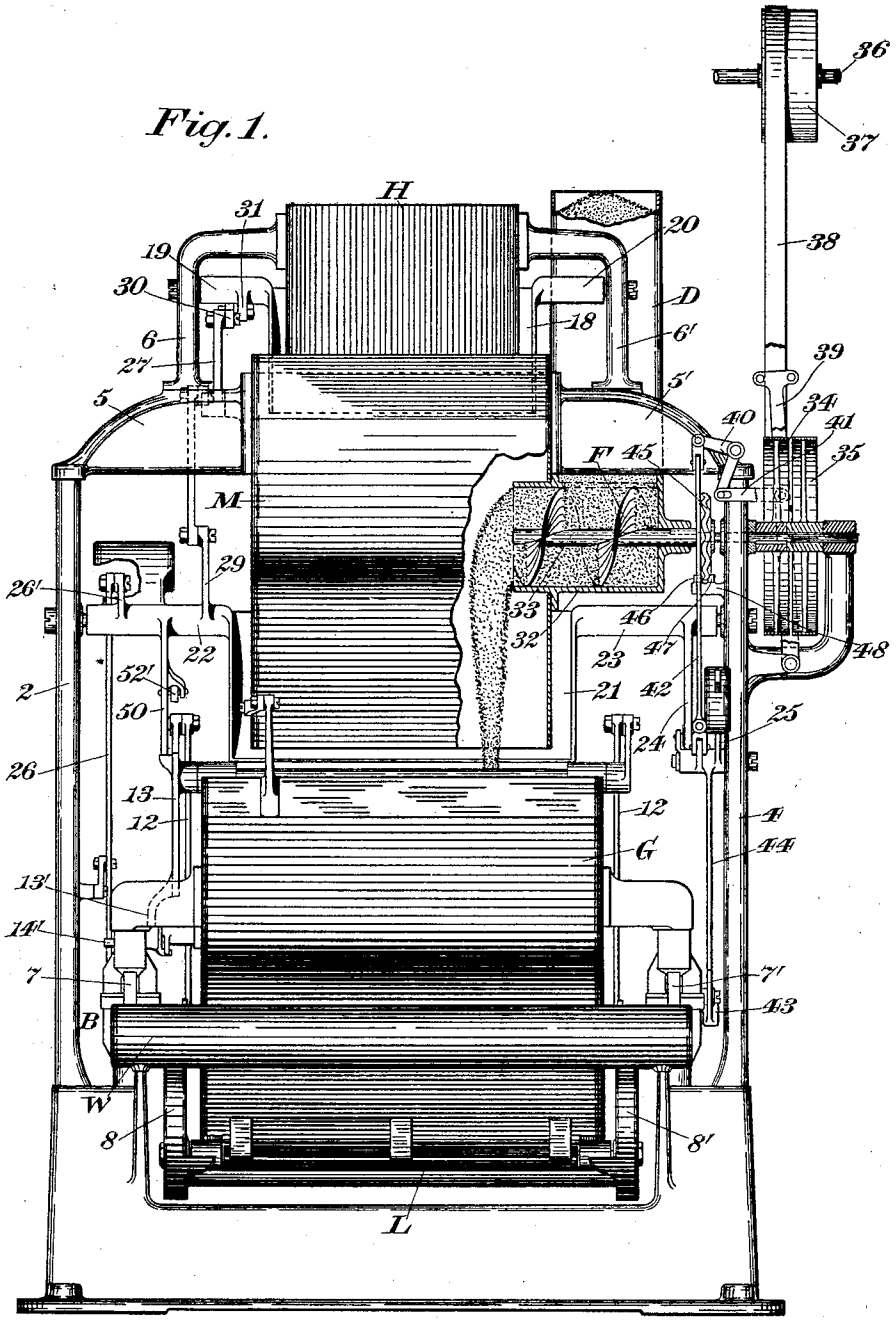
(No Model.) 5 Sheets—Sheet 1.

F. H. RICHARDS.

WEIGHING MACHINE.

No. 572,068. Patented Nov. 24, 1896.

Fig. 1.



Witnesses:
F. L. Edwards Jr.
Fred. J. Dole.

Inventor:
F. H. Richards.

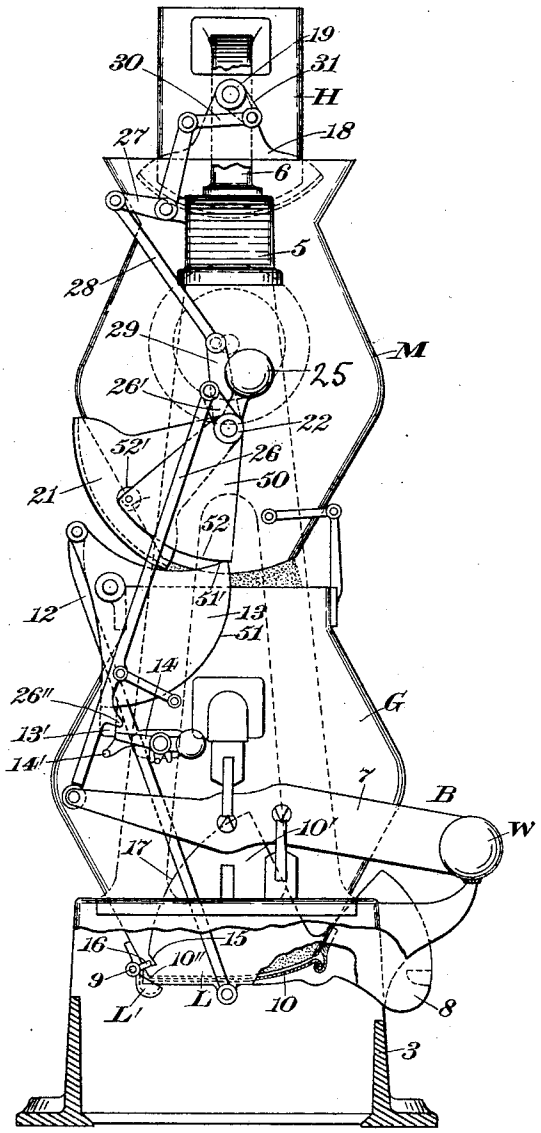
(No Model.) 5 Sheets—Sheet 2.

F. H. RICHARDS.

WEIGHING MACHINE.

No. 572,068. Patented Nov. 24, 1896.

Fig. 2.



Witnesses:

J. L. Edwards Jr.

Fred. J. Dole.

Inventor:

F. H. Richards.

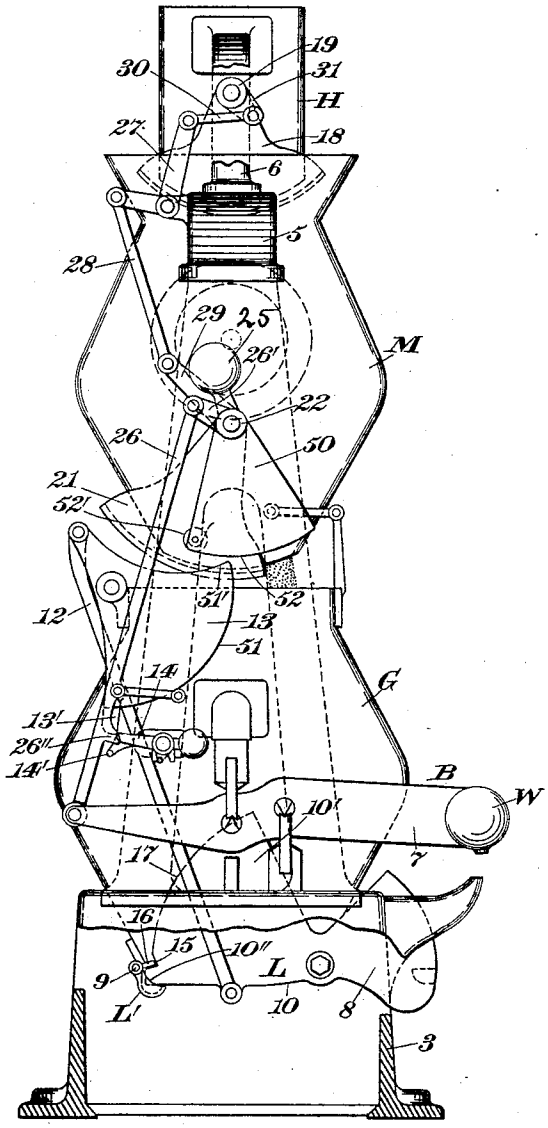
(No Model.) 5 Sheets—Sheet 3.

F. H. RICHARDS.

WEIGHING MACHINE.

No. 572,068. Patented Nov. 24, 1896.

Fig. 3.



Witnesses:
F. L. Edwards Jr.
Fred. J. Dole.

Inventor:
F. H. Richards.

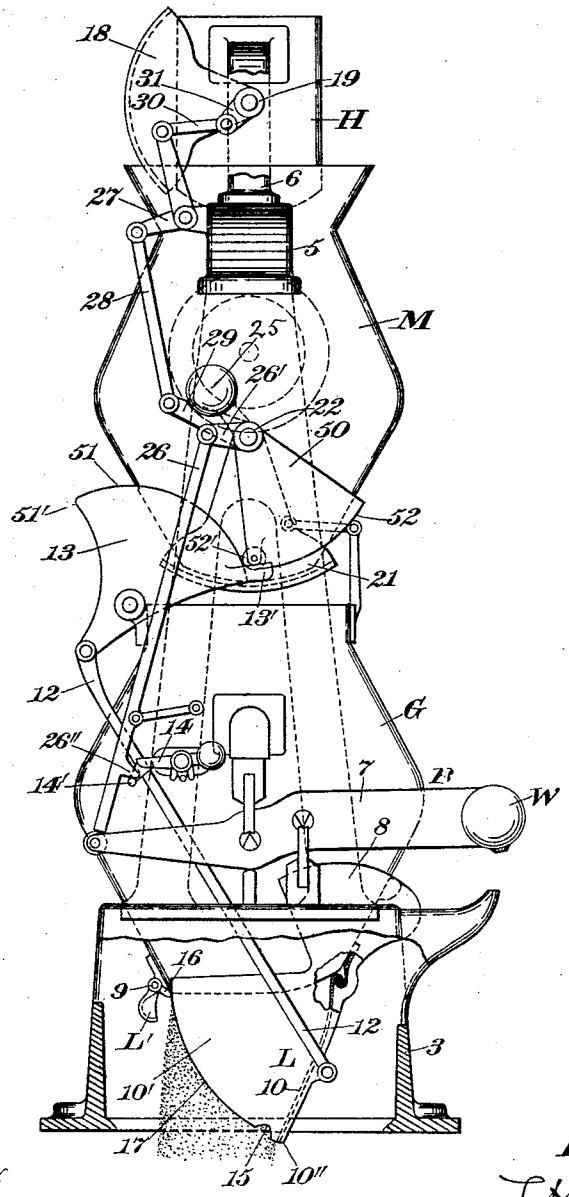
(No Model.) 5 Sheets—Sheet 4.

F. H. RICHARDS.

WEIGHING MACHINE.

No. 572,068. Patented Nov. 24, 1896.

Fig. 4.



Witnesses:
J. L. Edwards Jr.
Fred. J. Dole.

Inventor:
F. H. Richards.

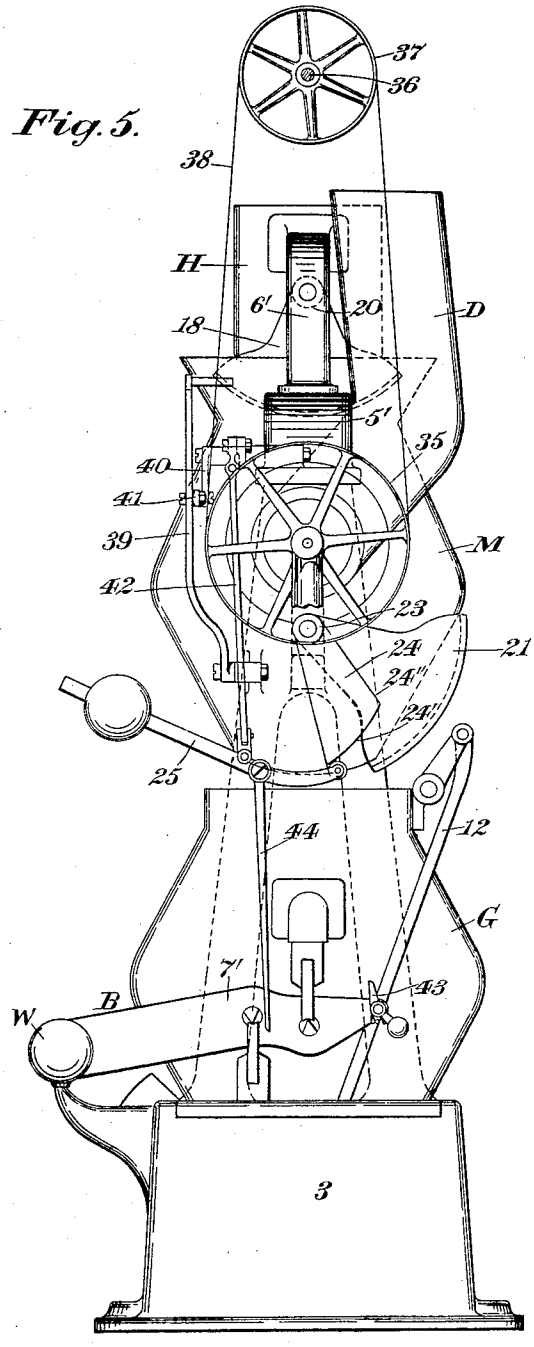
(No Model.) 5 Sheets—Sheet 5.

F. H. RICHARDS.

WEIGHING MACHINE.

No. 572,068. Patented Nov. 24, 1896.

Fig. 5.



Witnesses:
F. L. Edwards Jr.
Fred. J. Dole.

Inventor:
F. H. Richards.

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

WEIGHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 572,068, dated November 24, 1896.

Application filed July 10, 1896. Serial No. 598,652. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Weighing-Machines, of which the following is a specification.

This invention relates to weighing-machines, an object of the invention being to provide improved load-supply mechanism comprehending a meter for supplying a charge of material to the bucket, such charge composing the major part of a load to be made up therein; valve mechanism for controlling the influx and the efflux of material, respectively, to and from said meter, and means for furnishing a drip-stream to the bucket for completing the partial load therein, by virtue of which organization accurate bucket-loads may be obtained in a minimum space of time and the capacity of the machine also materially increased.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation of a weighing-machine embodying my present improvements in the preferred form thereof, portions being broken away to illustrate more clearly certain features of the invention, and shows the position occupied by the respective parts at the commencement of operation. Figs. 2, 3, and 4 are end elevations as seen from the left in Fig. 1, showing the positions successively occupied by the working parts at the commencement of operation, at the commencement of the poising period, and during the load-supply period. Fig. 5 is an end elevation as seen from the right in Fig. 1, the parts being in positions corresponding, respectively, with Figs. 1 and 2.

Similar characters designate like parts in all the figures of the drawings.

The framework for supporting the operative parts of the machine may be of any suitable character, and it is herein illustrated comprising the end frames 2 and 4, mounted upon the chambered base 3. A meter M, to be hereinafter more particularly described, is furnished with the lateral brackets 5 and 5′, suitably attached to the end frames 2 and 4. A supply chute or hopper is shown at H in the form of a tubular conduit, its mouth being located over the receiving-orifice of the meter M. A pair of risers are shown at 6 and 6′, fixed, respectively, to the brackets 5 and 5′ and to the supply-hopper H at opposite ends thereof, said members constituting a convenient support for the hopper.

The bucket or load-carrying receptacle of the machine is designated by G, and for supporting the same the counterweighted scale-beam B may be employed. The scale-beam B consists of a pair of arms 7 and 7′, joined by the combined connecting-shaft and counterweight W. The beam-arms will be furnished with suitable supports for the bucket and will be also fulcrumed to the base 3 in the usual manner.

For regulating the outflow of material from the bucket a pair of closers are illustrated and are designated, respectively, by L and L′, the first-mentioned constituting a main closer and the other an auxiliary or supplemental closer. The main closer L is in the form of an approximately flat closer-plate 10, the area of which is slightly larger than that of the discharge-opening of the bucket and is preferably formed integral with the counterweighted end plates 8 and 8′.

The counterweighted plates 8′ are pivoted to the opposite ends of the bucket and adjacent to the discharge-outlet thereof, and their office is to return the closer to its normal or shut position on the complete discharge of a bucket-load. The supplemental closer L′ is in the form of a concave or cup-shaped valve pivoted at 9 adjacent to the lower end of the front wall of the bucket, it being adapted, when in its normal position, to shut under the discharge end or lip 10″ of the main closer L, as indicated in Figs. 2 and 3, so that it will not be necessary for said main closer to fit so tightly against the lower edge of the bucket, which is an important consideration, and more especially when the machine is weighing substances of a lumpy nature.

Should any particles of material from the bucket work through the space that intervenes between the closer-plate 10 and the lower edge of the bucket they will be caught by the supplemental closer L′, and on the opening of the latter with the main closer L will be discharged into the chamber of the base 3.

The closer L is provided at its opposite ends with the relatively high vertical guard-walls 10', preferably formed integral therewith, and which constitute a means for preventing lateral flow or escape of the material during the making up of a bucket-load.

For sustaining the bucket-closer L and for also locking it against opening movement during the making up of a bucket-load the following-described means may be employed: A rocker is shown at 13, pivoted near the upper rear side of the bucket, it constituting one member of an inverted toggle, the other member being the connecting-rod 12, pivoted, respectively, to said rocker and the main closer L in such a manner that when the latter is in its normal position the three toggle-pivots will be approximately in line, so that the rocker 13, and hence the connected bucket-closer L, may be held against oscillation by a minimum pressure on the rocker 13. A weighted bucket-latch is shown at 14, supported by the bucket G for oscillation and adapted to swing upward to engage the rocker-arm 13'. On the depression of the latch 14 the rocker 13, and hence the connected closer L, will be freed of all restraint, so that the latter may be instantly forced open to discharge the bucket contents.

For maintaining the supplemental closer L' in its normal position the guard-wall 10', which is segmental, is furnished with a locking notch or recess 15, in which may be seated the projecting rock-arm 16 of the supplemental closer L' when the parts are in the closed position, said rock-arm bearing or resting against the lower face of said notch, as indicated in Figs. 2 and 3, whereby it is positively held against opening. On the opening movement of the main closer L the oblique face of the locking-notch 15 will impinge against the rock-arm 16 and acting in the nature of a cam will oscillate said arm and swing the supplemental closer L' outward. The rock-arm 16 on the conclusion of this action will be contiguous to the curved face 17 of the guard-wall 10' and will be thereby positively blocked against return movement so long as this relation continues. It will be evident that on the return of the closer L this operation will be reversed.

For increasing the capacity of the machine a meter or measuring device may be employed, the preferred form of which is shown at M as a hopper or receptacle located below the supply hopper or chute H and adapted to receive a stream of material therefrom. The capacity of the meter M will be preferably slightly less than that of the bucket G, so that the contents of the former, when dumped bodily or in bulk into the bucket G, will constitute the major part of a load to be made up therein, independent means being furnished for supplying a drip-stream to complete the bucket-load.

Suitable influx and efflux valves will be employed for governing or regulating the supply and discharge, respectively, of the meter M, the movements of these valves alternating, as will hereinafter appear, so that while the bucket is discharging a load and the efflux-valve is closed the influx-valve will be open, so that a stream of material may flow into the meter M and the charge measured out in the same to form the major part of a succeeding bucket-load, which will be discharged into said bucket when it has reached its normal position.

The influx-valve is designated by 18 and is of the "oscillating-pan" type, it being supported by a two-part shaft consisting of the members 19 and 20, which have bearings in the outer ends for receiving suitable journals carried by the risers 6 and 6'. The valve 18 has a cut-off movement below the mouth of the supply chute or hopper H, as illustrated in Fig. 2.

The efflux-valve is designated by 21 and is substantially similar in construction and mode of operation to the valve 18, it having a cut-off movement below the discharge-orifice of the meter M and being supported by the two-part shaft 22 and 23, furnished with suitable bearings for receiving journals carried by the framing of the machine. The movement of one of the pair of valves will be controlled by the other, as will hereinafter appear.

For closing the valve 21 mechanism substantially similar in construction and mode of operation to that disclosed in Letters Patent No. 548,843, granted to me October 29, 1895, is herein illustrated and will be now described. A cam is shown at 24 depending from the shaft-section 23 of the valve 21, and hence oscillatory with said valve. Said cam is shown having two cam-faces 24' and 24'', the last-mentioned of which is of a shape to permit the exertion of a relatively great amount of leverage thereon for effecting an instant closure of the valve 21. A counterweighted lever is shown at 25, having its rear or short arm provided with an antifriction-roll adapted to successively travel along the connected cam-faces 24' and 24'' for closing the valve, this action being caused by the descent of the counterweighted arm of said lever, as is obvious. The lever 25 normally tends to close the valve, but such tendency will be preferably checked or arrested during the making up of a bucket-load, and for this purpose the scale-beam B will be preferably utilized.

A relatively long rod is shown at 26, connected to the valve 21 at a point to the rear of its axis of movement, said rod being shown pivoted to the rock-arm 26' on the valve-shaft section 22 and being also in a position to receive a thrust from the scale-beam B, which is transmitted to the valve 21 for forcing the same open.

On the receipt by the bucket G of the measured charge of material from the meter M it, with the poising side of the scale-beam B or

that part of the latter to the left of its fulcrum, Fig. 2, will descend, and said beam falling from under the connecting-rod 26 will thereby permit the closure of the valve 21 by the counterweighted lever 25 in the manner previously described. As the beam B returns to its normal position it will impart an upward thrust to the rod 26, which is communicated to the valve 21 for forcing the same open. It will be evident that, the beam B being in contact with the connecting-rod 26, the closure of the valve 21 will be limited or checked on the descent of the bucket.

The influx-valve 18 will be preferably actuated from and by the efflux-valve 21, and the mechanism illustrated for this purpose will be now described. An angle-lever is shown at 27 pivotally mounted on the framing of the machine and constituting a convenient device for transmitting a thrust from the valve 21 to the valve 18 for alternately opening and closing the latter, said angle-lever being operatively connected with the two valves. A relatively long link is shown at 28 pivoted to the lower short arm of the angle-lever 27 and also to the rock-arm 29, projecting from the valve shaft-section 22. A second and short link is shown at 30 pivoted, respectively, to the long or upright arm of the angle-lever 27 and also to the rock-arm 31, projecting from the shaft-section 19.

The connections just described between the two valves 18 and 21 will be so proportioned that the closing of the valve 21 will not affect the position of the influx-valve 18 until the efflux-valve has nearly reached the end of its closing movement, or when it is released at the close of the poising period, as will hereinafter appear. At this time the short arm of the angle-lever 27 will be drawn downward and the long arm thereof swung to the left, this motion being communicated to the valve 18 for forcing or swinging the latter open. On the return movement of the valve 21 the operation will be reversed, but the valve 18 will not be opened until the efflux-valve 21 has practically reached its wide-open position.

For furnishing the drip-stream to the bucket to complete the partial load therein a positively-operated device will be employed and in the present instance consists of a force-feeder, which on its movement will supply the bucket G with a drip-stream of regular or unvarying volume, whereby the work of the machine is accomplished with extreme accuracy.

A drip-conduit is shown at D, which in practice will be constantly supplied with a body of material. Said conduit D has the horizontally-disposed preferably cylindrical spout 32, which projects through a similarly-shaped aperture formed in a wall of the meter.

The feeder is designated by F and is of the "screw" type, its supporting-shaft 33 being journaled in the rear wall of the drip-conduit D, said shaft having fast and loose pulleys 34 and 35, respectively, and being also telescopic, for a purpose to be hereinafter specified. On the effective movement of the feeder the drip-stream will be fed through the meter-chamber and its discharge-orifice, from whence it gravitates into the bucket G, and on the projection of the valve 21 across the discharge-orifice of said meter it will be evident that the mass which drops from the feeder F on its stoppage will be caught by said valve, whereby overloading of the bucket will be prevented.

By mounting a drip-stream feeder in the meter an important advantage is gained in the weighing of light materials, such as bran or the like, for, as is obvious, the drip-stream as it falls from the feeder is protected from drafts of air and consequently descends without scattering or dispersion to the bucket, thereby avoiding waste and largely contributing to the weighing efficiency of the machine.

A fragment of a suitably-mounted line or power shaft is shown at 36, having the pulley or drum 37 fixed thereon, said pulley 37 being connected, normally, by a belt 38 with the fast pulley, so that on the rotation of the shaft 36 the connected feeder F will be also rotated for forcing outward from the drip-spout 32 a stream of material.

It will be evident that on the shipment of the belt 38 from the fast pulley 34 to the loose pulley 35 the result will be a throwing of the feeder F out of action or the stoppage of the same. For thus shifting the belt automatically-operating belt-shipping means will be employed. A belt-shipping lever is shown at 39 pivotally supported on the framing of the machine and having the usual belt-engaging fingers, which, on the oscillation of said lever, alternately engage the belt 38 and ship it alternately to either of the pulleys 34 and 35 to either start or stop the feeder F.

The belt-shipper 39 is operatively connected with a reciprocatory member of the weighing mechanism, such member being herein illustrated as the valve-actuating lever 25. An angle-lever is illustrated at 40 operatively connected, respectively, with said lever 25 and with the belt-shipper 39, the joint between said angle-lever and belt-shipper being preferably a slide one, so that the lever may have a limited amount of movement without affecting the position of the belt-shipper 39.

A link is shown at 41 pivoted to the belt-shipper 39 at a point intermediate thereof and having at its opposite end a longitudinal slot the walls of which embrace a pin or stud carried on one arm of the angle-lever 40. The other arm of said angle-lever is shown connected by a rod 42 to the counterweighted arm of the valve-actuating lever 25, so that on the descent of said arm the rod 42 will be drawn downward and the link 41 and the belt-shipper swung outward, so that the latter may slip the belt 38 from the fast pulley 34 to the loose pulley 35, thereby stop-

ping the feeder F. By reason of the connection described between the angle-lever 40 and the belt-shipper 39 the counterweighted arm of the actuating-lever 25 may have an ineffective descending movement up to the poising period, the parts being then in the positions illustrated in Fig. 2, at which time the antifriction-roll of the lever 25 will be approximately at the intersection of the cam-faces 24′ and 24″, respectively, of the valve-closing cam, said lever at this point being held against further movement, the belt-shipper 39 being likewise held and the belt 38 maintained in peripheral contact with the pulley 34, it being understood that the measured charge has been emptied into the bucket G. For thus intercepting the connected parts a stop in the nature of a by-pass is illustrated at 43, and consists of a counterweighted latch pivotally supported upon the beam-arm 7′ and in position to engage the depending rod 44, concentrically secured to the lever 25, at the commencement of the poising period, suitable means being employed to limit the oscillation of the by-pass stop when such action takes place. On the release of the rod 44, due to the by-pass 43 passing below the poising-line with the scale-beam B, the connected lever 25 will be also released, and riding along the cam-face 24″ instantly shuts the valve 21, and simultaneously, through the operative connections with the shipper 39, the latter will shift the belt 38 from the fast pulley to the loose pulley 35, thereby throwing the feeder out of action. On the opening of the valve the lever 25 will be returned to its normal position and the depending rod 44 will engage the upper or vertical arm of the by-pass and thereby swing the latter ineffectively about its axis.

Means will be provided for vibrating the feeder F, and preferably in a direction longitudinally thereof, to thereby prevent the adherence to said feeder of particles of material and to also prevent the formation of lumps in the drip-conduit or feeder-chamber 32. The tubular member of the feeder-supporting shaft is splined to the complementary member and is also provided with a cam or wave wheel 45, which has a movement between the two guides 46 and 47, rigidly attached to the bracket 48, extending inward from the end frame 4, so that on the rotation of said cam between said rigid guides a vibratory or reciprocatory motion will be transmitted to the feeder F for effecting the results sought for.

Reciprocally-effective stops, operative, respectively, with the efflux-valve 21 and with the bucket-closer L, will be employed, the office thereof being to hold the valve closed when the closer is open, and vice versa. The rocker 13 constitutes the closer-operative stop, the coacting stop being designated by 50. The rocking stop 13 has the two stop-faces 51 and 51′, the first mentioned of which is a curved face concentric with the axis of movement of said member, the coacting stop having a similar curved face 52 and a supplemental stop 52′ in the form of an antifriction-roll. The action of these coacting stops will be obvious from an inspection of Figs. 2, 3, and 4 of the drawings. At the commencement of operation the stop-face 51′ will be contiguous to the curved face 52, so that should the latch 14 be accidentally depressed the oscillation of the rocker 13 will be positively prevented so long as this relation continues. As the valve 21 closes the curved face 52 will travel along the stop-face 51′ and when the valve 21 has reached its cut-off position will have passed out of contact therewith, so that the blocking influence of the stop 50 will be removed, and the latch 14 being tripped the rocker 13 is free to swing about its pivot; and when this action takes place the curved face 51 will ride in contact with the antifriction-roll 52′, so that reverse movement of the stop 50, and hence the opening of the valve 21, will be blocked. When the closer L has reached its normal position, the stop-face 51′ will have passed out of contact with the antifriction-roll 52′, so that the valve 21 may be opened by the scale-beam B in the manner previously described.

For tripping the bucket-latch 14, to which reference has been hereinbefore made, a latch-tripper, operative with the efflux-valve 21, will be preferably employed, such latch-tripper being herein shown as a projection 26″, formed on the connecting-rod 26 and having a descending movement into engagement with the latch-pin 14′ on the release of the valve 21, in the manner previously described, to thereby depress the latch and disengage it from the rocker-arm 13′. The rocker 13, and hence the connected closer L, will be released, so that the latter may be forced open by the weight of the bucket contents.

The operation of the hereinbefore-described machine is as follows: Fig. 2 represents the bucket-closer L locked in its normal position, the valve 21 being wide open and the meter M delivering a measured charge of material into the empty bucket G. During this stage of the operation the belt 38 will be on the fast pulley 34 and the feeder F consequently driven. When the measured charge of material has been received by the bucket G, it will descend and the beam B, falling away from the connecting-rod 26, will permit the closure of the valve 21 by the counterweighted lever 25. At the commencement of the poising period, as indicated in Fig. 3, the valve 21 will be in the position shown in Fig. 3, the counterweighted arm of the lever 25 having also descended and moved the stud on the bell-crank lever 40 against the outer short wall of the longitudinal slot in the connecting-link 41. At this point the further movement of the depending rod 44 will be intercepted by the by-pass 43, so that the lever 25, the valve 21, and the belt-shipper 39 will be held against movement, the feeder F then,

on its rotation, feeding the drip-stream to the bucket G for completing the partial load therein. On the completion of the bucket-load the scale-beam B will descend below the poising-line, the by-pass moving therewith and releasing the lever 25, so that it is operable for imparting the final closing movement to the valve 22. During this last-mentioned movement the belt-shipper 39 will be oscillated to the right in Fig. 1, slipping the belt 38 to the loose pulley 35, and concurrently therewith the valve 21, through its connections with the valve 18, will force the latter open to permit the flow of the supply-stream into the meter M. On the final closing movement of the valve 21 the projection 26″ on the thrust-rod 26 will move into engagement with the latch-pin 14′, thereby depressing said latch to release the rocker 13 and hence the connected closer L.

Having described my invention, I claim—

1. The combination with a bucket, of a meter adapted to deliver a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; valve-actuating mechanism; and means carried by said meter and serving to furnish a drip-stream to the bucket through the meter.

2. The combination with a bucket, of a meter adapted to deliver a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; valve-actuating mechanism; and a force-feeder carried by the meter for supplying a drip-stream to the bucket through said meter.

3. The combination with a bucket having a closer, of a meter adapted to supply a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; valve-actuating mechanism; and reciprocally-effective stops operative, respectively, with one of said valves and with the bucket-closer.

4. The combination with a bucket having a closer, of means embodying a latch for normally holding said closer against opening movement; a meter adapted to supply a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; and a latch-tripper operatively connected with one of said valves.

5. The combination with a bucket and its supporting scale-beam, of a meter adapted to supply a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; a depending rod connected to one of said valves and in position to receive a thrust from the scale-beam to open the same; and linkage-and-lever mechanism connecting said valve with the other valve and serving to close the latter when the first-mentioned valve is opened.

6. The combination with a bucket, of a meter adapted to supply a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; means for opening and closing said valves; and means carried by the meter, for furnishing a drip-stream to the bucket through the meter, whereby the efflux-valve when closed is adapted to catch the descending particles on the completion of the bucket-load.

7. The combination with a bucket, of a meter adapted to supply a charge of material to said bucket; means for controlling the influx and efflux of material to and from said meter; and a force-feeder carried by the meter and operable for supplying a drip-stream to the bucket through the meter.

8. The combination with a bucket, of a meter adapted to supply a charge of material to said bucket; means for controlling the influx and efflux of material to and from said meter; a drip-conduit in the wall of and communicating with said meter; and a force-feeder carried by the meter and operative in said conduit, said feeder serving to supply a drip-stream to the bucket through the meter.

9. The combination with a bucket, of a meter adapted for supplying a charge of material to said bucket; means for controlling the influx and efflux of material to and from said meter; a drip-conduit having a cylindrical spout passing through an opening formed in said meter; and a screw feeder located in said cylindrical conduit.

10. The combination with a bucket, of a meter adapted to supply a measured charge of material to said bucket; means operative, respectively, for controlling the influx and efflux of material to and from said meter; a force-feeder operable for supplying a drip-stream to the bucket; and means for vibrating said feeder.

11. The combination with a bucket, of a meter adapted for supplying a charge of material to said bucket; means for controlling the influx and efflux of material to and from said meter; a force-feeder operable for supplying a drip-stream to the bucket; and automatically-operated means for throwing said feeder out of action.

12. The combination with a bucket and its supporting scale-beam, of a force-feeder supported by a telescopic shaft, means for rotating said shaft; and means for also vibrating one of the shaft-sections.

13. The combination with a bucket and its supporting scale-beam, of a force-feeder supported by a telescopic shaft; means for rotating said shaft; a cam mounted on one of the shaft-sections; and rigid guides for said cam.

14. The combination with a bucket, of a meter for supplying a charge of material to said bucket; means for controlling the influx and efflux of material to and from said meter; a feeder and its supporting-shaft provided with fast and loose pulleys; a belt shift-

able from one of said pulleys to the other; and an automatically-operated belt-shipper.

15. The combination with a bucket, of a meter for supplying a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; a valve-actuating lever; a feeder and its supporting-shaft provided with fast and loose pulleys; a belt shiftable from one of said pulleys to the other; and a belt-shipper operatively connected with said lever.

16. The combination with a bucket, of a meter for supplying a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; valve-actuating mechanism embodying a lever; a feeder and its supporting-shaft provided with fast and loose pulleys; a belt shiftable from one of said pulleys to the other; a belt-shipper; and connections involving a slide-joint between said belt-shipper and lever.

17. The combination with a bucket, of a meter for supplying a charge of material to said bucket; a pair of valves operative, respectively, for controlling the influx and efflux of material to and from said meter; valve-actuating mechanism embodying a lever; a feeder and its supporting-shaft provided with fast and loose pulleys; a belt shiftable from one of said pulleys to the other; a belt-shipper; operative connections between said belt-shipper and lever; a depending rod connected to said lever; and a stop in position to arrest the movement of said lever.

18. The combination with a feeder and its supporting-shaft provided with fast and loose pulleys, of a belt shiftable from one of said pulleys to the other; a belt-shipper; an angle-lever, one of the arms of which is connected to said belt-shipper by a slide-joint; and a lever operatively connected to the other arm of said angle-lever.

19. The combination with a feeder and its supporting-shaft provided with fast and loose pulleys, of a belt shiftable from one of said pulleys to the other; a belt-shipper; an angle-lever having a stud; a link connected to said belt-shipper and having a longitudinal slot, the walls of which embrace said stud; and a lever operatively connected to said angle-lever by a link.

20. The combination with a bucket having a main closer provided with a locking-notch, of a supplemental closer having a projecting arm adapted to bear against one of the walls of said locking-notch, whereby said supplemental closer will be held against opening movement.

21. The combination with a bucket, of a main closer therefor having a locking-notch, a supplemental closer pivotally supported by said bucket and provided with a projecting arm adapted to bear against one of the walls of said notch, whereby said supplemental closer will be held against opening movement.

22. The combination with a bucket, of a main closer therefor having a segmental end plate, provided with a locking-notch; a supplemental closer movably supported by the bucket and having a projecting arm adapted to bear against one of the walls of said notch.

FRANCIS H. RICHARDS.

Witnesses:
FRED. J. DOLE,
HENRY BISSELL.