No. 648,617. Patented May 1, 1900.

G. HOEPNER.

ELECTROMAGNETIC AUTOMATIC WEIGHING MACHINE.

(Application filed Mar. 13, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

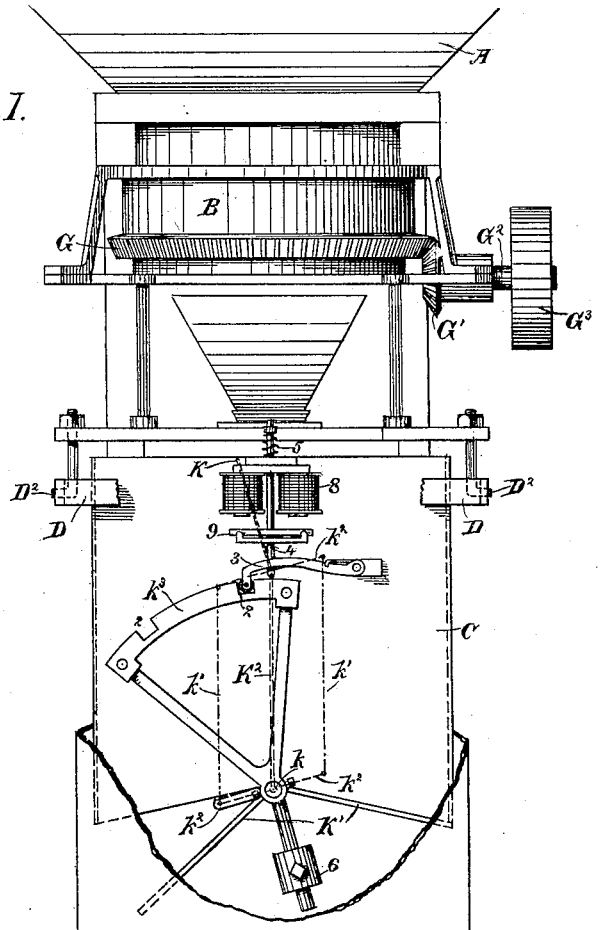

Fig. 2.

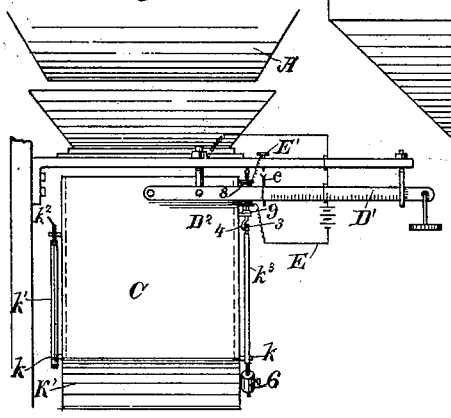

Fig. 3.

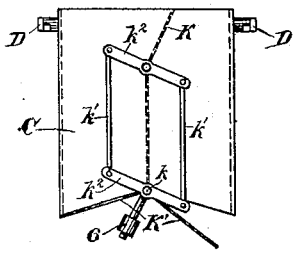

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Fig. 4.

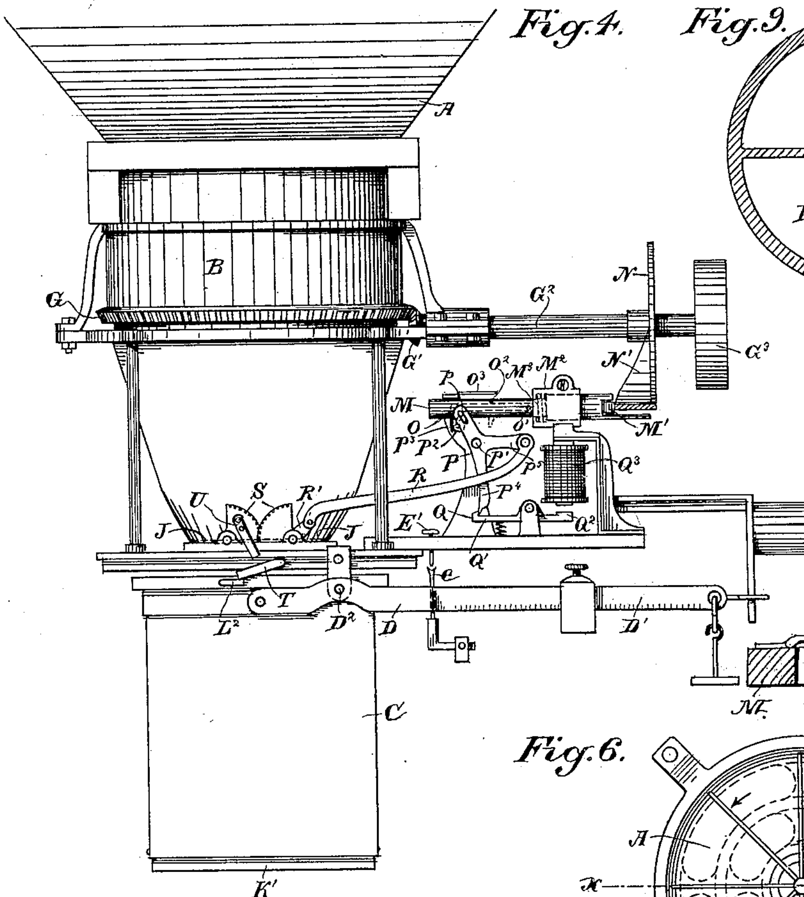


Fig. 9.

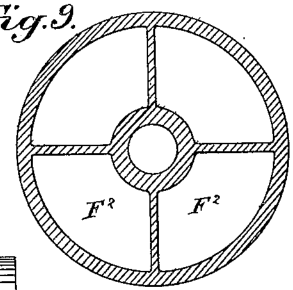


Fig. 8.

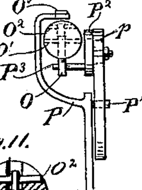


Fig. 11.

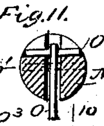


Fig. 10.

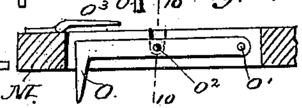


Fig. 6.

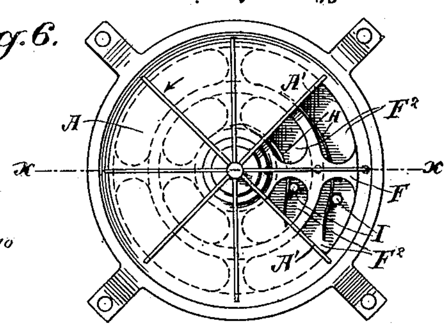


Fig. 5.

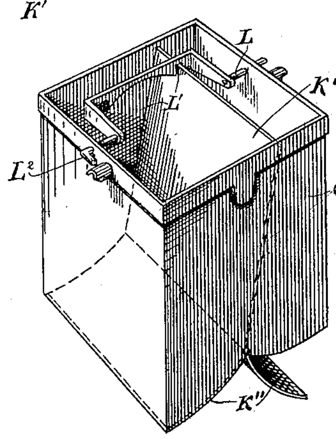
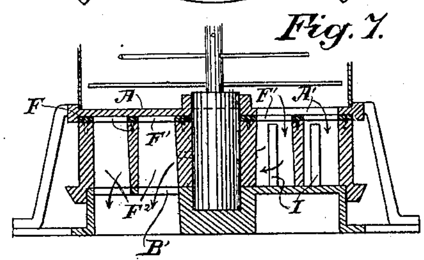


Fig. 7.



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UNITED STATES PATENT OFFICE.

GEORGE HOEPNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE UNION SCALE AND MANUFACTURING COMPANY, OF SACRAMENTO, CALIFORNIA.

ELECTROMAGNETIC AUTOMATIC WEIGHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 648,617, dated May 1, 1900.

Application filed March 13, 1899. Serial No. 708,923. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HOEPNER, a citizen of the United States, residing in the city of Chicago, county of Cook, State of Illinois, have invented an Improvement in Electromagnetic Automatic Weighing-Machines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in machines of that class which are designed to weigh powdered, granular, or similar substances and to deliver such substances in regular quantities into such receptacles as may be desired.

The invention consists of the parts and the constructions and combinations of parts hereinafter described and claimed.

Figure 1 is a front view. Fig. 2 is a side elevation of weighing-receptacle. Fig. 3 is a rear view of weighing-receptacle. Fig. 4 is a view showing gate-operating mechanism of intermediate chamber. Fig. 5 is a perspective view of one form of weighing-receptacle. Fig. 6 is a top view of feed and transfer device. Fig. 7 is a vertical section of same, line $x\,x$ of Fig. 6. Fig. 8 is an edge view of the spider and its connections. Fig. 9 is a modified form of transfer device. Fig. 10 is an enlarged sectional detail of a portion of the shaft M, showing the pivoted latch O and adjunctive parts. Fig. 11 is a sectional view of the same on the line 10 10 of Fig. 10.

A is the source of supply, which may be a conical hopper, into which any desired amount of material to be weighed may be placed, or a chute or other conveyer. It will be manifest that any suitable means of moving the material to the point needed may be employed. From the source of supply the material is conveyed to the weighing-receptacle C either directly, as shown in Fig. 2, or through an intermediate chamber, as shown in Figs. 1 and 4. The weighing-receptacle is here shown as suspended by suitable bearings in a fork or yoke D, which extends along upon each side of the upper part of the weighing-receptacle and across one end, or, if preferred, it may inclose the receptacle. From the center of this end portion, as shown in the present case, extends a scale-beam D′, having the usual weights suspended and movable thereon. The weighing-receptacle has projections upon opposite sides, and the usual knife-edge bearings upon the ends of the yoke D support the receptacle. The scale-beam is also fulcrumed, as shown at D^2, and is movable about this fulcrum-point to allow the weighing-receptacle to rise a short distance when empty and correspondingly sink a short distance when the amount of material in the receptacle is sufficient to counterbalance the weight. Connected with the scale-beam or other movable part is one contact-point e of an electrical circuit E, and a corresponding stationary contact-point E′ is situated in line with it, so that when the weight in the receptacle depresses it and raises the opposite end of the scale-beam these contacts are brought together and an electrical circuit is completed which actuates an electromagnet and other mechanism to be hereinafter described. When the receptacle is empty and the scale-beam depressed, these contacts are broken and the electrical circuit interrupted.

The weighing-receptacle C has within it a pivoted tilting gate K^{10}, the pivot or journal point of which is so situated that the upper edge is free to swing about this journal to one side or the other. The lower part of the receptacle has two bottoms diverging from each other, as shown at K^{11}, so that each of these divergent portions serves alternately to close the bottom of the weighing-receptacle C upon one side and the other when the upper end of the diaphragm is tilted to the opposite side. Thus when the diaphragm is tilted so that the larger portion of the top of the weighing-receptacle is exposed to receive material the bottom upon that side is closed, while the one upon the opposite side, receiving nothing, is opened. In the form shown in Figs. 1, 2, and 3 the part K^2 of the diaphragm forms a central stationary partition, the upper swinging portion K^{10} being fulcrumed along its upper edge, so that it may swing about this fulcrum. The divergent bottoms K^{11} are centrally pivoted at the bottom of the stationary partition, as shown at k. Upon the ends of the fulcrum-shafts are fixed lever-arms k^2, and links k' connect the ends of these levers in pairs, so that the swinging diaphragm K^{10} and the bottoms K^{11}

will move in unison. A segmental arc k^3 has its center fixed to the lower fulcrum-shaft, and the curved periphery is notched, as shown at 2. A spring-pressed latch 3 engages either of these notches when in line, and thus retains the bottom closed and the swinging leaf K^{10} locked until the weight is completed, the weighing-receptacle has been depressed, and the electrical circuit made.

The electromagnet 8 is fixed at the front of the weighing-receptacle, and the armature 9 is fixed to a slidable rod 4, the lower end of which is bent or otherwise formed to engage the latch 3. When the magnet is energized by the completion of the electrical circuit, the armature will be attracted, the hook-rod will disengage the latch 3, which carries an antifriction-roller at the end, and the weight of material in the weighing-chamber will open the bottom upon that side and close the opposite one and also shift the hinged section K^{10} to the opposite side of the supply-chute. The receptacle rises when relieved of the weight and breaks the electrical circuit, and the spring 5 acts to disengage the armature from the magnet. A counterweight 6 assists in moving the bottom of the receptacle when it is released.

As shown in Fig. 5, the tilting diaphragm is pivoted near the bottom of the receptacle, and the divergent bottoms K^{11} move in unison with it, and the portion K^{11} beneath the receiving-side extends entirely across the bottom, contacting against the side of the receptacle, and thus closes that particular chamber, while the other one (at the time receiving nothing) will be opened. In this construction in order to lock the diaphragm when tilted to either one side or the other I have shown a shaft L journaled across the top of the weighing-receptacle and having its central portion cranked and with notches L′ formed in the cranked portion. This crank is transverse to the partition and in line with its plane of movement as it tilts from one side to the other. When tilted to one side, the edge of the partition will be held by one of the notches L′. When tilted to the other side, it will be held by the other notch. The outer end of the shaft L upon one side is bent to form an arm or lever L^2, and this lever, being operated by suitable mechanism, hereinafter described, serves to partially rotate the shaft L and raise the notched yoke out of contact with the edge of the diaphragm K^{10}, thus allowing the diaphragm to be moved to the opposite side and interlocked with the other notch, this movement being effected as soon as the diaphragm is released by the weight of the material on the curved or angular wing K^{11}, which forms the bottom and supports the weight of the material within the receptacle. As soon as the diaphragm has thus swung across to the opposite side the other notch of the crank-arm, which by this time has been released, will engage with the edge of the diaphragm and lock it in its new position, in which the opposite side now forms the receiver, and its bottom is similarly closed by the curved or angular wing K^{11} upon that side. Thus the two chambers of the receptacle are being alternately filled and discharged, so that the operation is not interrupted.

For some purposes it may be found desirable to interpose a chamber B between the source of supply and the weighing-receptacle and to employ gates to momentarily close its bottom while the weighing-receptacle is emptied and shifted. J J are such gates. The mechanism by which the gates J J of the chamber B are opened and closed and by which the diaphragm K^{10} of the weighing-receptacle is alternately tilted to one side or the other is as follows: M is a shaft journaled in suitable relation with the driving-shaft G^2, and it may have in the end an antifriction-roller M′. Upon the shaft G^2 is fixed a disk N, and this disk has one edge formed into a cam N′, the edge of which when the disk rotates moves alternately back and forward in the line of the shaft M or its antifriction-roller. It will be manifest that a revolution of the shaft G^2 and the cam will push the shaft M longitudinally in its bearing-box M^2 a distance equal to the eccentricity of the cam. The shaft M has a portion made of smaller diameter, and the bearing-box M^2 contains a spring M^3, which, pressing against the shoulder formed between the larger and smaller diameters of the shaft M, tends to push the shaft toward the cam. The smaller portion of the shaft extending to the opposite side of the bearing-box from the cam has a latch O, the shaft of which extends along in a slot made vertically through the shaft, and the opposite end is pivoted, as shown at O′. A stop-pin O^2 passes through this shaft between the pivot and the latch portion, which projects below the shaft, as shown, and this stop limits the drop of the latch after it has been lifted. An arm O^3, fixed above the shaft in line with the latch O, prevents its being raised too high. A light spring may be fitted to press upon the back of the latch, so that when it has been raised the spring will cause it to close down again. Pivoted upon a standard or frame-work P is a three-armed spider centrally pivoted, as shown at P′, and turnable about its pivot. The upper arm of the spider carries an adjustable block P^2, which may be moved toward or away from the center by its bolt movable in a slot p in the end of the arm, and it may be turned about its bolt because the bolt is at one end of the block, and when the bolt is loosened the block can be turned to move it to one side or the other with relation to the arm. This block has projecting from it a pin P^3, and when the shaft M is moved endwise by the action of the cam M′ the latch O engages the pin P^3 and turns the spider about its axis, moving the arm which carries the pin forward, thus turning the spider about its fulcrum-point or journal. The pin moves

in an arc of a circle which carries it just below the latch O near the end of the movement; but the latch continues to move until it has passed beyond the pin. The pin being stopped and held in place, as hereinafter described, it will then engage the latch O from the opposite side and will thus prevent the shaft M being returned after it is released from the pressure of the cam N′. The second arm P^4 of the spider carries a point or catch, and when the spider is thus turned about its axis this point of P^4 is turned down until it engages with a catch Q on one end of a fulcrumed lever Q′. This lever carries upon the opposite end the armature Q^2, which is drawn toward the electromagnet Q^3 when the latter is energized and released therefrom when the magnet is deënergized. The magnet is deënergized at the time when the spider is turned, and consequently the latch P^4 will engage with the catch Q, and this retains the spider in the position to which it has been moved by the action of the shaft M and the cam N′. This latching and holding of the spider also retains the shaft M in its new position, and it is thus withdrawn, so that it is not further acted upon by the cam N′, which continues to revolve. Connected with the third arm P^5 of the spider, as here shown, is a connecting-rod R. This rod extends to a point where it connects with a crank-arm R′, fixed upon the pivot or journal shaft of one of the gates J, which closes the bottom of the chamber B. The shafts of these two gates carry toothed segments S, which mesh with each other, so that when one of these shafts is turned by the movement of the spider and the connecting-arm R, previously described, it will simultaneously act upon the other, and the two gates will then be opened. These gates, as here shown, are in the form of what is known as "butterfly-valves;" but it will be manifest that they may be made in any suitable or well-known form which can be equally operated to open or close the passage. When the spider has been turned by the action of the cam N′ and the arm P^4 engaged with the catch Q, the valves J will be opened, and the material which is delivered from the source of supply, as previously described, will fall down through the chamber B and through the open gates J at the bottom into the chamber of the weighing-receptacle, which is at that time opened to receive the material. When the amount of material is sufficient to cause the receiver to sink by reason of its counterbalancing the weight upon the scale-beam, the electrical points E E′ will be brought together, thus completing an electrical circuit from a battery or other source of electric energy through the electromagnet Q^3, which being thus energized immediately attracts the armature Q^2 and causes the catch at the opposite end of the lever Q′ to be depressed, thus releasing the latch P^4 of the spider. The spring M^3 then acts to force the shaft M back to its normal position, and the latch O, which was transferred to the opposite side of the pin P^3 when the parts were moved by the action of the cam M′, will act to pull the arm of the spider, which it engages, back in unison with the movement of the shaft M, thus returning the spider to its first position. At this point the pin P^3 again returns to the opposite side of the latch O in readiness for another forward movement when the cam N′ acts upon the shaft M. This return movement also moves the arm P^5 and the connecting-rod R, turning the rocker-arm R′, and through the toothed segments S the bottom plates J J of the chamber B are instantly closed to prevent any further flow of the material from the source of supply. This movement also acts to release the tilting diaphragm K^{10} of the weighing-receptacle as follows: An arm T is fulcrumed in such manner as to engage the end of the arm L^2, which controls the latching-crank shaft of the weighing-receptacle. A rod or push-bar U has its upper end connected with one of the rotary segments S and the other end adapted to contact with the rocker-arm T, so that when the gates J J are closed the movement of the closing actuates the arm L^2, releasing the diaphragm K^{10} of the weighing-receptacle by lifting the latching crank or yoke from it, and the weight of material on the curved or inclined bottom K^{11} of the filled chamber instantly swings the upper part of the diaphragm to the opposite side, allowing the material to escape. At the same time the opposite bottom K^{11} is closed, and the receptacle is in condition to receive a new supply of material. All this takes place when the gates J are closed and the actuating mechanism is stationary. When the cam N′ again engages with the shaft M, the latter is again pushed forward, the spider is turned, thus engaging the latch P^4 with the catch Q, and through the arm R moving the segments S, again opening the gates J of the chamber B. This movement of the segments withdrawing the pushing-bar U releases the rocker-arm L^2 and allows the latching-crank to drop so that the contiguous notch L′ will engage the upper edge of the diaphragm and lock it in its new position. This all takes place so instantaneously that the receptacle is in readiness to receive the material as soon as the gates J are opened. By this construction the operation is rendered automatic and practically continuous, with a slight interruption caused by the emptying of each chamber of the weighing-receptacle and bringing the other chamber into position to be filled.

In order to cause the material to flow freely from the source of supply, I have shown an agitating or stirring device interposed between the source of supply and the weighing-receptacle, in which the material passing from the source of supply is delivered through a perforated disk and annular channels, with agitators carried by the disk and constantly rotated by a suitable mechanism. The bottom of the source of supply A is entirely

closed, as shown at A′, with the exception of a segment which is cut away upon one side. Pivoted and turnable beneath this segmental bottom is the disk F, having suitable perforations or openings F′ made through it, and these openings connect with annular cylindrical and corresponding concentric channels F^2. These channels have a certain depth, and with the disk are interposed beneath the source of supply. The surface upon which the lower edges of the circular rims of the channels travel also has a segmental opening cut out, as shown at B′, upon the opposite side from the opening which is made in the bottom A′, so that material will first fall from the source of supply through the openings in the disk F into the channels beneath and will then be carried around to the opposite side to fall through the opening in the plate or top B′ into the receptacle below. The structure consisting of the disk and its connected channels is rotated about a vertical axis by means of a gear G, which is driven by a bevel-pinion G′, mounted upon a horizontal shaft G^2, which is driven continuously by a pulley G^3 or other suitable propelling device. In order to agitate the material which constantly falls through the openings A′ into the annular channels F^2 and to prevent its becoming clogged or sticking therein, I have shown flat springs H, standing on edge within the channels F^2, having one end fixed to one of the intermediate rings of the channels and the other extending diagonally across and normally resting against the ring which forms the other side of the channel. Pins I project upwardly from the bottom B′ into the path of the springs H, which are carried around by the rotary structure. Whenever one of these pins strikes a spring H, the free end will be forced back by the pin until it has passed the pin, when its elasticity will throw it forward after its release to its normal position. This constant movement of the springs agitates and loosens up the material, so that when it has reached the openings B′ in the top of the chamber B it will fall freely through into this chamber. The same result may be obtained by other forms of agitators which will suggest themselves to the mechanic, such as wavy or corrugated sides to the channels or other equivalent device. As shown at Fig. 9, the transfer device consists of chambers formed by radial arms within the outer periphery or rim, the device being revolved, as previously described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a weighing apparatus, a weighing-receptacle having a partition fixed centrally within it to form chambers upon each side, a tilting diaphragm pivoted at its lower edge to or near the upper edge of the partition, swinging bottoms below the lower edge of the partition and diverging therefrom and means connecting these bottoms with the tilting diaphragm, locking devices for holding one of the bottoms closed against the bottom of the chamber at one side of the partition and also holding the diaphragm in an inclined position away from the receiving end of said chamber, a releasing device for the locking mechanism, an electromagnet and an armature carrying a lifting-rod which is connected with the releasing device, and an electric circuit including fixed and movable contact-points adapted to establish said circuit to release the locking mechanism whereby the filled chamber discharges its contents.

2. In a weighing apparatus, a weighing-receptacle, a yoke from which it is suspended said yoke having a scale-beam projecting from it, a partition fixed within the receptacle, a tilting diaphragm pivoted to the upper edge of the partition, divergent bottoms below the receptacle and adapted to alternately close and open the chambers formed upon each side of the partition, means connecting the bottoms with the tilting diaphragm, means for locking the bottoms and diaphragm in each position to which they are moved, a locking mechanism for the bottoms and diaphragm, an electromagnet, and an armature having a lifting-rod adapted to engage and release the locking mechanism, an electric circuit and contact-points one of which is carried by the scale-beam, adapted to establish the circuit and release the bottoms to discharge the contents of the receptacle.

3. In a weighing apparatus, a weighing-receptacle, a yoke from which it is suspended, having a scale-beam projecting from it, a source of supply, means for delivering the material from the source of supply into the weighing-receptacle, a tilting diaphragm movable to form receiving-chambers alternately upon opposite sides, fulcrumed bottoms connected and movable with the diaphragm, a notched segment fulcrumed on the axis of the bottoms, a spring-pressed latch adapted to engage the notches in the segment and thereby hold the latter and the bottoms in either position to which they are moved, an electromagnet, an armature having a rod fixed to it and adapted to engage and lift the latch, to release the segment and bottoms, and an electric circuit including a fixed contact and a contact carried by the scale-beam whereby the magnet is energized when the weight in the receptacle causes the latter to move.

4. In a weighing-receptacle, a suspended counterbalanced weighing-chamber with subdividing diaphragm and mechanism whereby it is turned to form receiving-chambers alternately upon opposite sides, a source of supply, a transfer device consisting of a centrally-journaled disk and annular rings extending below it forming channels, plates above and below, the upper one forming the bottom of the source of supply having a segment cut out of one side to admit material to pass through the perforations of the disk and the other plate having a correspondingly-

shaped opening upon the opposite side for the discharge of the material, and agitating-plates fixed within the channels substantially as described.

5. In a weighing apparatus, a weighing-receptacle, a source of supply, a device for delivering material from the source of supply into the weighing-receptacle, consisting of a horizontally-rotating perforated disk and transfer-chambers beneath the disk, openings upon diametrically-opposite sides of the upper and lower plates through which material is delivered into and discharged from the transfer-chambers, and means for agitating the material while passing therethrough.

6. In a weighing apparatus, a weighing-receptacle, a source of supply, a device for delivering material from the source of supply into the weighing-receptacle, consisting of a horizontally-rotating perforated disk and transfer-chambers beneath the disk, openings upon diametrically-opposite sides of the upper and lower plates through which material is delivered into and discharged from the transfer-chambers, springs standing on edge having one end fixed to one side of the transfer-chambers and the other ends pressing against the opposite sides of the chambers, and pins projecting from the stationary bottom plate into the chambers, whereby the free ends of the springs are retracted to pass the pins and allowed to fly back by their elasticity after the pins have been passed.

7. In a weighing apparatus, a vertically-movable weighing-bucket with dividing partition, a suspended yoke from which the receptacle is hung, having a scale-beam projecting from it, a fulcrumed, tilting, and directing top section, bottoms connected and movable in unison therewith to alternately close and open the chambers, a swinging segment fulcrumed on the axis of the bottoms and having its upper surface notched, a spring-pressed retaining-latch, an armature having a lifting-rod connected with the latch, and an electro-magnet and fixed and movable contacts, one of which is carried by the scale-beam, and connections whereby the magnet is energized when the weight in either chamber moves the bucket, to release the latch and reverse the bottoms and change the delivery.

8. In a weighing apparatus, a weighing-receptacle suspended from the counterbalanced scale-beam and having a shifting diaphragm whereby the material to be weighed is alternately received into chambers thus formed upon one side and the other of the diaphragm, a source of supply, a chamber intermediate between it and the weighing-receptacle having gates by which the bottom is closed and opened, mechanism for operating said gates consisting of geared intermeshing segments fixed upon the ends of the pivot-shafts of the gates, a rocker-arm, connecting-rod, and a mechanism by which said rod is moved whereby the gates are closed by its movement in one direction and opened in unison by its movement in the opposite direction.

In witness whereof I have hereunto set my hand.

GEORGE HOEPNER.

Witnesses:
GEO. H. STRONG,
S. H. NOURSE.