a reverse movement thereof, and means associated with said receiving and motive elements for restricting the reverse movement of said load-receiving element, and automatically effecting a movement thereof laterally of its first-named movement.

39. In a loading machine, a carriage, a cylinder pivotally mounted thereon, a piston and piston rod adapted to be reciprocated thereby, a shovel carried by the piston, toggle levers each comprising two parts pivotally secured together at one end, means limiting their relative movement in one direction, one of said parts pivotally secured to the base and the other to the shovel, the connection of one of said parts to the base being nearer the shovel than the pivot of the cylinder and said means limiting the relative movement of said parts coacting with said pivots for converting movement of the shovel in one direction into a swinging movement of the same and said cylinder.

40. In a loading machine, a carriage, a cylinder pivotally mounted thereon, a piston and piston rod adapted to be reciprocated thereby, a shovel carried by the piston, and means connected with the shovel and the base for permitting free projection of the shovel away from the cylinder and a partial return movement thereof without varying the position of the cylinder with respect to the base, said means adapted to automati-

cally cause the cylinder to turn on its pivot during the balance of the complete return stroke of the shovel.

41. A shoveling machine comprising a base, a shovel reciprocable relatively to said base to project into and withdraw from a pile, a motive element associated with said shovel for effecting reciprocation thereof, and means associated with the base, the shovel and the motive element for automatically converting the withdrawal movement of the shovel into swinging delivery movement thereof through a curve of constantly decreasing radius.

42. A shoveling machine comprising a base, a shovel pivotally movable relatively to the base about a fixed axis, and reciprocable relatively to said axis to project it into and withdraw it from a pile, a motive element associated with the shovel to effect reciprocation thereof, and means associated with said shovel and said base for automatically converting the withdrawal movement of the shovel into a swinging delivery movement thereof.

43. A shoveling machine comprising a base, a shovel pivotally movable relatively to the base about a fixed axis, a motive element for imparting reciprocative movement to the shovel to project the same into and withdraw it from the pile, and means associated with the base, the shovel and the motive element for permitting the latter to impart a long thrust and a short withdrawing movement to said shovel, said means adapted to automatically convert the balance of the withdrawal movement of said shovel into a swinging delivery movement thereof until said shovel returns to its initial position preparatory to another thrust movement.

44. In a shoveling machine a base, a motor element thereon pivotally movable about a fixed axis, a shovel carried and adapted to be reciprocated by the said motive element to thrust it into and withdraw it from a load, means associated with said shovel and said base for permitting a long thrust movement of said shovel in a predetermined plane and a short withdrawing movement thereof in the same plane, said means adapted to compel said motive element and shovel to effect a swinging movement during the remainder of the withdrawal movement of the shovel to substantially its initial position with respect to the motive element.

45. In a shoveling machine, a base, a motive element, a shovel adapted to be reciprocated by said motive element and means associated with said base and shovel for converting reciprocative movement thereof into swinging delivery movement thereof through an arc of constantly decreasing radius and effecting a return swing of the shovel to initial position through an arc of a radius substantially equal to the shortest radius of the curve of delivery movement thereof.

In testimony whereof, I hereunto affix my signature.

BRUCE A. MIDDLEMISS.