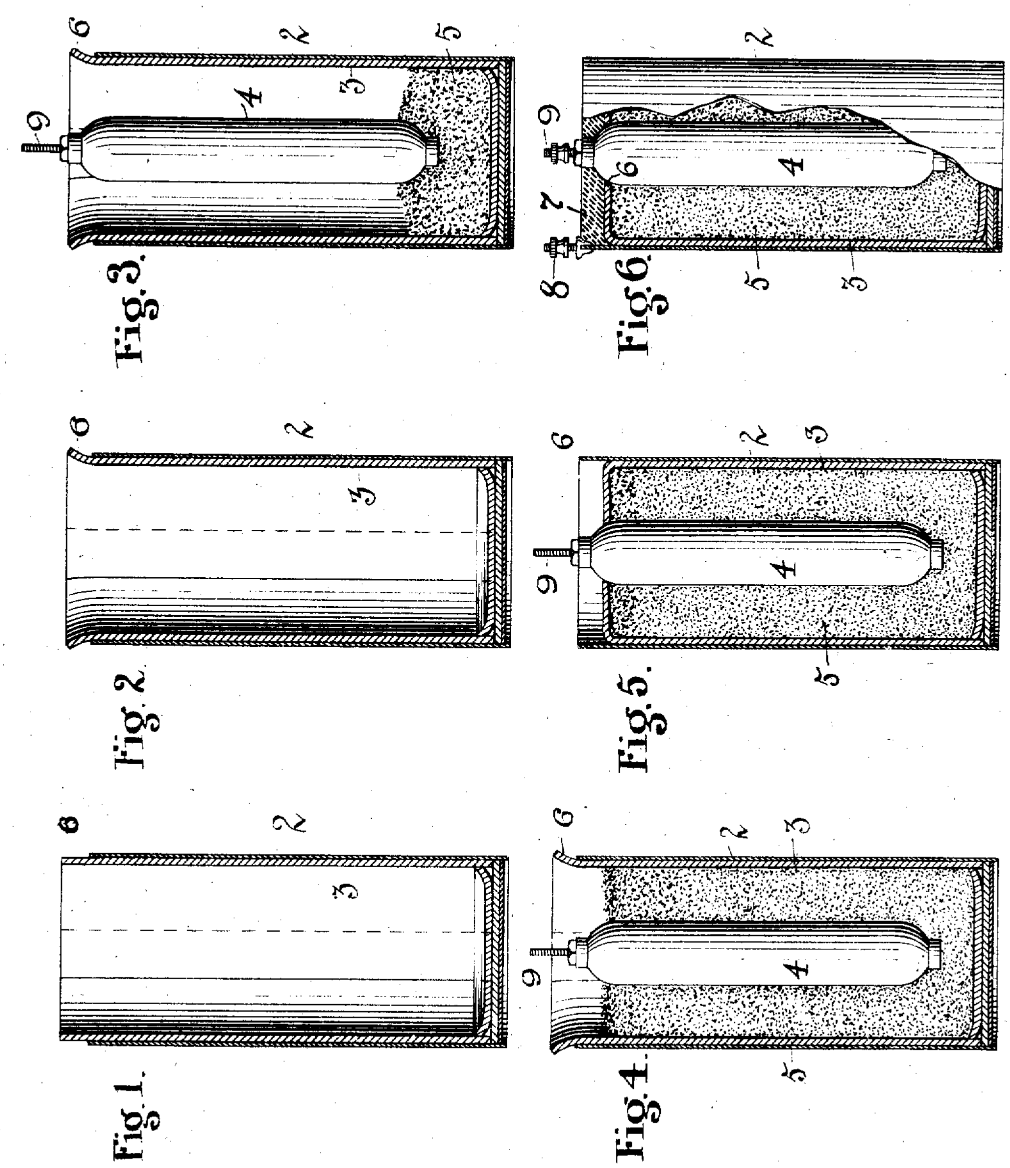
W. E. HARMON.

MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

APPLICATION FILED NOV. 9, 1908.

987,876. Patented Mar. 28, 1911.

27 SHEETS—SHEET 1.



Witnesses:

E. M. Fisher

F. C. Museum.

Inventor.

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Attorneys.

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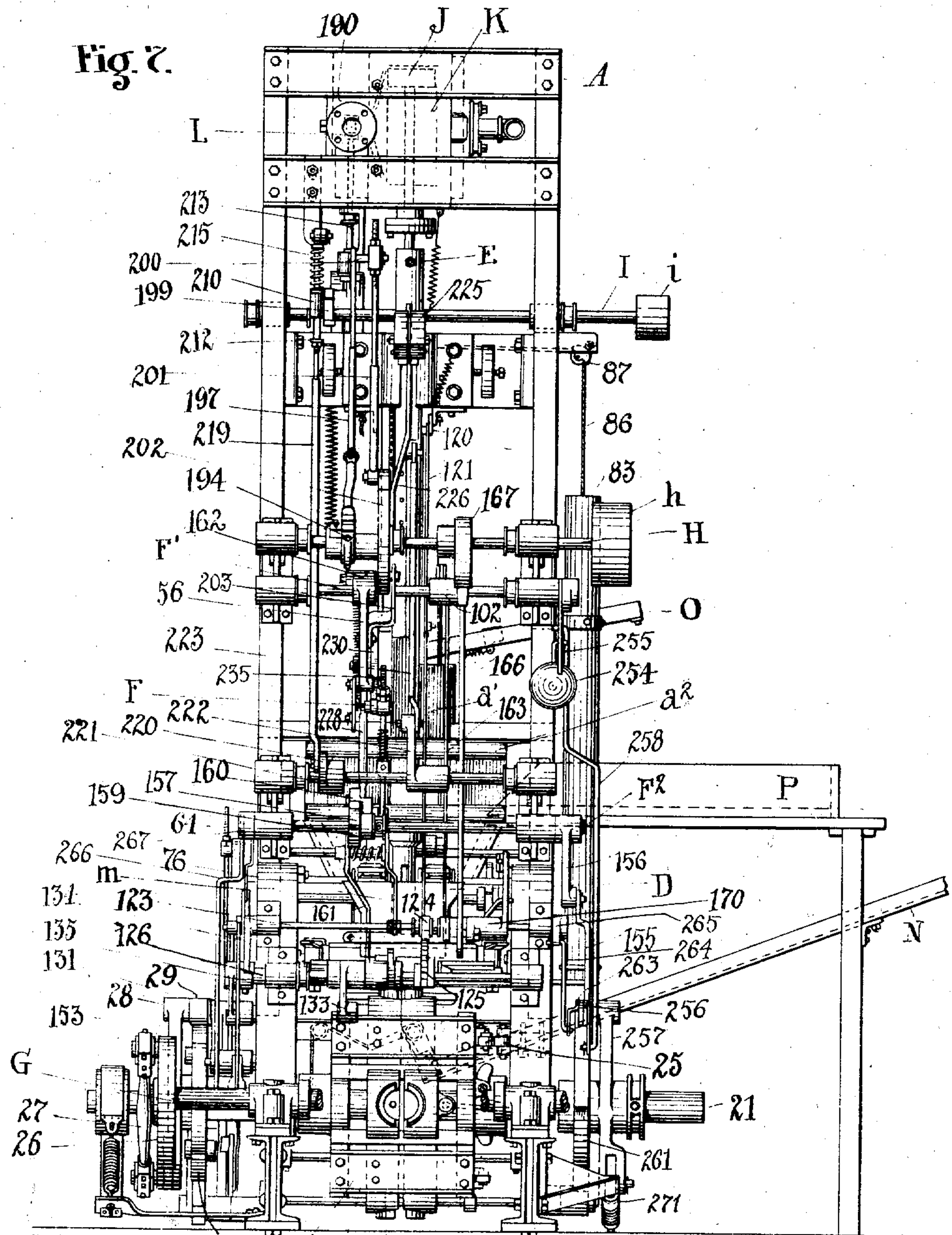
27 SHEETS—SHEET 2.

Fig. 7.



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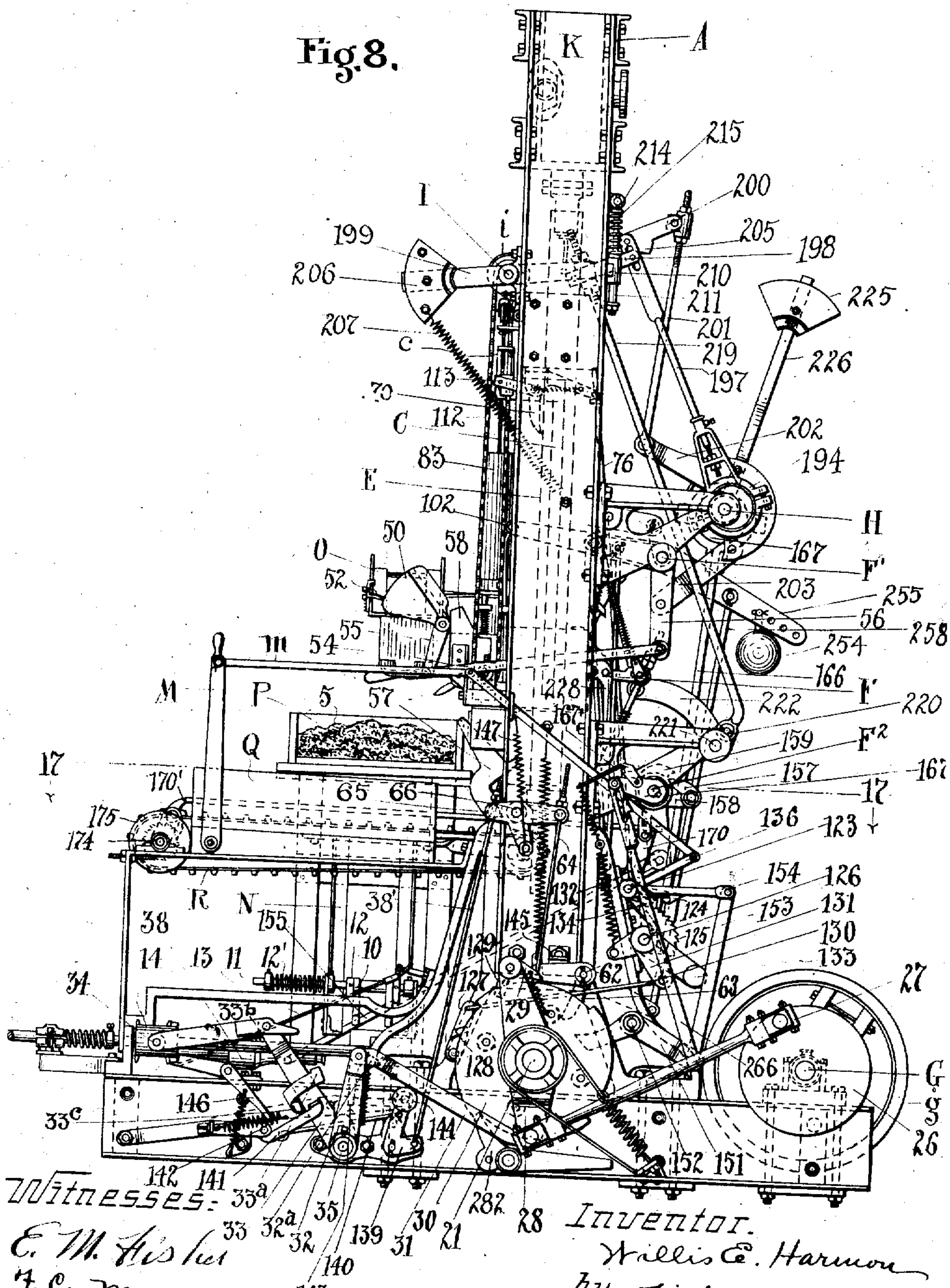
27 SHEETS—SHEET 3.

Fig. 8.



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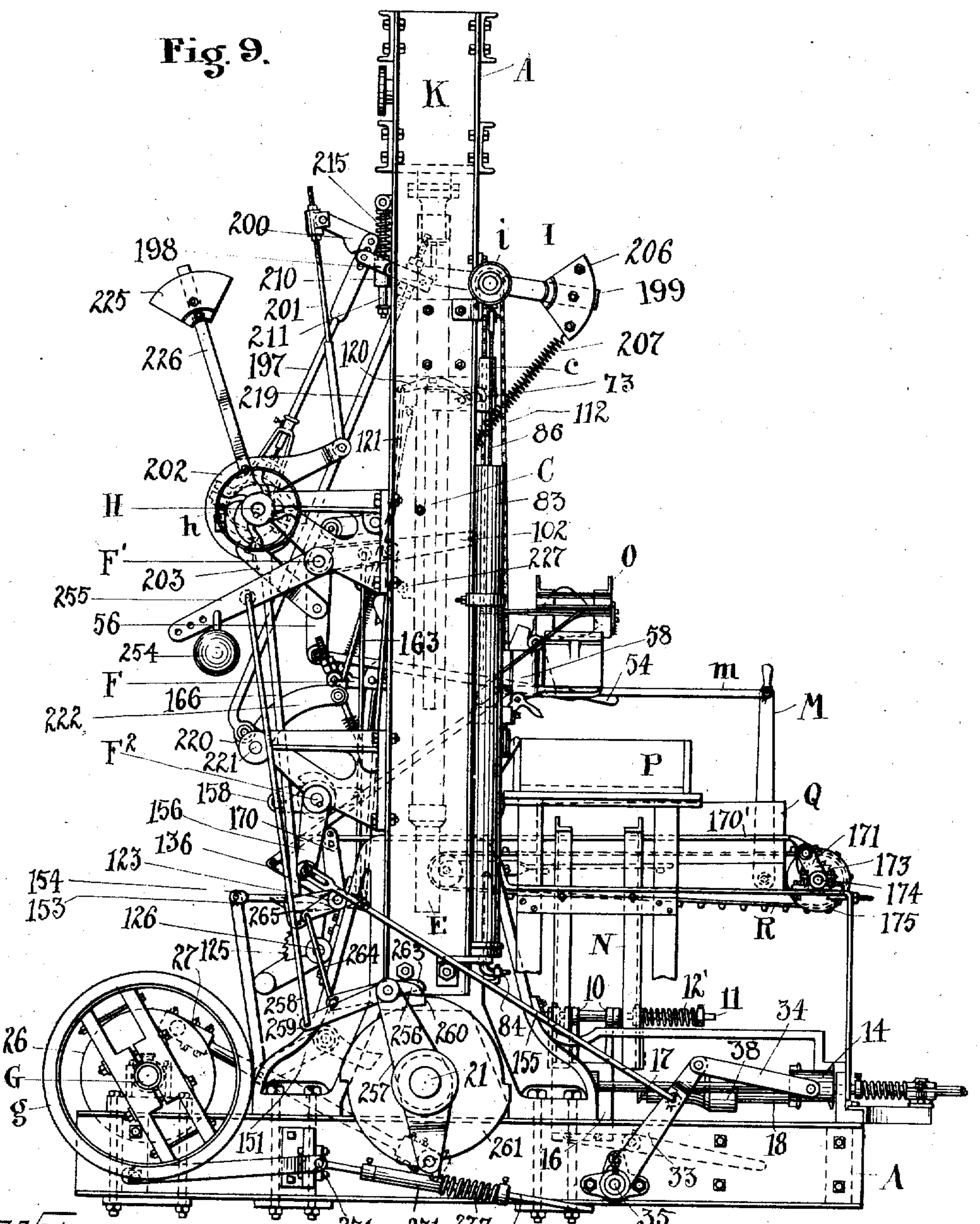
27 SHEETS—SHEET 4.

Fig. 9.



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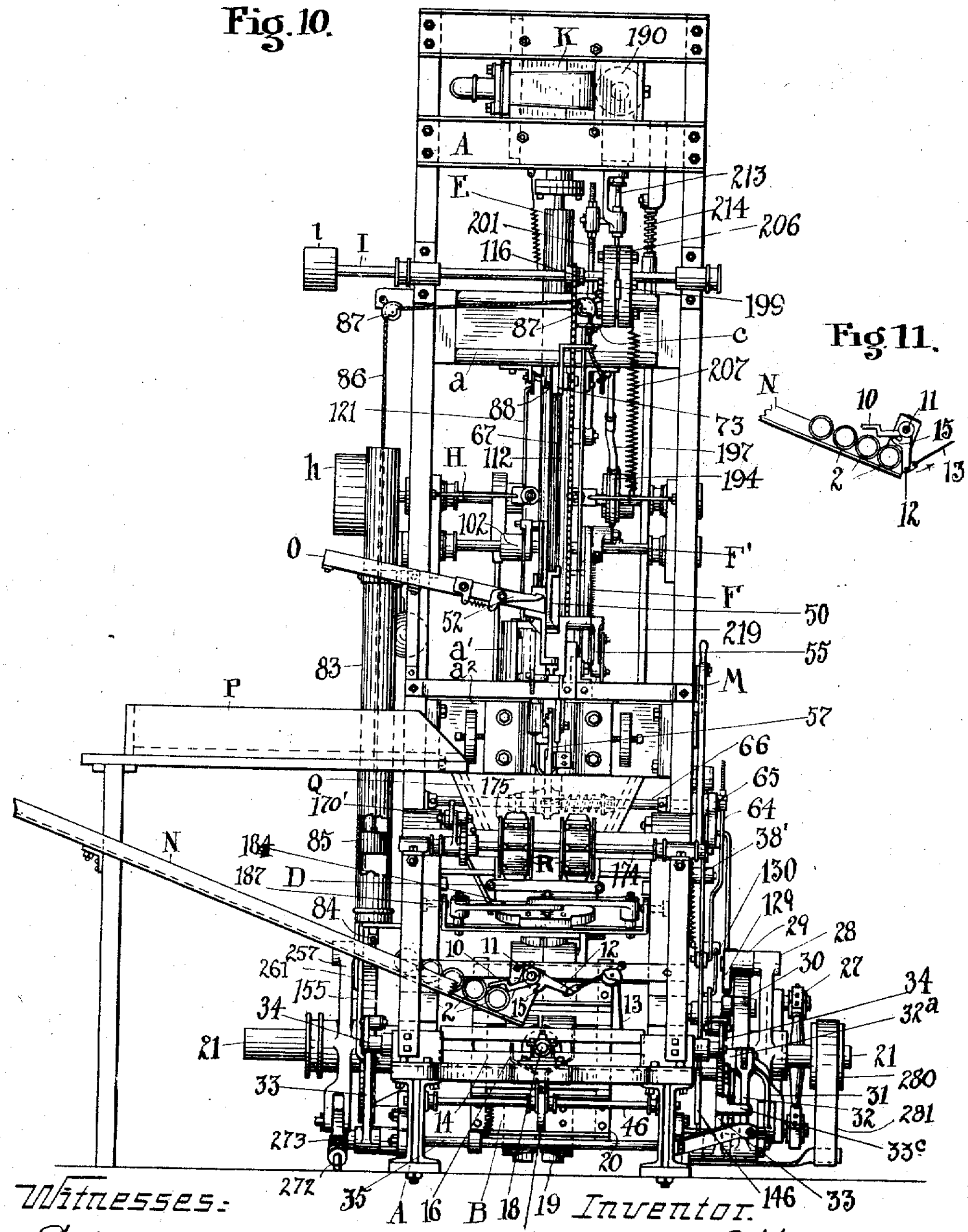
27 SHEETS—SHEET 5.

Fig. 10.



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27 SHEETS—SHEET 6.

Fig. 12.

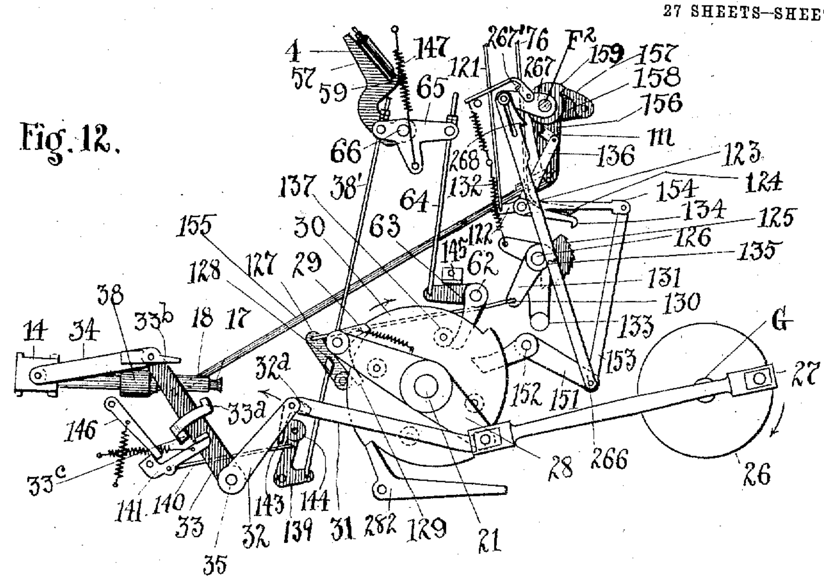
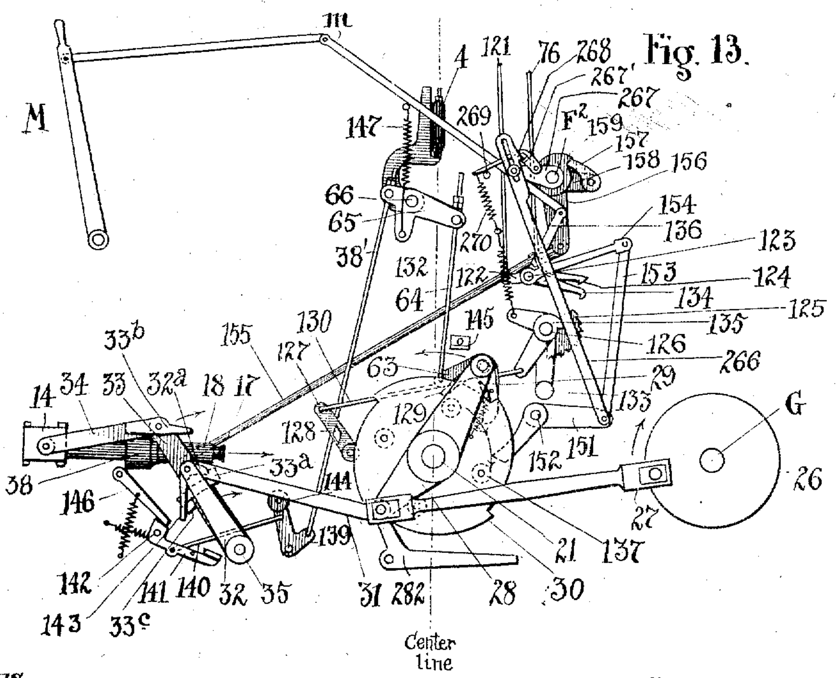


Fig. 13.



WITNESSES

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27 SHEETS—SHEET 7.

Fig. 14.

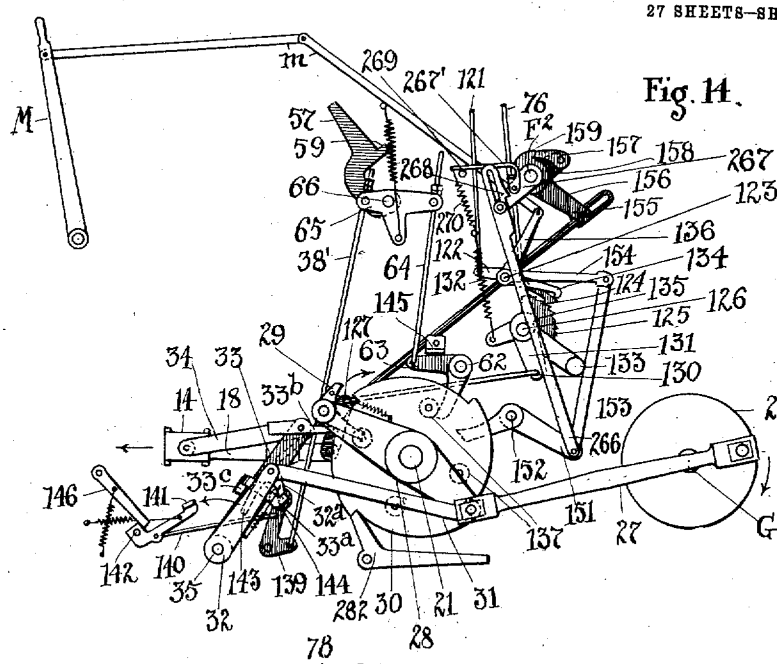
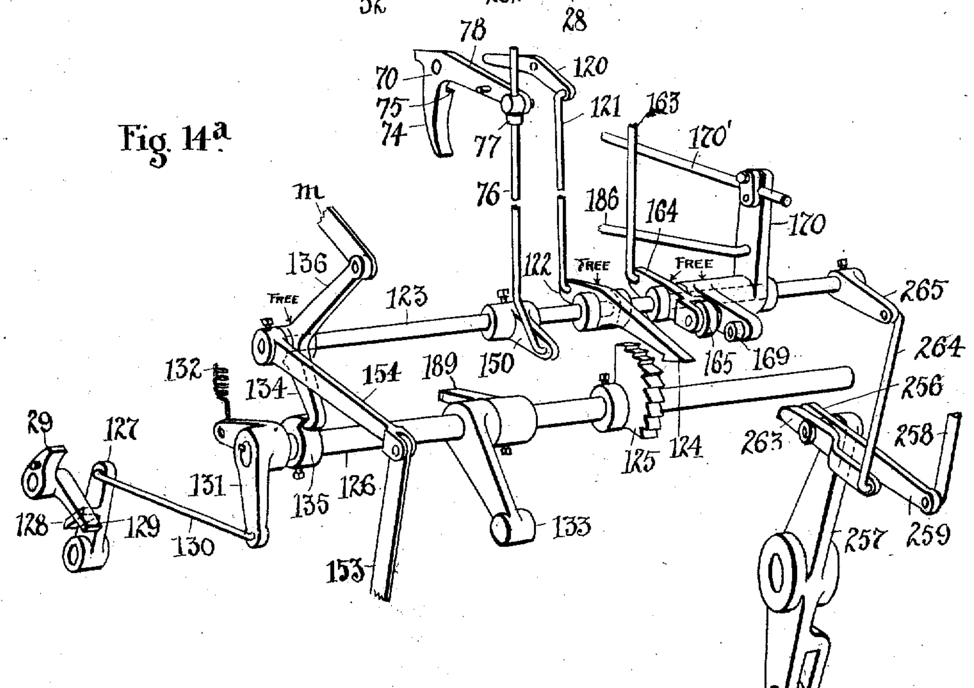


Fig. 14a.



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27 SHEETS—SHEET 8.

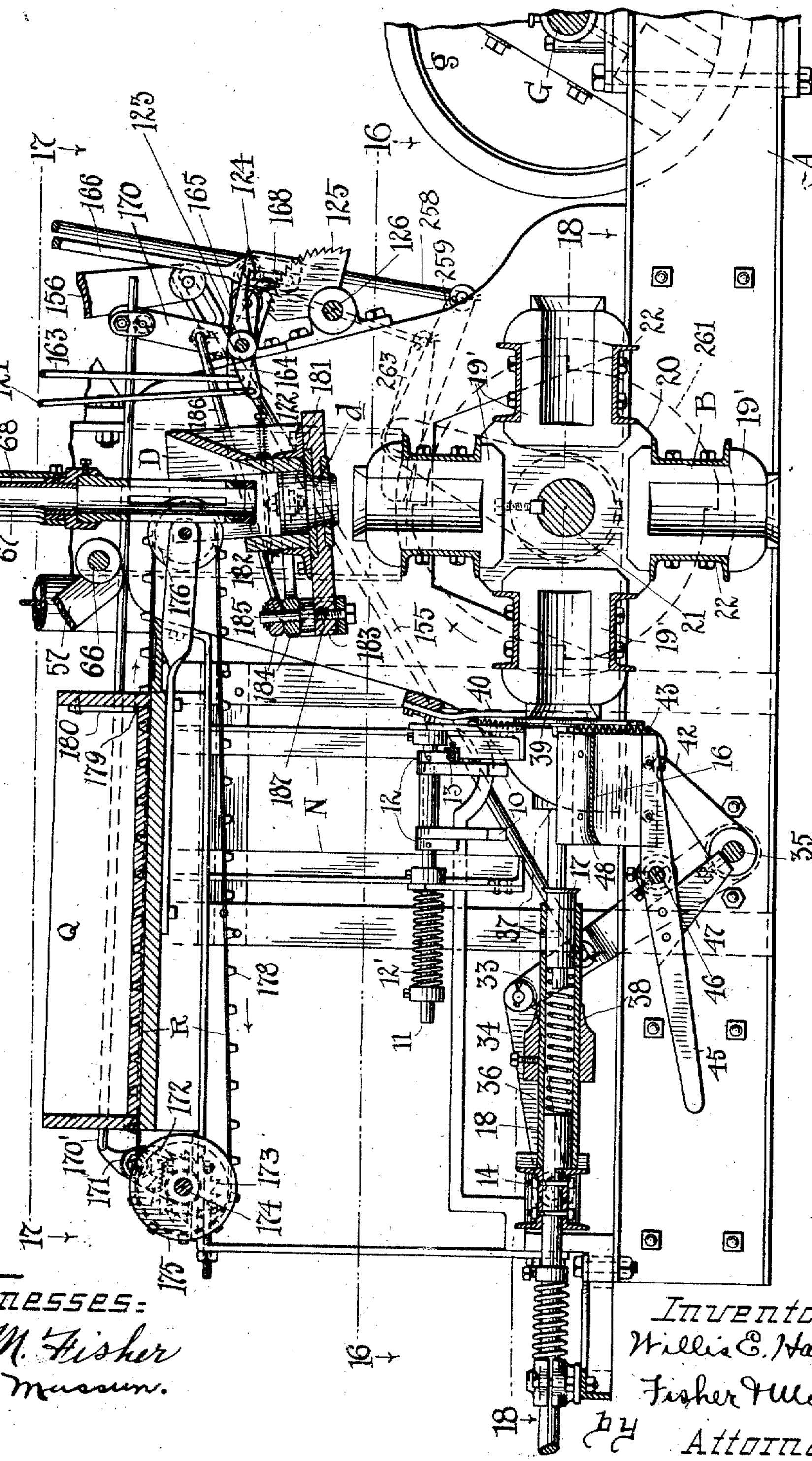

Fig.15.

Witnesses:
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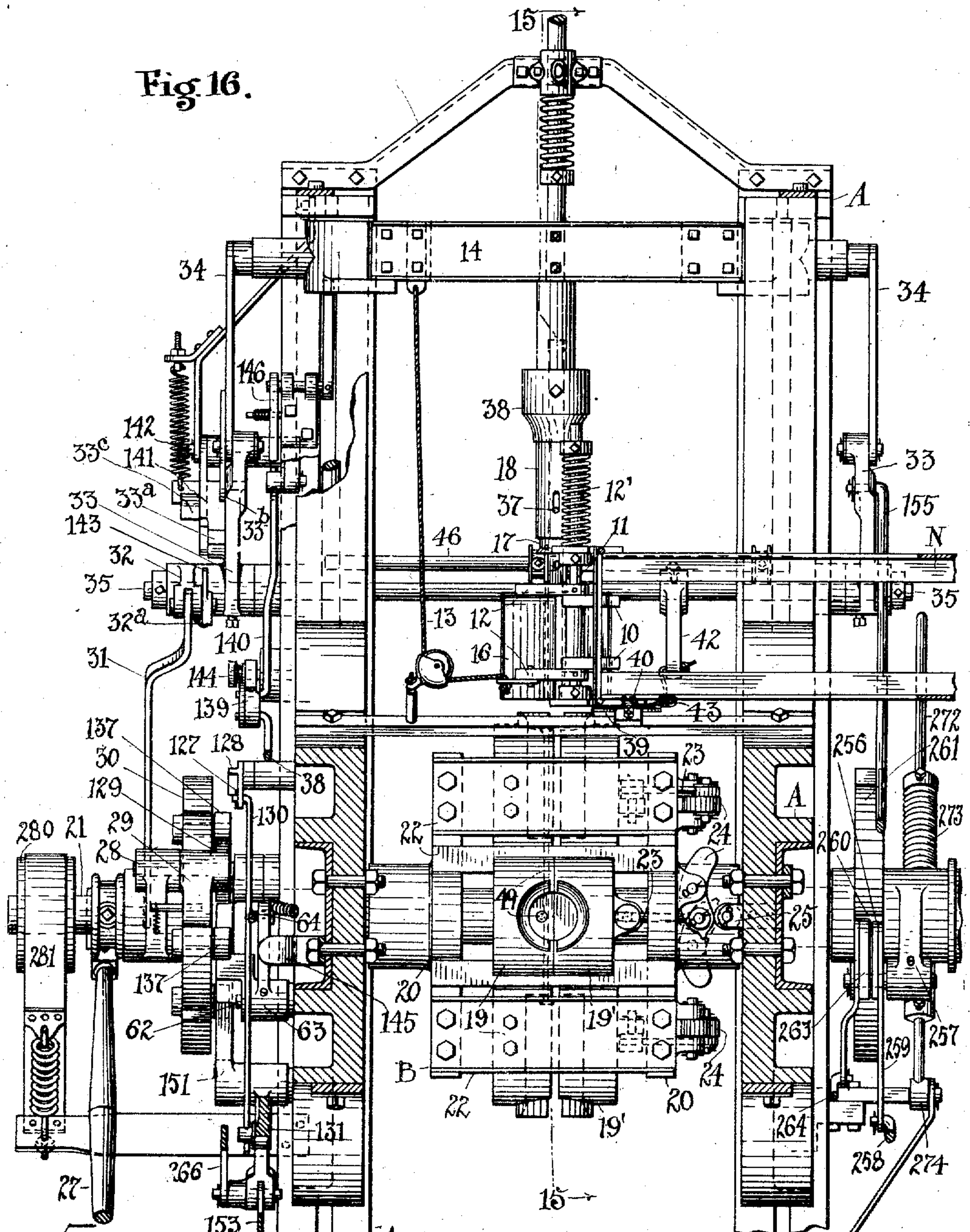
27 SHEETS—SHEET 9.

Fig. 16.



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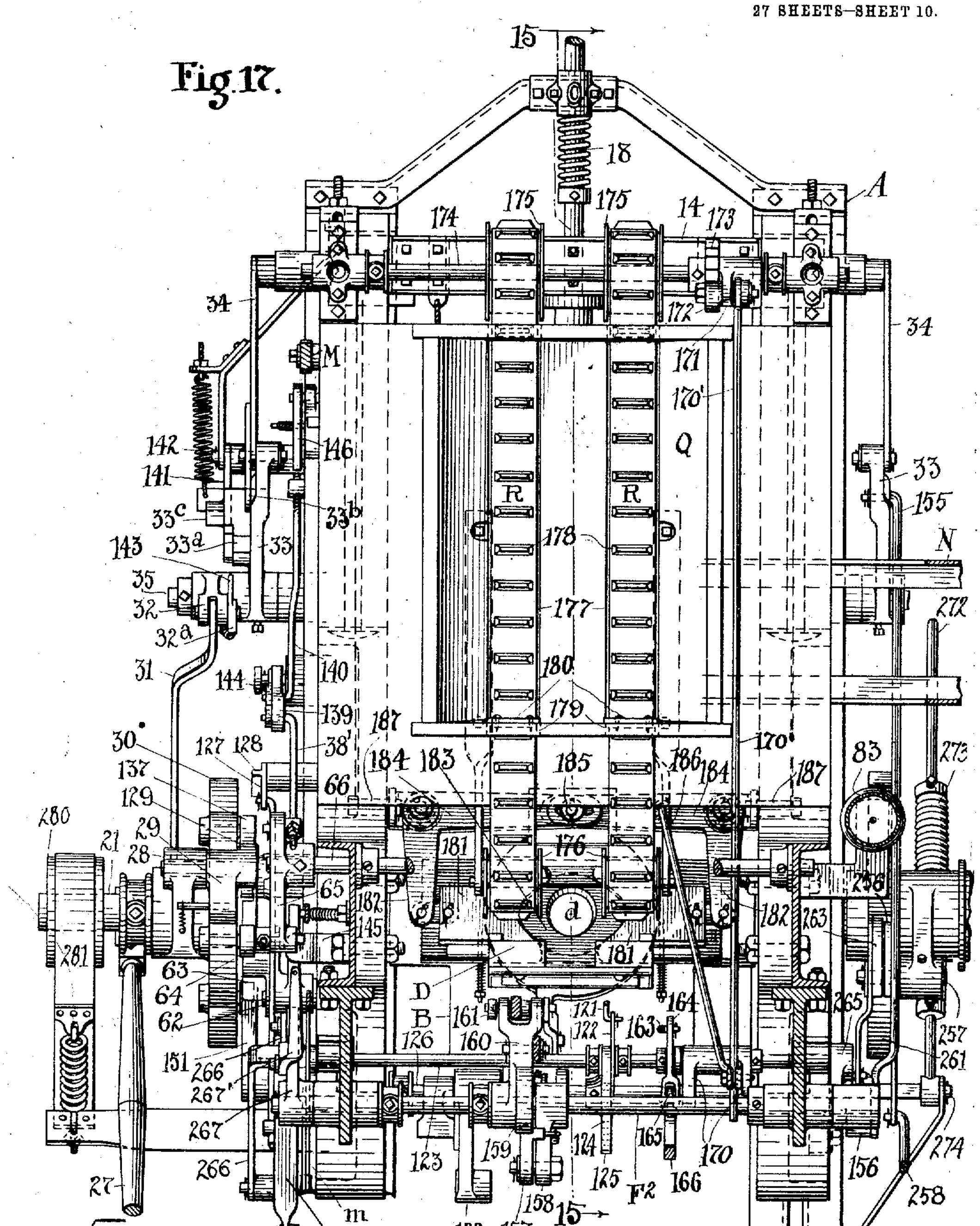
27 SHEETS—SHEET 10.

Fig. 17.



Witnesses:

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27 SHEETS—SHEET 11.

Fig 18.

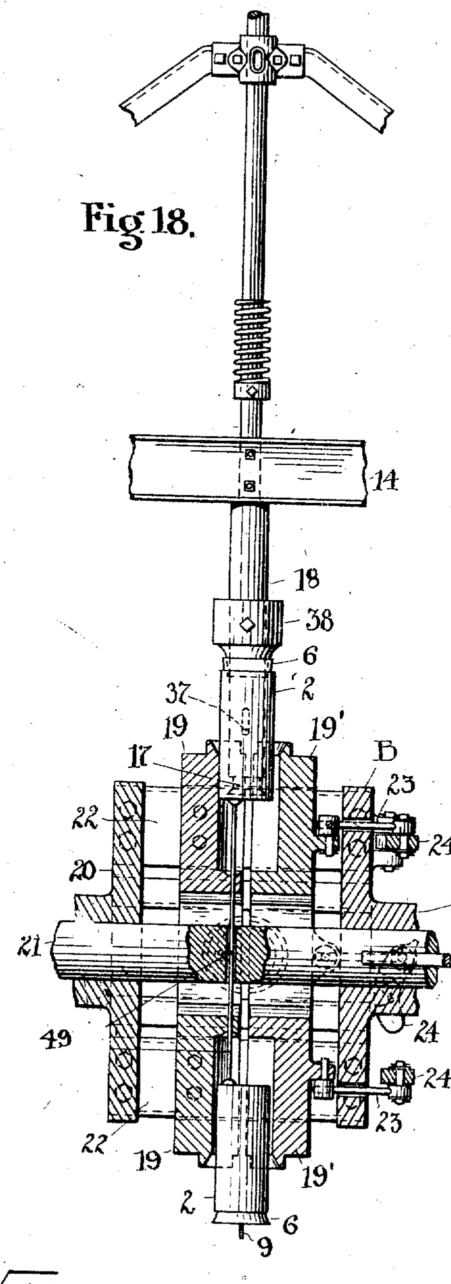
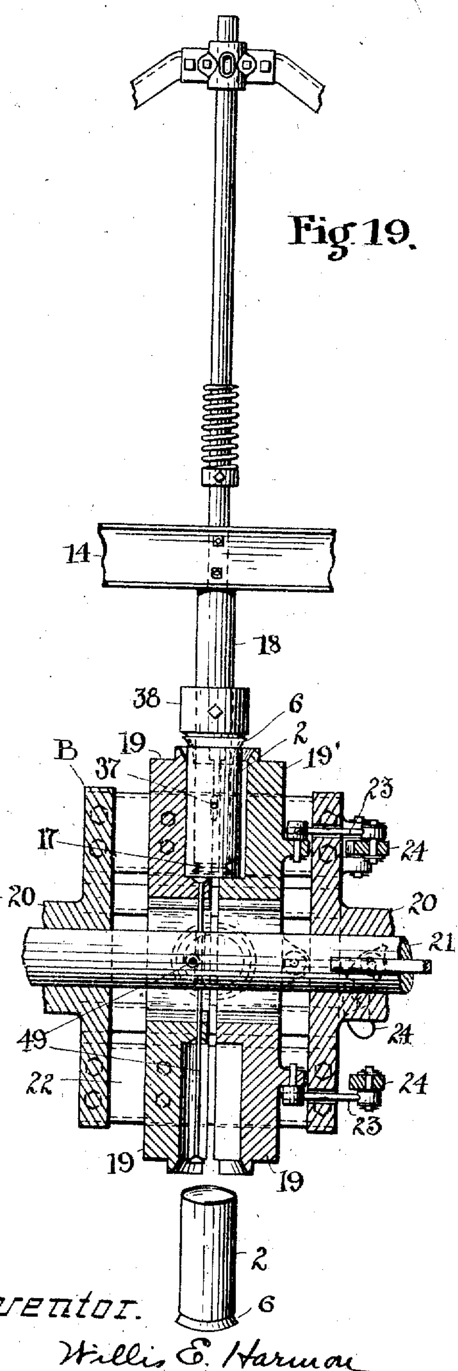


Fig 19.



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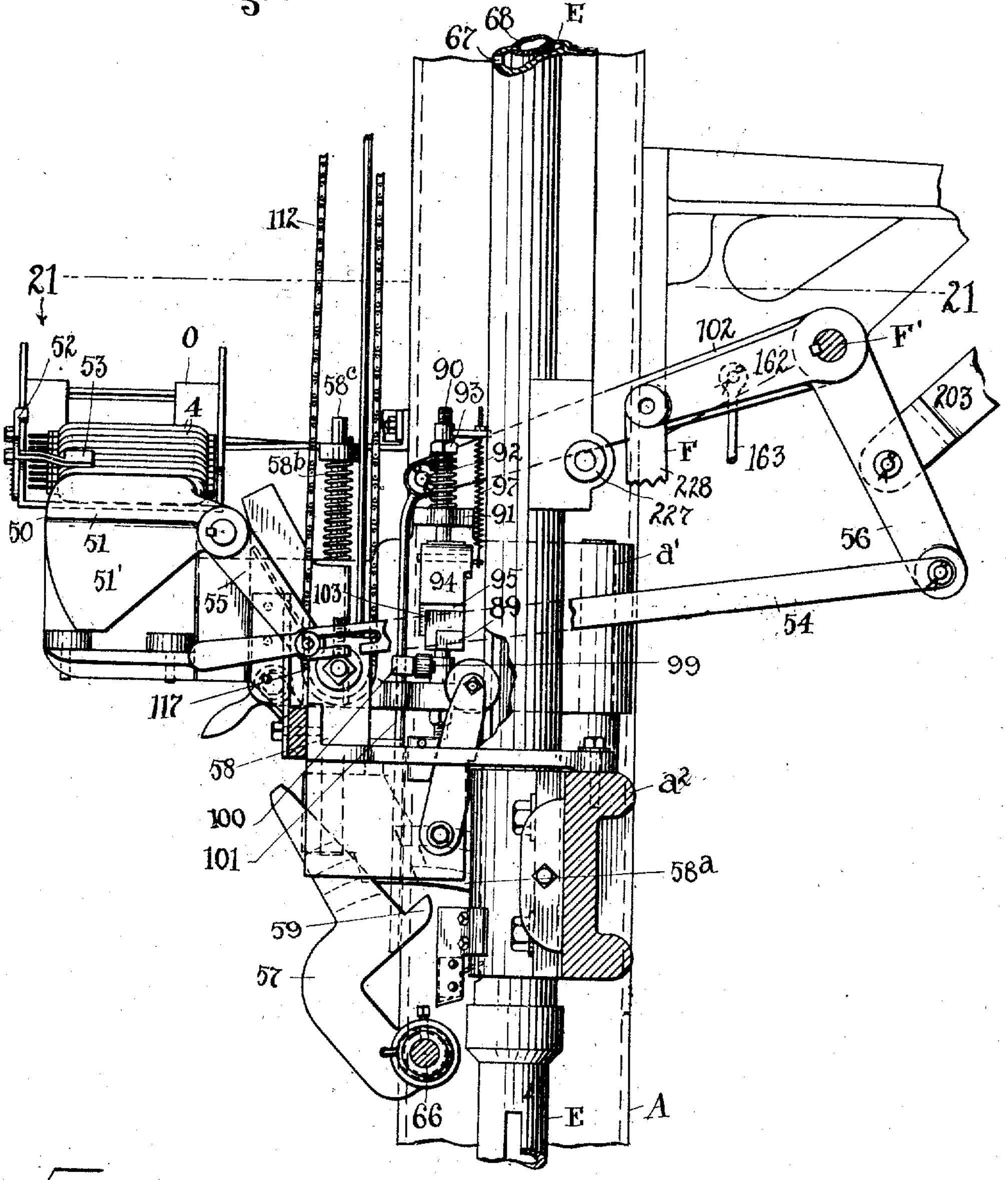
27 SHEETS—SHEET 12.

Fig. 20



Witnesses:
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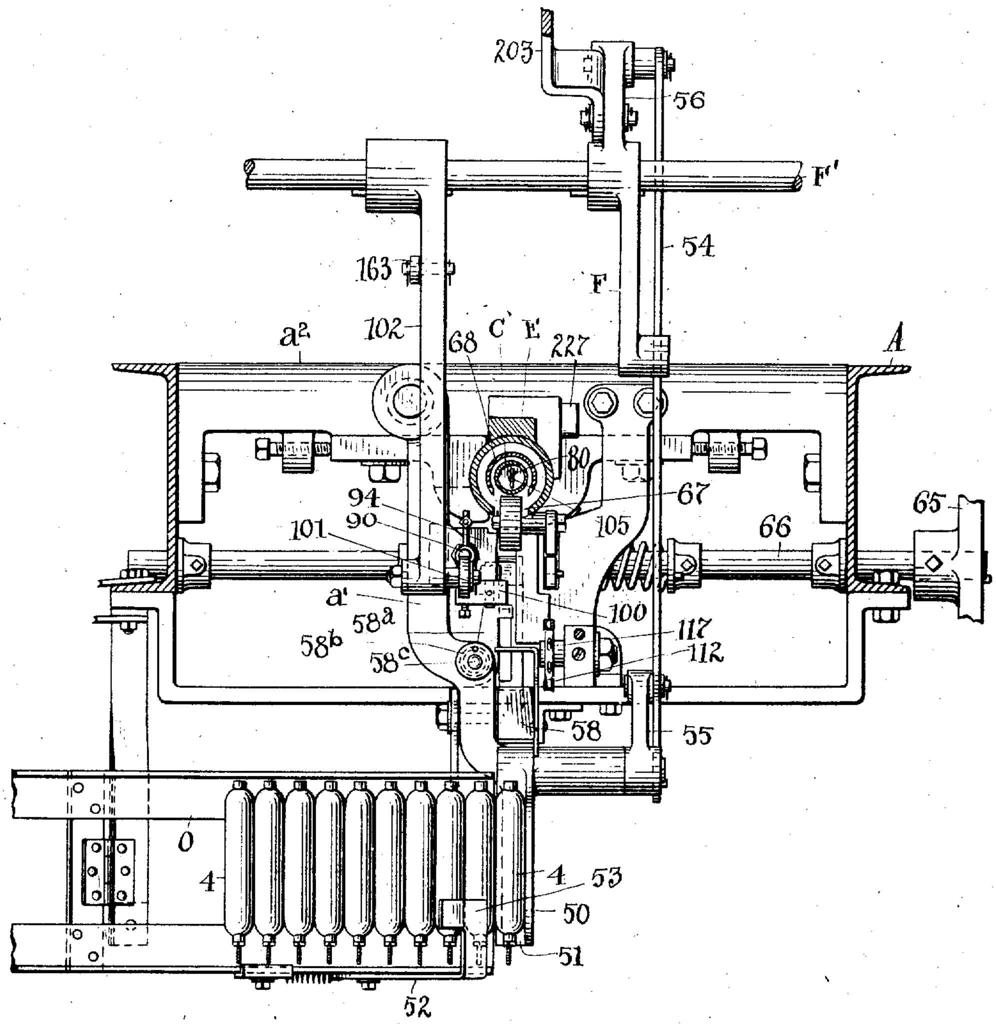
27 SHEETS—SHEET 13.

Fig. 21.



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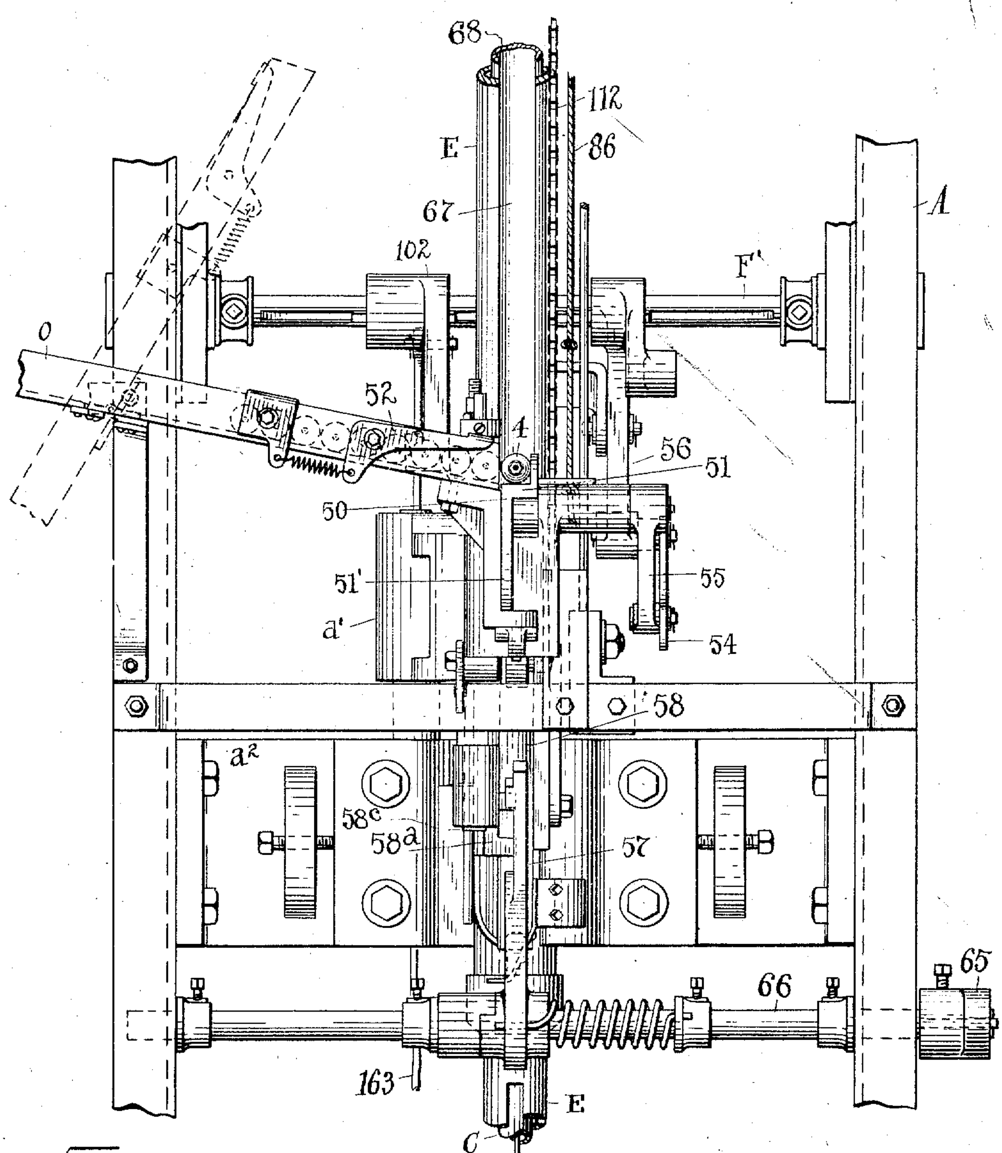
27 SHEETS—SHEET 14.

Fig 22.



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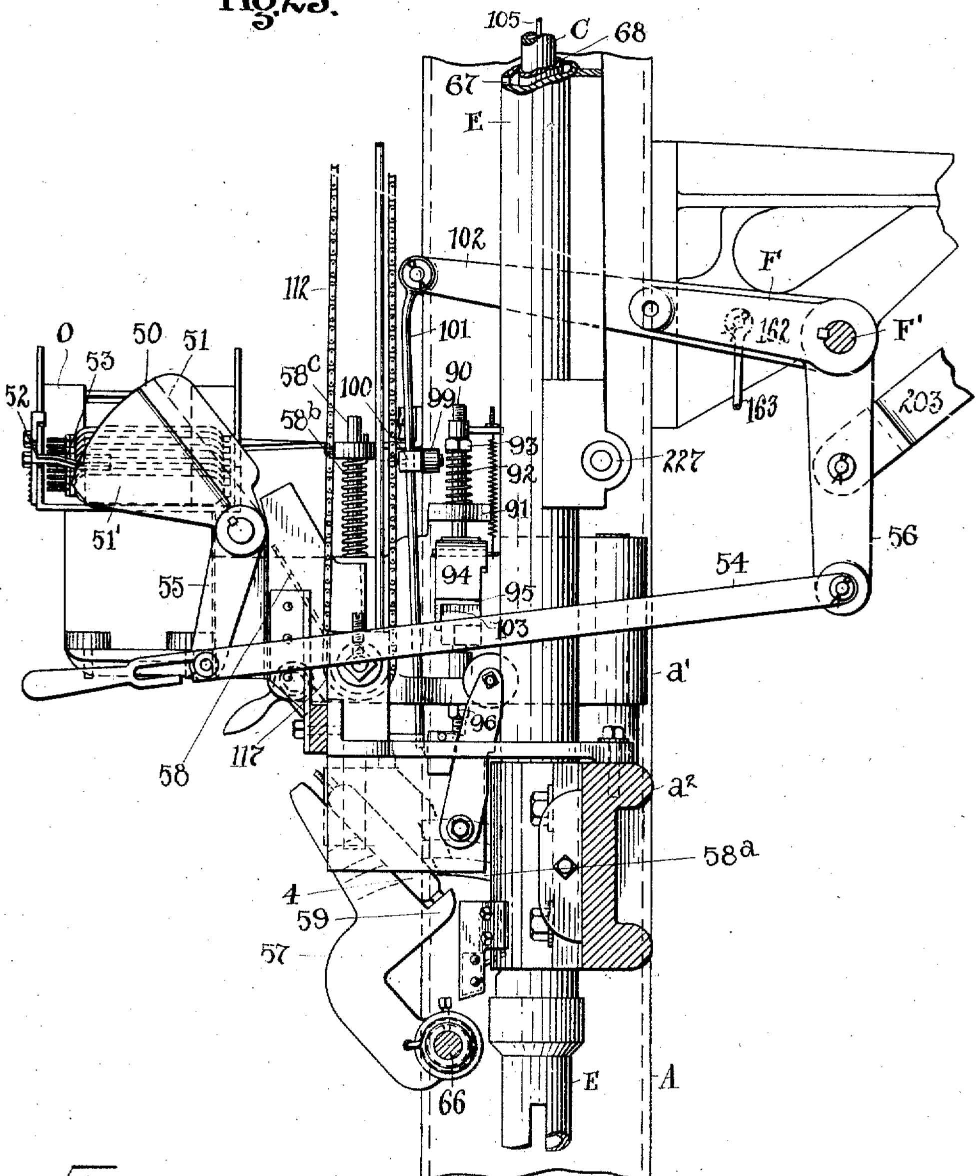
27 SHEETS—SHEET 15.

Fig. 23.



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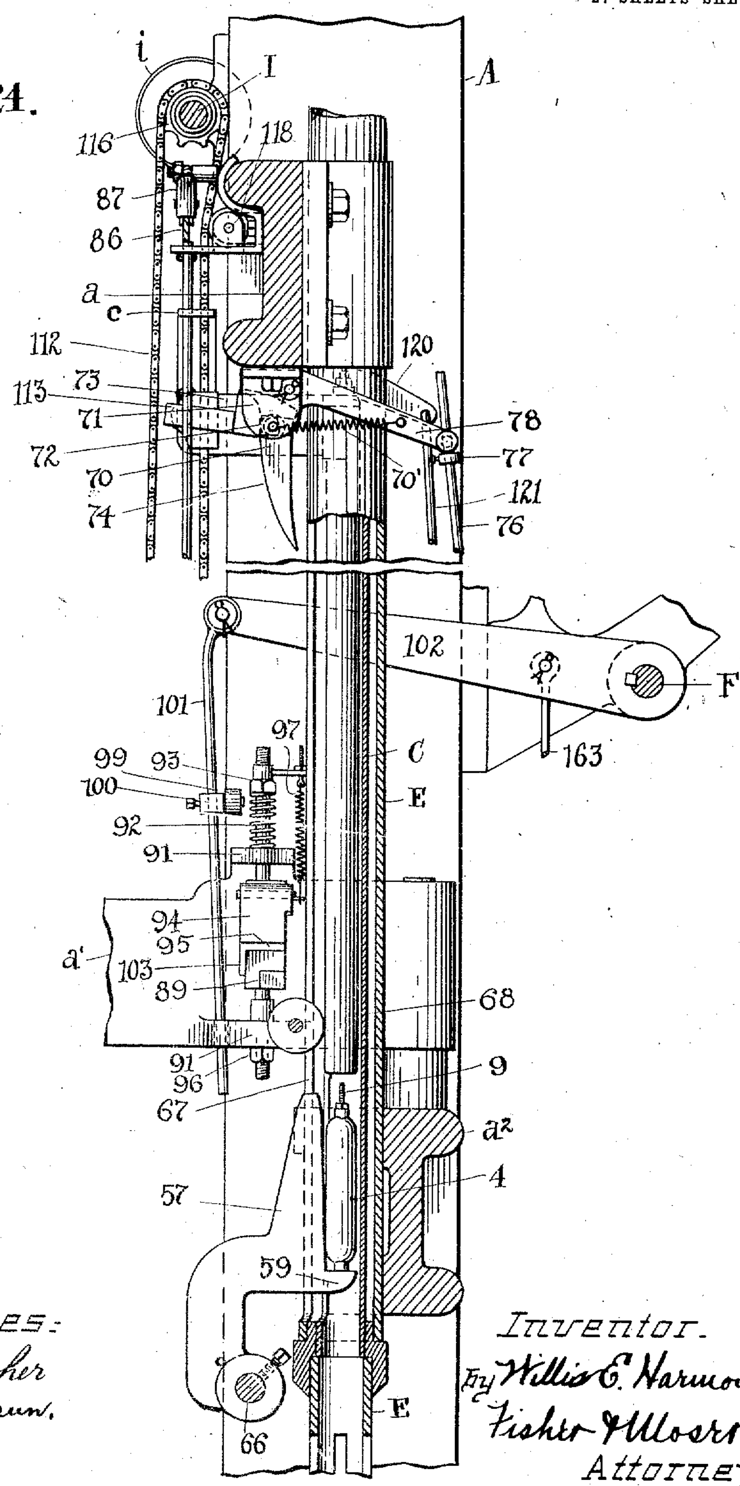
27 SHEETS—SHEET 16.

Fig. 24.



Witnesses:
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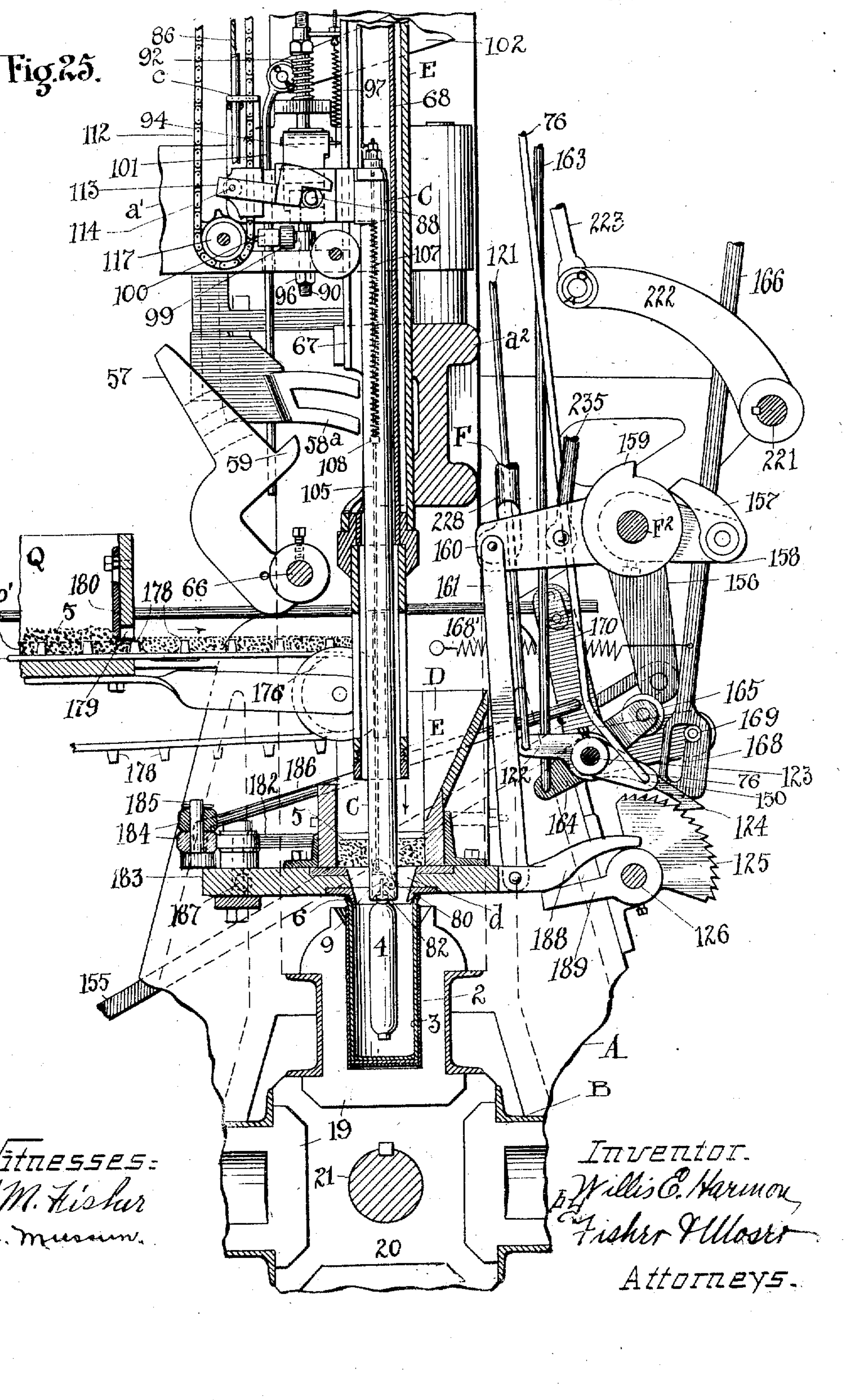
27 SHEETS—SHEET 17.

Fig. 25.



Witnesses:
E. M. Fisher
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MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

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987,876. Patented Mar. 28, 1911.

27 SHEETS—SHEET 18.

Fig. 26

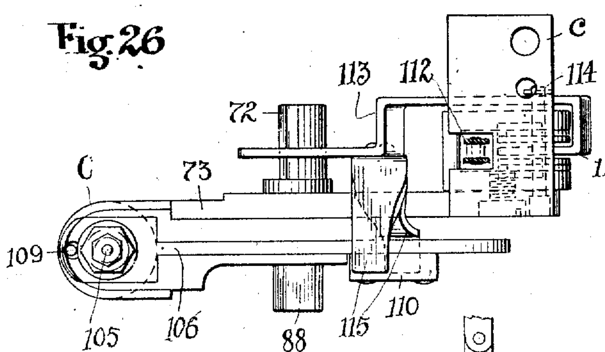

Fig. 27

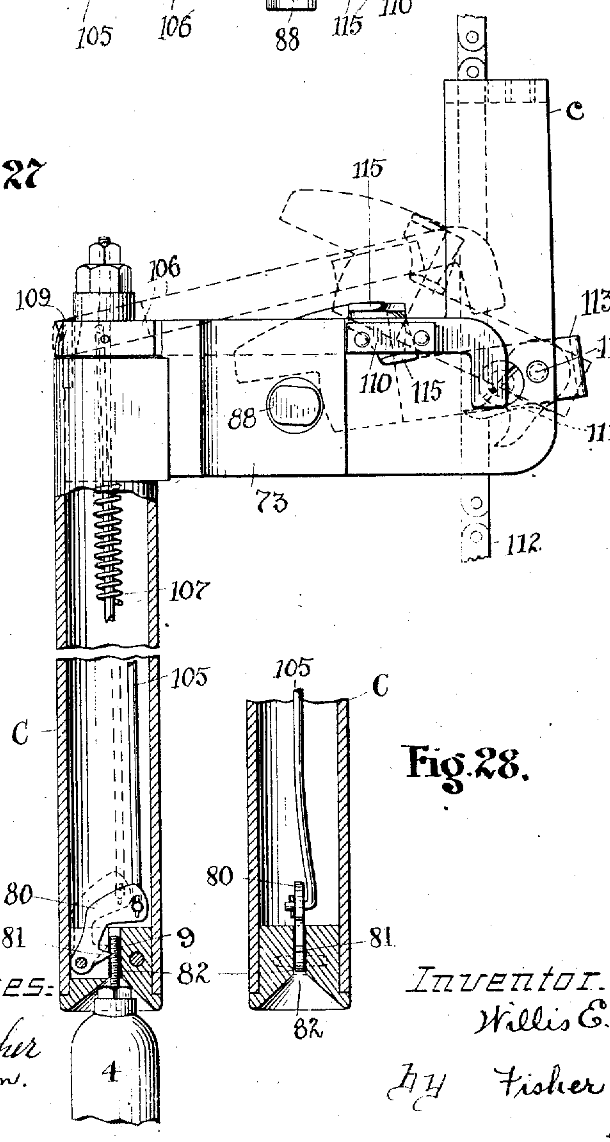

Fig. 28.

Witnesses:

E. M. Fisher

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27 SHEETS—SHEET 19.

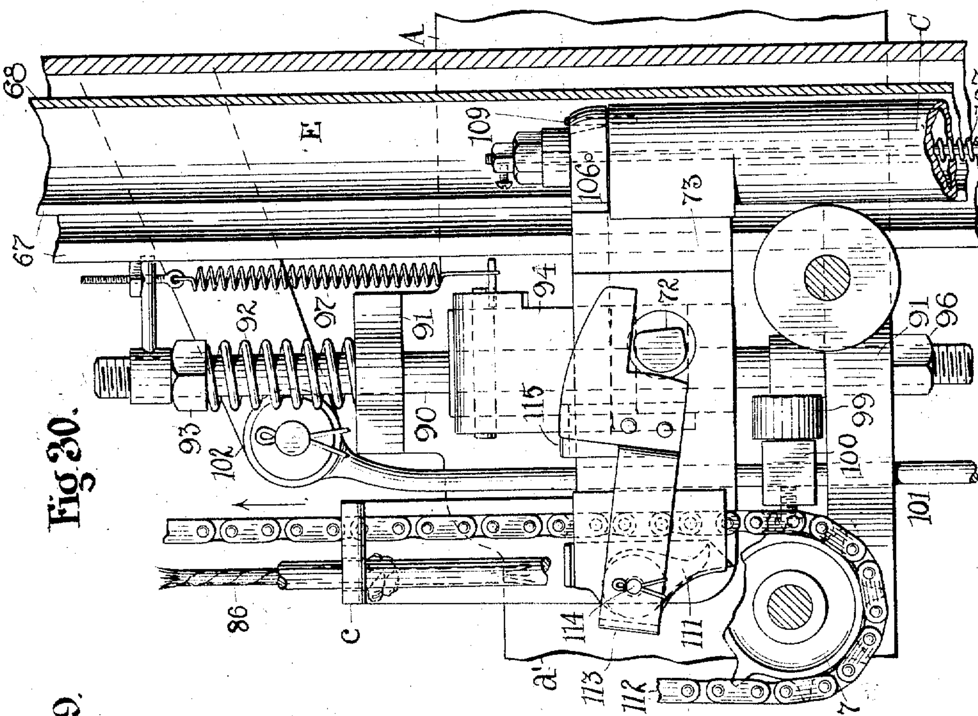

Fig. 30.

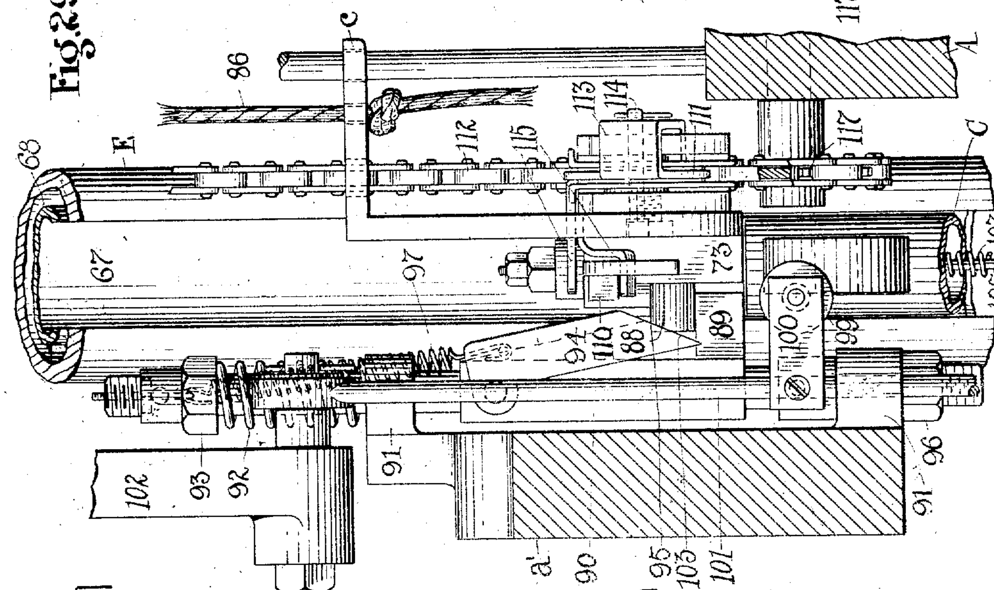

Fig. 29.

Witnesses:

E. M. Fisher

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MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

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27 SHEETS—SHEET 20.

Fig. 31.

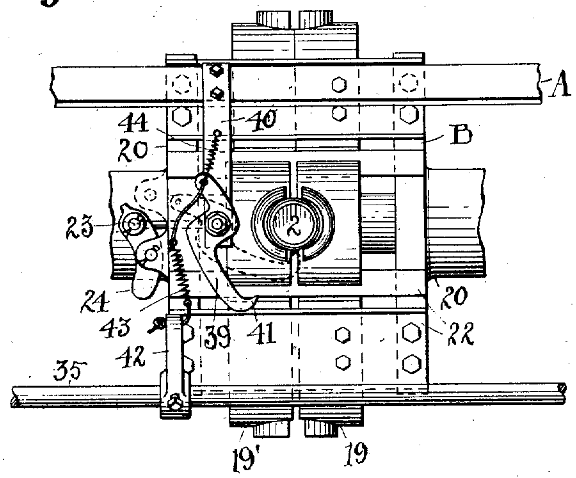


Fig. 32.

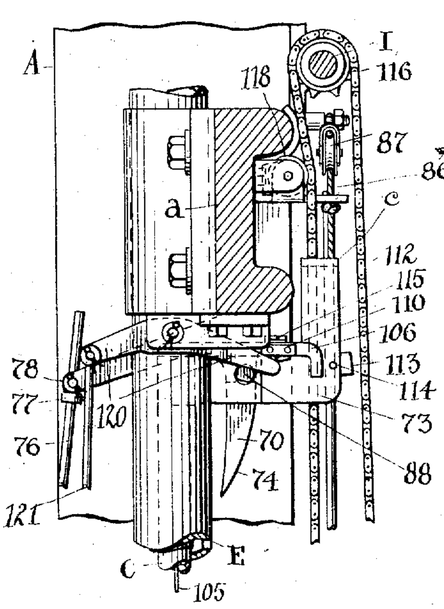
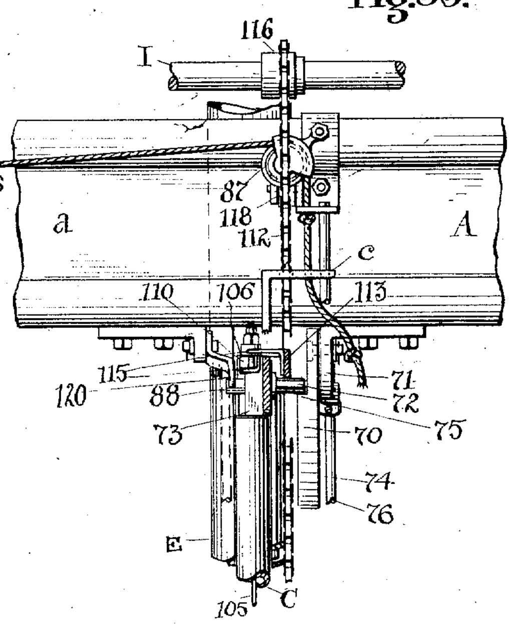


Fig. 33.



Witnesses:

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27 SHEETS—SHEET 21.

Fig. 35.

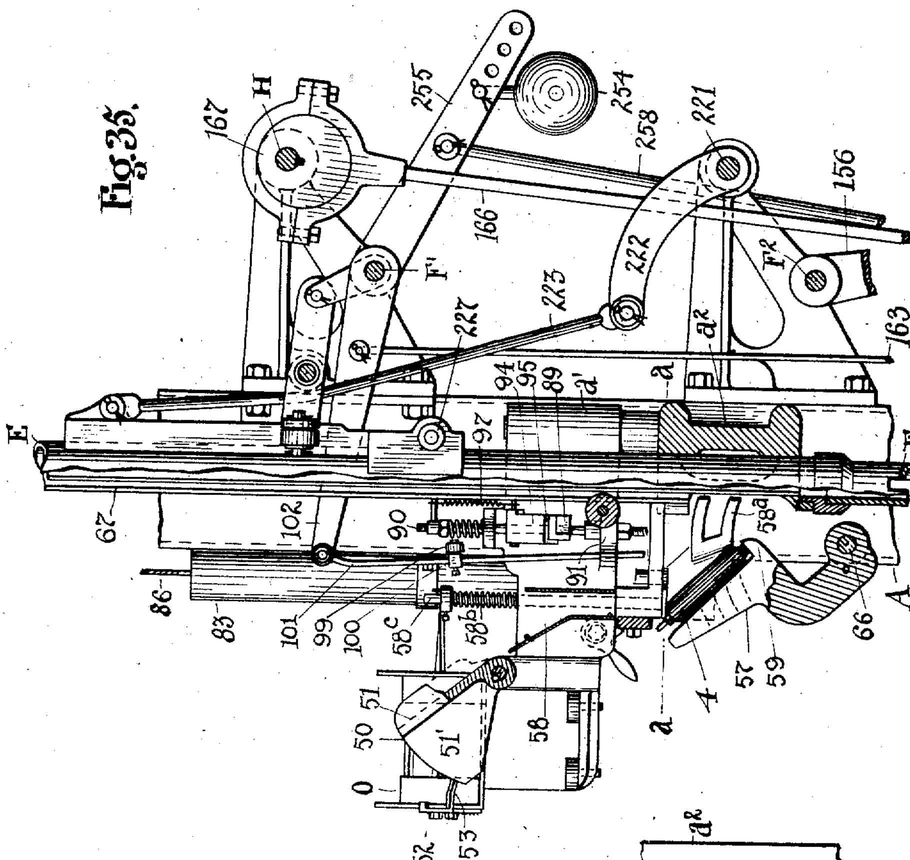


Fig. 34.

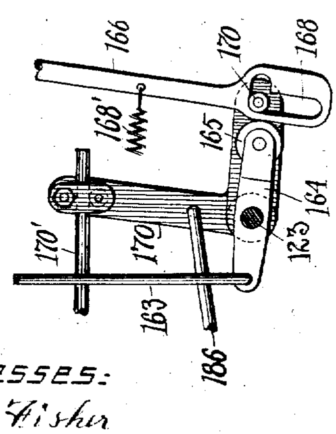
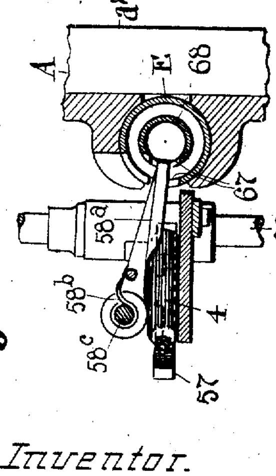


Fig. 35a.



Witnesses:
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27 SHEETS—SHEET 22.

Fig. 36.

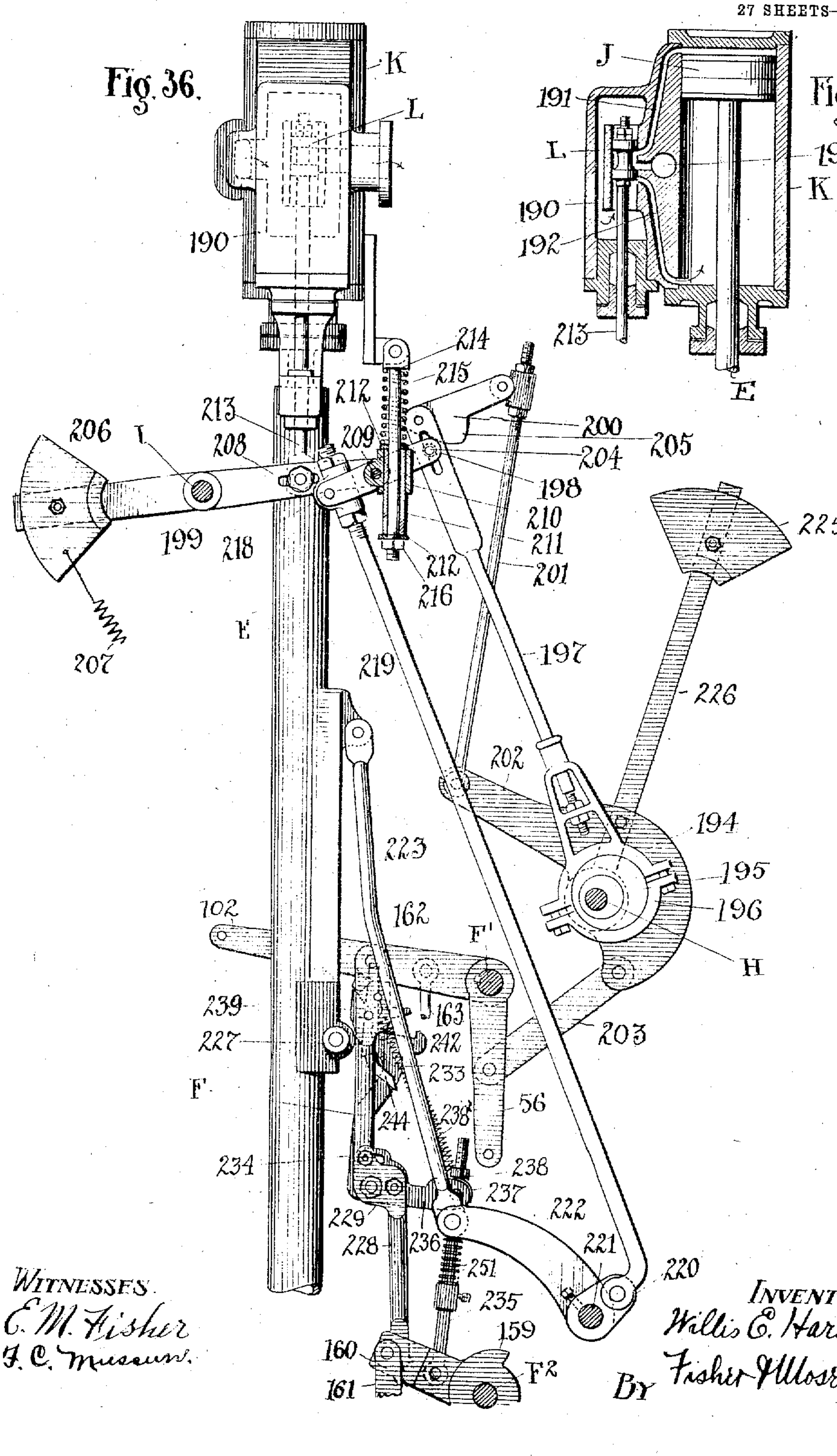

Fig. 37.

WITNESSES.
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27 SHEETS—SHEET 23.

Fig. 38.

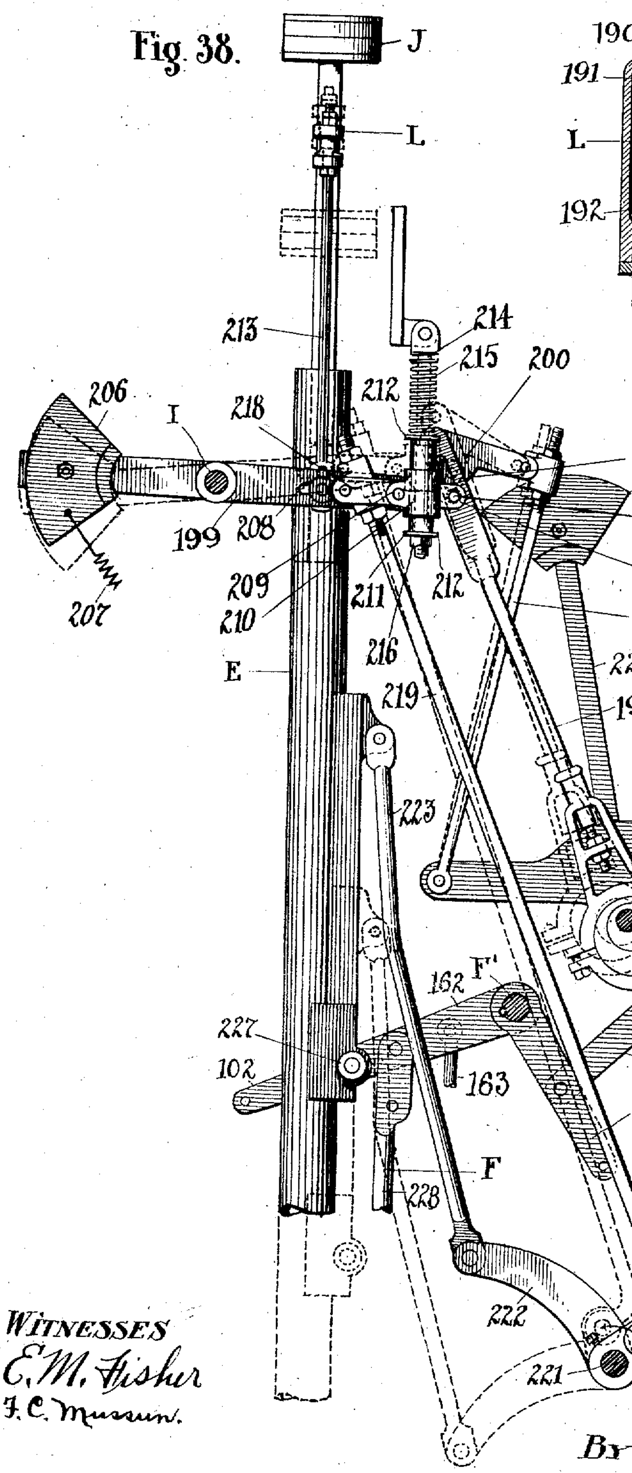
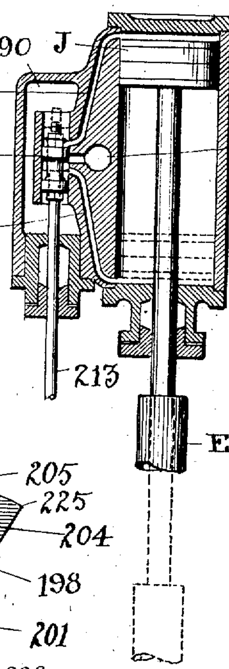


Fig. 39.



WITNESSES
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Patented Mar. 28, 1911

27 SHEETS—SHEET 24.

Fig. 40.

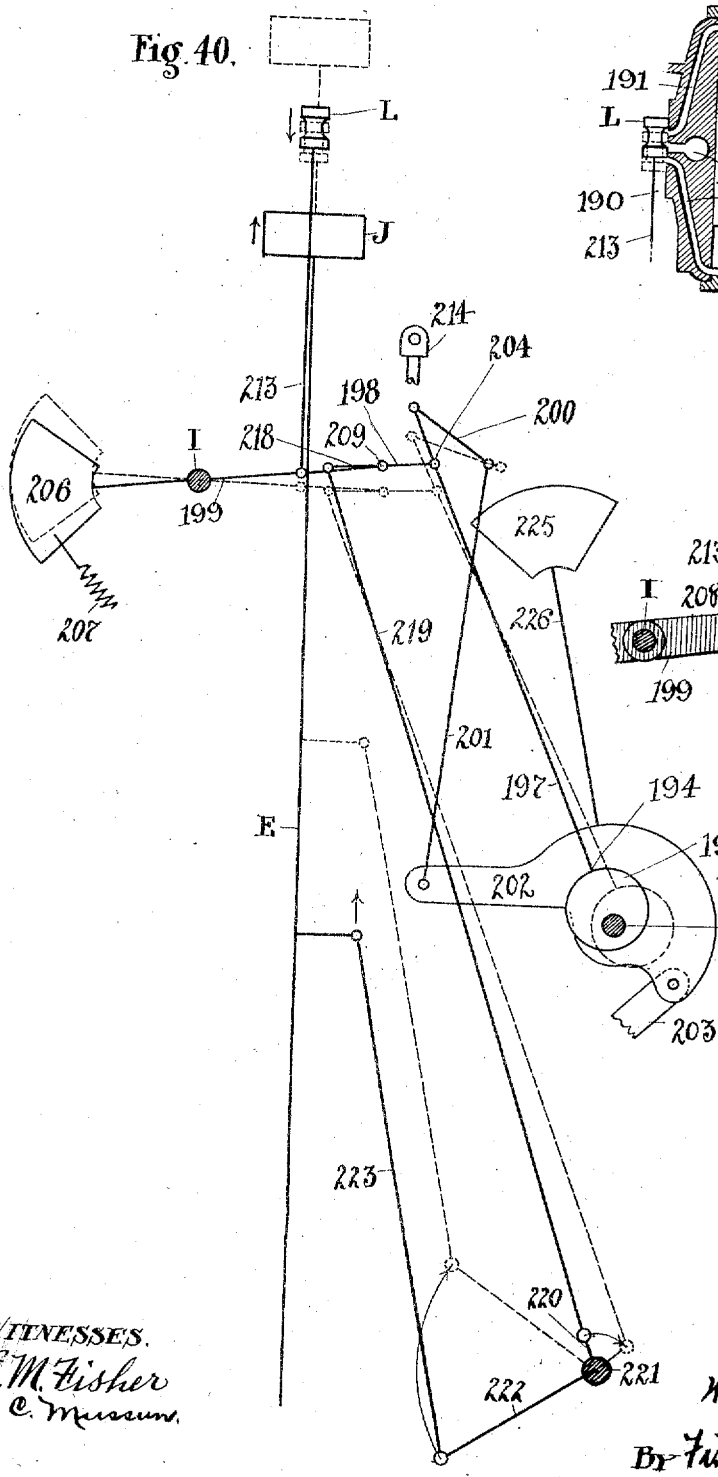


Fig. 41.

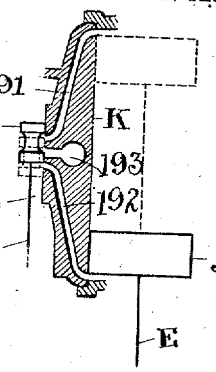
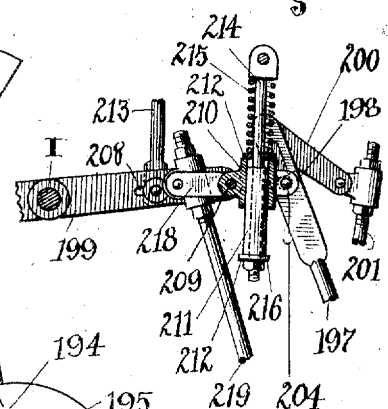


Fig. 41a.



WITNESSES.

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MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

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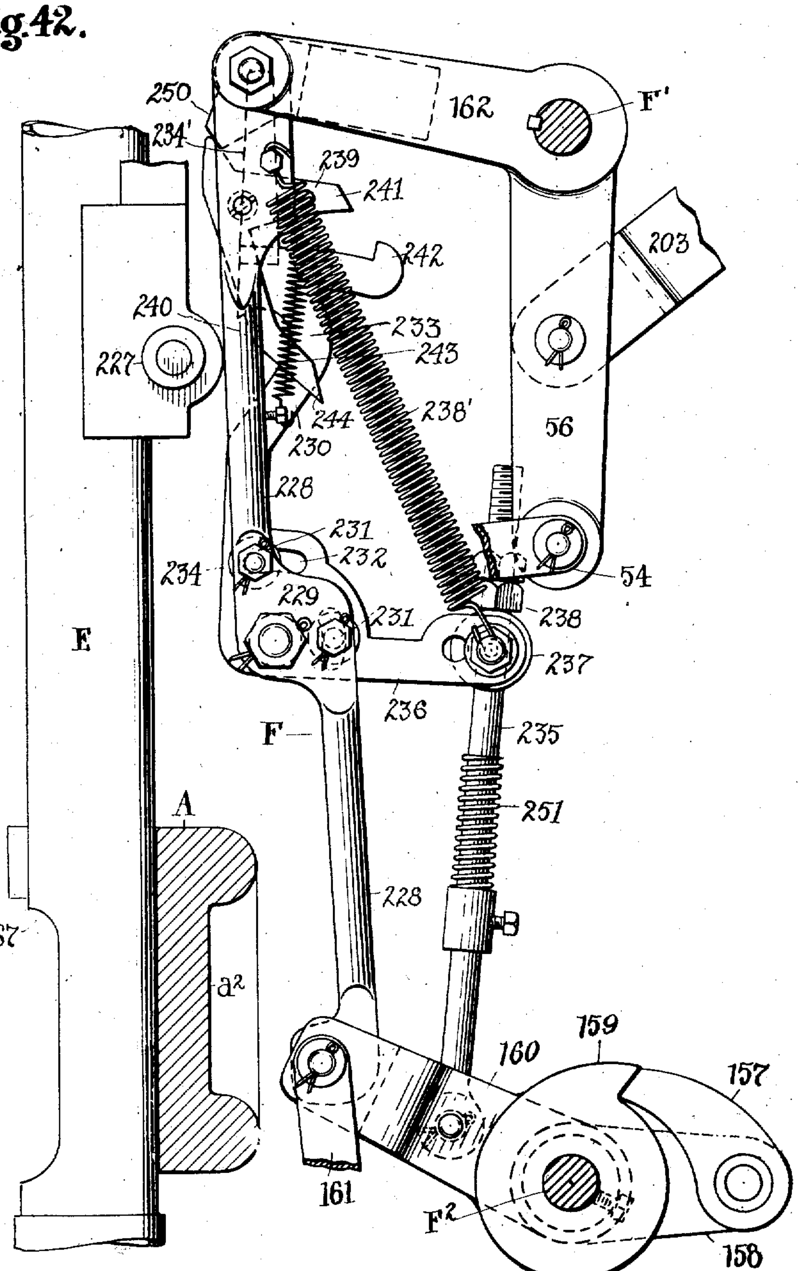
27 SHEETS—SHEET 25.

Fig.42.



Witnesses:

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MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

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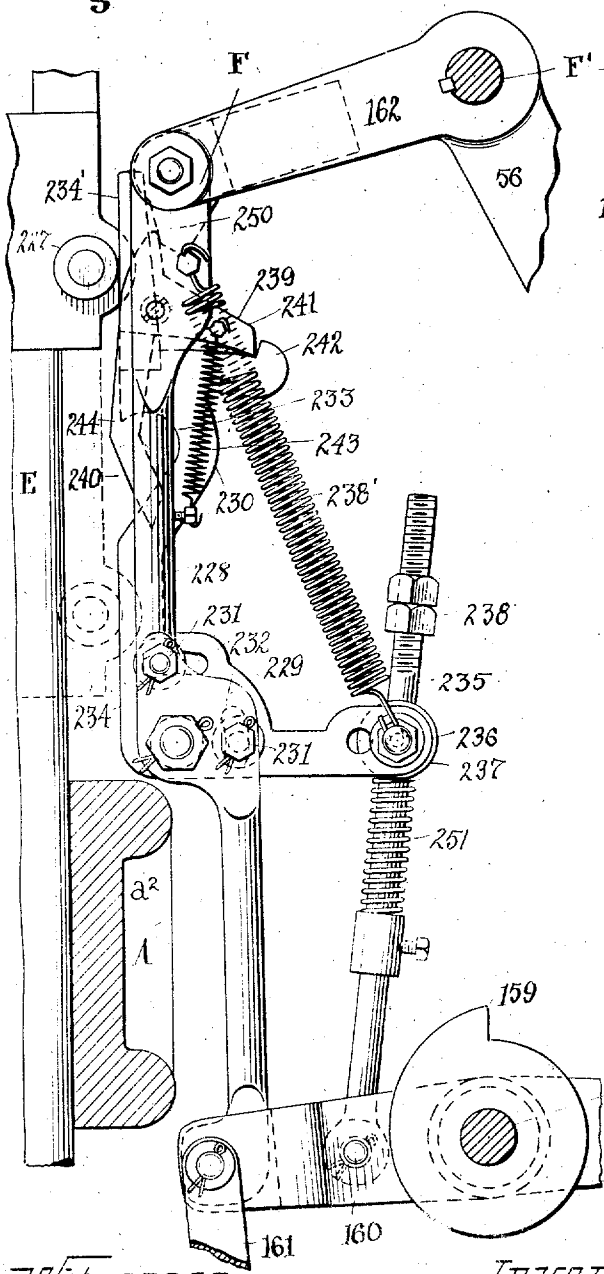
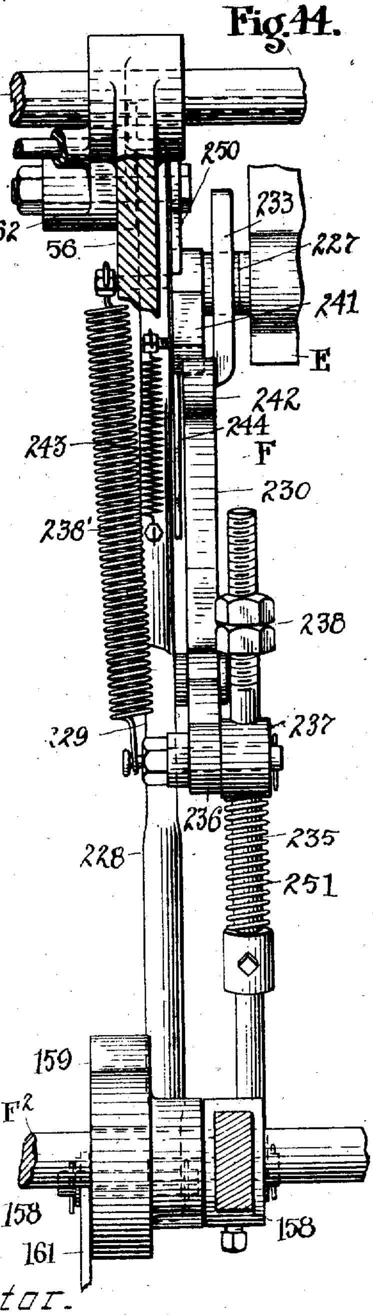
987,876. Patented Mar. 28, 1911.

27 SHEETS—SHEET 26.

Fig. 43.

Fig. 44.





Witnesses:
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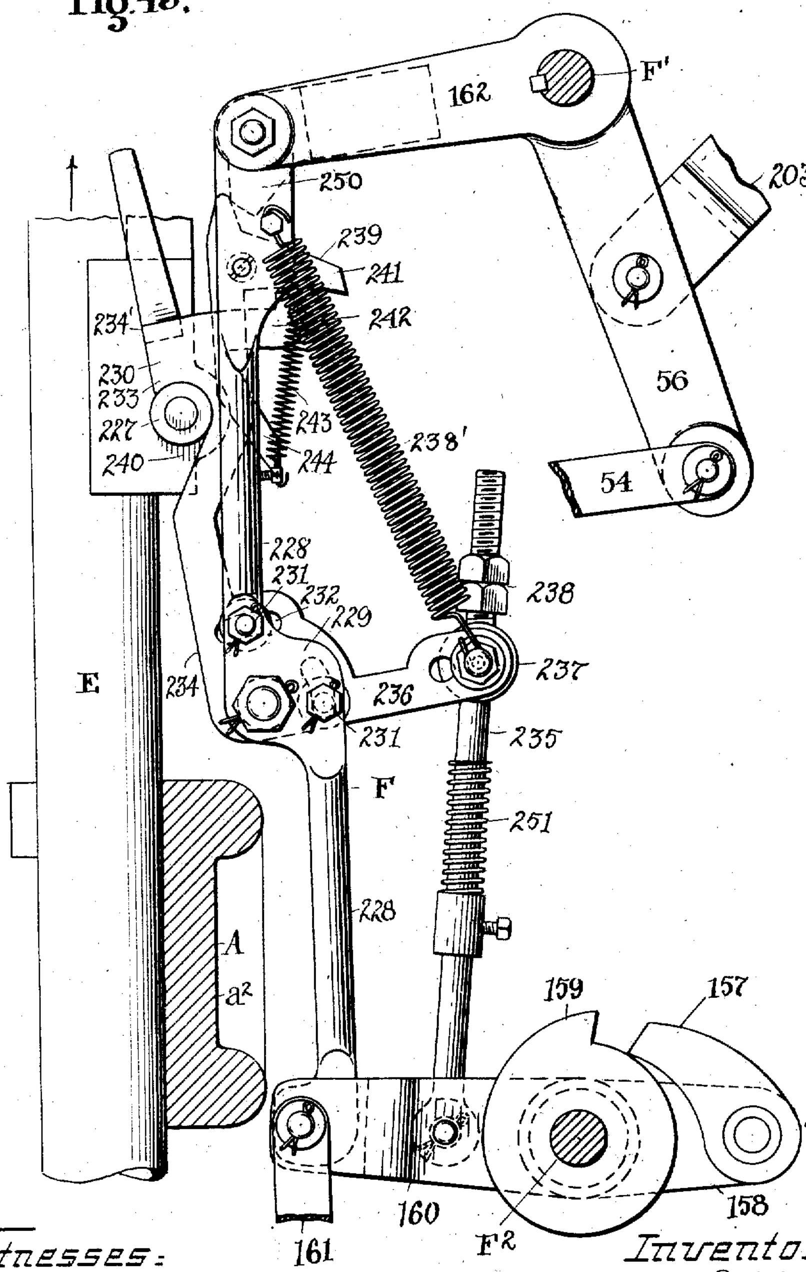
MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

APPLICATION FILED NOV. 9, 1908.

987,876. Patented Mar. 28, 1911.

27 SHEETS—SHEET 27.

Fig. 45.



Witnesses:

E. M. Fisher.

F. C. Mussun.

Inventor.

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Attorneys.

UNITED STATES PATENT OFFICE.

WILLIS E. HARMON, OF CLEVELAND, OHIO, ASSIGNOR TO THE NUNGESSER ELECTRIC BATTERY COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

MACHINE FOR MAKING ELECTRICAL DRY BATTERIES.

987,876. Specification of Letters Patent. Patented Mar. 28, 1911.

Application filed November 9, 1908. Serial No. 461,812.

To all whom it may concern:

Be it known that I, WILLIS E. HARMON, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Machines for Making Electrical Dry Batteries, and do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to machines for making electrical dry batteries, and the invention consists in a construction and arrangement of parts adapted to automatically produce such batteries, all as hereinafter shown and described and more particularly pointed out in the claims.

In the accompanying drawings, Figures 1 to 6 represent sectional views of the battery in its varying stages of development, and the remaining figures represent the machine. Thus, Fig. 1 is a sectional view of a battery can and lining as it is received by the machine, and Fig. 2 is a similar view but with the lining flared outwardly at its upper end. Fig. 3 shows a carbon and the first layer of filling in the receptacle. Fig. 4 shows the battery completely filled; Fig. 5 the next step with the lining bent inward to provide a cover for the battery, and Fig. 6 is a complete battery substantially as sent to the trade. Fig. 7 is a front elevation of the machine in its entirety, excepting that the main power shaft at the bottom is partially broken away to disclose the parts behind. This view and Figs. 8, 9 and 10 are approximately one-twelfth the full size of the machine. Fig. 8 is a side elevation looking from the left, and Fig. 9 is a side elevation from the right of Fig. 1. Fig. 10 is a rear view of the machine. Fig. 11 is a detail view of the can release fingers about to discharge a can. Fig. 12 is a diagrammatic view of the operating parts for the turret and plunger in the working positions assumed by them just at the beginning of turret movements. Fig. 13 is a similar view but with the turret advanced a quarter and with the plunger operating parts in action, and Fig. 14 illustrates the position of the operating parts when the plunger is at the limit of its forward stroke and about to be returned. Fig. 14ª is a perspective view of the various parts coupled to cross shafts —123— and —126—, respectively, at the front of the machine. Fig. 15 is a sectional view centrally of the lower part of the machine on line 15—15, Figs. 16 and 17, but enlarged as compared with Fig. 8. Fig. 16 is a cross section and plan view on line 16—16, Fig. 15, and Fig. 17 is a sectional view looking down from line 17—17, Fig. 8, and a plan view of Fig. 15. Fig. 18 is a sectional plan on line 18—18, Fig. 15, showing the feed plunger in operation. Fig. 19 is a similar view with a can seated within the turret and one discharging therefrom and showing the flaring action of the plunger upon the can lining. Fig. 20 is a side elevation and section of the carbon feed device which is located immediately above the parts shown in Fig. 15, and relatively enlarged as compared with said figure. Fig. 21 is a plan view and section taken on line 21—21 of Fig. 20, and Fig. 22 is a rear elevation of both said figures. Fig. 23 is a side elevation similar to Fig. 20 but with the parts in their position of rest. Fig. 24 is a central sectional view of the machine on the line of the tamping tube, the view being foreshortened by breaking an intermediate portion away to permit illustration of the upper portion of the elevator and the trip levers for the carbon holder, which is also shown suspended above a carbon on the transfer member. Fig. 25 is a central sectional view on the line of the tamping tube, hopper and turret, showing the carbon holder in lowered position as at the start of tamping operations. Fig. 26 is a plan view of the carbon holder alone, and Fig. 27 is a side elevation thereof, partly sectioned away to disclose the carbon gripper. Fig. 28 is a sectional view of the lower part of the carbon holder at right angles to Fig. 27. Fig. 29 is an enlarged detail and rear view of the upper end of the carbon holder and the lower end of the elevator, showing the interlocking devices of the said parts, and Fig. 30 is a side elevation thereof and a sectional view of a portion of the tamping tube. Fig. 31 is a rear view of the turret showing the retarding device for the cans. Fig. 32 is a sectional view and elevation of a portion of the frame and tamping tube and elevator parts for the carbon holder, the upper end of the latter being shown as engaged with the catch and trip levers, as hereinafter described, and Fig. 33 is an elevation of said parts looking from the rear of the machine. Fig. 34 is a side elevation of the clutch device for the flour feed mechanism. Fig. 35 is a view centrally of the machine on the line of the tamping tube, showing the valve operating connection with said tube, part of the governor, and the carbon feed chute. Fig. 35[a] is a cross section on line *a—a*, Fig. 35, showing the transfer member and guard fingers in plan. Figs. 36 to 41 are views illustrating various positions of the valve during tamping operations. Thus, Figs. 36 and 37, show the valve, piston, and valve connections, in their normal position of rest, with the valve slightly open to hold the tamping tube up. Figs. 38 and 39, show the same parts in full and dotted lines in two different positions, the full lines illustrating the relative position of the parts when the valve is fully opened for forcing the piston down, and the dotted lines illustrating the shifted relation with the valve open to cushion the piston and tube at the end of the down stroke. Figs. 40 and 41 are diagrams wherein the full lines serve to illustrate the position of the valve parts when the piston and tamping tube are down and the valve fully open to admit steam to raise the tamping tube, and the dotted lines show the changed position of the parts when the valve is shifted to admit steam to cushion the piston at the end of its up stroke. Fig. 41[a] is a detail view of the valve arm connections in extreme raised position and corresponding to full lines Fig. 40. Fig. 42 is a side elevation of the governor in its rest position. Fig. 43 is a similar view with the governor lowered to its working position. Fig. 44 is a front view of the governor as seen in Fig. 43. Fig. 45 is a side view of the governor partly raised as when engaged by the roller on the tamping tube, and preliminary to being thrown out of engagement therewith.

My main object is to provide a machine adapted to automatically produce electrical dry batteries, and wherein the cans, carbons, and active material are fed from a fixed source of supply, and feeding and filling operations are mechanically controlled. Sub-divided, the machine embodies, first, means for feeding, holding, and discharging the cans; second, means for delivering the carbons to the cans; third, means for charging the cans with the active material; fourth, means for tamping the charges within the cans; and fifth, means for automatically controlling the operations of all the foregoing means, whereby the successive steps of feeding, filling, tamping and discharging may proceed in a continuous manner to produce perfect batteries of uniform standard.

The battery is shown in detail in Figs. 1 to 6 inclusive, and consists of a zinc cell —2— having an inner lining 3 of pulp board or other suitable material, a centrally arranged carbon electrode —4—, and the active material —5— which is in the form of a wet flour solidly packed in place. The can, so-called, as it comes to the machine consists of cell —2— and lining —3— with the upper end —6— of the lining extending beyond the mouth of the cell. This extension is spread or flared by the machine to facilitate filling operations and then when the battery is filled to the required height this lining is pressed inward to cover the flour. However, this last is not done by the machine but is a hand operation, as is final sealing by pitch 7, and the placing of terminal —8— upon the cell. Briefly, the battery is discharged from the machine in the form shown in Fig. 4, and the machine simply places carbon —4— in the can and packs the latter with flour. The flour is fed in a moist state and by successive charges, each charge being tamped into place. Different grades of flour, different degrees of compression, or different amounts of flour to each charge, produce batteries of different qualities. Uniform charges and uniform compression of each charge, step by step, produce the most efficient batteries. My machine is constructed to operate with this latter end in view.

Skeletonizing the machine reveals a main frame A to support all the parts, a rotatable turret B for the cans, a vertically movable holder C for the carbons, a pivoted feed hopper D for the flour, a reciprocable steam operated tube E for tamping the flour, and a governor or controlling device F for the said operating parts. Power for the machine is independently applied at three separated points by main power shaft G having pulley *g*, a cam shaft H having pulley *h*, and a sprocket wheel shaft I having pulley *i*, all of which rotate continuously, but at varying speeds.

Tamping tube E has direct connection at its upper end with a piston J arranged within steam cylinder K at the top of frame A, and is separately controllable for variable movement by slide valve L. This valve is controlled in turn by governor F, and when the machine is once started, tamping proceeds automatically until each can is completely filled. Starting of the machine is accomplished by lever M which unlocks set relations of certain parts hereinafter detailed. Stopping of the machine is also determined by this lever, but not until the tamping operations within a can are finished. Stopping of tamping operations for each can is automatically brought about by governor F, but feeding, filling and discharging operations for successive cans proceed continuously until stopped by lever M. The empty cans are stored within an inclined tray N at the side of and to the rear of the machine, see Fig. 10, and are fed by gravity therefrom. The carbons are also fed to the machine by gravity from inclined trough O, and the flour is contained in a bin P, from which it is fed in bulk by hand to feed box Q from whence it is carried to hopper D by conveyers R.

Now detailing the machine, and beginning with the means for feeding, holding and discharging the cans, reference is had to Figs. 7 to 19. Thus in Fig. 10, it will be seen that the bottom can 2 in tray N rests against a pair of inclined fingers —10— free to swing on rock shaft —11— having fixed arms 12. A coiled spring 12′ engaged with shaft —11— normally tends to carry arms —12— against the cans, but is prevented from so doing by a cord —13— connected with one of said arms and with movable cross head —14— (see Fig. 16) when said cross head is at the limit of its outward stroke. However, at each forward movement of said cross head, arms —12— swing inward in the path of the cans, and projections —15— on said arms engage gravity fingers —10— and lift the same free from the end can, thereby permitting this can to roll down into engagement with fixed arms —12—, the other cans following in order (see Fig. 11). Now upon a return or back stroke of cross-head 14, arms —12— are lifted and the end can rolls upon can rest —16— axially in line with head —17— of reciprocable plunger —18— on cross-head —14—. At the same time, fingers —10— engage the next can in line to check its descent until the same movements are repeated. Thus, each return movement of cross-head —14— feeds a can upon rest —16—, and then upon each forward movement thereof, plunger head —17— enters the can and forces it forward into one of the divided holders —19— upon turret B, the axis of which is on the same horizontal plane as plunger —18— (see Fig. 15). Turret B comprises radially armed heads 20 splined upon horizontal cross shaft —21— of the machine, and having channel irons —22— connecting the arms between said heads to provide supports for four radially disposed can holders —19— arranged equally distant from each other. Each holder —19— is divided longitudinally into two equal parts, one being rigidly secured to the channel irons —22— and the other slidably mounted thereon in respect to its other half (see Fig. 18). The object of this movable relationship is to permit free introduction of the cans into the holders and free discharge therefrom when in their respective receiving and discharging positions, and as determined by rotation of turret B. A further object is to clamp the cans tightly when in their upright position during filling and tamping operations. Therefore, the movable half —19′— of each holder is connected by a link —23— to one end of a curved actuating lever —24—, one for each holder. This lever is pivoted between its ends upon side lugs on head —20—, and is adapted to be engaged at both ends, but successively, by a roller 25 on main frame A, (see Fig. 16). Thus, as turret B is rotated step by step as hereinafter described, roller 25 engages the advancing end of lever —24— and forces it and its respective movable holder part —19′— inward to clamp the can and holds it in this position until turret B is again revolved. The inward thrust of lever —24— at one end causes a corresponding outward movement at its other end, and consequently, when turret B is again revolved, roller 25 will again engage the same lever —24— and thereby open the holder and release the can so that it may be freely discharged when it comes to a horizontal position with the turret at rest. This open relation of the holder parts is sustained during the entire revolution of turret B excepting when roller —25— effects closure thereof to clamp the can in upright position for filling and tamping operations.

The means for imparting intermittent movement to the turret and can plunger is shown in Figs. 7 to 15, and comprise a crank wheel —26— on main power shaft G, a connecting rod —27—, a rock arm —28— sleeved between its ends upon shaft —21—, a dog —29— pivoted to the upper end of arm —28—, and ratchet wheel —30— fixed on shaft —21— and adapted to be engaged by said dog to rotate turret B at stated intervals. A link —31— connects the lower end of rock arm —28— with the upper end of an oscillatory arm —32— free to rotate on a cross shaft —35—, and a pawl —32a— pivoted upon arm —32— is adapted to engage a shouldered projection 33a on another arm —33— fixed to shaft —35—. In fact, there are two arms —33— on shaft —35—, one at each side of frame A, and each of said arms has a link —34— connected with cross head —14— whereby reciprocal movement is imparted to plunger —18—. Turret B must necessarily be at rest when plunger —18— is in action and there is also a period during filling and tamping operations when both the plunger and turret are stationary. In contradistinction, arms —28— and —32— are in continuous play, because main power shaft G revolves constantly although relatively slower than the other power shafts of the machine. Two distinct lines of throw out means are therefore provided to withhold dog 29 and pawl —32a— from power engagement with ratchet wheel —30— and arm —33—, respectively, during rest periods of turret B and plunger —18—. The first, relating to wheel —30—, consists of a throw-out lever —127—

pivoted upon the side of main frame A near the periphery of wheel —30— and having a side lug —128— adapted to project in the path of tail —129— of dog —29—, this being its normal station so as to withhold said dog from the tooth or shoulder on wheel —30— during oscillatory movements of arm —28—. But upon retirement of lever —127—, dog —29— will drop upon the peripheral face of wheel —30— and engage its tooth or shoulder upon forward movement of arm —28—, and thereby rotate turret B, (see Fig. 12). This retirement is effected by link rod —130— engaged with lever —127— and with crank arm —131— which is fixed upon the end of controller shaft —126—, see Fig. 14ª. A contracting spring —132— attached to main frame A and crank arm —131—, as well as a counterweighted arm —133—, serve to rotate shaft —126— in one direction to throw lever —127— to the rear when hook member —134— is lifted free from a shouldered collar —135— on shaft —126—, and when said shaft is otherwise free to rotate as will appear later. Hook member —134— is free to rotate on cross shaft —123— on main frame A, and lever M has link connections *m* engaged with operating arm —136— of hook member —134—. In brief, when lever M is actuated, hook —134— is disengaged from collar —135—, and lever —127— is automatically swung out of the path of dog —29— to permit engagement thereof with ratchet wheel —30—, assuming that shaft —126— is set free to rotate as in original starting operations. Then turret B is rotated a quarter turn, and in this action one of the four rollers —137— on the inside of wheel —30— presses back the depending finger of a bell crank —63— pivotally mounted upon stud —62— on main frame A, and therethrough operates sundry parts in the second line of throwout connections for causing an immediate reciprocal movement of plunger 18 upon the return or idle stroke of dog —29— and after turret B has come to rest. This second line of connections consists of a vertical link —64— connecting bell crank —63— with one arm of a tilting member —65— secured to cross shaft —66—. A second link —38′— extends from member —65— to a second bell crank —139— at the base of the machine, and a third link —140— extends therefrom to a detent member —141— rotatably mounted on stud —142— and adapted to project forward in the path of tail —143— of pawl —32ª— on arm —32—, and thereby withhold said pawl from locking engagement with projection —33ª— on arm —33— during oscillatory movement of arm 32, excepting when bell crank —63— is operated. Thus, while dog —29— is in action and carrying turret B around, bell crank —63— and its connected parts are being operated to lower detent member —141— beneath tail —143— on pawl —32ª— and thereby permit locking engagement of said pawl with projection —33ª— when the movement of arm —32— is reversed. Then arm —33— is carried forward and its shaft —35— rotated, thereby moving cross head —14— and plunger —18— forward by arms —33— and links —34— (see Fig. 13). Preliminary to this movement however, roller —137— on wheel —30— has ridden free of bell crank —63—, leaving it and its connected parts temporarily shifted from their original positions. Then at the end of the forward movement of arm —33—, said arm engages a roller —144— on the upper end of the vertical arm of lower bell crank —139— and restores the parts connected therewith to their original positions. That is, detent member —141— is raised, tilting member —65— is returned to a horizontal position, and bell crank —63— is again placed in line for engagement by a roller —137— on wheel —30—. Suitable stops, such as fixed part —145— for bell crank —63— and spring controlled stop arm —146— for detent member —141— limit the movements of said bell cranks and members. A coiled spring —147— connected with tilting member —65— serves to hold said member and the parts connected therewith in their reversely shifted positions. Now proceeding, the next return or back stroke of arm —32— will force arm —33— back by engaging side lug 33ᶜ on said arm and thereby retire cross head —14— and plunger —18— to its normal station of rest, and in so doing tail —143— on pawl —32ª— contacts with the now raised detent member —141— and disengages the pawl from projection —33ª— and withholds it from working engagement therewith during successive strokes thereafter, or until such time as bell crank —63— is again actuated by rotation of wheel —30— and consequent rotation of turret B. To guard against rotation of turret B when plunger —18— is within the turret, arm 33 is provided with a pivoted finger —33ᵇ— which is adapted to engage the tail of dog —29— and withhold it from wheel —30— as the plunger reaches the limit of its forward stroke, see Fig. 14.

Plunger 18 is in part tubular and of slightly less diameter than the tubular lining 3 of can —2— to permit head —17— to enter therein and engage the bottom of the can and thereby carry it forward into holder —19—. Head —17— is slidably mounted within plunger —18—, and spring —36— within said plunger, see Fig. 15, normally presses said head outward to its limit of movement as defined by pin —37—. This permits plunger —18— to have a slight advance movement in respect to the can after it is seated within holder —19—, and therethrough causes spreading of the mouth of lining —3— by the tapered collar —38— adjustably fixed on plunger —18—. Thus, in Fig. 18 can —2— is shown as it is related to the plunger and its parts when entering holder —19—, and in Fig. 19 plunger —18— is shown at the full limit of its stroke with head —17— compressed and collar —38— in spreading engagement with lining —3—.

The can detent.—Upon initial return stroke of the plunger, spring pressed head —17— holds can —2— seated until disengagement is effected between spreader —38— and lining —3—, and to further safeguard operations and prevent can —2— from being withdrawn by suction or friction between the parts, I provide a detaining member —39—, see Fig. 31, which comes momentarily into action at this time. This member 39 consists of a lever pivoted on a stationary hanger —40— bolted to a part of main frame A and this lever has a pointed end —41— adapted to be thrown into engagement with the can. An arm —42— on shaft —35— has a flexible spring connection —43— with the short end of lever —39— whereby engagement of point —41— with can —2— is brought about while the can is seated within holder —19—. Spring —44— reverses the movement of detaining lever —39— upon relaxation of pull through spring connection —43— during the return stroke of plunger —18—.

The can rest.—As hereinbefore stated, can —2— is supported upon a rest member —16— at the beginning of the forward stroke of the plunger, and necessarily, said can must be axially in line with the plunger to permit the plunger to enter the can. Rest —16— is therefore constructed and located in respect to the plunger with this end in view, but as spreader —38— is of greater diameter than can —2— and plunger —18—, and must pass the rest member both upon its forward and return stroke, I mount said rest —16— upon a counterbalanced arm —45— on cross shaft —46—, and provide a stop —47— on said arm which is adapted to bear against shaft —35—, see Fig. 15. Thus, cans —2— are held in the right relation to the plunger, but the rest member is depressible to permit spreader —38— to pass, its tapering end being adapted to engage the flaring portion —48— of the rest in its forward movement.

The can discharging device.—The forward movement of plunger —18— not only feeds an empty can to turret B but also discharges a filled can. The device for this purpose is simple and will now be briefly described, although the discharging operation is presumably the last step. Thus, referring to Figs. 18 and 19 the can holders —19— are diametrically paired and axially in line in turret B, and a rod —49— for each pair of holders is slidably sleeved in fixed head —20— and shaft —21—. The length of the rod is approximately equal to the distance between the bottom seat of one holder and the mouth of the opposite holder, whereby when an empty can is introduced at one side of the turret, the filled can at the other side will be discharged by rod —49—, as shown.

The carbon feeding device.—One of the next steps in the operation of the machine relates to the feeding of the so-called carbons —4— to the cans. This occurs when turret B is at rest with a can —2— clamped in its uppermost holder —19— in line with and beneath carbon holder C. Assuming the latter to be in its most elevated position, see Fig. 20, the carbons —4— are fed singly and successively from a horizontal position in trough O to a vertical position beneath carbon holder C within tamping tube E, see Figs. 20 to 24. In detail, this delivery means comprises an oscillatory member —50— adapted to act as a shutter at the lower discharge end of trough O, and whereby a single carbon —4— is permitted to roll upon its flanged ledge —51— when the same is lowered to a parallel plane with the bottom end of the trough, see Fig. 22. A spring controlled lever —52— is pivoted on the side wall of the trough and has an overhanging lip —53— adapted to check the carbons in their collective descent to oscillating member —50—. A depending wing —51′— of member —50— closes the end of trough O when said member is raised to bring the carbon resting thereon to an inclined position, relatively as seen in Fig. 23, or in other words to its gravity discharge position. This movement is brought about at the proper time by link —54— having slidable stop engagement with arm —55— of member —50—, said link being operatively connected with arm —56— splined on upper governor shaft F′. Rotation of this shaft to lift member —50— occurs when tamping tube E has made its last up stroke and governor F stops tamping operations, and as hereinafter more specifically described.

The carbon transfer member.—When turret B is rotated, shaft 66 is also rotated by tilting member —65— and bell crank —63— hereinbefore described, and a transfer member —57— on shaft —66— is thereby thrown in the path of carbon —4— on its way to carbon holder C. Thus, as carbon —4— is discharged from oscillatory member —50—, it drops bottom-end foremost into chute —58—, see Fig. 35, and down upon shoulder —59— of transfer member —57— which is now at rest in an outwardly inclined position to receive it. Now assuming that a carbon —4— is at rest upon transfer member —57—, a reverse movement of rock shaft —66— as hereinbefore described will throw member 57 forward to bring carbon —4— in a vertical position centrally within tamping tube E, a longitudinal slot —67— being provided for this purpose in said tube and in the inner tube —68— which forms a part of the main tamping tube. This position of the transfer member and carbon thereon is best seen in Fig. 24, which shows carbon holder C in its extreme upper rest position with its lower end about an inch above the threaded stem —9— of carbon —4—. A pair of guiding fingers or guards —58ᵃ— having a limited lateral movement as controlled by coiled spring —58ᵇ— on rotatable supporting stem —58ᶜ—, serve to prevent displacement of carbons —4— during forward and return movement of transfer member —57—.

The carbon holder.—The foregoing operations are immediately followed by an initial drop of holder C to gripping relation with carbon —4— while the latter is vertically supported by member —57—. To this end, holder C is temporarily suspended by a pivoted catch —70— secured to bracket —71—on cross bar *a* of main frame A, see Figs. 24, 32 and 33. A laterally projecting pin —72— in right angled head —73— at the top of holder C is adapted to engage rounded arm —74— of catch —70— on the upward movement of holder C, and in so doing the catch is pressed back until pin —72— passes shoulder —75— thereon. Catch —70— is then returned to its normal position by its spring —70′— with pin —72— adapted to rest upon shoulder —75—. Release of pin —72— from shoulder —75— is effected by rod —76— having collar —77— adapted to engage arm —78— of catch —70— when an upward movement of rods —76— is obtained by rotation of cross shaft —123—, said rod being attached at its lower end to fixed arm —150— on shaft —123—. Rotation of shaft —123— to raise arm —150— is obtained by a bell crank —151— pivotally mounted upon a stud —152— on main frame A, one arm of said bell crank lying below bell crank —63— and in position to be engaged by each successive roller —137— on wheel —30— immediately following each operation of bell crank —63— by said rollers. In brief, when turret B is rotated, bell crank —151— is actuated, thereby raising a link —153— connected therewith and with an arm 154 on shaft 123, thus rotating said shaft to release catch —70— and permit carbon holder C to drop into gripping relation with carbon —4— as it rests on member —57—.

The carbon gripping means within tubular holder C consists of a pivoted catch —80— having a pointed projection —81— adapted to engage the threaded stem —9— of carbon —4— (see **Fig. 27**) **when said** stem enters the central bore —82— in the lower end of holder C, a tapering mouth facilitating entrance thereto. Catch —80— is pivoted at its lower end and adapted to hold carbon —4— suspended from holder C when transfer member —57— is retired. When this occurs, both carbon —4— and its holder C drop by gravity to deliver the carbon into can —2—, see Fig. 25. However, holder C is controlled in its descent by a suction device comprising a tube —83— mounted in a vertical position on main frame A and which has a valved air intake —84— at its bottom and a gravity plunger or piston —85— adapted to travel therein and connected with bracket *c* of holder C by a cord —86— traveling over sheaves —87—, see Fig. 10. The speed of down travel of carbon holder C is regulated by opening or closing valved intake —84—, more or less. Carbon —4— is delivered with its bottom end above and out of contact with the bottom of can 2, and stopping of holder C is accomplished by pin or lug —88— which projects from right angled head —73— directly opposite pin —72— already described. This occurs when pin or lug —88— on its down travel strikes projecting lip —89— on vertically movable post —90— which is mounted to slide in ears —91— on a supplementary part —*a′*— of cross bar a^2 on main frame A, see Figs. 29 and 30. To cushion the blow, post —90— is provided with a compression spring —92— which rests upon upper ear —91—, and a nut —93— adjustably threaded upon said post above said spring supports post —90— for yielding movement. It follows also that adjustment of nut —93—, higher or lower, effects a corresponding adjustment or change of relation between carbon —4— and can —2—. In other words, carbon —4— may be delivered at predetermined elevations in the can. When lowered, holder C and carbon —4— are locked and held substantially stationary on a spring cushioned support until filling and tamping operations are finished, as hereinafter described.

The means for locking the holder in lowered position consists of a pawl —94— pivotally mounted on post —90— and having a shoulder —95—, see Fig. 29, adapted to engage pin or lug —88— on holder C. A nut —96— on the bottom end of post —90— is adapted to engage lower ear —91— on stationary part *a′* to prevent upward movement of said post, and a coiled spring —97— connected with pawl —94— normally pulls the same outward to effect locking engagement with lug —88—. When tamping operations are finished, release of pawl —94— is obtained by a roller —99— on extension —100— of suspensory rod —101— which is attached to governor arm —102— on upper governor shaft F′, said roller —99— riding over inclined edge —103— of pawl —94— and pressing it back free from pin —88—. Governor F which actuates these parts is responsive to the movements of tamping tube E, and after the last charge is tamped in the can, the said governor operates to stop tamping tube E while in raised position. Assuming that this has occurred, carbon holder C is also raised into locking engagement with catch —70—, but first of all, unlocking of catch —80— to release carbon —4— must be brought about. The means for this purpose is shown in Figs. 26 and 27, and comprises a rod —105— linked to the free end of catch —80— and projected upward through holder C to engage with tilting plate —106— resting upon the top end of the holder and its right angled head —73—. A compression spring —107— resting upon a collar —108— on rod —105— and within holder C at its top, see Fig. 25, holds plate —106— seated and catch —80— in locking position. Thus it will be noted that if plate —106— is lifted, catch —80— will also be lifted out of locking engagement with stem —9— of carbon —4—, and this is accomplished by extension —100— on suspensory rod —101— of governor arm —102— at the same time that roller 99 releases pawl —94— as described. Again, referring to Figs. 26 and 27, plate —106— rests freely upon holder head —73— with one end sleeved loosely over a vertical pin —109—, and the fulcrum of its tilting movement is at this point. A side lug —110— at the other end of plate —106— is stationed directly in the path of extension —100—, see Fig. 29, and when engaged thereby, said plate is lifted to unlock latch —80—. This movement is further utilized to throw a dog —111— into traveling chain —112— to bodily elevate carbon holder C. Dog —111— is a fixed part of a trip member —113—pivotally mounted upon pin —114— at the bifurcated end of right angled head —73— of holder C through which chain —112— is sleeved and adapted to travel. Trip member —113— is of irregular shape and bent to rest at its free end upon pin —72— at the side of head —73—. A pair of fingers —115— riveted to member —113— extend over head —73— and freely engage plate —106—, whereby when said plate is lifted, trip member —113— is also raised at its free end and its dog —111— caused to enter and engage the links of chain —112—. This elevates holder C, the endless chain being continuously driven by sprocket gear —116— on power shaft I. An idler sprocket —117— is also employed at a lower elevation on the machine, chain —112— being stretched between said sprockets and arranged vertically and parallel with carbon holder C. A second idler —118— is mounted on cross bar —*a*— of main frame A to maintain this parallel arrangement.

During up travel of carbon holder C, trip member —113— sustains the upwardly inclined position, relatively as shown by dotted lines in Fig. 27, because of the locked engagement of its dog —111— with chain —112—. Therefore, when carbon holder C reaches a predetermined elevation and after pin —72— has passed into locking engagement with catch —70—, said trip member —113— will strike the bottom of cross bar *a* of the main frame and stop holder C by prompt withdrawal of dog —111— from traveling chain —112—. The carbon holder then drops and rests in suspended position upon catch —70— ready for a repetition of the operations as outlined.

Feeding of the first charge of flour from feed box Q is coincident with the first delivery of a carbon —4— to the can, or may precede it slightly, and the means for delivering predetermined charges to each can at successive intervals, see Figs. 15 and 17, is operatively dependent upon rotation of shaft —35— which operates plunger —18— after turret B has come to rest. At each forward movement of the plunger, governor F is lowered from a raised position of rest to an operative position and thereby not only lowers hopper D into close discharging position with the can to be filled, but also starts the feed of the flour and tamping operations as well. The connecting means between governor F and the operating parts for plunger —18—, whereby said governor is lowered, comprise a link —155— attached to one of the plunger operating arms —33— on shaft —35—, see Fig. 9. This link is slidably connected for limited play with arm —156— on the end of lower governor shaft F^2. When shaft —35— is rotated, link —155— actuates arm —156— and rotates lower governor shaft F^2, thereby causing working engagement between dog —157— on arm —158— fixed on said shaft, and a shouldered collar —159— free to rotate thereon and having an integral arm —160— to which the governor parts are pivotally attached, and which governor parts will be described later. Suffice to say when shaft F^2 is rotated, governor F is lowered and its arm —160— lowers hopper D, the same being connected therewith by bar —161—. The same movement throws the flour feed mechanism into action. To this end, upper governor arm —162— on upper governor shaft F′ is lowered at the same time and by the same mechanism, as will be seen later thereby depressing link rod —163— attached to arm —102— and which rod connects with one end of lever —164— rotatably mounted between its ends on cross shaft —123— and having a roller —165— at its opposite end adapted to have riding engagement with the lower portion of reciprocable eccentric rod —166— of the eccentric gearing —167— on power shaft H, see Fig. 34. The lower end of rod —166— has an L shaped slot —168— wherein a roller —169— on the short arm of bell crank —170— is adapted to ride without effect when roller —165— on lever —164— is engaged therewith, but when governor link rod —163— is depressed, lever —164— lifts roller —165— free from eccentric rod 166, and the roller —169— on the bell crank will enter the lateral portion of the L slot —168—, and spring 168′ will cause locking or clutching engagement between the parts, whereby each reciprocal movement of eccentric rod —166— will rock bell crank —170— correspondingly. This rock movement of the bell crank is utilized for dual purposes, both having to do with the feed of the flour. Thus, the first, feeds the flour from feed box Q to hopper D, and the second, feeds a charge thus carried forward from the hopper to the central opening *d* therein and packs it about carbon holder C, which is now presumably in lowered position. Separate lines of mechanism are brought into play for this double feed, the first consisting of a horizontally arranged rod —170′— connected at one end with the upper end of the vertical and longer arm of bell crank —170— and pivotally engaged at its other end with oscillatory member —171— having a dog —172— adapted to engage ratchet wheel —173— on conveyer shaft —174— at the rear of the machine, see Figs. 15 and 17. Upon each forward stroke of the dog —172—, ratchet wheel —173— and its shaft —174— is rotated a predetermined distance, thereby causing conveyer belts R which are carried by sheaves —175— on shaft —174 to move correspondingly. Belts R are arranged horizontally, a pair being used, one at either side of the center of feed box Q to discharge equal quantities of flour into hopper D at each side of holder C where idlers —176— serve to support the belts for discharge purposes. Thus the belts are endless and run between sheaves —175— and idlers —176— with the upper stretch passing through suitable grooves —177— in the bottom of box Q. A series of cross pieces —178— are fastened transversely on the outer face of the belts at equal distances apart and these are of the same height and pass through end opening in the end walls of the box. The outlet openings —179— each have a slide gate —180— vertically arranged thereat to determine the depth of flour to be carried away by the belts and the amount of each charge to be delivered into hopper D.

The charges of flour fall into hopper D directly in the path of a pair of laterally movable push plates —181— slidably mounted upon bottom 183 at either side of central opening *d*, see Fig. 17. Push plates —181— are reciprocable and have curved end edges conforming to opening *d* and arranged opposite thereto and adapted to engage the charges to push the same into opening *d*, or rather to pack the charge about holder C, the flour being more or less wet and tending to pack together. Now, as tamping tube E descends, this ring like packing of flour is forced down into can —2— and tamped therein by the same stroke as well as by successive strokes.

Push plates —181— are operated by the second line of mechanism referred to, which consists of a pair of crank arms —182— horizontally arranged upon bottom —183— of hopper D and pivoted thereon at the rear thereof. Each push-plate —181— is respectively linked to the forwardly projecting arm of each crank —182—, the other arms —184— of said cranks extending toward each other and having a slot and pin connection —185—, whereby when one crank is operated, both will respond to move push plates —181— toward each other or away from each other. A link rod —186— connects one of said crank arms —184— with the vertical arm of bell crank —170— to bring about this result during rock movements thereof by eccentric rod —166—.

Hopper D is pivotally mounted upon trunnions or bolts —187— on main frame A, see Fig. 17, and has considerable weight. Therefore, when hopper D is lowered by governor connecting bar —161—, the front projection —188— thereon is adapted to depress an arm —189— fixed on controller shaft —126—, thereby rotating said shaft to what may be termed a set position. A catch lever —124— sleeved on shaft —123— will engage the teeth of ratchet segment —125— at this time to prevent a return rotation of shaft 126 under the combined pull of spring —132— and weighted arm —133— when hopper D is lifted by governor F.

Catch lever —124— is free upon shaft —123—, and its release from segment —125— is automatically brought about by final uplift of carbon holder C when pin —88— on head —73— engages and lifts one end of lever —120— pivotally mounted on cross bar *a*, see Figs. 32 and 33. When this occurs, the opposite end of lever —120— depresses rod —121— which in turn depresses end —122— of catch lever —124— to which it is pivotally attached. In this connection it will be remembered that shaft —126— controls working engagement of dog —29— with wheel —30— to rotate turret B, and has a shouldered collar —135— thereon adapted to be engaged by hook member —134— for this purpose. But if the machine is to operate continuously, hook member —134— is kept in unlocked and raised position by setting lever M. In that event, reliance is solely placed upon ratchet segment —125— on shaft —126— to withhold operations of turret B until feeding and tamping operations are finished. Lowering of governor F also starts tamping operations by reversing slide valve L in steam chest —190— of cylinder K, thereby admitting steam above the piston and exhausting it from below and forcing the piston down for its first stroke. Thus, referring to Figs. 36 to 41, slide valve L is shown as of the balanced type adapted to control intake and exhaust of steam through suitable ducts and ports —191—, —192— and —193—, respectively, in cylinder K. A reciprocable movement of valve L is obtained by eccentric gearing —194— on power shaft H, said gearing comprising eccentric wheel —195—, strap —196— and rod —197—. The upper end of rod —197— is slidably and pivotally engaged with one end of a balance lever —198— connected with the free end of a counterweighted arm —199— which is adapted to have a free but limited rock movement on shaft I. But such rock movement is not imparted to arm —199— unless balance lever —198— and eccentric rod —197— are locked together by a cam member —200— pivotally mounted upon the upper end of rod —197—. Locking of said parts is effected by lowering governor F, the connections therewith comprising connecting rod —201— adjustably engaged with the arm of cam member —200— and pivotally connected to rock member —202— free to rotate on shaft H. Rock member —202— is the equivalent of a bell crank and has a portion beneath shaft H pivotally connected by bar —203— with arm —56— of governor F. Thus, when governor F is lowered, cam member —200— is thrown into locking engagement with roller —204— on balance lever —198—, the shouldered portion —205— on said member forcing said roller to the lower end of the slot, thereby preventing independent slidable movement between balance lever —198— and rod —197—, see Figs. 38 and 40.

Now returning to the valve connections, arm —199— is sleeved freely upon shaft I, and is provided with a weight —206— and a spring —207— to normally throw the free end of the arm upward, thereby holding valve L in raised position by reason of its rod 213 and pivotal engagement therewith in slot —208— located substantially midway between shaft I and stud —209— on the end of arm —199—. This stud —209— provides a rotatable engagement for balance lever —198— and also supports a sleeve member 210 which is mounted to slide freely within fixed limits on tube —211— as determined by washers —212— above and below, see Fig. 36. Tube —211— is in turn mounted to slide on a stem —214— on main frame A. A coiled spring —215— sleeved over said stem bears upon upper slidable washer —212—, and this device as a whole provides a cushioning stop for arm —198— when said arm is raised either by counter weight —206— or by eccentric rod —197—. Moreover, spring —215— permits valve L to be lifted to relatively different working positions during positive operations thereof by eccentric rod —197—, see Fig. 40. A nut —216— on the lower threaded end of stem —214— provides for adjustment of stop tube —211— on the stem: also a varying tension of spring —215—, and a corresponding adjustment of valve L relative to the steam ports. In this manner, set relations may be established to admit more or less steam into the cylinder at predetermined times. However, this set adjustment merely subserves automatic adjustments for valve L, it being essential to provide a varying throw for said valve to produce different steam cushioning effects during tamping operations. To understand this function of the parts, it is necessary to bear in mind that the battery can is filled by successive charges; that each stroke of tamping tube E and piston J is thereby successively shortened, and that necessarily the momentum of the tamping tube and piston is not as great at the close of tamping operations as at the beginning when it has its maximum travel. The weight of the tube and piston is a factor to be considered as well as the speed of operations, and it is desirable that the maximum cushioning effects be obtained at the start of operations, and that less steam shall be admitted below the piston to properly cushion the tamping blow during the latter part of tamping operations than at the beginning. The end sought after is to produce uniform tamping of course, but it must also be remembered that this steam controlled tamping device has no fly wheel to balance its operations and that cushioning by steam must be relied upon at opposite end strokes of the piston, otherwise injury to the device as a whole would result.

The means for providing a variable throw of valve L is obtained by indirect connections with the tamping tube itself. Thus, balance lever —198— provides a form of toggle or jointed connection between valve arm —199— and eccentric rod —197— with its pivotal joints at stud —209— centrally between its ends. The inner end —218— is pivotally and adjustably connected with what is hereinafter termed the cushion rod —219—. The lower end of this rod is pivotally connected with a short crank arm —220— adjustably fixed upon cross shaft —221— opposite governor F, and a curved arm —222— fixed on shaft —221— has a link connection —223— with tamping tube E, see Fig. 35.

Now assuming that eccentric rod —197— and the outer end of balance lever —198— are locked together, said parts will jointly rise and fall without any variation in stroke, being driven by eccentric gearing —194— on power shaft H. This shaft revolves continuously and its speed determines the number of tamping blows per minute. But because of the jointed connection between rod —197— and arm —199—, a fulcrum support for balance lever —198— is necessary to communicate a like oscillatory movement to arm —199—, and this is provided for by rod —219—. Thus, every movement imparted to balance lever —198— by eccentric rod —197— is in turn carried to arm —199— but in lesser degree. And, it follows that any change in the position of the fulcrum for balance lever —198— will effect the working position of arm —199— and also valve L. With this end in view, cushioning rod —219— is raised when the tamping tube descends, and is lowered when the said tube rises, by the connections leading to the tamping tube itself. This movement of rod —219— is not very great, and is obtained by an arc movement of approximately sixty degrees of crank arm —220— during the full stroke of tamping tube E. But the stroke of said tube is shortened step by step as the can is filled by successive charges of flour, and this necessarily shortens the stroke of crank arm —220— and cushioning rod —219—, thereby affecting valve L in like degree. Crank arm —220— is preferably set to bring the dead centers of movement thereof and of rod —219— substantially in line when the tamping tube is at the extreme limit of its down stroke. Changes in cushioning effects are thereby not as extreme during the first tamping blows as toward the end when the battery is full, because the pivotal connection between cushioning-rod —219— and crank arm —220— has more of a lateral or horizontal play than down and up play at this time, being near the dead center lines of movement. In other words, cushioning rod —219— has approximately the same amount of end play during the first part of tamping operations, but a varying shortening stroke thereafter, and whereby valve L is likewise affected to admit steam into the cylinder for cushioning purposes in varying degrees, first, in relatively like amounts for maximum cushioning effects, and thereafter, in variable decreasing amounts for lessening cushioning effects.

Recapitulating in part and describing tamping operations only, it follows that when governor F is lowered, arm —56— on upper governor shaft F′ is actuated to throw cam member —200— into clutching action with eccentric rod —197— through its connecting parts as described. A downward stroke of rod —197— immediately lowers arm —199—, balance lever —198— forcing said arm down by reason of its support upon cushion rod —219—. Piston J and tube E are now quickly forced to descend, valve L having been lowered to admit live steam into the top of cylinder and to exhaust from below. The piston and its tube E make their maximum stroke at this stage of the proceedings and tamp the first charge of flour into the can, but before the piston reaches the end of its down stroke, valve L is timed to open the live steam port —192— leading to the lower end of cylinder K and thereby admits sufficient steam beneath piston J to cushion the blow on the head of the cylinder and on the material being tamped. The initial upward or reverse movement of valve L to bring this cushioning result about, is obtained by link connection —223—, which depresses curved arm —222—by reason of the descent of tamping tube E to which it is connected, and because short arm —220— on shaft —221— is raised in this proceeding, thereby lifting cushion rod —219— and end —218— of balance lever —198— and therethrough lifting arm —199— and valve L. Eccentric wheel —195— also comes into play to lift rod —197— and arm —199— and thereby fully reverse valve L to drive it upward again by admitting more stem below, see full lines, Figs. 40 and 41. In this reverse or upward movement of piston L, tamping tube E lifts connecting link —223—, and lowers cushion rod —219— to lower end —218— of balance lever —198—, thereby lowering arm —199— and valve L for admission of live steam into the upper end of cylinder K before piston J reaches the limit of its upward stroke and cushioning the same to avoid shock to the machine, see dotted lines, Figs. 40 and 41. Eccentric gearing —194— then opens the valve additionally to impel the piston down again, see full lines Figs. 38 and 39. Reciprocal movements of tamping tube E now follow in rapid succession, each end movement of the piston being cushioned, and as the charges increase in number and are tamped, the down stroke of piston L and tube E is shortened to correspond to the increasing depths of flour in the can. To compress the charges equally and thereby obtain a uniformly packed battery from top to bottom, I adjust short arm 220 on shaft —221— so that cushion rod —219— will operate to open valve L to its greatest degree for cushioning purposes during initial filling and tamping operations when tamping tube E has its greatest travel and momentum. It is at this time that the weight and momentum of the tube and piston are at the maximum and must be largely offset. Otherwise the blow would be too great for the flour and the can. But, the cushioning effect at the beginning of operations is proportionately too great for later tamping operations when the momentum of the tube and piston is less by reason of their shortened strokes, and therefore, the amount of steam admitted beneath the piston is preferably gradually decreased for final cushioning purposes. and as hereinafter more specifically described. When the battery is completely filled and tamped, operations relating thereto, are automatically stopped by governor F.

The governor and its operations will be best understood by referring to Figs. 42 to 45. These views illustrate three different positions assumed by the governor parts. Thus, Fig. 42 shows the parts in their raised positions of rest, and this is the starting position, and the position maintained during rotative movements of turret B. A weight —225— on arm —226— rigidly affixed to rock member —202— on shaft H holds the governor in this position of rest, said arm and weight being in an inclined position and to one side of the vertical center of movement of said rock member, see Figs. 8 and 36. Dog —157— on arm —158— acts as a stop for these parts when in this position, see Fig. 42. Rock member —202— is connected by bar —203— to arm —56— on upper governor shaft F′, (see Fig. 36) and the connections leading from this shaft to shaft F^2 consist of sundry link and lever members adapted to have operative play with a roller —227— on tamping tube E when governor F is lowered. Thus, arm —162— on upper shaft F′ is linked for joint movement to arm —160— on lower shaft F^2 by an intermediate rod —228— having a flattened portion —229— upon which a right angled lift member —230— is pivotally mounted. Bolts —231— on rod portion —229— extend through curved slots —232— in member —230— and prevent lateral or side play of said member on rod —228—.

Lift member —230— is so-called because its vertical arm has a hook end —233— adapted to be engaged by roller —227— on tamping tube E at a definite point in its reciprocable travel, or more specifically speaking, when said tube has tamped the very last charge in the battery can and the governor is to be thrown out of action and into its position of rest. To this end, the vertical arm of lift member —230— lies substantially parallel with tube E and in such close working relation thereto that roller —227— has constant riding engagement with straight edges —234— and —234′— respectively, of said member when the governor is lowered. But when in its position of rest, lift member —230— is retired as seen in Fig. 42, a connecting rod —235— between arm —160— and the short arm —236— of said member serving to positively tilt the same rearwardly upon the maximum up movement of the governor parts. Thus it will be noted that rod —235— is slidably engaged with a rotatable eye —237— on arm —236— and that nuts —238— on the threaded end of said rod will limit the down play thereof in respect to arm —236—. It will also be observed that this rod —235— is pivotally engaged at its lower end with arm —160— between the pivotal connection of governor rod —228— at the outer end of said arm and shaft F^2, and that a differential end movement is thereby obtained wherewith lift member —230— is forcibly retired when up lift of arm —160— is brought about, rod —235— having less upward movement than governor rod —228— upon which lift member —230— is pivotally mounted. A coiled retracting spring —238′— connects short arm —236— of lift member —230— with the upper end of rod —228— and constantly tends to throw the lift member forward.

The working position of the governor is shown in Figs. 43 and 45. Now assuming that the governor parts are lowered into this working position, a detent —239— prevents outward movement of lift member —230— during a portion of the reciprocal movements of tamping tube E and especially when roller —227— in its up travel leaves lower straight edge —234— of the lift member and crosses the gap or hook space designated by numeral —240—. Detent —239— is therefore pivotally mounted upon the upper end of rod —228— and has a projecting portion —241— adapted to engage shouldered extension —242— of lift member —230— under tension of coiled spring —243— attached to said detent and rod. However, this locking engagement is but temporary during reciprocal movements of tamping tube E because detent —239— is further provided with a depending leg —244— of angular shape which bridges hook space —240— at the side of lift member —230— and which leg —244— is also engaged by roller —227— during its up travel to effect unlocking operations.

Governor operations.—The maximum travel of tamping tube roller —227— is approximately twelve inches, more or less, and hook space —240— lies intermediate the stopping points of the roller. In the down travel of the roller, straight edge —234′— of lift member —230— is first engaged. Leg —244— is also engaged thereby but without effect as the roller immediately engages straight edge —234— at a point below hook space —240—, thereby throwing lift member —230— back into locked relation with detent —239—, see Fig. 43. Now in the up travel of tamping tube E, roller —227— engages leg —244— and unlocks detent —239— from shouldered extension —242— of the lift member, but not before roller —227— has arrived opposite upper straight edge —234′— of the lift member thereby preventing outward throw thereof. Upper straight edge —234′— is parallel with but not on the same plane as lower straight edge —234—, being slightly retired in respect thereto, and when roller —227— engages said straight edge —234′— the detent portion —241— will not drop into locking engagement with the shouldered extension —242— of the lift member. But, it will be recalled that tamping tube E has a gradually shortening stroke due to filling operations. Therefore, when the can has been filled to the requisite depth, say five inches, the filling and tamping operations are automatically stopped. This occurs when the last tamping stroke of tube E carries roller —227— down directly opposite hook space —240— and no farther, thereby permitting lift member —230— to fly out to its maximum engaging position during the slight interval of rest of tube E at the end of its stroke and as reversal of the same is brought about. Now upon the up stroke of tube E, roller —227— carries lift member —230— with it, (see Fig. 45) thereby forcing arm —162— upward and also lifting arm —160—, or in other words, thereby raising the governor. It must be understood that when the governor is down as in Fig. 43, weight arm —226— stands at the opposite side of shaft F′ from that of the position of rest seen in Fig. 42, and thereby holds the parts in this relatively changed position, see Figs. 38 and 40. Now as the governor rises with tube E, weighted arm —226— passes the center of gravity and operates to bring about disconnection between roller —227— and lift member —230—. That is to say, balance weight —225— when shifted from one side of shaft F′ to the other throws the governor parts into the position of rest shown in Figs. 36 and 42, and rod —235— and its nuts —238— engage short arm —236— to rock lift member —230— on its pivot and thereby forcibly withdraw its hook end —233— from roller —227—.

When governor F is in rest position, or during upward movement thereof, detent —239— is engaged by a fixed projection —250— on the end of arm —162—, said projection serving as a stop to prevent outward throw of leg —244— under tension of spring —243—. A cushioning spring —251— is also mounted on throw-out rod —235— to engage short arm —236— of lift member —230— during oscillating movements thereof. The greater number of governor parts being at one side of governor shafts F′ and F^2, a ball —254— is suspended from an arm —255— on shaft F′ on the other side to counterbalance the same. This arm —255— is also utilized to throw out a stop pawl —256— pivotally mounted on recoil lever —257— for turret B, see Fig. 9. Thus, arm —255— depresses link —258— and therethrough depresses end —259— of stop pawl —256—, thereby lifting said pawl free from its previous engaging relation with shoulder —260— of stop wheel —261— on turret shaft —21—. Said turret may then be revolved to discharge the filled can and to bring up an empty can, all as hereinafter described. Stop pawl —256— is supplemented by a second check member —263— pivotally mounted at the side thereof on recoil lever —257—, but this check is operatively controlled by a different line of connections leading to cross shaft —123— and comprising a short connecting link —264— attached to arm —265— on the end of shaft —123—. Check member —263— is thrown into stopping relation with stop wheel —261— when cross shaft —123— is rotated by bell crank —151— on the opposite side of the machine. This occurs during the latter part of movement of turret B when a roller —137— on wheel —30— engages bell crank —151— as formerly described. The check member remains in locking engagement with stop wheel 261 until stop pawl —256— is also brought into locking relation therewith. To this end, bell crank —151— has a second link bar —266— extending upward therefrom which has slotted upper end slidably engaged with arm —267— on governor shaft F^2, see Fig. 8.

When bell crank —151— is operated, link bar —266— is raised at the same instant that check member —263— comes to stopping position with stop wheel —261—, and the parts hold this position for a brief interval after roller —137— has disengaged itself from bell crank —151— because a pivoted catch —267′— on governor arm —267— interlocks with tooth —268— on link bar —266—. Catch —267′— rests at its free end on a stop projection —269— on main frame A and has a spring —270— to hold it down thereon. However, when governor shaft F^2 is rotated to lower governor F, arm —267— is also lowered and in its rotative movement catch —267′— is sufficiently shifted to release tooth —268— and permit link bar —266— to drop free by gravity, the balance of weight of the various levers and parts being in favor of this movement. Thus, when governor F is lowered during the forward movement of plunger —18— as originally described, check member —263— is lifted free from stop wheel —261—, and when governor F is raised stop pawl —256— is also released, thereby setting the parts to permit rotation of turret B after tamping operations.

During rotation of turret B, bell crank —151— operates to throw check member —263— in the path of the next shoulder on stop wheel —261— to limit its rotation to a quarter turn, but the momentum of the parts requires cushioning and this is obtained by recoil lever —257— which has an attached member —271— slidably mounted upon a rod —272— and adapted to bear against a recoil spring —273— also sleeved on said rod. Rod —272— is pivoted at —274— on a lateral brace on the base of main frame A to provide for compensating movements between the parts. A pulley —280— on turret shaft —21— and a friction band —281— about said pulley also have useful functions in stopping and holding turret B at set positions.

A final review of all machine operations from start to finish will now be briefly described. Thus, assuming that the parts are in their rest and set positions, operations are started by shifting lever M. Thereupon turret B is rotated a quarter turn, this result being brought about by release of hook member —134— from collar —135— on controller shaft —123— and whereby throw-out lever —127— is retired from the path of dog —29— on oscillating arm —28—. Assuming one can to be in place within the turret, rotation of the turret brings this can beneath tamping tube E and hopper D. Positive stopping of the turret at this rest position is obtained by check member —263— which is thrown in the path of a shoulder on stop wheel —261— by the operation of bell crank —151— when engaged by a roller —137— on wheel —30—. Bell crank —151— it will be remembered connects with and rotates cross shaft —123— which in turn connects with and operates check member —263—. And, as said member is mounted upon recoil lever —257— having cushioning spring —273—, the shock of turret stopping operations is absorbed thereby. Return movement of turret B is checked by pawl —282— pivotally mounted upon the base of main frame A beneath operating wheel —30—. But before turret B has reached its position of rest, other parts have been actuated by it to cause reciprocal movement of can feeding plunger —18—. Thus, roller —137— on wheel —30— engages bell crank —63— which in turn operates (through its various link and lever connections as described.) to lower detent member —141— out of the path of dog —32ª— on oscillatory arm —32—, thereby permitting said dog to lock with shoulder —33ª— on arm —33—, see Fig. 13. This being accomplished and the turret having reached its station of rest, a return movement of oscillatory arms —33— and —32— is brought about by eccentric wheel —26— on power shaft G. Then dog —29— is carried to the rear, and arm —33— is brought forward at the same time which brings cross head —14— and plunger —18— forward, see Fig. 14. The tail of dog —29— will now be engaged by finger —33ᵇ— on arm —33— if throw-out lever —127— is not in its normal position, and this thereby prevents rotation of turret B while plunger —18— projects into turret B. In this forward movement, arm —33— engages the roller end of bell-crank —139— at the base of the machine and restores detent member —141— and bell crank —63— and their connected parts to their normal stations of rest, as in Fig. 8. Then in the next cycle of operations of eccentric wheel —26—, arm —32— forces arm —33— to the rear thus retiring cross head —14— and plunger —18— to their rest positions.

The return movement of cross head —14— operates to deposit a can —2— upon rest —16— by pull upon cord —13— and arms —12— located at the bottom end of inclined tray N. Assuming that this has occurred, and plunger —18— is now moving forward, said can will be forced into a holder —19— in turret B, the can rest being depressed by head —17— when engaged thereby, and the lining —3— being flared outwardly at —6— when the can is fully entered into the holder. And if a filled can is in holder —19— on the opposite side of the entering can, the same will be discharged by rod —42—, see Fig. 19. Upon return movement of plunger —18—, detaining device —39— prevents accidental displacement of the can, and in the next rotation of turret B, this can is clamped in its holder in an upright position beneath tamping tube C. Clamping thereof is obtained by levers —24— operating to slide the movable half of the holders to clamping position when the lever —23— engages roller —25— on the main frame, and as hereinbefore specifically described.

In operations, one can is always in clamped upright position in turret B while another is being entered at the side thereof. This permits start of the carbon feed, the flour feed, and tamping operations during forward movement of plunger —18—, and is accomplished by link —155— attached to one of the arms —33— on plunger operating shaft —35—, and which link is connected to arm —156— on governor shaft F^2 and whereby governor F is lowered to operative position when shaft —35— is rotated. It will be remembered that a dog —157— or ratchet clutch device is employed on shaft F^2 to lower free governor arm —160— and thereby pull upper governor arm —162— down and carry weighted arm —226— from its inclined position of rest to the other side of shaft F′ to hold the governor F down in working position.

Lowering of governor F starts many trains of mechanism into motion, one of which feeds a single carbon forward from trough O upon shutter —50— when it is lowered, the connection thereto being by link —54— and governor arm —56—. When the governor is raised to rest position, shutter —50— discharges the single carbon —4— thereon down upon transfer member —57—. Now it will be recalled that transfer member —57— is mounted upon shaft —66— and is operatively controlled by the rock movements of bell cranks —63— and —139—, respectively. Thus, when turret B is rotated, bell crank —63— and its connections operate to throw transfer member —57— into a vertical position centrally within tamping tube E beneath carbon holder C. Then in the next step of operations when plunger —18— is moving forward, the roller on re-setting bell crank —139— is engaged by arm —33— and shaft —66— is rotated reversely and transfer member —57— is thrown back into inclined position again to receive another carbon. But in the meantime, carbon holder C is permitted to drop into gripping relation with the carbon as it rests upon transfer member —57— within tube E.

The carbon holder is held in raised position by trip catch —70—, which releases its hold upon pin —72— when link rod —76— is raised by rotation of cross shaft —123—, this movement being dependent upon rock movement of bell-crank —151— during final rotative movement of turret B. Thus, when a roller —137— on wheel —30— engages bell crank —151—, link —153— and arm —154— cause rotation of cross shaft —123— and up-lift of rod —76— by arm —150— on shaft —123—. Release of carbon holder C being effected as described, its initial drop is approximately about an inch, and as screw stem —9— of carbon —4— enters the bottom end of the holder, gripping device —80— engages it so that when transfer member —57— is thrown back, both the holder and the carbon will fall together by gravity, and at such speed as may be predetermined by intake of air in tube 83 and so that carbon —4— will be held suspended within the battery can above its bottom, see Fig. 25. But to this latter end, carbon holder C drops down upon and is stopped in its descent by spring cushioned member —90— having lug —89— which intercepts and engages pin —88— on head —73— of the carbon holder, see Figs. 29 and 30. Lock plate —94— is pressed back by lug —89— as it passes down opposite thereto and its spring —97— throws it outward into locking relation with pin —88— to prevent upward movement of the carbon holder during tamping operations which follow. But before transfer member —57— is shifted to drop the carbon holder and carbon held thereby, governor F is lowered, which lowers governor arm —102— and thereby lowers its suspensory rod —101— to bring roller —99— thereon beneath the stopping place of the carbon holder head —73—, or in other words, in position to release lock plate —94— and to lift lug —110—, as will hereinafter be explained. Now that a carbon —4— is in the can the next step relating to the feed of the flour to the can will be described. Thus, when governor F is lowered, link rod —163— engaged with governor arm —102— is depressed to actuate lever —164— sleeved on shaft —123— and thereby lift its roller end to bring about locking engagement between bell crank —170— and the slotted end of eccentric rod —166—.

Eccentric gearing —167— on power shaft H keeps eccentric rod —166— constantly in motion, and when the roller —169— on bell crank —170— rides into the lateral portion of the slot —168—, said bell crank will transmit power to flour belts R by means of connecting rod —170′ and the ratchet mechanism which is adapted to rotate pulley shaft —174— for the belts. Bell crank —170— at the same time operates push plates —181— through its link and crank connections therewith, so that at each intermittent movement of belts R, a similar movement is imparted to the push plates to pack the flour, charge after charge, about carbon holder C and directly above can —2— in the turret. Each charge is then forced into the can and tamped solidly therein, and this is done by tamping tube E which is immediately thrown into action when governor F is lowered. Thus at the start, tamping tube E is in raised rest position, and valve L is inoperative insofar as its connections with eccentric gearing —194— is concerned. But when governor F is lowered, arm —56— thereof rocks crank member —202— on shaft H and throws cam lock —200— down to operatively lock balance lever —198— with eccentric rod —197—. Weighted arm —226— holds the parts in this locked relation during operations and therethrough holds the governor down also. Now, the power through shaft H and the eccentric gearing thereon lowers weighted valve arm —199— and valve L and opens port —191— to force piston J down for its first stroke, thereby carrying the first charge of flour into the can and tamping it therein. As tube E descends, valve L is reversed, this being accomplished by the cushioning rod connections —219— to —223—, inclusive, which connect balance lever —198— with tube E and which operate to raise valve L, first to cut off the steam from above, and then to admit steam into the bottom end of the cylinder for the requisite cushioning effects upon piston J, and whereby the blow or degree of compression of the flour is also modified as the needs require. Eccentric gearing —194— now comes into play and opens valve L still more at lower port —192— to drive the piston and tube up again, see Figs. 40 and 41. In this reversal, the cushioning rod connections and eccentric gearing again act to steam cushion the piston before it reaches the limit of its up travel, and these reciprocal operations of the parts proceed without cessation until governor F is automatically thrown to its position of rest by roller —227— on the tamping tube. However, this important feature of the invention must be considered before throw-out operations occur, to wit,— the variable stroke of tamping tube E and valve L. Thus, as the can is successively charged with flour and in turn successively tamped, the stroke of tamping tube E is correspondingly foreshortened. But with steam as a motive agent and a gravity plunger, the impact of the successive blows noticeably vary as the tamping tube strokes become shorter, and the flour and the can, as well as all the operative parts, feel the effects of this to a marked degree. The battery, moreover, would not be uniformly packed and its efficiency as a commercial product would not be as great as desired. In this connection it may be stated that the flour mixture is susceptible to varying conditions, such as the degree of compression thereof, moisture, puddling, and so forth, and therefore requires proper handling to obtain the best results. To meet these conditions and in the end produce a uniformly well packed battery, each successive down stroke of piston J is decreasingly cushioned toward the latter part of tamping operations, or in other words, less steam is permitted to enter cylinder K beneath the piston as the battery is being filled especially after the lower part of the battery has been filled, thereby obtaining a varying cushioning effect on tamping tube E but an equalizing effect in tamping successive charges of flour in the can. As hereinbefore more specifically described, this result is obtained by balance lever —198— for valve L, and the cushioning rod connections with the tamping tube, and further details would be verbose.

The next step in operations is to stop flour feeding and tamping operations, and this is automatically determined by the depth of tamped flour in the can. Assuming this to be five inches, when tamping tube E is foreshortened in its down stroke to this extent, roller —227— on tube E comes to a momentary stop opposite gap —240—, and the hook end of lift member —230— is immediately thrown into engaging relation therewith, and the governor as a whole is forcibly carried upward upon the up stroke of tamping tube E. Prior to this time, lift member —230— has been withheld from roller —227— by detent —239—. The impulse of movement by roller —227— carries governor F to its normal station of rest, weighted arm —226— assisting after passing the vertical center of gravity. In this operation, the differential movements of rod —235— on arm —160— in respect to lift member —230— will forcibly disengage hook end —233— from roller —227— as weighted arm —226— seeks its place of rest. The can may now be said to be finished insofar as the machine is concerned, and is ready to be discharged from turret B. But this cannot be done until the gripping device —80— is released from stem —9— of the carbon now packed tightly in the can, and until carbon holder C is raised to its position of rest upon trip catch —70— at the top of the machine. Up lift of governor F brings this about by raising arm —102— thereof, which has extension —100— and roller —99— thereon, see Fig. 29. This roller in traveling upward releases stop plate —94— from pin —88— on carbon holder head —73— and extension —100— engages and lifts lug —110— on top plate —106— which controls catch —80— by connecting rod —105—, see Fig. 27. This disengages point —81— from the carbon screw stem —9—, and the up lift of plate —106— also throws dog —111— into elevator chain —112— by raising pivoted trip member —113—. Thereupon, carbon holder C is bodily lifted by chain —112— until member —113— strikes the bottom of cross bar *a* of the main frame and releases dog —111— from chain —112—. In the mean time, pin —72— on head —73— passes trip catch —70— and comes to rest upon shoulder 75 thereof. Final uplift of carbon holder C causes a repetition of all the operations outlined by reason of pin —88— on head —73— striking lever —120— and therethrough depressing link —121— to lift hook member —124— free from ratchet segment —125—, weight —133— and spring —132— then coming into action to again retire throw-out lever —127— so that dog —29— may rotate turret B another quarter. Shaft —126— is free to rotate at this time because governor F in raising has also lifted hopper

D by link bar —161—, thus freeing arm —189— on shaft —126— of its weight.

In tamping the flour about the carbon electrode, the tendency of each packed charge is to lower the carbon in the can. Although slight, the action is cumulative due to repeated charges and successive tamping blows, and in the end there is always danger of the carbon breaking, especially if the carbon be immovably supported. But any trouble due to this peculiarity of working is overcome by supporting the carbon, either yieldingly at the lower end of carbon holder C, or by the means shown and described comprising post —90— and spring —92— adapted to yieldingly support holder C and the carbon carried thereby.

What I claim is:—

1. In machines for making electrical batteries, a rotary turret having a series of radially disposed can holders arranged diametrically opposite each other in pairs, and a reciprocating can discharging device interposed between each pair of said holders to engage the respective cans therein.

2. In machines for making electrical batteries, a rotary turret for the cans having intermittent operating power connections comprising a continuously revolving shaft, eccentric connections, an oscillating arm having a dog, a ratchet wheel, and throwout means for said dog adapted to prevent working engagement thereof with said wheel as may be predetermined.

3. In machines for making electrical batteries, a rotary can holder and a reciprocating can feeding plunger mounted opposite thereto, a gravity feed tray for the cans, and a rest in line with the plunger to receive single cans from said tray.

4. In machines for making electrical batteries, a rotary turret for holding the cans and a can feeding plunger arranged opposite thereto, a rest for the cans in line with the plunger and a gravity tray for the cans opposite said rest, and means adapted to feed single cans from said tray upon said rest.

5. In machines for making electrical batteries, a holder for the battery cans and a plunger adapted to feed single cans thereto, and a can engaging head yieldingly mounted upon the end of said plunger.

6. In machines for making electrical batteries, a holder for the cans and a plunger adapted to deliver lined cans to said holder and a spreading device on said plunger adapted to flare the lining of the cans during feeding operations.

7. In machines for making electrical batteries, a holder for the cans and a plunger adapted to feed cans having an inner lining to said holder, a yielding head at the end of said plunger to engage the cans, and a spreading device on said plunger adapted to flare the lining of the can when the can is carried to its seat in the holder by said head.

8. In machines for making electrical batteries, a holder for the cans and a plunger adapted to feed lined cans thereto, a depressible can rest to temporarily support the cans, and a spreading device carried by said plunger adapted to pass said rest and flare the can lining upon a forward movement of said plunger.

9. In machines for making electrical batteries, a holder for the cans and a reciprocal plunger adapted to feed single cans thereto, and a detaining device at the mouth of said holder adapted to engage the cans during initial retiring movements of the plunger.

10. In a machine for making electrical batteries, a battery can holder and a carbon delivery device therefor comprising a vertically movable holder and means to feed single carbons thereto from a stored supply.

11. In a machine for making electrical batteries, a battery can holder and a carbon holder movably related thereto and a cushioned stop to limit the down movements of said carbon holder.

12. In a machine for making electrical batteries, a can holder and a carbon holder vertically movable in respect thereto and an adjustable stopping device for the carbon holder adapted to fix the position of the carbon in the can.

13. In a machine for making electrical batteries, a can holder and a carbon holder vertically movable in respect thereto, a stop rest for limiting the down movement of the carbon holder and a lock to hold the same in rest position.

14. In a machine for making electrical batteries, a can holder and a lowering device for the carbon adapted to fix the elevation of the carbon in the can, and means to automatically deliver carbons to said lowering device.

15. In a machine for making electrical batteries, an intermittent rotary holder for the cans and a lowering device to automatically deliver carbons to the can, and means to operatively control said holder and device for timed movements.

16. In a machine for making electrical batteries, an intermittent rotary holder for the cans, a lowering device for the carbons, means to feed carbons from a stored supply to said lowering device, and power means and controlling devices to automatically operate said parts for timed movements.

17. In a machine for making electrical batteries, a holder for the battery cans, a receptacle for the battery carbons, a device to lower the carbons into the cans, and devices to feed and transfer the carbons from said receptacle to the lowering device.

18. In a machine for making electrical

batteries, a holder for the battery cans, a gravity drop holder for the carbons, and a transfer member adapted to temporarily support the carbons beneath the carbon holder.

19. In a machine for making electrical batteries, a holder for the cans, a gravity lowering device for the carbons, means to hold the same suspended, means to feed the carbons to said lowering device, and means to elevate said lowering device after each delivery of a carbon to a can.

20. In machines for making electrical batteries, a support for the cans, a gravity holder for the carbons, a transfer member to deliver the carbons beneath said holder, means to cause initial dropping of said holder, means to retire the transfer member to permit the holder and the carbon to drop by gravity, and a stopping device to limit the down movement of said holder and carbon.

21. In machines for making electrical batteries, a support for the cans and a gravity delivering device for the carbons, means to elevate said device, a trip support for said device, and means to feed the carbons to said device.

22. In machines for making electrical batteries, a gravity delivery holder for the carbons, a device for suspending the holder in raised position, an elevating chain and clutch to raise the same to this position, and means to operatively control said devices for raising and lowering movements of said carbon holder.

23. In a machine for making electrical batteries, a gravity holder to deposit the carbons in the cans, an elevating device to raise said carbon holder, a governor to control the operation of said device, means to feed carbons to said holder while in raised position, and means to limit the travel of said holder.

24. In a machine for making electrical batteries, a carbon lowering device, means to elevate said device and means to control its descent.

25. In a machine for making electrical batteries, a gravitating carbon holder adapted to lower carbons into the can, means to raise said holder, and a fluid controlled plunger adapted to regulate the descent of said holder.

26. In a machine for making electrical batteries, a gravitating delivery device for the carbons, a fluid cylinder and piston plunger therein for said delivery device, and a valved connection for said cylinder adapted to regulate the movements of said plunger.

27. In a machine for making electrical batteries, a gravitating delivery device for the carbons, and a valved cylinder having a piston plunger therein provided with operative connections leading to said delivery device to control its descent.

28. In a machine for making electrical batteries, a carbon lowering device having a carbon gripper and means to effect release thereof when the device is to raised, and means to elevate said device.

29. In a machine for making electrical batteries, a rotary can holder and means to provide an intermittent movement thereto, combined with a carbon lowering device, and a governor to control the operations of said can holder and carbon holding device, respectively.

30. In a machine for making electrical batteries, a rotary can holder and a reciprocating plunger to feed cans thereto, and means to operate said holder and plunger progressively, combined with a carbon holder and means to deliver carbons thereto, means to elevate said carbon holder, and means to operatively control starting movements of said can holder and plunger means by the elevation of said carbon holder.

31. In a machine for making electrical batteries, a rotary can holder and a reciprocating plunger to feed the cans thereto, a carbon lowering device adapted to deliver the carbons to the cans, and power means for said parts having timed operating connections adapted to operate said can holder, plunger, and lowering device successively.

32. In a machine for making electrical batteries, a rotary can holder, a reciprocating can feeding plunger, and means to operate said holder and plunger, progressively, combined with a carbon lowering device and means to feed carbons thereto comprising a transfer member, and power means comprising joint operating connections for said can holder, plunger and transfer member.

33. In a machine for making electrical batteries, a holder for the cans, a hopper for the flour, a set of push plates within said hopper, a flour conveyer to said hopper, and means to impart intermittent movements to both said conveyer and push plates.

34. In a machine for making electrical batteries, a holder for the cans, and a hopper for the flour, a set of reciprocal plates to deliver charges of flour from said hopper to the cans in said holder, and means to operate said plate comprising eccentric gearing and clutch mechanism to control operativeness thereof.

35. In a machine for making electrical batteries, a rotary holder for the cans and means to revolve the same at intervals, in combination with a holder for the flour movably mounted opposite said holder, and means to raise and lower the same during rotary and rest positions of said holder.

36. In a machine for making electrical batteries, a rotary can holder and a reciprocating plunger to feed cans thereto, and power means to operate said parts successively, in combination with a hopper for

the flour, means to feed the flour to said hopper, and means to throw said flour feed means into operation by the movements of said plunger.

37. In a machine for making electrical batteries, a rotary can holder and a reciprocating plunger to feed the cans thereto, and power means to operate said parts successively, in combination with a flour feed device adapted to feed successive charges to the cans in said holder, and means to automatically start and stop flour feeding operations.

38. In a machine for making electrical batteries, a holder for the cans, a hopper for the flour, a lowering device for the carbon, and means to pack the flour about said device and means to deliver the same to the can.

39. In a machine for making electrical batteries, a can holder, a flour hopper having a discharge opening, a flour feed member at each side of said opening, and a carbon holder adapted to pass between said feed members.

40. In a machine for making electrical batteries, a can holder, a flour hopper having a discharge opening, a carbon holder adapted to be lowered through said opening to deposit the carbon in the can, push members to pack the flour about said carbon holder, means to feed flour to said hopper and said members, and means to force the flour into the can.

41. In a machine for making electrical batteries, a rotatable can holder and means to rotate the same at intervals, in combination with a flour hopper and means to feed flour thereto, a reciprocating carbon holder to deliver carbons to the can, means to feed carbons to said carbon holder, and means to tamp said flour into the cans about said carbons.

42. In a machine for making electrical batteries, a holder for the battery cans, a tamping tube to pack the flour into the cans, and a lowering device for the carbons within said tamping tube.

43. In a machine for making electrical batteries, a holder for the battery cans, a reciprocable tamping tube for the flour, a carbon delivery device within said tube, and means to independently operate said tube and device, respectively.

44. In a machine for making electrical batteries, a holder for the battery cans, a reciprocating tamping tube, a carbon delivering device adapted to be raised and lowered within said tube, and means to automatically control the operations of said tube and said device.

45. In a machine for making electrical batteries, a holder for the cans, feed devices for the flour, a lowering device for the carbons, a tamping tube and a fluid operated piston therefor, and a governor and valve mechanism to control the operations of said tamping tube.

46. In a machine for making electrical batteries, a fluid operated reciprocating tamping device having a valve and variable throw connections therefor adapted to variably fluid-cushion the device upon lessening strokes thereof.

47. In a machine for making electrical batteries, a variably movable tamping plunger for the flour having a fluid operated piston, and a valve operatively connected to said plunger to open and close the same variably therewith.

48. In a machine for making electrical batteries, a tamping tube and an operating piston therefor, a valve having eccentric power connections adapted to control the movements of said piston and tube, and means to provide a variable throw of said valve to produce variable fluid cushioning effects for said piston and tube.

49. In a machine for making electrical batteries, a tamping tube and a steam operated piston therefor, a steam valve to control reciprocating movements of said piston, and crank and lever mechanism connecting said valve and said tamping tube adapted to provide variable movements of said valve during variable strokes of said piston and tube.

50. In a machine for making electrical batteries, a holder for the battery cans and means to feed successive charges of battery flour to the cans, in combination with a fluid operated tamping device having a variable throw valve to control reciprocating movements thereof and constructed to provide fluid cushioning effects for said tamping device throughout tamping operations.

51. In a machine for making electrical batteries, a holder for the battery cans, means to feed uniform charges of flour successively to the cans, and means to tamp the successive charges in the cans comprising a fluid operated piston having a fluid controlling valve, power connections to operate said valve, variable throw mechanism for said valve operatively connected with said tamping means, and means to automatically stop tamping operations when the battery can is finally filled.

52. In a machine for making electrical batteries, a fluid operated tamping device having a fluid controlling valve operatively connected therewith, power connections for said valve, and clutch mechanism to operatively control working of the valve.

53. In a machine for making electrical batteries, a fluid operated tamping device having a valve to control the operation thereof, and operating connections for said

valve comprising a valve arm having a balance lever with power connections, and variable throw connections leading from said balance lever to said tamping device.

54. In a machine for making electrical batteries, a fluid operated tamping device having a valve to control the same, and means to operatively control said valve comprising a balance lever and valve arm, power connections for said lever, and tamping tube connections engaged with said lever having an adjustable member adapted to produce a variable movement of said lever and valve.

55. In a machine for making electrical batteries, a fluid operated tamping device having a valve to control the same, and means connected with said valve and tamping tube adapted to control the valve and comprising a balance lever having a movable spring pressed fulcrum support, and power connections and variable throw connections for said lever having operative connections with said tamping tube.

56. In a machine for making electrical batteries, a fluid operated tamping plunger and a valve to control the same, means connected with said plunger adapted to provide a variable throw for said valve, and a governor operatively engaged with said plunger and constructed to disengage itself at predetermined working positions of said plunger.

57. In a machine for making electrical batteries, devices to feed flour and carbons to the cans and a reciprocating tamping tube having a self releasing device coöperatively engaged with said tube to stop flour feeding and tamping operations.

58. In a machine for making electrical batteries, a holder for the cans, a delivery device for the carbons, mechanism to feed the flour, a reciprocating plunger to tamp the flour, and means to operatively control said plunger comprising a governor constructed to lock with said plunger upon an upward stroke thereof.

59. In a machine for making electrical batteries, a holder for the cans, and means to tamp flour in the can, comprising a tamping tube having power connections, and a governor having lift connections with said tamping tube.

60. In a machine for making electrical batteries, a holder for the cans, a tamping device for the flour, and a governor for said device having balancing means to hold the same in rest or operative positions.

61. In a machine for making electrical batteries, a holder for the cans, a device to tamp flour in the cans, and a governor to control the operations of said device having means to lower the same to operative position and lift mechanism to automatically engage and disengage said device during operations thereof.

62. In a machine for making electrical batteries, a holder for the cans, a reciprocating tamping tube for the flour and means to operate the same for variable reciprocal movements, and a governor having throw connections to automatically start said tube for tamping operations and to stop the same at predetermined stages of tamping.

63. In a machine for making electrical batteries, a holder for the cans, and a reciprocating plunger to tamp flour in the cans, and a balanced governor having a pivoted lift member adapted to lock with said plunger to raise the governor.

64. In a machine for making electrical batteries, a holder for the cans and a reciprocating plunger for tamping flour in the cans, and a balanced governor having a lift member adapted to be raised by said plunger and means to positively disengage said lift member from said plunger when raised.

65. In a machine for making electrical batteries, a holder for the cans and a reciprocating tamping device for the flour, and a balanced governor to control the operations of said device having a lift member adapted to lock with said plunger at certain stages of its movement and constructed to prevent locking thereof during the balance of its movements.

66. In a machine for making electrical batteries, a holder for the cans and a reciprocating tamping plunger for the flour, and a governor to control operations of said tamping plunger having a pivoted lift member adapted to lock with said plunger, and means having differential movements adapted to withdraw said lift member from locked relation with said plunger.

67. In a machine for making electrical batteries, a holder for the cans, a reciprocating tamping tube for the flour, and a governor to control operations of said tube comprising a pivoted lift member having a hook to engage the plunger, and a detent for said member to withhold the same from working lift engagement during predetermined tamping operations.

68. In a machine for making electrical batteries, a reciprocating device to tamp the flour in the cans, and a governor having a balance weight to control the operations of said device comprising a spring controlled lift member, a detent for said member, and throw-out connections for releasing said member from the tamping device.

69. In a machine for making electrical batteries, a holder for the cans and means to feed flour to the cans and a tamping tube having a fluid operated piston and a valve therefor, combined with eccentric power con-

nections and variable throw connections for said valve, and a balanced governor having operating connections with said flour feed means and said valve connections and with said tamping tube.

70. In a machine for making electrical batteries, a rotary holder for the cans, a can feeding plunger for said holder, a device to feed flour to the cans, delivering means to place carbons in the cans, a fluid operated device to tamp the flour, a valve for said device, means to apply power to all said parts, and means to control the operations of said parts for timed movements.

71. In a machine for making electrical batteries, a rotary can holder and a can feeding plunger therefor, and power means to provide intermittent movements for said holder and plunger, in combination with devices to successively feed predetermined charges of flour to the cans in said holder, power connections for said flour feed devices having a controlling clutch, and operating connections for said clutch having working connections with said intermittent power means.

72. In a machine for making electrical batteries, a turret having a plurality of can holders radially thereof, and means to rotate said turret at intervals, in combination with a flour feed device and means to impart intermittent movements thereto, and controlling mechanism to establish successive operations of said turret rotating means and said flour feed means, respectively.

73. In a machine for making electrical batteries, a turret comprising a series of radially arranged can holders, and power means to rotate said turret at intervals, in combination with a lowering device for the carbons having a trip detent, and means operatively connected with said turret power means adapted to actuate said trip detent to lower the carbon device after each rotative movement of the turret.

74. In a machine for making electrical batteries, a can holding turret having power means to rotate the same intermittingly, in combination with a carbon holder adapted to lower and hold the carbons in the cans within said turret, means to release said holder from the carbons, means to elevate said holder, and devices operated by final elevation of said holder adapted to control starting of said turret power means.

75. A machine for making electrical dry batteries comprising collective means to successively feed cans, carbons and flour from a source of supply and to automatically tamp the flour in the cans, combined with controlling devices to automatically repeat said cycles of operations indefinitely, and collective means to stop said operations at the end of a cycle of movements.

76. In a machine for making electrical batteries, a tamping device for the flour, and means to yieldingly support the carbon electrode within the can during tamping operations, whereby breakage of said carbon electrode is prevented.

77. In a machine for making electrical batteries, a tamping device for the flour, and a spring supported holder for the carbons adapted to permit accommodating movement of the carbons during tamping operations.

78. A machine for making electrical batteries comprising means to automatically feed empty battery cans end first thereinto in a horizontal position and means to stand each can upright into filling position.

79. A machine for making electrical batteries comprising lowering means to automatically deliver and support the carbons within the cans apart from the bottom and sides thereof during filling operations.

80. A machine for making electrical batteries comprising means to automatically form successive ring-shape charges of predetermined size and quantity of the active material opposite the mouth of the can and means to automatically tamp said charges into the can.

81. A machine for making electrical batteries comprising means to automatically form successive ring-shape charges of the active material, means to tamp said charges into the cans, and means to hold the cans immovably fixed during said tamping operations.

82. A machine for making electrical batteries comprising means to automatically feed battery cans successively to a fixed stationary position and means to automatically fill the batteries with active material and tamp the same therein from bottom to top while the cans are fixed and stationary.

83. A machine for making electrical batteries comprising means to automatically feed empty cans endwise in a horizontal position, means to carry the cans to an upright stationary position, and means to automatically feed successive charges of the active material to the cans and tamp said charges therein while the cans are at rest.

84. A machine for making electrical batteries comprising a fluid operated tamping device and means to automatically control the operations thereof by its own variable movements.

85. A machine for making electrical batteries comprising means to automatically fill and tamp the active material in the battery cans and a governor having operating connections with said tamping means to control the operations of filling and tamping.

86. A machine for making electrical batteries comprising means to feed the battery cans thereto and means to deliver the carbon to the cans, and controlling means to auto-

matically produce timed movements between said can feeding and carbon delivering means.

87. A machine for making electrical batteries comprising means to feed the battery cans thereto, means to automatically form ring-shape charges of the active material, means to tamp said charges successively into the cans, and means to hold the cans stationary during tamping operations.

88. A machine for making electrical batteries comprising means to feed the cans and means to hold the cans immovably fixed until filled, in combination with means to automatically feed successive charges of active material to the cans and variable-reciprocating means to tamp said charges repeatedly therein.

89. A machine for making electrical batteries comprising means to feed the cans thereto, means to hold the cans immovably fixed until filled, means to automatically feed successive ring-shape charges of active material to each of the cans, and a variable reciprocating plunger to tamp said charges successively during feeding operations.

90. A machine for making electrical batteries comprising means to automatically feed the cans, means to deliver carbons to the cans, means to feed active material to the cans, and means to tamp said material, in combination with means to successively operate said foregoing means in the order named.

91. A machine for making electrical batteries comprising means to automatically deliver a carbon to the can by a lowering device adapted to hold the carbon while feeding of the active material occurs, and means to automatically feed active material about said carbon.

92. A machine for making electrical batteries comprising gripping means to automatically lower and support carbons within the cans and means to automatically pack successive charges of active material about said carbons when suspended within the cans.

93. A machine for making electrical batteries comprising gripping means to automatically deliver carbons to a stationary suspended position within the cans, means to automatically feed the active material to the cans, and means to repeatedly tamp the active material within the can.

94. A machine for making electrical batteries comprising means to automatically feed the battery cans thereto, means to automatically deliver carbons to the cans, means to automatically feed active material to the cans, and means to automatically tamp said active material, in combination with means to automatically control and time the operations of said foregoing means for the purposes set forth.

95. A machine for making electrical batteries comprising gripping means to automatically lower a carbon and means to deliver active material to a can and a tamping device to pack said material uniformly in the can.

96. A machine for making electrical batteries comprising means to deliver a carbon and means to deliver active material to a can and a tubular tamping device inclosing said carbon delivery, means adapted to automatically pack successive charges of said material in the can.

97. A machine for making electrical batteries comprising gripping means to bodily lower a carbon and means to deliver active material to a can about said carbon, a fluid operated device to repeatedly tamp said material in the can, and a governor to control said device.

98. A machine for making electrical batteries comprising gripping means to deliver a carbon into the can and means to feed active material about said carbon, a device to repeatedly tamp said material in the can, and means to automatically stop operations of said device when the can is filled.

99. A machine for making electrical dry batteries comprising automatic means to simultaneously feed and tamp elementary materials into a stationary can, means to automatically stop feeding and tamping operations for each can, and means to automatically cause a repetition of said operations.

100. In machines for making electrical batteries, a rotary holder for the battery cans having a horizontal axis and means to operate the same, and means to automatically feed the cans endwise into said holder.

101. In machines for making electrical batteries, a rotary turret having hollow holders for the battery cans, and a reciprocal plunger to feed the cans endwise into said holder.

102. In machines for making electrical batteries, a rotary support having clamping devices to hold the cans, and means to automatically open and also close said devices when said support is rotated.

103. In machines for making electrical batteries, a rotary turret comprising a set of divided holders movably related to clamp the battery cans therein, and means to automatically clamp and unclamp said holders successively during rotative movements of said turret.

104. In machines for making electrical batteries, a rotary turret having can clamping devices thereon, and means carried by said turret adapted to discharge the cans by positive push engagement therewith.

105. In machines for making electrical batteries, a rotary can holder and a can feeding device therefor, and means to rotate said

can holder and to operate said feeding device successively and at separate intervals.

106. In machines for making electrical batteries, a rotary device adapted to hold a series of cans and a can feeding plunger to feed single cans thereto, means to successively rotate said holding device, and means to reciprocate said plunger intermittingly while said holding device is at rest.

107. In machines for making electrical batteries, a rotary turret for the cans, a reciprocating plunger to feed the cans endwise to the turret, oscillating devices to impart successive movements to said turret and plunger in turn, and means to operatively control working movements of said parts to assure a predetermined rest position of one while the other is operating.

108. In machines for making electrical batteries, a rotary turret for the cans, a reciprocating plunger to feed the cans to the turret, power devices to successively operate said turret and plunger in turn, and means to prevent rotation of said turret by said power devices when the plunger is within the turret.

109. In machines for making electrical batteries, a rotary turret for the cans, a reciprocating plunger to feed the cans to said turret, means to operate said turret and plunger successively and intermittingly, a cushioning stopping device for said turret, and separate cushioning devices for said plunger.

110. In machines for making electrical batteries, a rotary can support and a reciprocating plunger adapted to feed battery cans thereinto, and a vertically movable rest intermediate said parts.

111. In a machine for making electrical batteries, a battery can holder and a carbon gripping device above the same adapted to lower the carbon into the can, and means to automatically feed carbons to said carbon gripping device.

112. In a machine for making electrical batteries, a holder for the cans, a gripping device to lower carbons to a permanently suspended position in the cans, and means to automatically feed battery flour to the cans approximately coincident with the delivery of the carbons.

113. In a machine for making electrical batteries, a holder for the cans, a hopper for battery flour above said holder, mechanism for forming packed charges of predetermined quantities of flour, and means to feed said packed charges from said hopper to the cans in said holder.

114. In a machine for making electrical batteries, a holder for the cans, a hopper opposite said holder, means to form successive ring-like charges of packed flour, and means to force said charges into the cans.

115. In a machine for making electrical batteries, a rotary holder for the cans, a flour hopper movably mounted in respect to said holder to permit rotation of said holder, and means to feed flour to said hopper and the cans in said holder.

116. In a machine for making electrical batteries, a rotary holder for the cans, a flour hopper hinged opposite said holder, a bin and means to feed predetermined amounts of flour therefrom to said hopper, and a tubular plunger to tamp ring-shape charges of flour from said hopper to the cans in said holder.

117. In a machine for making electrical batteries, a holder for the battery cans, a flour hopper opposite said holder, means to feed flour from a source of supply to said hopper, a set of oppositely disposed reciprocating members to form packed charges of flour and a tamping plunger to carry and tamp said charges into the cans.

118. In a machine for making electrical batteries, a rotary holder for the cans, a vertically movable delivery hopper for the battery flour, a flour receptacle apart from said hopper, and means to feed the flour in a horizontal plane from said receptacle to said hopper.

119. In a machine for making electrical batteries, a holder for the cans and a flour hopper opposite thereto, a feed box for the flour and a horizontally arranged endless conveyer belt adapted to carry the flour therefrom to said hopper, means to operate said conveyer at intermittent intervals and a tubular tamping member reciprocally mounted within said hopper.

120. In a machine for making electrical batteries, a holder for the cans and a flour delivery hopper therefor, means to feed predetermined quantities of flour to said hopper, and means comprising a set of packing members to pack successive charges of flour and a tamping device to deliver said charges to the cans.

121. In a machine for making electrical batteries, a holder for the cans and a flour hopper opposite thereto, a flour feed box and a conveyer therein having transverse pockets adapted to feed the flour to said hopper, means to pack the flour in separate charges within the hopper before delivery to the cans, and means to deliver the flour charges by compression into the cans.

122. In a machine for making electrical batteries, a rotary holder for the cans and a flour hopper pivoted adjacent thereto, a flour feed box and a pair of conveyers adapted to travel horizontally therethrough to feed flour to said hopper, means to regulate the amount of flour to be carried away from said box by said conveyers and a reciprocating tamping device mounted between said conveyers within said hopper.

123. In a machine for making electrical

batteries, a rotary can holder having a horizontal axis and means to revolve the same at intervals, in combination with a hopper for the flour, means to feed the flour to said hopper, a reciprocating device to tamp the flour within the cans, and means to automatically start flour feed and tamping operations during immovably fixed positions of said can holder.

124. In a machine for making electrical batteries, a rotary can holder and means to feed cans thereto, in combination with a flour hopper and means to deliver charges of flour to the cans in said holder, and power means to simultaneously feed a can to said holder and flour to a can in said holder, said parts having a governor to control timed working thereof.

125. In a machine for making electrical batteries, a holder for the cans, a hopper for the battery flour, a carbon lowering device adapted to pass through said hopper in depositing the carbon in the can, and a reciprocating member operative independently of said lowering device.

126. In a machine for making electrical batteries, a holder for the cans, a hopper for the flour, a lowering holder for the carbon, a tamping device independently operative of said lowering holder, and devices to feed charges of flour from said hopper to the can.

127. In a machine for making electrical batteries, a can holder, a flour hopper having a bottom opening, a carbon holder adapted to be lowered to a stationary position through said opening, and flour feed devices independently operative of said carbon holder adapted to successively charge the can with flour through the said hopper opening.

128. In a machine for making electrical batteries, a reciprocating device for tamping the flour into the can, comprising a plunger and a fluid operated piston therefor having a valve, and power connections between said valve and said tamping device adapted to variably open and close said valve.

129. In a machine for making electrical batteries, a reciprocating tamper for the flour, a separate reciprocating carbon-lowering device, and means to feed the flour to the can, in combination with governing means adapted to control the operations of said tamper and carbon-lowering device and flour feed means.

130. In a machine for making electrical batteries, means to feed battery flour by successive charges, mechanism to tamp the flour by successive blows, a reciprocating device to deliver carbons, and a governor operatively connected with said parts to control tamping, flour feeding, and carbon delivering operations to the cans.

131. In a machine for making electrical batteries, a turret having a set of clamping holders for the battery cans, and power mechanism to rotate the same about a horizontal axis at intervals, in combination with a vertically reciprocating tamping device, and means to start operations of said device having control connections with said turret power mechanism.

132. In a machine for making electrical batteries, a can clamping turret and means to intermittingly rotate the same about a horizontal axis, and devices to withhold operation of said rotating means, in combination with means to feed cans end-first into said turret and devices operatively controlled by the rotation of said turret to start can feeding operations as the turret comes to rest.

133. In a machine for making electrical batteries, a can holding turret and means to rotate the same at intervals about a horizontal axis, a plunger to feed cans end-first into said turret while the same is at rest, and means to feed flour and means to tamp the flour in a can placed in said turret by preceding plunger operations.

134. In a machine for making electrical batteries, a can holding turret and means to rotate the same at intervals, and a device to feed cans to the turret while the turret is at rest, in combination with separate means to independently deliver carbons and flour to cans previously placed in the turret, and means to simultaneously operate said can-feeding device and said carbon and flour-delivery means, and means to tamp the flour in the cans.

135. A machine for making electrical batteries comprising collective means to automatically feed cans, carbons and flour and to automatically tamp the flour by successive blows in the cans, and controlling means for said collective means to automatically produce a repetition of said operations.

In testimony whereof I sign this specification in the presence of two witnesses.

WILLIS E. HARMON.

Witnesses:

R. B. MOSER,

E. M. FISHER.