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15

(No Model.)

7 Sheets—Sheet 1.

H. E. SMYSER.

AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

Fig. 1a

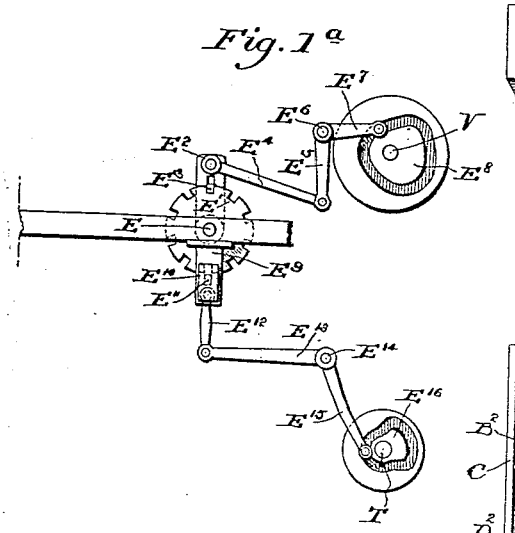


Fig. 1b

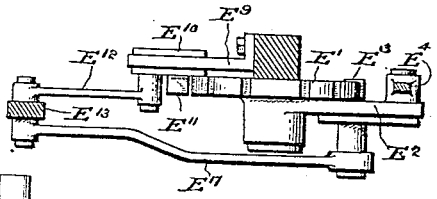
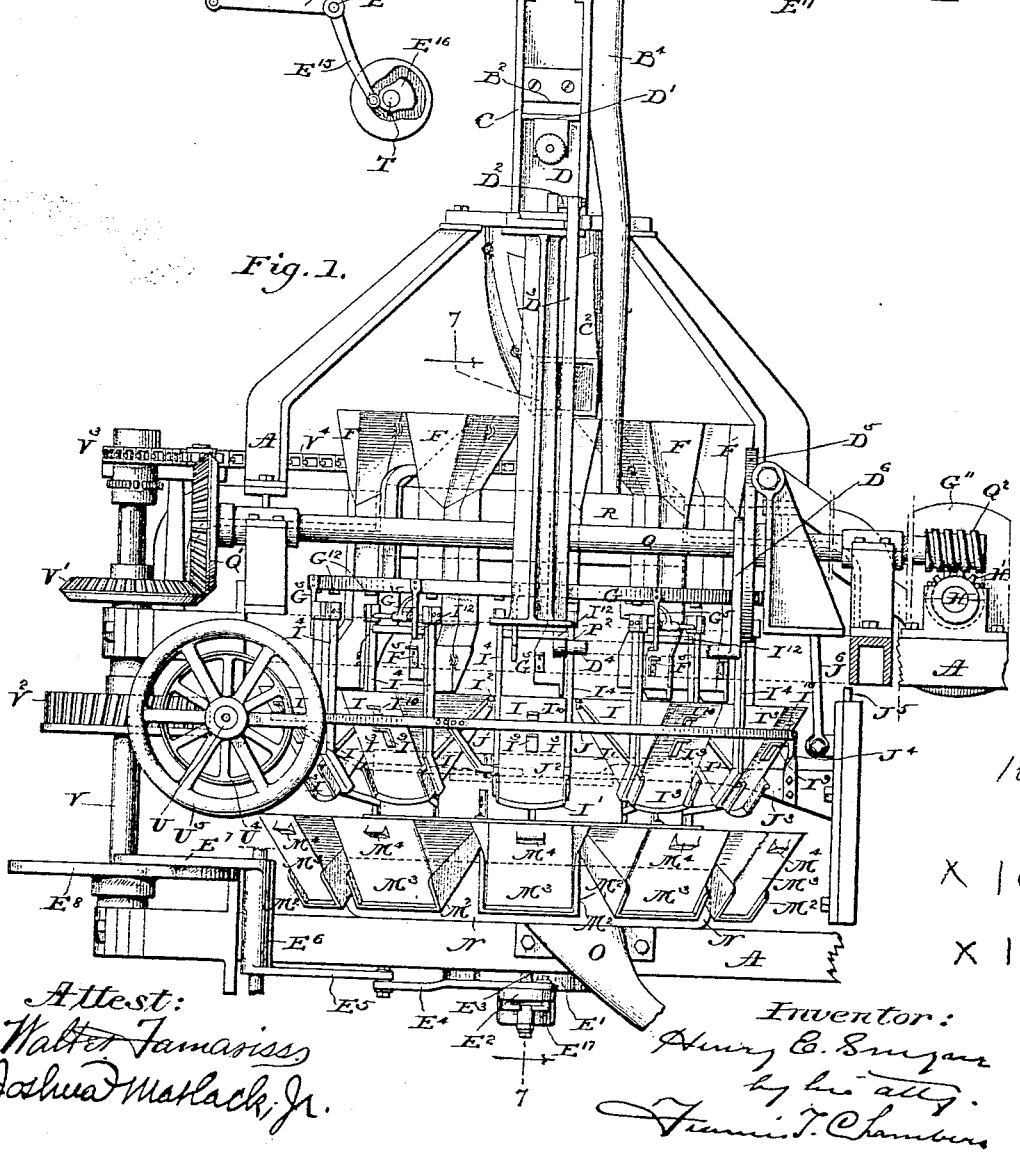


Fig. 1.



1074

X 1060

X 1062

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(No Model.) 7 Sheets—Sheet 2.

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AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

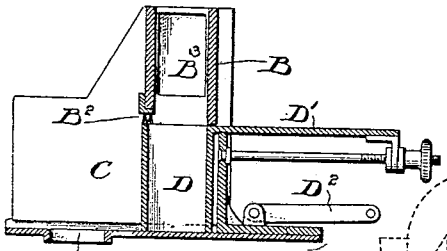

Fig. 2ª

Fig. 2.

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AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

Fig. 6.

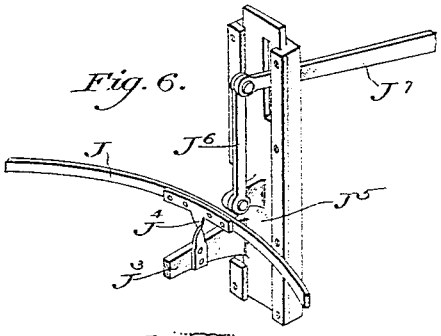


Fig. 3.

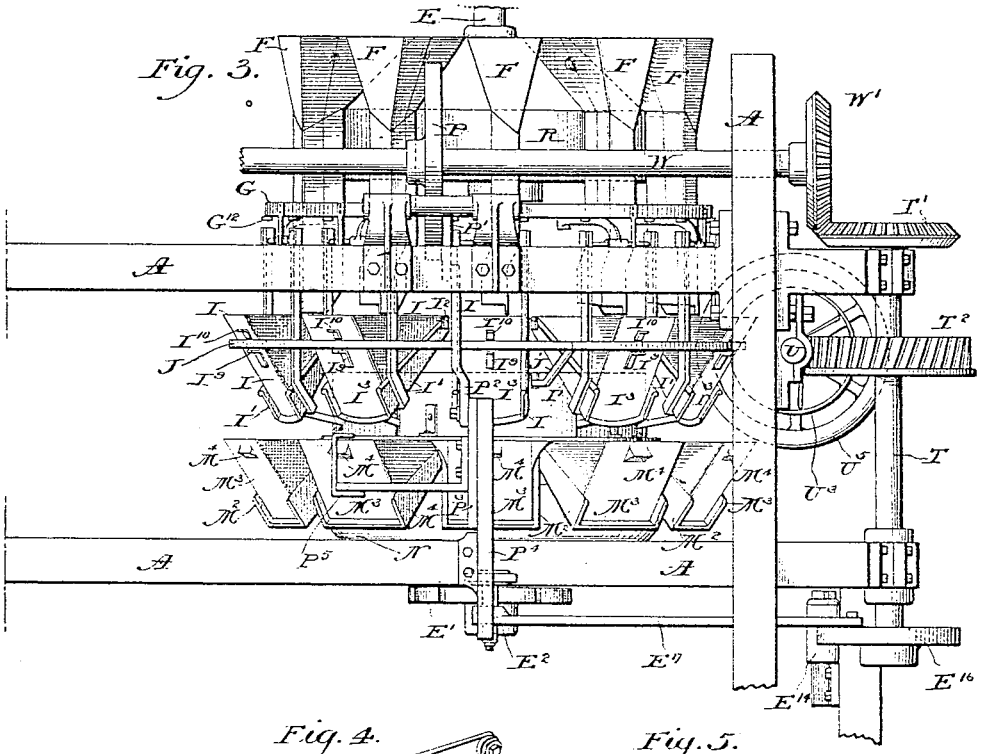


Fig. 4.

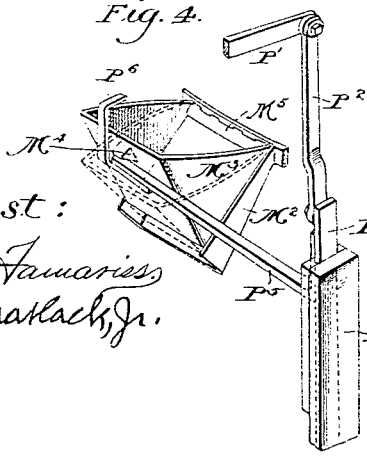
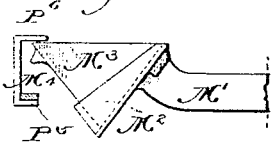


Fig. 5.



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No. 493,795. Patented Mar. 21, 1893.

Fig. 11.

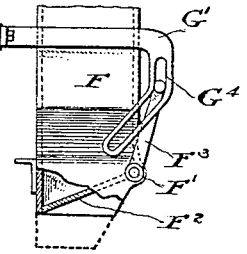


Fig. 7.

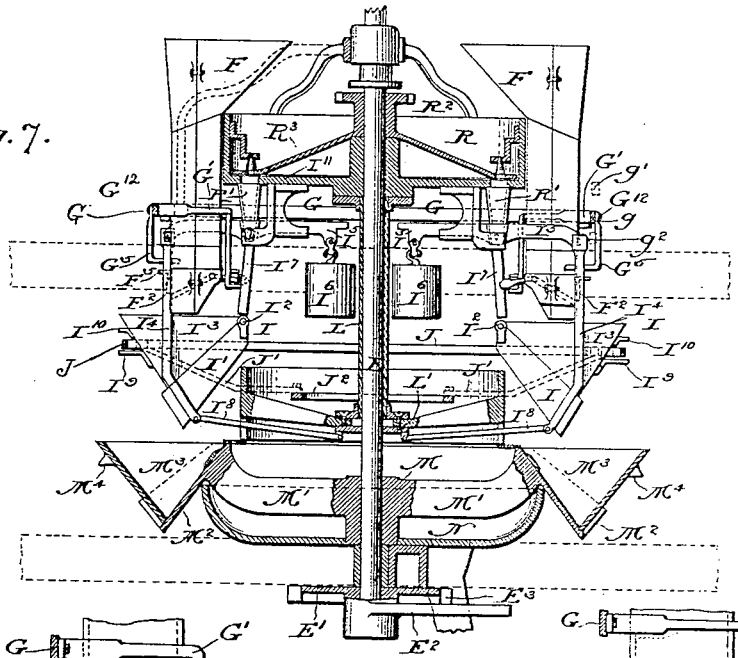


Fig. 9.

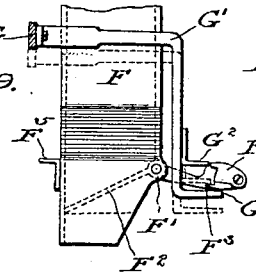


Fig. 8.

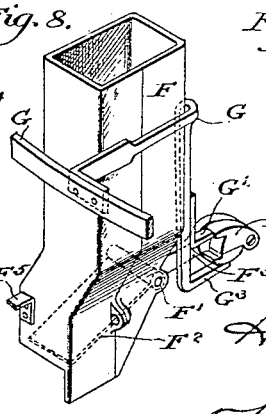
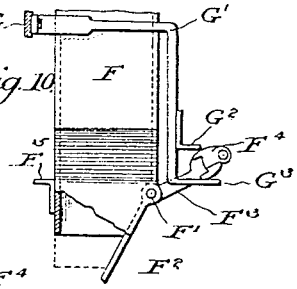


Fig. 10.



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H. E. SMYSER.

AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

FIG. 12.

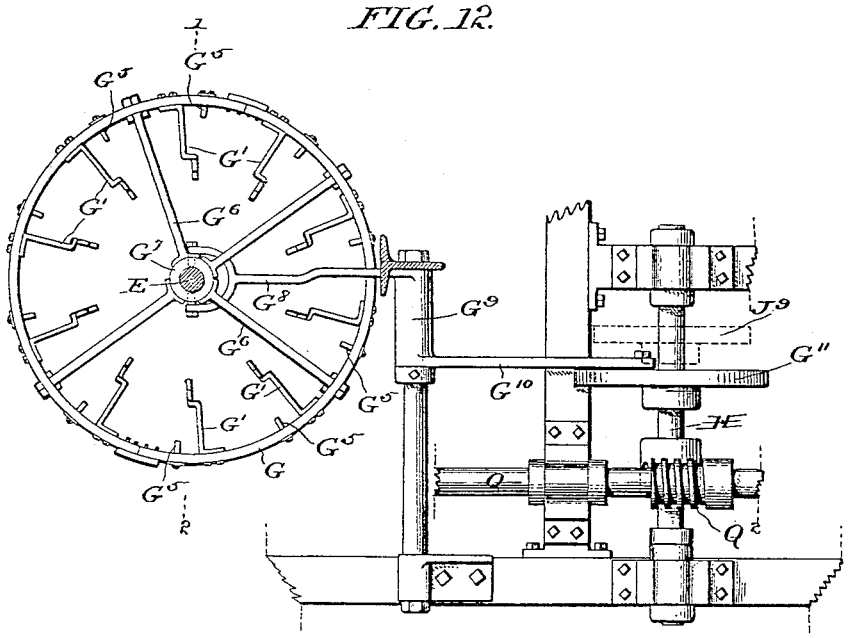
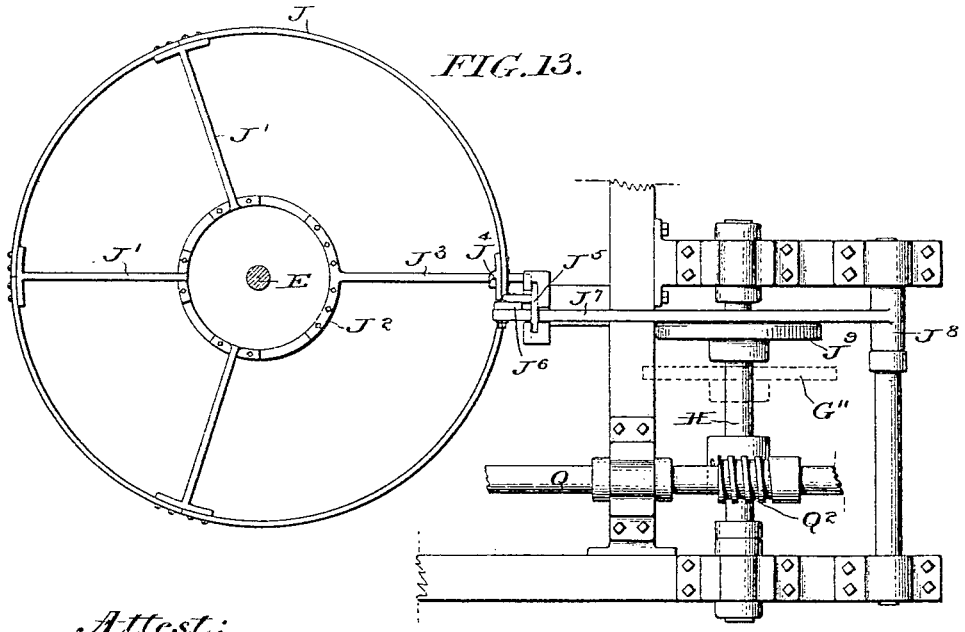


FIG. 13.



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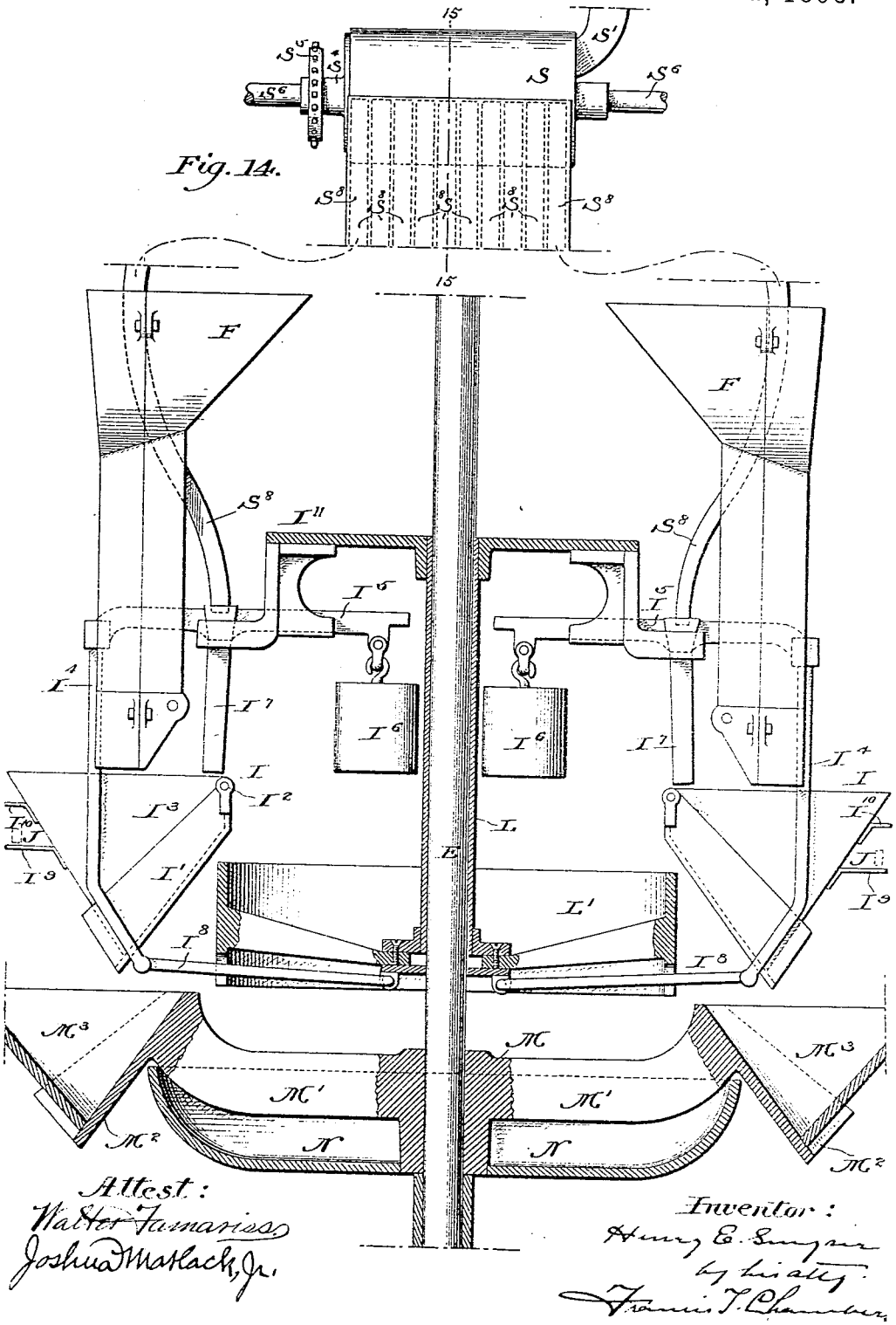
(No Model.) 7 Sheets—Sheet 6.

H. E. SMYSER.

AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

Fig. 14.



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H. E. SMYSER.

AUTOMATIC WEIGHING MACHINE.

No. 493,795. Patented Mar. 21, 1893.

FIG. 15.

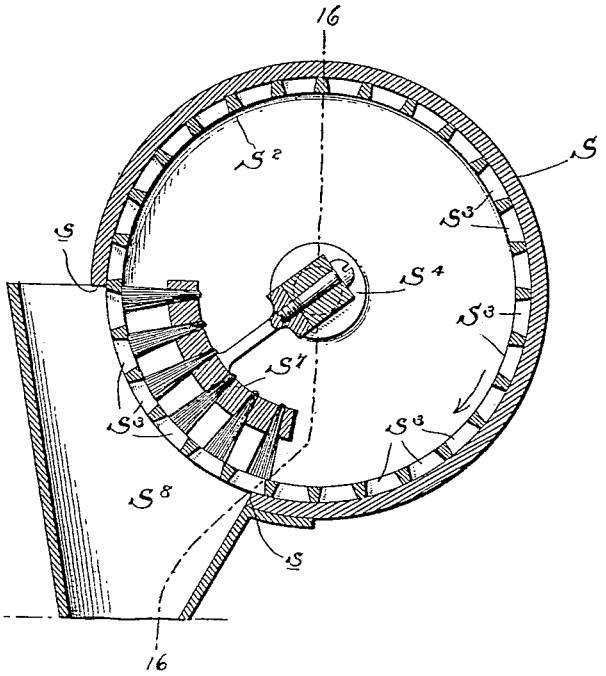
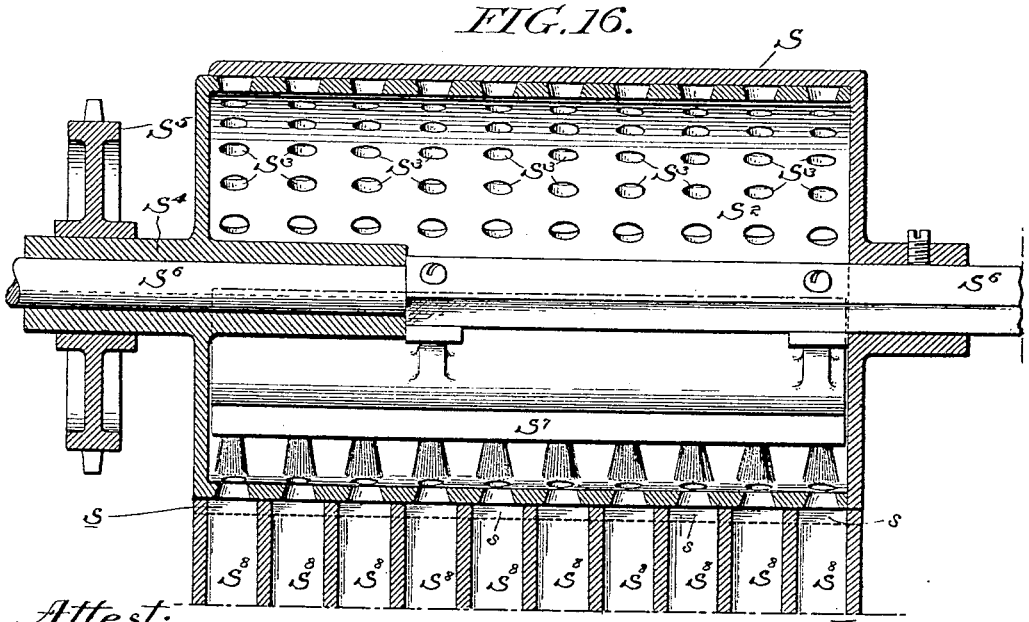


FIG. 16.



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Inventor:
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by his Att'y
Francis T. Chamberlain

UNITED STATES PATENT OFFICE.

HENRY E. SMYSER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO ARBUCKLE BROTHERS, OF NEW YORK, N. Y.

AUTOMATIC WEIGHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 493,795, dated March 21, 1893.

Application filed April 15, 1891. Serial No. 389,030. (No model.)

To all whom it may concern:

Be it known that I, HENRY E. SMYSER, of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Automatic Weighing-Machines, of which the following is a specification.

This invention relates to mechanism for automatically weighing and delivering uniform quantities of material, and constitutes an improvement upon the mechanism shown and described in my patents granted March 31, 1891, and numbered respectively 449,275 and 449,276. These patents illustrate a weighing apparatus for an automatic packaging machine wherein the material to be weighed is first measured out into charges of somewhat less than the desired weight, these charges being dumped alternately into two scale pans, and a graduated flow of material added to each pan until the desired weight is attained, whereupon the flow is cut off or diverted from the pan, after which the weighed charge is dumped from the two scale pans in alternation and discharged through a chute to the packaging mechanism. In the operation of this mechanism, I have found that when the weighing mechanism is speeded to keep pace with the capacity of the packaging mechanism, the weighing operation is not performed as accurately as is desirable for the weighing of certain substances.

The principal object of my present invention is to overcome this difficulty by enabling a greater number of scales to be employed, so that the time that each scale has in which to complete the weighing is prolonged, and the weighing operation is thereby rendered more accurate. One invention for accomplishing this result is embodied in my application, Serial No. 393,678, dated May 22, 1891, which illustrates a weighing machine employing a revolving series of scales moving intermittently, receiving the measured charges in succession in one position, receiving thence the graduated supply to complete the weight as they revolve, and the weighted charges being dumped from the scales one after another as they reach the final position over a discharge chute. Such mechanism however, in common with others wherein the scales are moved bodily while performing the act of weighing, is not capable of weighing as closely and accurately as is frequently desirable, owing probably to the jar imparted to the scales while moving.

My present invention constitutes an improvement upon those mechanisms employing a revolving series of scales. According to my present invention the several scales are mounted so as to remain stationary, and revolving mechanism is employed for charging and discharging them. The material to be weighed is delivered to the pans of the several scales either simultaneously or successively, a measuring apparatus being preferably employed for measuring out and delivering successively the charges of material for the respective scales. An intermittently-revolving chute or spout is arranged to receive the material delivered from the measuring mechanism, the discharge end of this spout standing in successive positions over the respective scale pans. The material may be delivered from this spout directly into the scale pans, but preferably is delivered into a series of receptacles formed preferably as chutes and located directly above the scale pans, these chutes being preferably provided with means for closing them in order to hold the charges of material in the chutes until all are full, whereupon by suitable mechanism all the chutes are discharged simultaneously into the scale pans. This enables the several scales to commence simultaneously the operation of weighing and to continue their operation together, those scales which first receive the full weight remaining inert until all have completed their weight, whereupon in the preferred construction all the scales are dumped simultaneously. A series of receptacles corresponding in number to the scales is arranged to receive the charges dumped from the respective scale pans. The scales preferably dump simultaneously into these receptacles, although they may dump successively or in any other suitable order. A dumping mechanism is provided for dumping the receptacles at equal intervals, each receptacle being dumped in turn, the dumping being performed preferably in succession, so that each receptacle after the next shall de-

liver its charge, the several charges being directed preferably into a delivery chute leading to packaging mechanism, or wherever the weighed charges are to be employed. By preference the receptacles are made to be movable intermittently beneath the scale-pans so that they constitute carriers for receiving the charges from the pans and carrying them to a point where they are successively dumped into a delivery chute.

The distinguishing features of my present invention are (first) the employment of a stationary series of scales operating to weigh out charges which are eventually delivered in succession; (second) the provision of receptacles for receiving the weighed charges dumped from the scales and for delivering these charges at proper intervals; (third) the arrangement of these receptacles to act as carriers for conveying the charges from the scale pans to a point of delivery; (fourth) means for charging all the scales simultaneously with the material to be weighed so that the weighing operations of the scales shall be performed together; (fifth) means for dumping the weighed charges from the several scales simultaneously into the receiving receptacles; (sixth) the combination with a stationary series of scales of an intermittently-acting measuring device delivering successive charges of material for the respective scales; (seventh) the interposition between such measuring device and the scale-pans of chutes or pockets adapted to retain the charges dropped into them successively from the measuring device until all are filled, and thereupon to dump simultaneously into the scales; (eighth) means for holding up the scale-pans while the charges of material are being dropped into them; (ninth) means for holding down the scale-beams while the scales are being dumped to prevent their flying up upon the dropping of the charges from the pans; and (tenth) an improved mechanism for delivering a graduated stream of material to the several scales to complete their full weight.

The preferred form of my improved weighing machine is that shown in the accompanying drawings, wherein

Figure 1 is an elevation of the machine viewed from the left hand side; Fig. 1^a a plan view of the mechanism for intermittently rotating the central shaft; Fig. 1^b an elevation of the said mechanism; Fig. 2 a rear elevation of the machine; Fig. 2^a a vertical section of the measuring device; Fig. 3 a side elevation viewed from the right-hand side of the machine and having a portion of the mechanism broken away so as to better show the remainder. Fig. 4 is a perspective view showing one of the carriers and the mechanism used for dumping such carrier; Fig. 5 a side elevation of one of the carriers and of the dumping finger used in connection with it. Fig. 6 is a detached perspective view illustrating a part of the mechanism used for dumping the scale-pans. Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 1 (with a part of the mechanism broken away to better show the remainder). Fig. 8 is a perspective view of one of the receiving chutes with its gate and the mechanism for actuating the gate. Figs. 9 and 10 are sectional side elevations showing the receiving chute with its gate both open and shut. Fig. 11 illustrates a modification of the gate-actuating mechanism shown in Figs. 8, 9 and 10. Fig. 12 is a plan view showing the mechanism for actuating the gates of the receiving chutes and for acting upon the scales in the way hereinafter to be described. Fig. 13 is a plan view of the mechanism used in dumping the scale pans. Fig. 14 is an enlarged elevation showing my preferred form of supplemental feeding device to be used in completing the desired weight of material in the scale-pans. Fig. 15 is an enlarged sectional view taken on the line 15—15 of Fig. 14; and Fig. 16 is a sectional view taken on the line 16—16 of Fig. 15.

Referring to the drawings, let A designate the frame of the machine, suitably constructed to form supports for the working parts. At the top of this frame in Figs. 1 and 2, is seen a chute B into which the material to be weighed is fed, a gate for shutting off the flow being shown at B′. This chute delivers the material into a measuring device C, while a branch chute B^4 (Fig. 1) conducts a portion of the material into a feed hopper R. The measurer C acts to deliver measured charges of material at regular intervals, these charges being dropped down a spout or chute C^2, which is mounted on an intermittently-rotating shaft E, so that after each charge falls through the chute it moves forward to a new position for delivering the next charge. The charges are delivered by the chute into a series of pockets or stationary chutes F F arranged circularly beneath it, there being ten of these in the construction shown, and the measured charges being dropped into them one after another from the revolving chute. The bottoms of these chutes are closed by gates F^2, as shown in Figs. 8, 9 and 10, so that the charges of material are retained in the chutes.

Directly beneath the chutes F F are the scale-pans of a series of scales I I, equal in number to the chutes or retaining pockets F F. When the entire series of chutes F F have been filled with the measured charges, that is, just as the charge is dropped into the last of the series, the gates are simultaneously opened, and the several charges are dropped into the several scale-pans. Thereupon a supplemental feed of material is delivered in a gradual stream into each of the scale-pans through a chute I^7 (Fig. 14) carried by the scale-beam, so that as the pan descends under full weight, the rocking of the beam deflects the chute so that it deposits the material outside of the scale-pan. Sufficient time being given for all the scales to complete their weighing, a dumping mechanism acts to dump all the scale-

pans preferably simultaneously. The charges dumped from the scale-pans fall into receptacles M^3, equal in number to the scales. Preferably these receptacles are mounted on the intermittently-revolving shaft E or otherwise, so that they constitute carriers which being charged with material from the scale-pans, carry this material to the point of delivery, at which point they are successively dumped, so that the weighed charges of material are dropped down through a delivery spout O (Fig. 1). During the time that the entire series of carrier receptacles are being emptied one by one down the delivery spout, the scales receive fresh charges of material and perform the weighing, which operation is completed before the last carrier is dumped, so that thereupon the carriers receive a fresh series of charges to be again dumped from them one after another at the delivery point, whereby the operation of the machine is effected continuously.

The nature and general operation of the preferred construction of machine embodying my present invention being now understood, I will proceed to describe the particular construction thereof in detail.

The measurer C is constructed of a box or casing into which the chute B leads and in which moves a reciprocating measuring box D (Fig. 2^a) open at both ends and having a travel from a point beneath the bottom of chute B to a point over an opening C′ in the bottom of the casing C communicating with the oblique chute C^2. D′ is a plate secured to the top of the box D and which serves to close the mouth of chute B when the box is moved away from beneath it. The measuring box is actuated by a cam D^5 (Fig. 2) acting through a lever D^3 and connecting-rod D^2. In all of the above particulars the mechanism illustrated is identical with that shown and described in my patent No. 449,276.

The intermittently-rotating shaft E which carries the oblique chute C^2 and the series of carriers of receptacles M^3 M^3, is arranged vertically in the center of a circular series of scale-pans and carriers. This shaft is intermittently rotated, preferably by the following described mechanism shown best in Figs. 1^a and 1^b. To the shaft near its bottom is fastened a notched or slotted disk E′ having as many radial notches as the number of intermittent movements in a revolution, that is to say, as many as the number of scales employed. A swinging arm E^2 is mounted loosely on the shaft beneath this disk, and is given an angular movement equal to the angular interval between the notches, by the action of a cam E^8 on a rotary shaft V, acting through an elbow-lever E^7 E^6 E^5 and connecting rod E^4, to swing the lever arm E^2 back and forth at intervals. This lever arm E^2 is formed with a longitudinal slideway in which works a slide carrying a locking tooth or bolt E^3 adapted to enter the notches in the disk. A stationary grooved slideway or frame E^9 is arranged radially of the disk, and in it works a slide E^{10} having a locking tooth or bolt E^{11}. The slides carrying both locking bolts E^{11} and E^3 are connected by links E^{12} and E^{17} respectively to one arm of a lever E^{13} E^{14} E^{15}, which is vibrated at intervals by a cam E^{16} fixed on the rotating shaft T. The two bolts are situated at a distance apart preferably a little less than the diameter of the disk E′, so that the movement of the lever arm E^{13} in either direction first engages one bolt and then withdraws the other. The shafts B and T revolve at equal speeds, each making one complete revolution to each intermittent advance of the shaft E, and their cams are so timed that the bolt E^3 is first engaged with the disk to lock the lever arm E^2 thereto, the bolt E^{11} being withdrawn, whereupon the lever arm E^2 swings forward, carrying the shaft and disk with it the distance from one notch to the next; whereupon the bolts E^{11} and E^3 are moved to engage the former with the disk and lock it in place, while the latter is withdrawn from the disk; and thereupon the lever arm E^2 is swung back to the initial position shown in Fig. 1^a ready for the next forward movement. This ratchet mechanism is shown and claimed in my said application, Serial No. 393,678, dated May 22, 1891.

The series of stationary receptacles, pockets or chutes F F is equal in number to the scales, and arranged directly over the scale-pans. These chutes F might be merely conduits through which the material should fall freely to the scale-pans; in this case the chutes might be dispensed with and the material supplied directly to the scale-pans from the inclined chute C^2, and this plan is within the purview of my invention; but preferably the chutes F act not merely as conduits but as holders for the material supplied to them, so that the material will be retained by the chutes until all are filled, and then, by dumping the chutes, will be delivered simultaneously into the whole series of scale-pans. In the construction shown this is provided for by constructing each chute with a retaining gate F^2 (Figs. 8 to 10) which closes the said chute, permitting the material to fall therefrom only when the gate is open. As shown the gate F^2 is pivoted at F′ and provided with an actuating lever F^3 counterweighted at its end so that the gate will be held closed against the pressure of the material resting upon it—the opening of the gate being effected by an intermittently-moving arm or finger G^3 which, as shown, is formed or attached to the end of an arm G′ extending out from a ring G one arm, G′, being provided for each chute F and the ring G being secured by spokes or arms G^6 to a sleeve G^7 supported in turn on the arm G^8 of a bell-crank lever G^8 G^9 G^{10}, which lever is actuated by the cam G^{11} on shaft H (see Fig. 12). The shape and timing of the cam are such that the ring and its supported

arms will be elevated when all the chutes are filled and ready to be dumped into the scale-pans.

It will be seen that in Figs. 8, 9 and 10, a finger G^2 is attached to the arm G', the use of which, as shown in the said figures, is by pressing down upon the end of the lever F^3 to close the gate F^2. As shown, a latch F^4 is attached to the end of the lever F^3, upon which the finger G^2 rests in closing the gate F^2, but which can be lifted in case the finger G^2 engages its under edge. In place of the fingers G^2 G^3 a cam slot G^4, as shown in Fig. 11, may be used, this construction having the advantage of positively actuating and holding the gate so that it is not necessary to counterweight the lever F^3.

The series of scales is stationary, that is to say, the scales have no circular or lateral motion. As shown the scale-beams marked I^5 are pivotally connected with brackets extending out from a plate I^{11} (which may form the bottom of the feed hopper R in Fig. 7) fixedly mounted on the frame. A counterweight I^6 is carried by the inner end of each scale-beam, while to a cross-bar on the outer end of the scale-beam are pivotally secured hangers I^4, to the lower ends of which hangers are secured the scale-pans.

I^8 indicates links pivotally connected to the bottom of the hangers I^4 and to a disk L' carried at the lower end of a stationary sleeve L which surrounds the shaft E and is attached to the disk I^{11}. The purpose of the links I^8 is to prevent the scale-pans from swinging and hold them in approximately uniform position while permitting them to rise and fall with the scale beams.

The scale-pans are of peculiar and novel construction, consisting each of an inclined bottom I' carried directly by the hangers I^4, and a movable body portion I^3 adapted to be lifted relatively to the inclined bottoms in order to permit the charge of material in the pan to slide out down the bottom and escape. The body I^3 consists preferably of the inclined front and two sides of the scale-pan, and is preferably pivoted to the rear or upper edge of the inclined bottom, as best shown in Fig. 14. The body portion of the pan rests on the bottom by its own weight, its shape being such that the weight of the mass of material cannot tend to open it, but in order to provide for the dumping of the pans, I provide the body I^3 of each pan with a projecting arm or finger I^{10} which projects over a ring J engaging the fingers of all the scale-pans, and movable vertically in order by its ascent to lift the portion I^3 of the respective pans and thereby dump their contents. Each pan has also preferably a finger I^9 projecting under the ring J. The chutes I^7 I^7 are secured to the respective scale beams so as to turn with them, and each is so placed that when the outer end of the beam is in its upper position the mouth of the chute will be over the scale-pan, while when the scale-beam falls, the mouth of the chute will extend out behind the scale-pan. Chutes of this kind, (which are covered by a former patent to myself) are, in the present state of the art, but one of several known devices for making the motion of the scale-beam to control the delivery of the material to the scale-pan. I have shown this construction in my present apparatus because it is, I believe, the best adapted for use, but it will be understood that I do not mean to limit my claims to the use of this particular one of the many known devices for accomplishing the same result. The scale-pans having received their measured quantities of material are fed with additional material supplied gradually until the desired weight is obtained, when the weight in the scale-pan overcoming the counterweight causes the beam to fall and cuts off all further supply of material.

I have shown in the drawings two different feeding devices for delivering material to the scales, which, generally speaking, may be considered equivalent to each other. The one device, best shown in Fig. 7, consists of a feed hopper R having openings around its periphery with which openings chutes R' register, the lower ends of said chutes in turn registering with the upper ends of the chutes I^7. The feed hopper R receives the overflow of material from the measurer C, the material overflowing through an opening B^3 (Fig. 2^a) in the side of the chute B and descending through a chute B^4 (Fig. 1) to the supply box or hopper R. Inside of the box R, which is stationary, is an annular feed-plate R^3, preferably cone-shaped as shown, and journaled on the shaft E so as to turn freely thereon, its outer portion or rim, which covers the openings leading to the chutes R' being formed with perforations which, as the disk revolves, register with the perforations in the hopper permitting material contained in the perforations of the disk to fall into the chutes R' and thence pass through the chutes R' and I^7 either to the scale-pans I or to the receiving box N situated beneath and inside of the scale-pans. This feeding device need not be more particularly described, as in its general features it is similar to the one described and claimed in my patent No. 449,276, such improvements as it involves being claimed in my application, Serial No. 393,678, filed May 22, 1891.

The other, and preferred form of feeding device, is illustrated in Figs. 2, 14, 15 and 16, and consists of a cylindrical horizontally-set casing S fed at a spout S' and having a series of openings *s s* Fig. 16, one being shown from *s* to *s* in Fig. 15 on its under side; within this casing, which is stationary being secured to a stationary shaft S^6, is a rotating cylinder S^2 pierced with a series of perforations S^3 S^3, and fastened to the shaft S^6 is a stationary brush or scraper S^7 which rests against the inner cylinder and over the space of the outer cylinder in which the openings *s s* are formed.

Extending from the openings *s s* is a series of chutes S^8 which, in the plan shown, extend to the mouth of the respective chutes I^7. The operation of this device is easily followed: The material is fed to the inner cylinder and falls into the holes or perforations S^3; as the inner cylinder revolves the surplus material not contained in the holes is wiped off by the brush or scraper S^7, and when the holes register with the chutes S^8 beneath the brush, the material contained in them falls into the said chutes and is delivered by them to the chutes I^7 of the respective scales. The effect of suddenly shooting or dumping the measured charge of material from the chutes F F into the scale-pans is to thrust the latter downward and thereby set the scale-beams into operation.

For accurate weighing, it is desirable that the scale-beams be as quiescent as possible, being acted upon by no other force than the material being weighed. I therefore provide means for upholding the scale-pans or the outer ends of the scale-beams while the charges are being dumped into the scale-pans from the chutes F F, and for slowly or gradually lowering the pans until the scale-beams are left in equipoise. For this purpose I provide fingers G^5 Fig. 7 which are attached to the ring G and have hooked ends which extend beneath the scale-beams or beneath any part attached thereto, preferably a cross-bar I^{12} (see Fig. 1) formed on the hangers I^4. In rising to open the gates of the chutes F and let the material fall into the scale pans, the ring G draws up the fingers G^5 until they engage the under side of these cross bars, this engagement taking place simultaneously with or just before the dumping of the material to the pan and preventing the weight and momentum of the material from depressing the scale-beam as it is shot into the scale-pan. The provision of a catch or stop such as G^5 which will engage the scale and keep it from falling under the momentum of the mass shot into it, is an important detail of the apparatus. It may of course be independent of the mechanism for dumping the chutes, but is conveniently connected with it in the way shown. When the scales have received their full weight they sink down in the manner already described and to some determined point or resting place; as shown, lugs F^5 attached to the chutes F are provided as stops to limit the downward motion of the scale pans. Any part of the scale-beam or pan may be stopped by this lug; in the construction shown it is the cross-bar I^{12} (Fig. 1) before referred to, on the hangers I^4 that encounters the lug or stop. It is obvious of course that when the contents of the scale-pans are dumped the counterweight will tend to draw or throw the empty pans up with great rapidity. This action would produce a jar which would be highly objectionable and injurious to the machine if not provided against, and I therefore provide stops which, at the time the scales are dumped, will hold the beams in position and prevent their flying up, the said stops moving up gradually after the pans are emptied and permitting the pans to rise with a speed which will not produce an injurious jar. As shown these stops, marked G^{12}, are secured to the ring G in such position that they will come immediately over the end of the scale-beam, or preferably, as shown, over the upper ends of the hangers I^4, and the cam which actuates the ring G is so formed that it will move the said ring to the position indicated at g^2 (Fig. 7) just prior to the dumping of the scale-pans. In this position the stops G^{12} are down so that they rest upon the upper ends of the hangers I^4, and serve to hold the scale-pans down. After the pans are dumped the ring slowly rises, the ascent of the stops G^{12} permitting the pans to slowly rise to their highest position. The other positions of the ring G are indicated at *g* and *g'*, *g* being the position in which the ring and its attachments are performing no service or merely serving to keep the gate F^2 closed; and *g'* the position to which the ring G is moved in opening the gate F^2 and engaging the fingers G^5 with the scale-beams. The ring J for dumping the scale-pans is supported from a central ring J^2 (Fig. 13) by arms J' J', the whole annular structure thus formed being supported on an arm J^3, which, as shown, is connected with the central ring J^2 and with the outer ring J by means of an upright J^4 (see Figs. 1, 6 and 13). The arm J^3 is fastened to a slide J^5 which is actuated by a cam J^9 on shaft H through the lever J^7 pivoted to J^3 and having its movable end secured to a connecting arm J^6 which in turn is secured to the slide J^5. The elevation of the ring J by the above described mechanism opens all of the gates I^3, permitting the material contained in the scale-pans to fall into the carriers M^2 M^2 situated beneath them. The depression of the ring J acting on the lugs or fingers L^9 serves to close the gates I^3 which, however, may be made of sufficient weight in themselves not to require this action of the ring J. The series of carriers M^2 M^2 is supported on a hub M secured to the intermittent rotating shaft E by means of spokes M'. These carriers have the intermittent rotary motion of the shaft E, coming in turn above a delivery chute O, at which point each is in turn dumped.

To provide for the convenient dumping of of the carriers I prefer to construct them in similar manner to the scale-pans. Each carrier or receptacle is therefore constructed with an inclined bottom connected rigidly to the spokes M', and with a movable body portion M^3 comprising preferably the inclined front and the two opposite sides of the receptacle, and so connected with the inclined bottom as to be upwardly movable to permit the charge of material to slide out down the bottom and beneath the body M^3. Preferably the body M^3 is hinged at M^5 to the rear upper edge of the inclined bottom, as shown in Fig. 4. The

body M^3 is provided on its upper or front side with a projecting lug M^4, by which it may be lifted to dump the carrier. The dumping in the construction shown in the drawings is effected by a rod P^5 so arranged as to come beneath the lug M^4 when the carrier reaches the dumping position, this rod being lifted intermittently, so that at the proper instant it raises the body M^3 of the carrier to the position shown in full lines in Fig. 4, holding it long enough to permit the charge to run out, and then dropping it back. The rod P^5 may be provided with a finger P^6 to press the body of the carrier back to its position, although ordinarily its weight will be sufficient to restore it. In the construction shown the rod P^5 is attached to a slide P^3 working in a stationary slideway P^4 (Fig. 4) and actuated from a cam P (Fig. 2) which has a cam-groove acting on a lever P′ which connects through a link P^2 with the slide P^3.

U is the main driving shaft of the machine; fast and loose pulleys U^3 and U^4 being respectively secured and journaled upon it; U^5 being a hand-wheel at the end of the shaft. The shaft U has worms secured to it which mesh with the worm-wheels T^2 and V^2 of the shafts T and V. The shaft V has upon it the cam E^8 and a sprocket-wheel V^3 which, by means of a drive-chain V^4, may be made to drive the feed-plate R^3 to which, as shown in Fig. 7, the sprocket-wheel R^2 is connected. A miter-gear V′ is also attached to shaft V which engages a miter-gear Q′ on the shaft Q; which shaft, besides carrying a cam or cams, is, in the plan shown, provided with a worm Q^2 engaging a worm-wheel H′ on the shaft H. To the bottom of the shaft T is secured the cam E^{16}, and to its top a miter-wheel T′ which engages a similar miter-wheel W′ on the shaft W; this shaft carries the cam P, and may carry other cams if desired, and, as shown in Fig. 2, is provided with a sprocket-wheel S^{10} through which and the drive-chain S^9, a sprocket-wheel S^5 attached to a sleeve S^4, is driven—the perforated cylinder S^2 being attached to the sleeve S^4.

The entire operation of weighing as performed by this machine is as follows: The material to be weighed being supplied in bulk to the chute B so as to keep this chute constantly filled, falls into the measuring compartment or box D of the measurer C each time this box is moved to the position shown in Fig. 2^a, while the overflow from this measurer passes down the auxiliary chute B^4, keeping this also constantly filled, and is delivered therefrom into the supplemental feed hopper R. Or in the preferred construction the branch feed from the chute B communicates with the chute S′ of the supplemental feed cylinder S, thereby conducting the overflow of the material to the interior of the inner cylinder S^2, which is kept filled or nearly so with the material. Each time the measuring box D is moved over the delivery opening C′, it carries with it a measured charge of material somewhat less in weight than the full weight desired to be measured out. For example, if the material is to be measured out into charges of one pound each, this measurer may measure out a charge approximately fifteen ounces in weight. The successive charges thus measured are dropped down the inclined spout C^2 and delivered successively into one after another of the receptacles or chutes F F, until the entire series of these chutes is filled with the material, whereupon the ring G rises, thereby through its fingers G′ opening the gates of the several chutes and dumping their contents into the scale-pans, which at this moment are upheld by the hooked fingers G^5 depending from the ring G. The ring G then moves downwardly sufficiently to reclose the gates of the chutes and to release the scale-pans, so that the scales may begin to weigh the charges. The supplemental feed is introduced into the several scales through the chutes I^7, the supplemental feed coming from the supplemental feed cylinder S through the chutes S^8. As the scales are filled to the full weight, their pans deflect the chutes I^7 and cause them to deliver the supplemental feed outside of the scale-pans and into the tray N. As the scale-pans descend they are arrested by the stops F^5, and after sufficient time has elapsed for all of the scales to have completed the weighing operation, the ring G descends, so that the stops G^{12} engage the scale-pan hangers and hold the scales down, while by the ascent of the ring J the several scales are dumped, their contents being discharged into the respective carriers M^3. These carriers then move intermittently one after the other, each in turn stopping or pausing an instant over the delivery chute O, and while in this position being dumped by the dumping arm P^5 (Fig. 4). When the last of the carriers has been thus dumped, leaving them all empty, the scales, which in the meantime have been weighing out a new series of charges, is again dumped into the carriers and the operation continued.

It will be understood that my invention in its broader features is not limited to the details of apparatus herein shown and described with such circumstantiality, it being apparent that the details of the apparatus may be greatly varied without departing from the essential features of my invention. As an example of one modification that might be employed, I will suggest the substitution for the intermittently-acting measurer C and intermittently-rotating spout C^2 for delivering the measured charges therefrom to the chutes F F wherein the charges are arrested and subsequently delivered to the scales, of the multiple measurer embodied in my patent No. 470,146, dated March 1, 1892, having independent chutes communicating with the respective scale-pans and dumping the simultaneously measured charges at the same instant into all of the pans. Other detail fea-

tures of my apparatus may be in similar manner substituted by mechanisms which in a broad sense will constitute equivalents thereof.

The features of my invention which are believed to be essential are those defined in the claims following this specification.

I claim as my invention the several improvements in automatic weighing apparatus hereinafter defined, each substantially as hereinbefore specified, namely—

1. In an automatic weighing machine, the combination with a series of stationary scales of a series of receptacles adapted to receive the weighed charges from the scales, and mechanically-driven mechanism for automatically dumping the receptacles in regular succession.

2. In an automatic weighing machine, the combination with a series of stationary scales of a series of carriers adapted to receive the weighed charges from the scales, and movable to convey the charges away, and mechanism for automatically dumping the carriers successively.

3. In an automatic weighing machine, the combination with a series of stationary scales of a corresponding series of movable carriers, mechanism for dumping the scale-pans simultaneously into the carriers, and mechanism for dumping the carriers successively at a given point.

4. In an automatic weighing machine, the combination with a circular series of stationary scales, of a circular series of carriers adapted to receive the weighed charges from the scales, a rotary shaft on which said carriers are mounted, and a mechanism for dumping the carriers successively.

5. In an automatic weighing machine, the combination with a circular series of stationary scales, of a circular series of carriers adapted to receive the weighed charges from the scales, intermittent driving mechanism for moving the carriers step by step from one scale to the next, mechanism for dumping the scale-pans simultaneously, whereby all the carriers are filled, and a mechanism for dumping the carriers as they reach a given point, whereby they are successively emptied.

6. In an automatic weighing machine, the combination of a series of stationary scales, means for supplying material thereto, means operated by the deflection of the scale-beams for cutting off the supply therefrom, means for simultaneously dumping the scale-pans, a series of receptacles adapted to receive the weighed charges dumped from the pans, and a dumping mechanism for dumping the receptacles successively.

7. In an automatic weighing machine, the combination of a series of stationary scales, a measuring mechanism for delivering charges of the material to be weighed at intervals, and a movable chute over said scales arranged to receive the charges from said measuring mechanism and moving to deliver the successive charges to the respective scales successively.

8. In an automatic weighing machine, the combination of a circular series of stationary scales, a revolving chute mounted above them and movable to deliver into them in succession, a mechanism for feeding charges of material to be weighed into said chute, a series of receptacles arranged to receive the weighed charges from the respective scales, and means for dumping said receptacles in succession.

9. In an automatic weighing machine, the combination of a series of stationary scales, a corresponding series of stationary chutes delivering into the respective scale-pans, mechanism for dumping charges of material to be weighed into said chutes, mechanism for dumping the scales, a series of receptacles adapted to receive the weighed charges therefrom, and mechanism for automatically dumping the receptacles successively.

10. In an automatic weighing machine, the combination of a series of stationary scales, a series of stationary chutes leading to the respective scale-pans, means for supplying material to the pans through said chutes, means for conducting an additional supply to the pans, operated by the deflection of the scale-beams for cutting off the supply from each pan upon its descent under full weight, a series of carriers adapted to receive the weighed charges from the scales, and means for dumping said carriers successively.

11. In an automatic weighing machine, the combination of a series of stationary scales, a corresponding series of stationary chutes delivering into the respective scale-pans, a measuring mechanism operating intermittently to deliver measured charges of material, and a movable chute receiving said charges therefrom and coinciding in its successive movements with the successive stationary chutes, whereby it delivers the measured charges to the stationary chutes in succession.

12. In an automatic weighing machine, the combination of a series of stationary scales, a corresponding series of stationary chutes delivering into the respective scale-pans, and having mechanism for closing them, means for delivering charges of material into the chutes successively, and mechanism for automatically dumping the contents of the several chutes simultaneously into the scale-pans.

13. In an automatic weighing machine the combination of a series of stationary scales, a corresponding series of stationary chutes delivering into the respective scale-pans, and having gates for closing them, mechanism for charging said chutes with material to be weighed, while their gates are closed, so that the charges to be weighed are stored in said chutes, mechanism for opening said gates to dump the stored charges from the chutes into the scale-pans, and mechanism for dumping the scale-pans.

14. In an automatic weighing machine, the combination of a series of stationary scales, a corresponding series of stationary chutes delivering into the respective scale-pans, a measuring mechanism operating intermittently to deliver charges of material, an intermittently-revolving chute for conducting the charges from said measuring mechanism to the stationary chutes successively, an intermittently revolving series of carriers adapted to receive the weighed charges dumped from the scale-pans, and means for dumping said carriers.

15. In an automatic weighing machine, the combination with the series of stationary chutes F and an intermittently-discharging measure D of an intermittently-moving spout C^2 arranged to receive the contents of the measure and deliver it *seriatim* to the chutes.

16. In an automatic weighing machine, the combination with a circular series of scales and a corresponding series of chutes above them, of an intermittently-discharging measure, an intermittently-revolving central shaft, a chute carried thereby receiving the material from said measure and conducting it to said series of chutes *seriatim*, and a series of carriers arranged beneath the scales to receive the weighed material therefrom, and mounted on said shaft.

17. In an automatic weighing machine, the combination with a scale and mechanism for dumping charges of material to be weighed therein, of a movable finger arranged to hold the scale while the charge is being dumped therein and then to release it.

18. In an automatic weighing machine, the combination with a scale and mechanism for dumping the same, a stop arranged to hold the scale-beam depressed while the scale is dumped and to retract slowly therefrom to permit the beam to rise gradually after dumping.

19. In an automatic weighing machine, the combination with a series of stationary scales and mechanism for simultaneously dumping charges of the material to be weighed therein, of a series of movable fingers, connected and moving together, arranged to hold the respective scales while the charges are being dumped therein, and movable to gradually release them.

20. In an automatic weighing machine, the combination with a series of stationary scales and mechanism for simultaneously dumping them, of a series of stops connected and movable together, arranged to hold the scale-beams depressed while the scales are dumped, and movable slowly away therefrom to permit the beams to rise gradually after dumping.

21. In an automatic weighing machine, the combination with the series of scales I, of a ring G having fingers G^5 arranged to engage the scales and prevent their falling, and stops G^{12} arranged to engage the scales and prevent their rising, and mechanism for alternately raising and depressing said ring so as to bring said fingers and stops into operation alternately and intermittently.

22. In an automatic weighing machine, the combination with a series of scales and a series of chutes above them having gates, of mechanism for operating said gates, consisting of arms engaging the respective gates and connected together, and driving mechanism for moving said arms simultaneously to open the gates and dump the charges in said chutes into the scale pans.

23. In an automatic weighing machine, the combination with a series of scales and a series of chutes above them having gates, of mechanism for operating said gates, consisting of a ring G having arms G^3 arranged to engage lever arms F^3 attached to said gates, and mechanism for raising and lowering said ring.

24. The combination of the chutes F, the gates F^2 in said chutes having lever-arms F^3, the series of scales situated below said chutes, a ring G having fingers G^3 arranged to engage and lift levers F^3, and fingers G^5 arranged to engage and hold the scales, said fingers G^3 and G^5 being arranged to act simultaneously, and mechanism for raising and lowering the ring intermittently.

25. The combination of the chutes F, the gates F^2 in said chutes having lever-arms F^3, the series of scales situated below said chutes, a ring G having fingers G^3 arranged to engage and lift levers F^3 and fingers G^5 arranged to engage and hold the scales, said fingers G^3 and G^5 being arranged to act simultaneously, stops G^{12} also secured to ring G and arranged to engage the scales and prevent their rising during dumping, and mechanism for raising and lowering the ring intermittently.

26. In a scale, a scale-pan consisting of an inclined bottom hung from the scale-beam, and a movable body adapted to be lifted from said bottom to dump the scale.

27. In a scale, a scale-pan consisting of an inclined bottom hung from the scale-beam, and a movable body pivoted to the upper part of said inclined bottom, and adapted to be lifted from the lower part of said bottom to permit the contents of the pan to slide out.

28. In a scale, a scale-pan consisting of an inclined bottom hung from the scale-beam, by hangers guided to confine the bottom to a vertical motion, and a movable body adapted to be lifted from said bottom to dump the scale.

29. The combination with the scale-pans I each consisting of an inclined bottom I′ supported on the scale-beam, and movable only in a substantially vertical line, and a movable body I^3 pivoted to the upper end of said inclined bottom, of a dumping ring J arranged to lift the bodies I^3 and mechanism for intermittently raising and depressing said ring.

30. The combination with a series of scales of a series of receptacles adapted to receive the charges dumped from the scales, consist-

ing each of an inclined bottom and a movable body adapted to be lifted off said bottom to dump the receptacle.

31. The combination with a series of scales of a series of receptacles adapted to receive the charges dumped from the scales, consisting each of an inclined bottom and a movable body pivoted to the upper part of the inclined bottom and adapted to be lifted at its opposite side from the lower part of said bottom to permit the contents of the receptacle to escape.

32. The combination with a series of scales of a series of receptacles adapted to receive the charges dumped from the scales, consisting each of an inclined bottom and a movable body adapted to be lifted off said bottom to dump the receptacle, and means for dumping said receptacles consisting of an intermittently-rising finger engaging the movable bodies thereof in succession and lifting each in turn.

33. The combination with a series of stationary scales of a series of intermittently-rotating carriers, consisting each of an inclined bottom and a movable body adapted to be lifted off said bottom to dump the carrier, and means for dumping the carriers as they arrive at the dumping position, consisting of an intermittently-rising finger engaging the carriers as they reach said position, and by its rising movement lifting the movable body of each carrier in turn.

34. In an automatic weighing machine, a feeder for delivering a graduated feed to the scales, consisting of a cylindrical casing having openings communicating by chutes with the respective scales, a perforated cylinder revolving in said casing, and a stationary part mounted in said casing to cover the perforations during their coincidence with said openings.

35. In an automatic weighing machine, a feeder for delivering a graduated feed to the scales, consisting of a cylindrical casing having openings communicating by chutes with the respective scales, a perforated cylinder revolving in said casing, and a stationary brush mounted in said casing to cover the perforations in the perforated cylinder during their passage over said openings, and brush off all material except that carried in the perforations.

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