No. 607,469. Patented July 19, 1898.

F. H. RICHARDS.

BOX FILLING MACHINE.

(Application filed Oct. 19, 1897.)

(No Model.) 5 Sheets—Sheet 1.

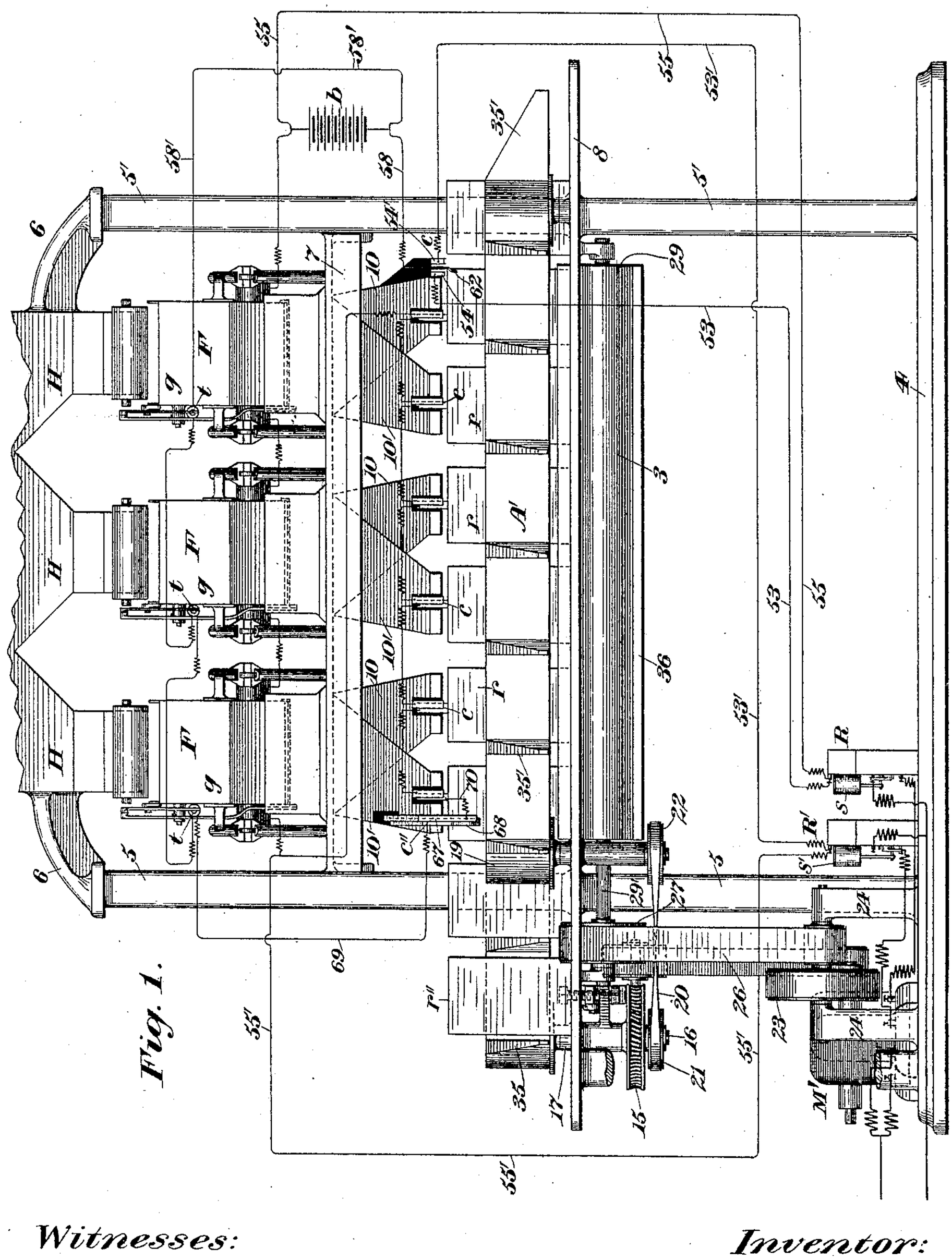

Fig. 1.

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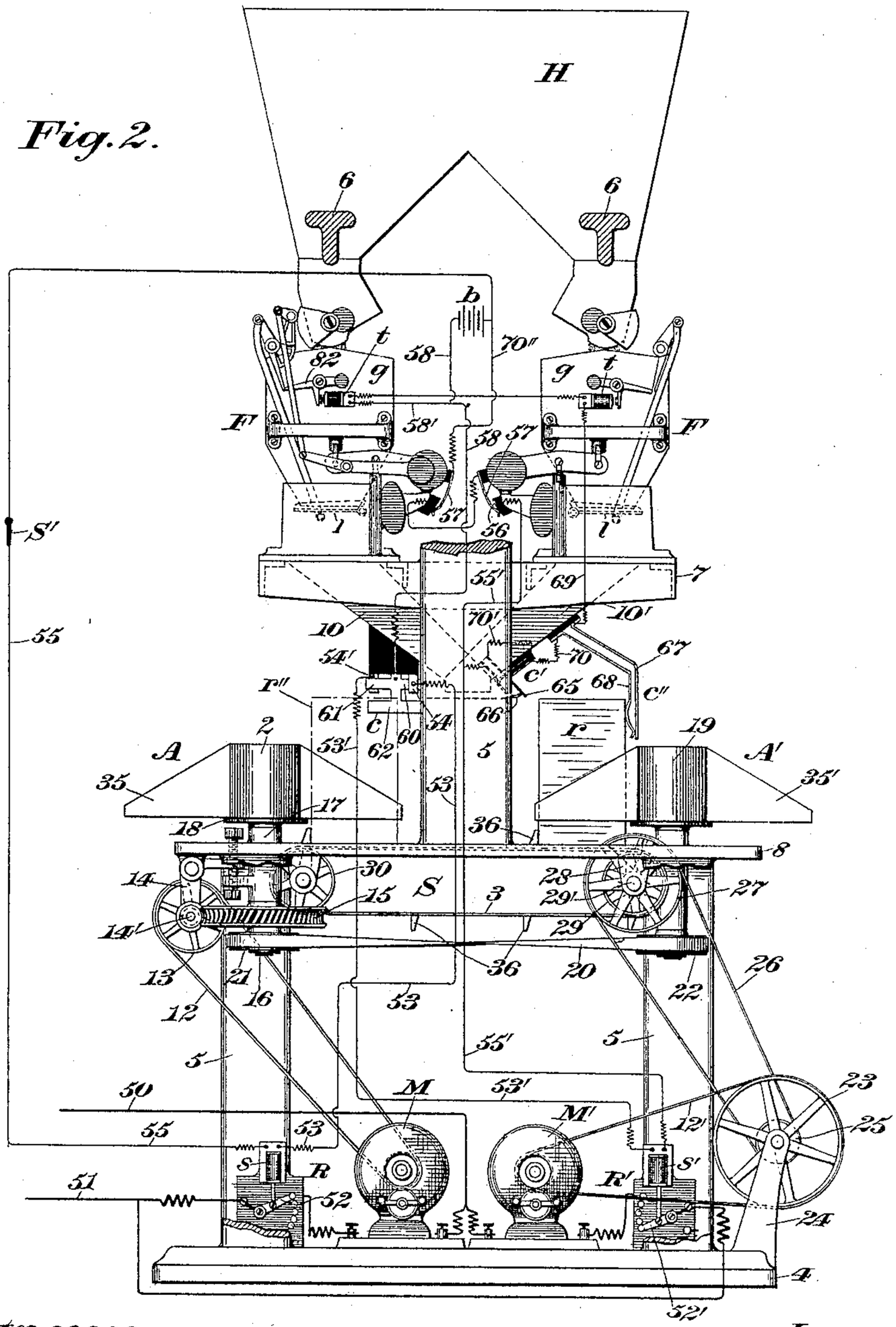
Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

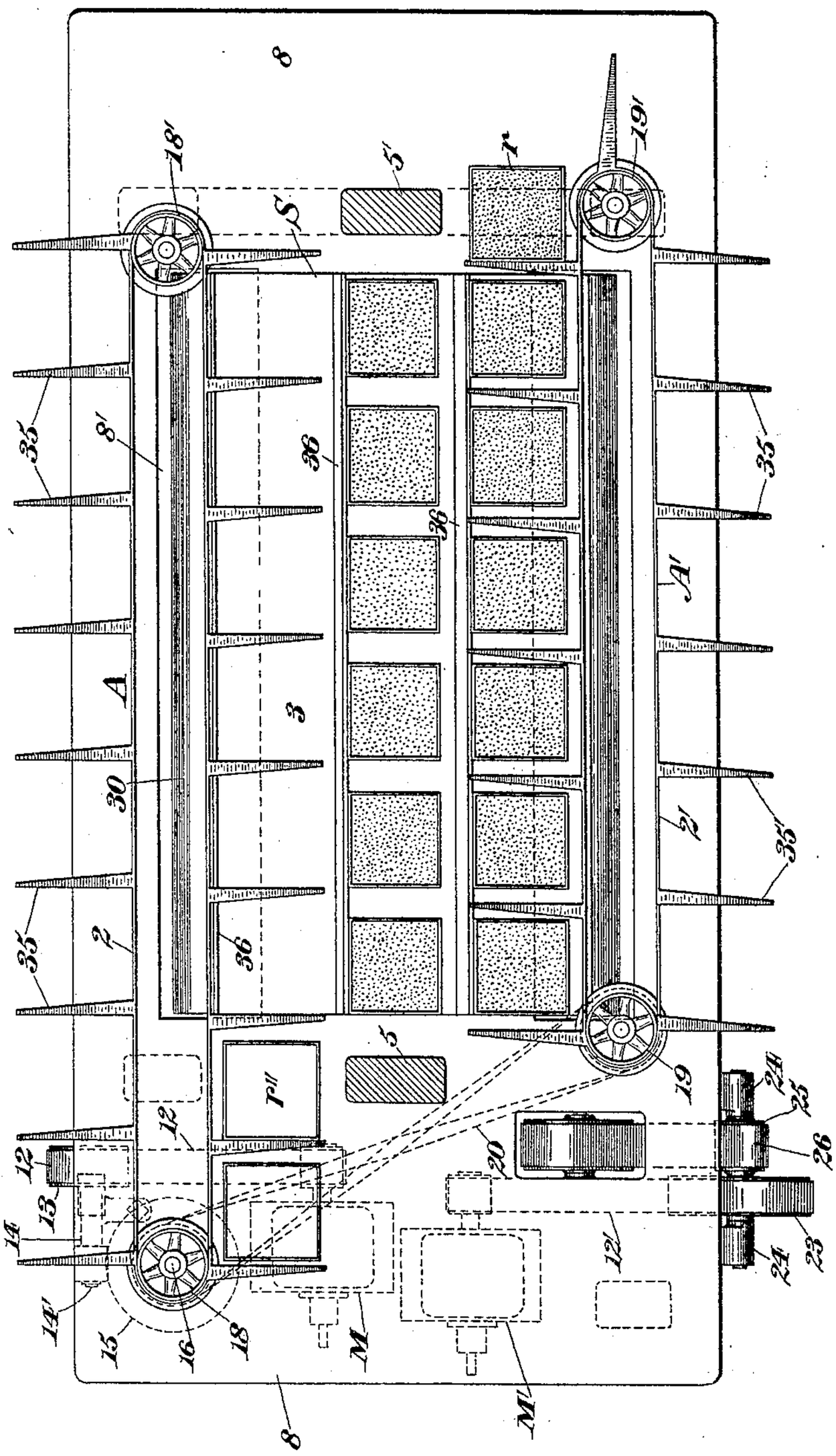

Fig. 3.

Witnesses:
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(No Model.) 5 Sheets—Sheet 4.

Fig. 4.

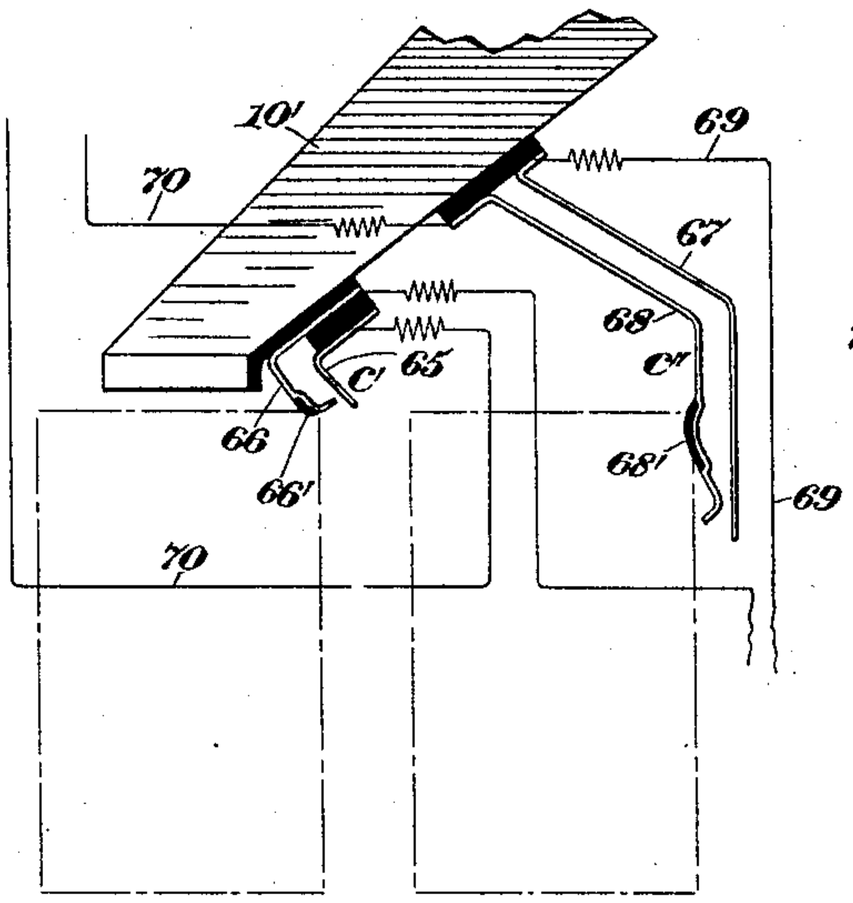


Fig. 5.

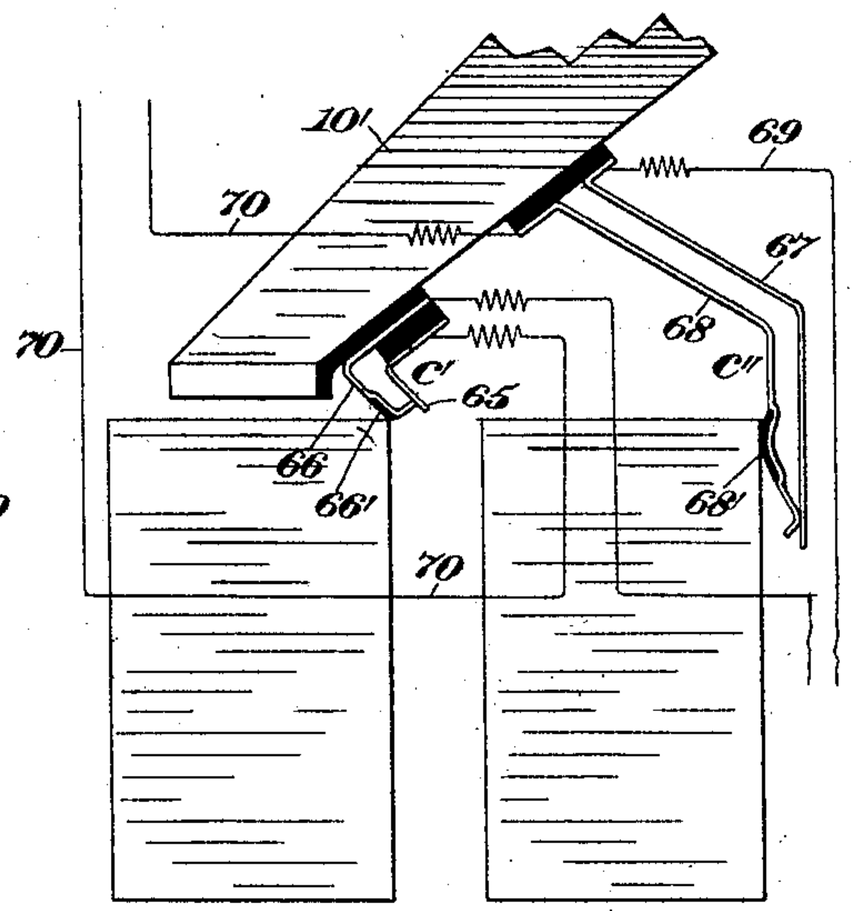


Fig. 6.

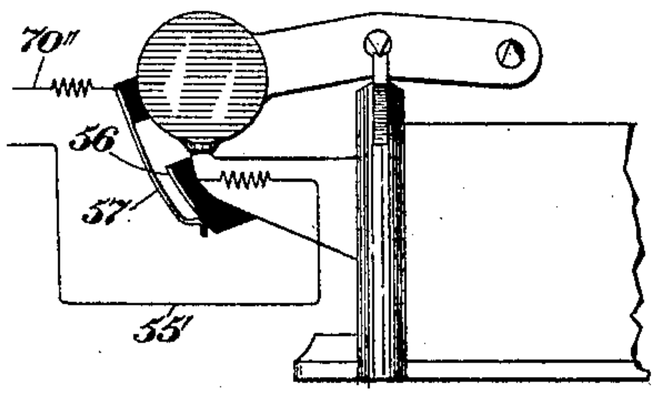


Fig. 7.

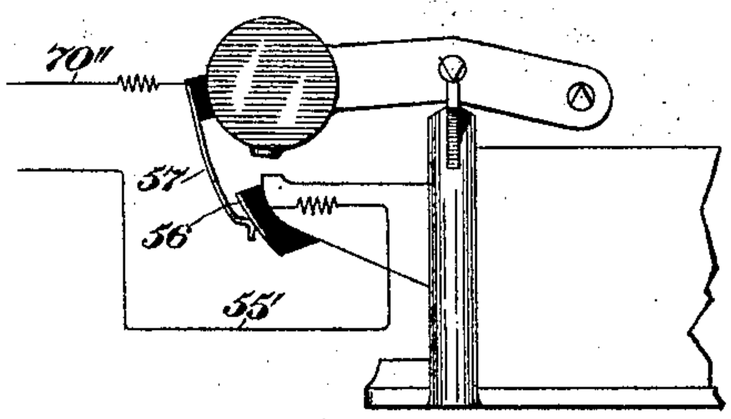


Fig. 8.

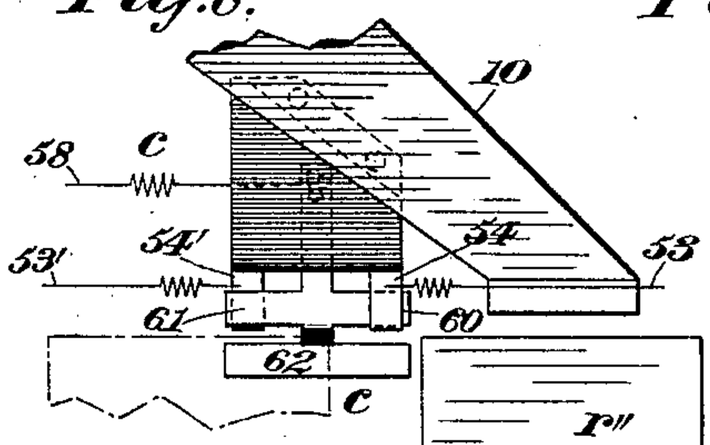


Fig. 9.

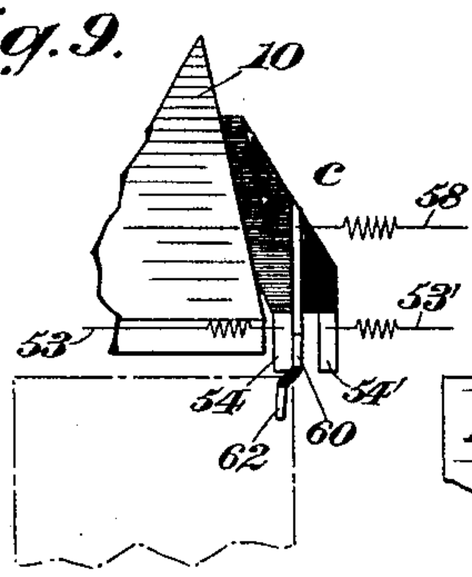
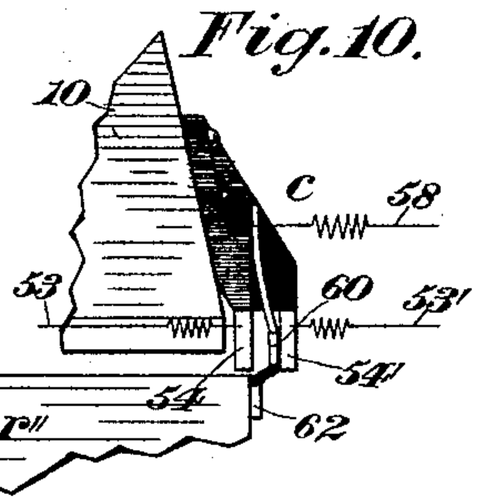


Fig. 10.



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F. H. RICHARDS.

BOX FILLING MACHINE.

(Application filed Oct. 19, 1897.)

(No Model.) 5 Sheets—Sheet 5.

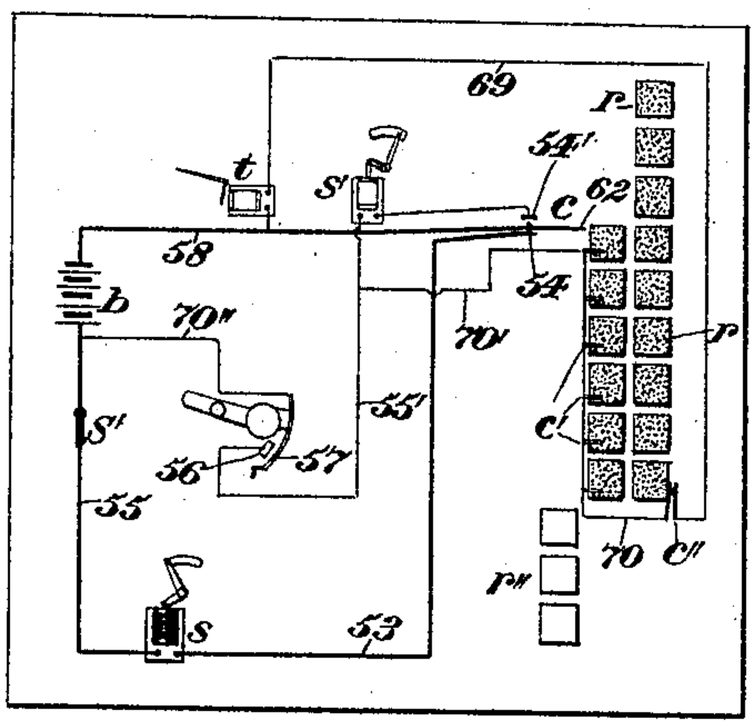


Fig. 11.

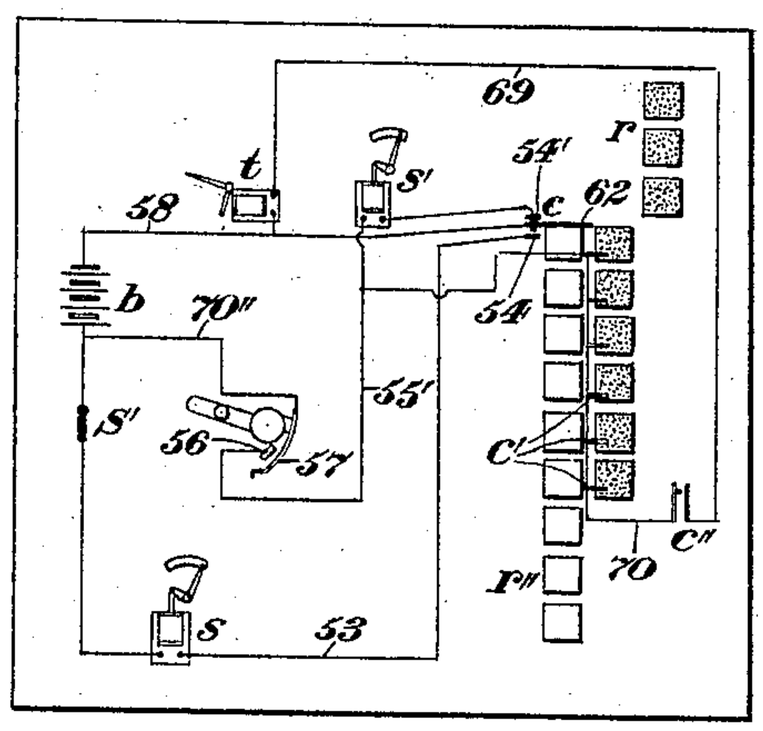


Fig. 12.

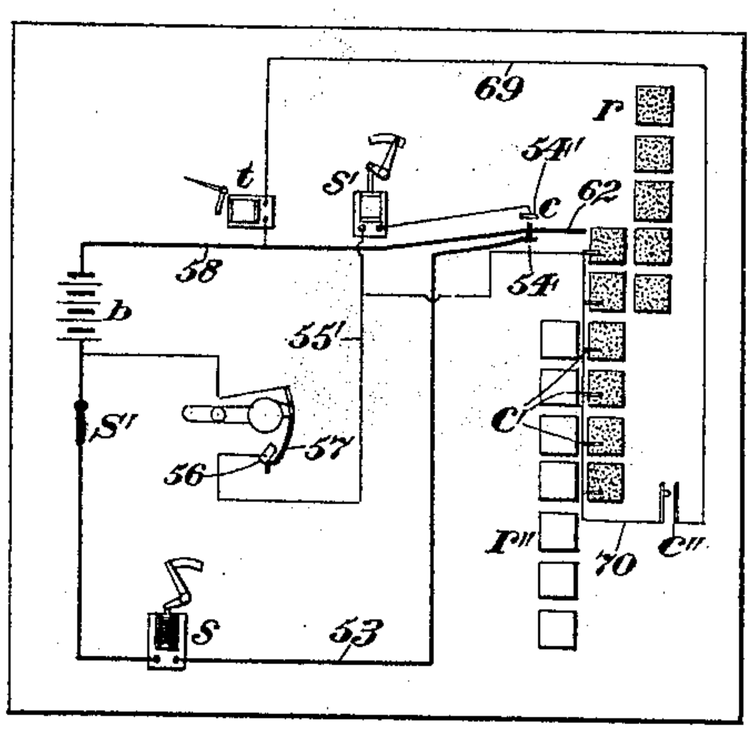


Fig. 13.

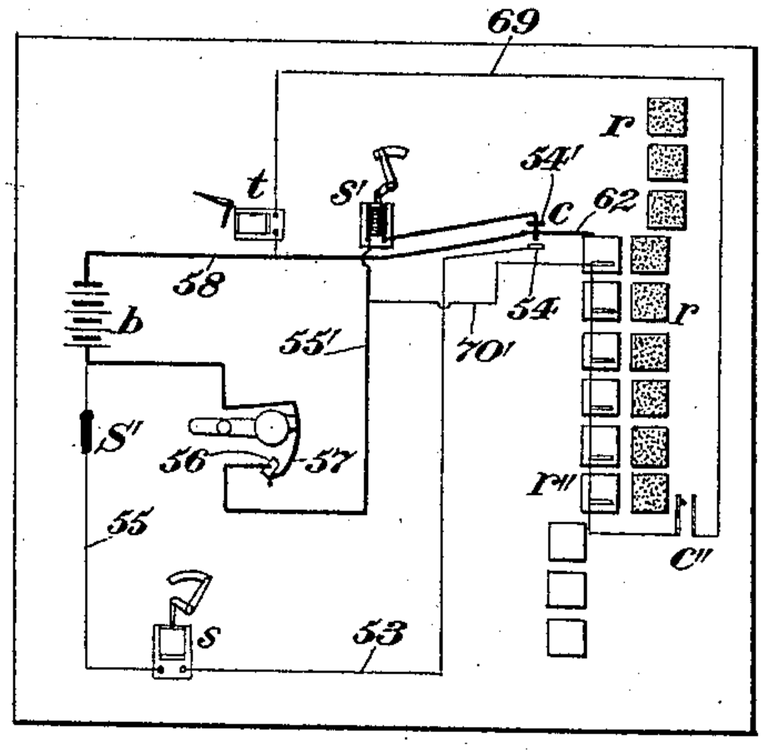
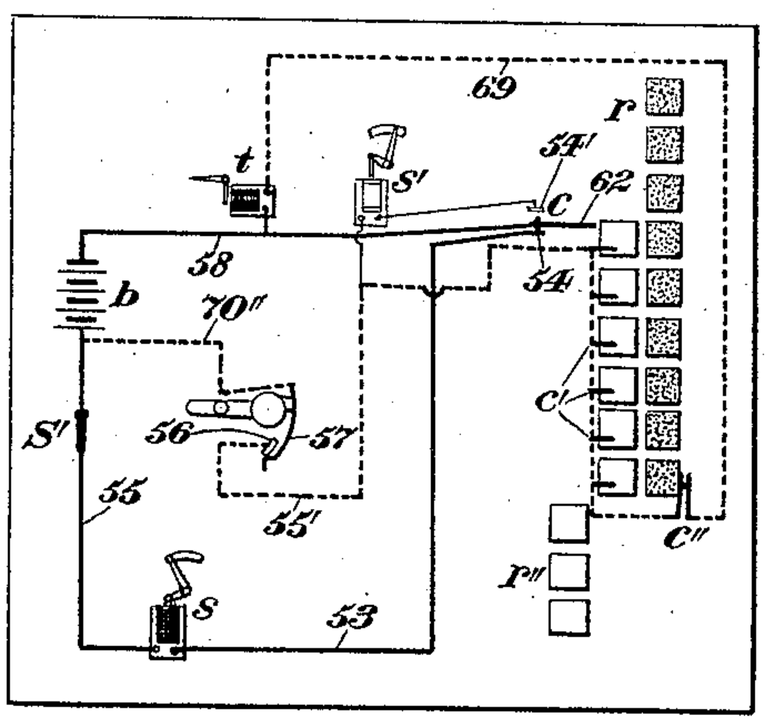


Fig. 14.

Fig. 15.



Witnesses:
D. L. Hawkins.
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Inventor:
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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

BOX-FILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 607,469, dated July 19, 1898.

Application filed October 19, 1897. Serial No. 655,736. (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 Box-Filling Machines, of which the following is a specification.

This invention relates to box-filling machines, and especially to a machine adapted for automatically filling boxes with predetermined amounts of material and for removing such boxes automatically as soon as they are filled, the apparatus forming a combined box filling and transferring machine for properly advancing the empty box or boxes into position to receive material from suitable load-supplying means and then shifting the filled boxes away from such load-supplying means.

One of the main objects of my present invention is the employment of intermittently-operative box-feeders adapted to impart two or more movements to the box or other receptacle to be filled, one of these movements being imparted by a box-advancing feeder movable in one direction to bring the box or boxes under the load-supplying or box-filling means, while the other movement is effected by a box-shifting feeder operative to move the box in another direction, preferably transverse to that in which it is moved by the box-advancing feeder.

It should be understood here that the term "box" wherever it is used is intended to include all forms of vessels or receptacles adapted to receive material and suitable for use in connection with a machine of this type.

In connection with some suitable means, such as that just referred to, for feeding boxes into position to be filled and then shifting the filled boxes out of the way I prefer to make use of devices for preventing the filling of each box unless the box is properly positioned under the spout or filling means from which it receives its contents, and to employ also stopping and starting means for controlling the movements of the feeding means. Preferably I employ two intermittently-operative box-feeders, one for advancing the box or boxes and the other for shifting them sidewise, and these feeders will usually be alternately operative, the box-advancing feeder operating to move the box forward while the box-shifting feeder is still and the latter shifting the box sidewise when such box is filled and the box-advancing feeder is stopped.

The machine that I have illustrated in the drawings of this application is intended particularly as a means for delivering to the boxes exact predetermined loads, all of which shall be of equal weights, and hence I have illustrated in connection with the transferring mechanism box-filling means embodying one or more automatic weighing-machines adapted to weigh automatically exact predetermined loads in a manner well understood and not necessary to be deseribed in detail herein.

As it is obvious that a box-filling machine should usually be capable of filling a plurality or series of boxes at each operation, I prefer to make use of a plurality of separate filling means or weighing mechanisms, each constructed and operative to weigh out an exact predetermined load of fixed weight and to deliver it to a corresponding box to fill the latter. These means, while they may be separately operative so far as the making up of their loads is concerned, should be so organized relatively to the transferring means that none of them will discharge its load unless there is a box in position to receive the material, and all of these machines will advantageously be interdependent in operation, so that they will discharge their loads practically simultaneously and so that no load of the series will be emptied if any box of the series to be filled is lacking or is out of its proper position, suitable blocking means being employed for preventing the discharge of these loads until there is a complete series of boxes in place, properly located, one for each filling means or mechanism.

In a machine of this type, where the proper operation of many parts that coact with each other and yet are separately operative so far as some of their functions are concerned depends very largely upon the timing of the movements, and where, also, it is necessary to block or prevent the action of certain parts until the action of certain other parts is completed, it is desirable to employ, for many obvious reasons, automatic electrical controlling devices for properly regulating this timing of the movements, and in the machine illustrated

herein a very important feature of my invention is the provision of such automatic electrical controlling means included in proper electric circuits and acting conjointly or in suitable groups to prevent premature action of any desired mechanism and to block the action of such mechanism until the completion of the operation of all of the other elements upon the proper action of which the movement of such mechanism is dependent.

Having thus described in a general way the essential functions of the box filling and transferring machine constituting the subject-matter of my present invention, I shall reserve for a more detailed description hereinafter the several novel devices or mechanisms embodied in the complete machine.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation, with parts of the framework broken away, of a box filling and transferring machine, illustrating one embodiment of my present improvements. Fig. 2 is a corresponding end view of the same with parts broken away. Fig. 3 is a plan of the box-feeding means employed in the present case for advancing and shifting the empty and filled boxes. Figs. 4 and 5 are enlarged details illustrating certain circuit-controllers governed by the movements of the box-feeders. Figs. 6 and 7 are details illustrating a circuit-controller governed by the movement of the poising mechanism of the weighing-machine. Figs. 8, 9, and 10 are enlarged details illustrating in side and end elevation circuit-controlling means governing the movements of the box-feeder; and Figs. 11 to 15, inclusive, are diagrammatic views illustrating different steps in the operation of the controlling devices governing the movements of the several parts of the machine.

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

As before stated, the machine forming the subject-matter of this invention embodies two main parts—viz., box-filling means and box-transferring means—and in connection with these main mechanisms I employ suitable auxiliary and controlling means for regulating the movements of the box-filling and box-transferring means so that they will operate in the proper manner.

Preferably the box-filling means comprises a plurality of separately-operative mechanisms or weighing-machines, six of which are illustrated in the present case and each of which is designated in a general way by F. As the construction and operation of these machines are well understood in the art, a particular description thereof is not deemed necessary, except in so far as it may be necessary for a clear understanding of the manner in which these machines coöperate with the box-transferring mechanism.

The box-transferring mechanism embodies as its essential features a pair of alternately-operable box-feeders or box-feeding means, one of which is in the nature of a box-advancing feeder and the other of which forms a box-shifting feeder movable transversely to the box-advancing means, so as to shift the box or boxes sidewise after being advanced into position to be filled. Preferably I make use of two simultaneously-operative box-advancing feeders—such, for instance, as those indicated herein in a general way by A and A'. (See Fig. 3.) These two box-advancing feeders may be connected for movement in unison by suitable driving means, which will be described more particularly hereinafter, and each will usually be in the nature of an endless traveling feed-belt, one of which is designated by 2 and the other by 2'. The other box-feeder—that is, the box-shifting feeder—may be also in the nature of an endless feed-belt, such as S, adapted to travel in a path transverse to the path of movement of the two feeders A and A', the belt proper of the box-shifting feeder being indicated by 3.

The main frame on which the weighing-machines and the transferring apparatus are carried may be of any suitable type; but in this view I have illustrated at 4 a suitable base or bed having standards 5 and 5' rising therefrom and connected at their upper ends by means of a cross-beam 6 and suitable hoppers or stream-supplying means for delivering material to the load-receivers of the weighing mechanisms.

Each of the weighing-machines is mounted on a support or table, such as that shown at 7, carried between the side arms or uprights 5 and 5' and extending from one end of the machine to the other.

The major portion of the box-transferring apparatus is in this case mounted on a table, such as that shown at 8, between the bed 4 and the table 7, supporting the weighing-machines.

The weighing-machines F may be supported on the table in any suitable manner and will be arranged in the most convenient way. In this instance the six machines shown are arranged in two rows facing each other, each row containing three machines, and said machines may discharge their contents through discharge-spouts, such as are shown at 10 and 10', the discharge ends of these spouts being centralized longitudinally of the machine, as shown in Figs. 1 and 2, and spaced at substantially equal distances from each other in order that the boxes to be filled thereby may be delivered in position, spaced at equal distances, and in a single series.

For the purpose of operating the box-transferring apparatus I have illustrated at M and M' a pair of electric motors, from which pass belts 12 and 12' to suitable intermediate mechanism for driving the several box-feeders. In the present instance the driving-belt from the motor M passes around a pulley 13, journaled in the lower end of a hanger 14, depending from the table 8, the shaft 14' on which this pulley is mounted having thereon a worm

meshing with a worm-gear 15, carried by a vertical shaft 16, mounted in a bearing 17 on said table 8 and carrying at its upper end a rotary driven member or pulley 18, around which the feed-belt 2 is adapted to travel. A second substantially similarly mounted pulley is shown at 18′, around which said feed-belt passes at the other end of the table 8. The feed-belt 2′ of the box-feeder A′ may be mounted in a similar manner on pulleys 19 and 19′, carried by corresponding vertical shafts or studs, and these feed-belts are connected for movement in unison, so as to be simultaneously operative, a driving-belt being shown at 20 for this purpose, this belt connecting the two box-feeders and being carried around a pair of pulleys 21 and 22.

The driving-belt 12′, by means of which the box-shifting feeder is operated, is carried in this instance around a large pulley 23, journaled for rotation in bearings 24, rising from the base 4 of the machine, (see Figs. 1, 2, and 3,) and the movement of this pulley 23 is transmitted by means of a small pulley 25 to a belt 26, passing around a pulley 27, journaled for rotation in brackets 28, depending from the under side of the table 8. The pulley 27 is secured to one end of the shaft 29′ of a feeder-carrying cylinder or roll 29, on which the box-shifting feeder is supported, and this last-mentioned feeder passing around a corresponding cylinder 30, journaled in like manner at the opposite side of the table 8. These two cylinders may support the belt 3 of the box-shifting feeder S, so that the upper run thereof will be approximately flush with the face of the table 8, which table has a large rectangular opening therein, as shown at 8′, Fig. 3, for the purpose of permitting the box-shifting feeder to form a support for the box to be moved thereby.

It will be noticed that both of the two simultaneously-operative box-advancing feeders are supported at a suitable distance above the box-shifting feeder, and these two box-advancing feeders are not intended in this instance to support any of the boxes, but merely to actuate them.

It will be seen, of course, that the actuating means just described for operating the two box-advancing feeders and the single box-shifting feeder may be varied at will and also the number of box-feeders employed, and hence I do not limit myself to the particular construction of the driving means and intermediate connections or to the number of feeders employed.

For the purpose of actuating the boxes continuously and moving the empty boxes into position to be filled and shifting the filled boxes out of the way each of the several box-feeders will preferably embody suitable means for positively spacing and engaging the boxes, whether filled or empty, so as to space these boxes at regular intervals and shift them into place while so spaced. Hence each of the feeders preferably embodies as a part thereof suitable box-spacing and box-actuating members or fingers projecting therefrom and of such size and so positioned as to control properly a box of any dimensions for which the machine may be designed.

The box spacing or actuating members or fingers of the two box-advancing feeders A and A′ are substantially similar in construction, and these box-actuating members form a circuit around each belt, the projecting members of the belt 2 being designated herein by 35 and the corresponding members of the belt 2′ being indicated by 35′. It will be noticed that each of these projecting members or fingers is considerably longer than the transverse dimension of the box or boxes to be handled and that said fingers are spaced at intervals slightly greater than the width of each box in order to permit freedom of action. Moreover, the two box-advancing feeders are disposed substantially in parallelism with each other, and the inner ends of the box-actuating members projecting from their adjacent working runs are disposed at intervals greater than the width of the boxes to be handled, thus forming between the two feeders a space in which a box or row of boxes may be supported upon the box-shifting feeder—while the box-advancing feeders are operative—without moving the boxes of such intermediate row, it being obvious, of course, that the box or row of boxes engaged by the projecting actuating members of the two feed-belts 2 and 2′ would be advanced during such time.

The box-spacing members or fingers of the box-shifting feeder are disposed at substantially the same intervals as the corresponding members projecting from the feed-belts 2 and 2′; but the members projecting from the feed-belt 3 are relatively long and project only a slight distance from the surface of the feeder, as they are primarily "spacers" and not "actuators." These projecting members of the belt 3 are designated by 36 and are clearly shown in Figs. 2 and 3. Preferably they will extend from side to side of the wide box-shifting feed-belt 3, the width of which will of course be dependent upon the size and number of the boxes to be filled at a single operation of the apparatus. Of course this box-shifting feed-belt will be also of relatively great width as compared with the width of the belts 2 and 2′.

Without describing in detail at this point the complete cycle of movements of the several parts of this machine it may be stated in a general way that two box-advancing feeders are intended to operate in unison, the former to carry the empty buckets under the discharge-spouts of the weighing-machines and the latter to carry off a row of previously-filled boxes. As soon as the row of empty boxes is in place the advancing movement of the two feeders A and A′ will be stopped, the stopping of this movement being preferably controlled by such movement of one of the

box-feeders. At this point the box-shifting feeder should begin to operate, its operation being preferably controlled by such stopping of the other feeders or box-advancing means, and the box-shifting feeder should carry the row of empty boxes into the intermediate position, (shown in Fig. 3,) whereupon the further movement of this shifting or transferring feeder should also be stopped, this stopping of the box-shifting feed-belt being effected advantageously by one of a row of previously-filled boxes—viz., the row shown in Fig. 3—between the spacing actuating members of the box-advancing feeder A'. Immediately on the stopping of the movement of the box-shifting feeder the several loads will be discharged from the weighing-machines F if the loads therein have been completed, but if the operation of the machines for making up these loads is not quite finished the load-dischargers thereof of course should not be actuated prematurely, or if the loads in the weighing-machines are entirely made up before the row of empty boxes is properly positioned by the box-shifting feeder in such case also the load-dischargers should not be operated prematurely. When the empty boxes of this row are properly positioned sidewise to receive their contents, the movement of the box-shifting feeder may be stopped and the box-advancing means started again to advance another row of empty boxes and also the boxes of the previously-filled row. At the end of such advancing movement the box-advancing means will be stopped again and the intermediate row of boxes, which will have been filled in the meantime by the several weighing-machines or box-filling means, may be transferred by the box-shifting feeder from such intermediate position into the path of movement of the second box-advancing feeder A', the first of these two disconnected shifting movements imparted to this row of boxes serving to transfer such boxes from one box-advancing feeder to a position out of the range of action of such feeder, while the next sidewise movement carries these boxes into the path of movement of the other feeder.

The movements of the box-advancing and box-shifting feeding means and the discharging movements of the load-dischargers of the box-filling means should be positively-controlled, and in this case the box-shifting means and the box-advancing feeding means are controlled in their movements each by the other, one of them serving also to govern the release of the load-dischargers for filling the empty boxes. Preferably the movements of these two feeding means will be regulated by feed-controlling means governed by the proper positioning of the empty and filled boxes in their different movements, and such feed-controlling means may embody two or more mutually-dependent or interdependent blocking devices for preventing premature movement of the box-feeders and also premature discharge of any one or more of the load-dischargers of the box-filling means.

In the drawings of the present application the blocking devices illustrated are in the form of circuit-controllers included in electric circuits, by means of which all of the operations just described are governed, and these circuit-controllers may be arranged so as to coact in groups controlling conjointly certain operations of the apparatus. For instance, the load-poising means of the several weighing-machines may have each a circuit-controller which will operate only when the load is properly poised, and will prevent not only the discharge of the load of its own machine but also of all of the others until it is actuated the proper distance corresponding to the movement of its poising means from a normal idle position to a poised position. Suitable circuit-controllers may also be employed in connection with this series for preventing such discharging movements of the several load-dischargers until all of the boxes of a row are properly located under the discharge-spouts, these circuit-controllers being governed advantageously by the boxes themselves in such a manner that if any box is lacking or is out of position in any way the box-filling means therefor, or all of the different box-filling means, may have its or their discharging movements blocked until such boxes are properly positioned. Moreover I may make use of additional circuit-controllers governed, respectively, by the box-advancing or box-shifting movements of the two box-feeding means, and preferably directly by the movements of the boxes themselves, for determining when the feeding means for effecting the advancing and shifting movements of the boxes shall begin operating, and for controlling, conjointly with the several circuit-controllers governed by the different poising means and by the positioning of the boxes under the discharge-spouts, the load-discharging movements of the box-filling means.

Although the several controlling devices of this apparatus may be connected in various ways in different electric circuits, the manner in which the different parts are wired in the construction illustrated in the drawings of this application is deemed most desirable for the apparatus illustrated therein.

The two motors M and M', which control, respectively, the box-advancing and box-shifting movements of the respective feeding means, are connected in this case in parallel of the main conductors 50 and 51, as will be obvious by reference to Fig. 2, and each of these motors may be cut into and out of circuit by the switch-arm of a rheostat, which switch-arm may be controlled automatically in a manner that will be described more particularly hereinafter.

The two rheostats may be of any suitable construction—such, for instance, as shown at R and R'—the switches therefor being desig-

nated by 52 and 52′, these switches being automatic in their action and controlled, preferably, by means of a pair of solenoids, such as *s* and *s*′, included in electric circuits governed by the movements of the box-feeding means.

In the construction illustrated one terminal of the solenoid *s* is connected by means of a conductor 53 to an insulated contact-arm 54 on the end of the last discharge-spout 10 of the series shown, while the corresponding terminal of the other solenoid *s*′ is connected by a conductor 53′ to a second insulated contact member 54′, also carried by said discharge-spout. The other terminal of the solenoid *s* is connected by means of conductor 55 with one side of a suitable battery or other source of energy, such as *b*, while the corresponding terminal of the solenoid *s*′ is connected by means of a conductor 55′ with a contact member 56 on the framework of one of the weighing-machines, with which contact a circuit-controller or circuit-closing arm, such as 57, is adapted to make contact, this circuit-controller being movable with and preferably carried by the poising means of one of the box-filling machines. This circuit-controller and its contact member are illustrated clearly in detail in Figs. 6 and 7, and all of the machines have similar circuit-controllers, one for each machine, said circuit-controllers and their contact members being preferably connected in series in a single circuit with the same side of the battery *b* as that with which the conductor 55 is connected, as will be clear by referring to Fig. 2. As all of these circuit-controllers are substantially identical in construction and operation, a description of one is deemed sufficient for all, it being apparent, of course, that so long as a single weighing mechanism remains unpoised the circuit in which these devices are included will remain open. The other side of the battery *b* is connected by a conductor 58 with circuit-controlling means coöperative with the two contact members 54 and 54′. In the present case this circuit-controlling means, which is illustrated clearly in detail in Figs. 8, 9, and 10, is in the nature of an arm secured to and insulated from the last discharge-spout 10, said circuit-controlling means being designated in a general way by *c* and having a pair of oppositely-projecting arms 60 and 61, adapted to make contact, respectively, with the contact-makers 54 and 54′. This circuit-controller is governed by the movements of the box-advancing and box-shifting feeders and is actuated in one direction preferably by direct engagement of a box therewith, it being understood that it may be reactive to its normal position to close the circuit controlled, for instance, by the contact member 54. For the purpose of operating it this circuit-controller has an insulated operating-arm 62 below the circuit-controlling arms thereof and projecting into the path of movement of the upper edge of the foremost box of a series, so as to be shiftable by such box. This operating-arm 62 is of considerable length in order to permit the box to remain in engagement therewith until such box arrives at its intermediate position between the two box-advancing feeders, whereupon said circuit-controller will be released and will return automatically to its normal position for closing the circuit through contact 54. It will be noticed that this circuit-controller governs two circuits, including, respectively, the contacts 54 and 54′, and that the two solenoids *s* and *s*′ will be energized alternately and the motors M and M′ correspondingly operated to cause the box-advancing feeders to move alternately with the box-shifting feeder.

For the purpose of operating the load-dischargers of the several filling means, which load-dischargers are indicated herein by *l* and are releasable for permitting efflux of the contents of the several load-receivers, such as *g*, of the weighing-machines, I prefer to make use of an electrically-operated latch-tripper, such as the electromagnet *t*, coöperative with a latch, such as 82, of any suitable construction, which in turn may engage directly with a load-discharger *l*, or indirectly, in the manner shown herein, and which will be readily understood from the drawings in this case and by reference to prior patents granted to me. These latch-trippers may be included in a normally open circuit or circuits, the closing of which should be blocked until the loads in the receivers of the weighing-machines are completed and said receivers brought to the poising-line, and said circuit or circuits should also remain open until the boxes are in their proper positions under the discharge-spouts 10 and 10′. Hence it will be apparent that the energization of the electromagnets constituting the latch-trippers *t* should be dependent upon the prior weighing of the exact predetermined amount of material to be discharged into the box and also upon the proper positioning of such box under the discharge-spout that is intended to fill the same. I have therefore provided, in connection with these latch-trippers, electrical circuit-controllers governed by the individual boxes of the row to be filled in addition to the circuit-controllers 57, controlled by the poising means or beam mechanisms of the weighing-machines and hereinbefore described. The circuit-controllers governed by the positioning of these boxes are shown in detail in Figs. 4 and 5 and are designated in a general way by *c*′. In the construction shown herein each comprises a pair of contact members mounted in some suitable manner—as, for instance, on the discharge-spouts 10 and 10′, and insulated from such spouts and from each other. The fixed member of each circuit-controller is in the form of a contact-arm, such as 65, and the movable member is a yielding circuit-closer or circuit-controlling member, such as that shown at 66. Both of the arms 65 and 66

are bent at such an angle as to yield during the movement of the box-shifting feeder and permit the proper box to engage the corresponding arm 66 to carry the same into contact with the arm 65, as shown in Fig. 5, to thereby close the circuit at that point. Insulation may be advantageously applied to the movable circuit-controlling arms 66 at the points 66', where said arms are engaged by the boxes. It will be clear now that when a row of boxes is shifted sidewise by the feeder A into position to be filled by the spouts 10 and 10' these boxes will not close the normally open breaks at the circuit-controllers c' unless the boxes are properly positioned, and hence if any box is lacking or is improperly positioned on the box-shifting feeder the non-closing of the circuit controlled by such box may form a means for preventing the discharge not only of the contents of the weighing-machine corresponding thereto, but of all the other machines as well.

For the purpose of controlling the apparatus with even greater certainty I prefer to employ, in connection with the circuit-controllers just described, an additional blocking device or circuit-controller governing the discharging movements of the load-dischargers of all of the weighing-machines and included in a single circuit with the two series of circuit-controllers just described in connection with the poising means and the boxes of the row to be filled. This additional circuit-controller is designated herein by c'' and may be of any suitable type, so long as it is positioned in such a manner as to be controlled by the sidewise movement of a series of laterally-shifted previously-filled boxes, and this circuit-controller, as well as that shown at c, should be so positioned as to form not only a circuit-controller, but also a box-stop for limiting the sidewise movement of a row of filled boxes in the same manner as the circuit-controller c limits the advancing movement of a row of empty boxes. In the present instance the circuit-controller c'' comprises a pair of yielding arms, such as 67 and 68, which may be secured to the first spout 10', and the arm 68 or circuit-controller preferably has insulated material at 68' at the point where the side of the box engages it. The yielding contact-arm 67 is connected by means of a conductor 69 with one of the latch-trippers l, while the contact-arm 68 is connected by the conductor 70 with the contact member 65 of the first circuit-controller c'. All of these circuit-controllers c', the circuit-controllers c'', and the circuit-controllers 57 of the poising means, as well as the latch-trippers l, will preferably be connected in series in a single circuit, as will be clear by referring to Figs. 11 to 15, inclusive. It will be seen, therefore, that the latch-trippers cannot be energized until all of the breaks in the circuits are closed, although, so far as the release of the latches is concerned, the order in which these breaks are closed is immaterial, thus rendering it possible for the different weighing-machines to come to a poise separately and independently of one another and for the breaks spanned by the circuit-controllers c' to be closed in any order.

The operation of a machine constructed in accordance with my present invention as embodied in the apparatus shown in this application is as follows: It being understood that the parts are in their normal positions for the beginning of a cycle of operations, with the valves wide open to deliver material to the load-receivers g of the weighing-machines from some suitable source of supply—such, for example, as a common hopper H—that the load-dischargers l are latched shut by the latches 82, and that circuits are broken at 57 and 54, it will be seen that a circuit is closed from the battery b through conductor 58, (see Fig. 2,) contact-arm 61, contact 54, conductor 53, solenoid s, and conductor 55, provided some hand-operated switch, such as S', is in its circuit-closing position. The closing of this circuit by causing the energization of the solenoid s effects the shifting of the switch 52 to the position shown in Fig. 2 to cut out the resistance-coils of the rheostat R and start the motor M, whereupon the two box-advancing feeders will begin their traveling movements. This is the condition of the apparatus at the beginning of each cycle of movements, and it will be assumed that the machine is at the beginning of a new cycle of movements after having filled two or more rows of boxes, as shown, for example, in Figs. 3 and 11.

As soon as the box-advancing feeders commence to operate a row of empty boxes (designated herein by r'') will be advanced by the belt 2 toward the circuit-controller c, it being understood, of course, that the empty boxes may be fed into the path of movement of the box-feeder A in any suitable manner, either by hand or by mechanism. When the boxes r'' have been advanced to a sufficient distance, the foremost one of the row will come into contact with the depending arm 62 of the circuit-controller c and the latter will be shifted to break the circuit at 54 and make contact at 54', whereupon, of course, the solenoid s, being deënergized, will return to its idle position, throwing the coils of the rheostat R into circuit and causing the stopping of the motor M, and hence stopping the advance of the feeders A and A'. During the advancing movement of this row of empty boxes the load-receivers g of the weighing-machines will of course be filling up by the delivery of material thereinto, and each of these weighing-machines will operate independently of the others ordinarily, so far as the making up of its load is concerned. The loads in these receivers may be completed and the beam mechanisms may come to a poise and close the circuits controlled by the contact-arms 57 either in advance of the breaking of the circuit at 54 and the making of the opposite

circuit at 54′ or else after the stopping of the motor M by the breaking of the circuit through the solenoid *s*. These two conditions of the controlling devices of the system are shown in Figs. 12 and 13, respectively, from the former of which it will be evident that the boxes have reached the end of their advancing movement prior to the poising of the weighing-machines, while it will be clear that in the condition of the controlling means shown in Fig. 13 the poising of the several weighing mechanisms has been completed before the arrival of the row of empty boxes *r*″ at the end of the first stage of their advancing movement.

As soon as the circuit is closed at 54′ and all of the normally open breaks controlled by the contact-arms 57 are closed a circuit will be completed from the battery through conductor 58, contact-arm 62, contact 54′, solenoid *s*′, conductor 55′, and beam-controlled contacts 57 back to the battery *b*, as will be evident by referring to Fig. 14. When this circuit is closed, the motor M′ will be started in a manner similar to that just described with reference to the motor M, and the box-shifting feeder S will begin to operate and will continue its movement until the row of empty boxes *r*″ is clear of the arm 62 and in a substantially central position between the two box-advancing feeders, whereupon the circuit-controller *c* will break contact at 54′ and, returning to its normal position, make contact again at 54. (See Fig. 15.) When the circuit at 54′ is thus broken and the circuit at 54 reëstablished, the motor M′ will of course be thrown out of operation and the box-shifting belt stopped, while the motor M will be started again to cause the two feeders A and A′ to operate, the former to advance another row of empty boxes and the latter to feed off the row of filled boxes *r*. Just before this action and immediately upon the making of the circuit by the circuit-controller *c*″, due to contact of the last-filled box of the row *r* with the circuit-making arm 68, a circuit should be closed for releasing the load-dischargers if all of the boxes of the row to be filled are in their proper positions and all of the breaks controlled by the arms 57 are closed, as illustrated in Fig. 15. If, however, there is a single break in this circuit, the loads made up by the weighing-machines will not be discharged, and when the box-shifting feeder begins to operate again only a row of empty boxes will be carried away from the discharge-spouts of the weighing-machines. If, however, all of the box-controlled and beam-controlled breaks are properly closed, a circuit will be completed from the battery *b* through the conductors 58 and 58′ and through the electromagnets or latch-trippers *t* to conductor 69, circuit-controller *c*″, conductor 70, through the box-controlled circuit-closers *c*′ to conductor 70′, to conductor 55′, and through the beam-controlled circuit-closer contacts 56 and 57 and conductor 70″ back to the battery *b*, whereupon all of the latch-trippers *t* will be energized, the latches controlled thereby tripped, and the loads made up by the several weighing-machines discharged from the spouts 10 and 10′ into the empty boxes located thereunder. The circuit last traced is broken as soon as any one of the beam mechanisms returns to its normal position, and of course the load-dischargers will be latched shut again by the latches 82 in the usual manner, the valves which are closed on the making up of the several loads being reopened on the rising of the load-receivers with the poising mechanisms.

The advancing movements of the two feeders A and A′, controlled by the making of the circuit at the contact 54, will continue until a new row of boxes advanced to the limit of its forward movement causes the breaking of the circuit at 54 and the making of the circuit at 54′, whereupon the row of boxes just filled will be shifted sidewise into the path of movement of the box-actuating members of the feeder A′, to be carried away by said last-mentioned feeder when the latter begins to move again, these last-mentioned operations being substantially the same as those illustrated in Figs. 14 and 15. Hence a complete cycle of operations of the different parts for the purpose of positioning the row of empty boxes and for filling these boxes and subsequently carrying the filled boxes away involves practically two complete cycles of operation of the controlling devices hereinbefore described, owing to the fact that in a machine illustrated herein a row of empty boxes is first advanced, then moved sidewise and stopped and held stationary, while another row of empty boxes and a row of previously-filled boxes are advanced, then shifted sidewise again when filled, and finally advanced to carry them away from the machine.

Having described my invention, I claim—

1. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder, one of said feeders being intermittently operative; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

2. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of intermittently-operative box-advancing and box-shifting feeders movable transversely to each other; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

3. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of alternately-operative box-advanc-

ing and box-shifting feeders movable transversely to each other; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

4. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of intermittently and alternately operative box-advancing and box-shifting feeders movable transversely to each other, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

5. In a box filling and transferring machine, the combination, with automatically-operative and intermittently-discharging box-filling means, of traveling box-feeders movable in different directions, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

6. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of endless traveling box-feeders movable in different directions, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

7. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a traveling box-advancing feeder; a traveling box-shifting feeder movable transversely relatively to the box-advancing feeder; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

8. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a traveling box-advancing feeder; a traveling box supporting and shifting feeder, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

9. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a box-advancing feed-belt; a box supporting and shifting feed-belt movable transversely to the box-advancing feed-belt; and automatic feeder-actuating mechanism for operating said feed-belts to move a box to its load-receiving position before the discharge of the box-filling means.

10. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of traveling box-advancing and box-shifting feeders, one of which feeders constitutes a box-support, and the other of which feeders has box-actuating members projecting therefrom, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means.

11. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of box-advancing and box-shifting feed-belts, one of which belts constitutes a box-support, and the other of which belts has a circuit of box-actuating members projecting therefrom, and automatic feeder-actuating mechanism for operating said feed-belts to move a box to its load-receiving position before the discharge of the box-filling means.

12. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of box-advancing and box-shifting feed-belts, one of which feed-belts constitutes a box-support, and the other of which belts has a circuit of equidistant actuating members projecting therefrom, and automatic feeder-actuating mechanism for operating said feed-belts to move a box to its load-receiving position before the discharge of the box-filling means.

13. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of box-advancing and box-shifting feed-belts, one of which belts constitutes a box-support, and each of which belts has a circuit of box-spacing members projecting therefrom, and automatic feeder-actuating mechanism for operating said feed-belt to move a box to its load-receiving position before the discharge of the box-filling means.

14. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of box-advancing and box-shifting feed-belts, one of which belts constitutes a box-support, and each of which belts has a circuit of equidistant box-spacing members projecting therefrom, and automatic feeder-actuating mechanism for operating said feed-belts to move a box to its load-receiving position before the discharge of the box-filling means.

15. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of separated box-advancing feeders; a box-shifting feeder movable in a different direction from the box-advancing feeders; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

16. In a box filling and transferring machine, the combination, with automatically-

operative intermittently-discharging box-filling means, of a pair of separated box-advancing feeders; a box-shifting feeder movable between, and transversely to, said box-advancing feeders for transferring a box from one to the other of such box-advancing feeders; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

17. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of separated box-advancing feeders movable in the same direction; a box-shifting feeder movable in a different direction; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

18. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of simultaneously-operative separated box-advancing feeders; a box-shifting feeder movable in a different direction from the box-advancing feeders, and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

19. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of separated box-advancing feeders; a box-shifting feeder movable in a different direction and operative alternately with said box-advancing feeders; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

20. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of separated box-advancing feeders simultaneously and intermittently operative; an intermittently-operative box-shifting feeder operative alternately with said box-advancing feeders; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

21. In a box filling and transferring machine, the combination, with automatically-operative intermittently-discharging box-filling means, of a pair of simultaneously-operative separated box-advancing feed-belts each having a circuit of box-actuating members projecting therefrom, said feed-belts having an interval between the ends of the box-actuating members of their working runs greater than the width of the box controlled thereby; a box-shifting feed-belt movable transversely to the box-advancing feed-belts and operative alternately therewith; and automatic feeder-actuating mechanism for operating said feeders to move a box to its load-receiving position before the discharge of the box-filling means, and to remove said box.

22. In a box filling and transferring machine, the combination, with box-filling means embodying a load-discharger, of a box-advancing feeder, and a box-shifting feeder movable in a different direction and controlling the load-discharging movement of said load-discharger.

23. In a box filling and transferring machine, the combination, with box-filling means, of a pair of box-feeders; box-controlled feeder-starting means governed by one of said feeders; and box-controlled feeder-stopping means governed by the other of said feeders.

24. In a box filling and transferring machine, the combination, with box-filling means, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; feeder-stopping means governed by the movement of the box-advancing feeder and operative for stopping the latter; and feeder-starting means governed by the movement of the box-shifting feeder and operative for starting the box-advancing feeder.

25. In a box filling and transferring machine, the combination, with box-filling means, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder and operative alternately therewith; and box-controlled feeder starting and stopping means controlling the starting and the stopping of both of said feeders.

26. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying a load-discharger, of box-advancing feeding means operative for advancing a plurality of boxes into position to be filled, one by each box-filling means; and a plurality of box-controlled load-discharger-controlling blocking devices, one for each box, for preventing the discharging movement of a load-discharger when the box corresponding thereto is not properly positioned.

27. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying a load-discharger, of box-advancing feeding means operative for advancing a plurality of boxes into position to be filled, one by each box-filling means; and a plurality of interdependent box-controlled load-discharger-controlling blocking devices, one for each box, for preventing the discharging movement of each of said load-dischargers until all of the boxes are properly positioned.

28. In a box filling and transferring machine, the combination, with box-filling means embodying a load-discharger, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; and a pair of mutually-dependent load-dis-

charger-controlling blocking devices controlled, respectively, by said respective feeders and controlling the discharging movement of said load-discharger.

29. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying a load-discharger, of alternately-operative box-advancing and box-shifting feeding means operative, respectively, for advancing a plurality of boxes into position to be filled, one by each box-filling means, and for subsequently shifting said boxes sidewise; and a plurality of interdependent load-discharger-controlling blocking devices for preventing the premature discharge of said load-dischargers and embodying a series of box-controlled blocking devices, one for each box, and controlled by the advancing movement thereof, and a blocking device controlled by the sidewise movement of the box-shifting feeding means.

30. In a box filling and transferring machine, the combination, with box-filling means embodying load-poising means and a load-discharger, of a box-feeder, and mutually-dependent load-discharger-controlling blocking devices controlled, respectively, by the load-poising means and the box-feeder for preventing premature discharge of the load-discharger.

31. In a box filling and transferring machine, the combination, with box-filling means embodying load-poising means and a load-discharger, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; and interdependent load-discharger-controlling blocking devices controlled, respectively, by the load-poising means, the box-advancing feeder, and the box-shifting feeder, for preventing premature discharge of the load-discharger.

32. In a box filling and transferring machine, the combination, with automatically-operative box-filling mechanism embodying stream-supplying means and stream-controlling means for feeding a predetermined load, and also embodying a load-discharger shiftable for delivering such load to a box, of electrically-controlled box-feeding means operable for feeding a box in different directions, and automatic electrical circuit-controlling means governing such movement of the box-feeding means.

33. In a box filling and transferring machine, the combination, with box-filling means of a pair of electrically-controlled box-feeders movable in different directions and each controlling the movements of the other, and automatic electrical circuit-controlling means controlled by said respective box-feeders.

34. In a box filling and transferring machine, the combination, with box-filling means, of a pair of electrically-controlled box-feeders movable in different directions, and each controlling the stopping of its own movement and the starting of the other in operation.

35. In a box filling and transferring machine, the combination, with automatically-operative box-filling mechanism embodying stream-supplying means and stream-controlling means for feeding a predetermined load, and also embodying a load-discharger shiftable for delivering such load to a box, of a pair of electrically-controlled box-feeders movable in different directions; a pair of electric circuits controlling such box-feeders; and automatic electrical circuit-controlling means for opening and closing said circuits alternately.

36. In a box filling and transferring machine, the combination, with box-filling means, of an electrically-controlled box-advancing feeder; an electrically-controlled box-shifting feeder movable transversely to, and operable alternately with, the box-advancing feeder; and a box-operated electrical circuit-controller governing the movements of said feeders and shiftable in one direction by the advancing box and shiftable in the other direction on the shifting of the box.

37. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-feeder, and a pair of automatic electrical circuit-controllers governed, respectively, by the beam mechanism and the box-feeder and controlling conjointly the discharging movement of said load-discharger.

38. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-feeder, and an electric circuit having two normally open breaks controlled by a pair of automatic electrical circuit-controllers governed, respectively, by the beam mechanism and the box-feeder and controlling conjointly the discharging movement of said load-discharger.

39. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying a load-discharger, of box-advancing feeding means operative for advancing a plurality of boxes into position to be filled, one by each box-filling means; and box-operated circuit-closers, one for each box, and all included in a single electric circuit controlling the discharging movements of said load-dischargers, whereby each circuit-closer is adapted to control the discharge of every load-discharger.

40. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-feeder; an automatic electrical circuit-controller governed by the beam mechanism; and an automatic box-operated electrical circuit-controller controlling conjointly with the first-mentioned circuit-controller the discharging movement of the load-discharger.

41. In a box filling and transferring machine, the combination, with a plurality of

box-filling means, each embodying beam mechanism and a load-discharger, of box-feeding means; automatic electrical circuit-controllers governed, respectively, by the respective beam mechanisms of said box-filling means; and an automatic electrical circuit-controller governed by the box-feeding means and controlling conjointly with the other circuit-controllers the discharging movements of said load-dischargers.

42. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying beam mechanism and a load-discharger, of box-advancing feeding means operative for advancing a plurality of boxes into position to be filled, one by each box-filling means; automatic electrical circuit-controllers governed, respectively, by the respective beam mechanisms of said box-filling means; and box-operated electrical circuit-controllers controlling conjointly with the other circuit-controllers the discharging movements of said load-dischargers.

43. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; an automatic electrical circuit-controller governed by the beam mechanism; and a pair of electrical circuit-controllers governed, respectively, by the box-advancing and box-shifting feeders and conjointly with the first-mentioned circuit-controller the discharging movement of said load-discharger.

44. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; an automatic electrical circuit-controller governed by the beam mechanism; and a pair of box-operated electrical circuit-controllers governed, respectively, by the movements of the box-advancing and box-shifting feeders and controlling conjointly with the first-mentioned circuit-controller the discharging movement of said load-discharger.

45. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying beam mechanism and a load-discharger, of box-advancing feeding means; box-shifting feeding means; automatic electrical circuit-controllers governed, respectively, by the respective beam mechanisms of said box-filling means; box-operated electrical circuit-controllers, one for each box to be filled, and governed by the movement of the box-advancing feeding means; and a box-operated electrical circuit-controller governed by the movement of the box-shifting feeding means and controlling conjointly with the other circuit-controllers the discharging movements of said load-dischargers.

46. In a box filling and transferring machine, the combination, with box-filling means embodying beam mechanism and a load-discharger, of a box-advancing feeder; a box-shifting feeder movable transversely to the box-advancing feeder; and a pair of automatic electrical circuit-controllers governed, respectively, by the beam mechanism and the box-advancing feeder and controlling conjointly the starting of the box-shifting feeder.

47. In a box filling and transferring machine, the combination, with a plurality of box-filling means, each embodying beam mechanism and a load-discharger, of a box-advancing feeder operative for advancing a plurality of boxes into position to be filled, one by each box-filling means; a box-shifting feeder movable transversely to the box-advancing feeder; automatic electrical circuit-closers governed, respectively, by said respective beam mechanisms and included in a normally open circuit; and an automatic electrical circuit-closer governed by the box-advancing feeder and controlling conjointly with the first-mentioned circuit-closers the starting of the box-shifting feeder.

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Witnesses:
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