(No Model.) 6 Sheets—Sheet 1.

C. A. MAYRHOFER.

MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

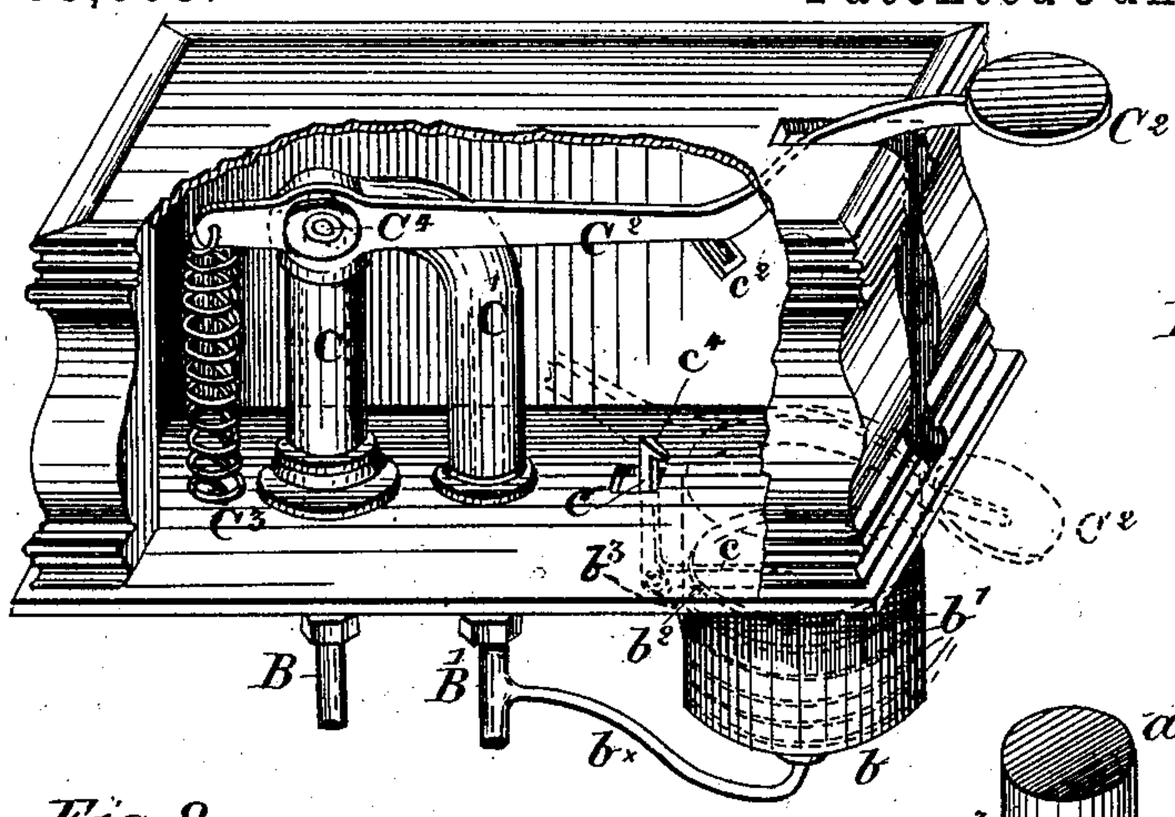


Fig. 3.

Fig. 2.

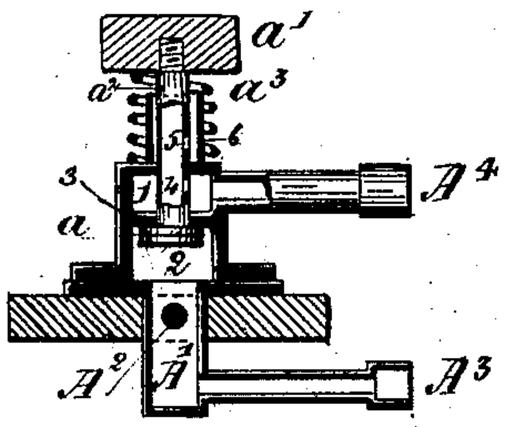


Fig. 1.

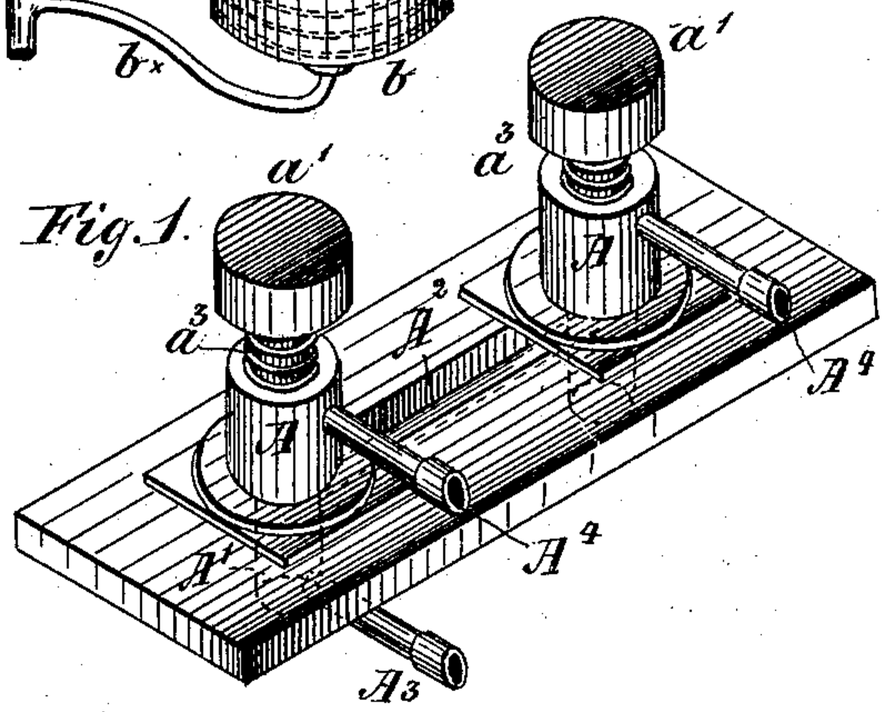


Fig. 4.

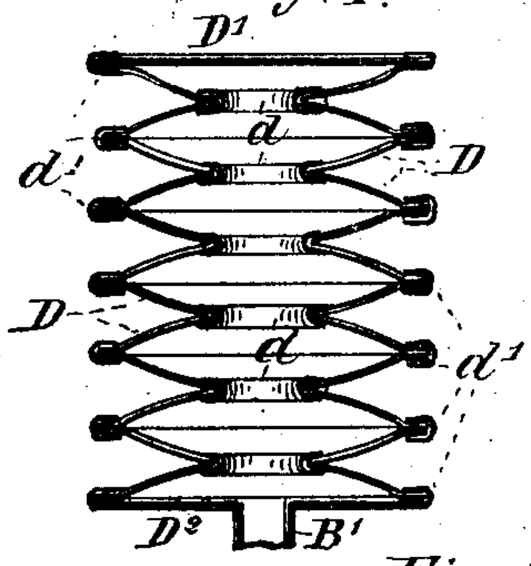


Fig. 4a

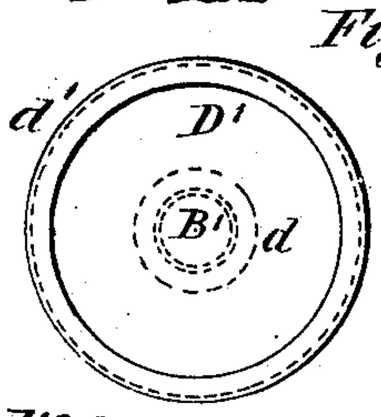
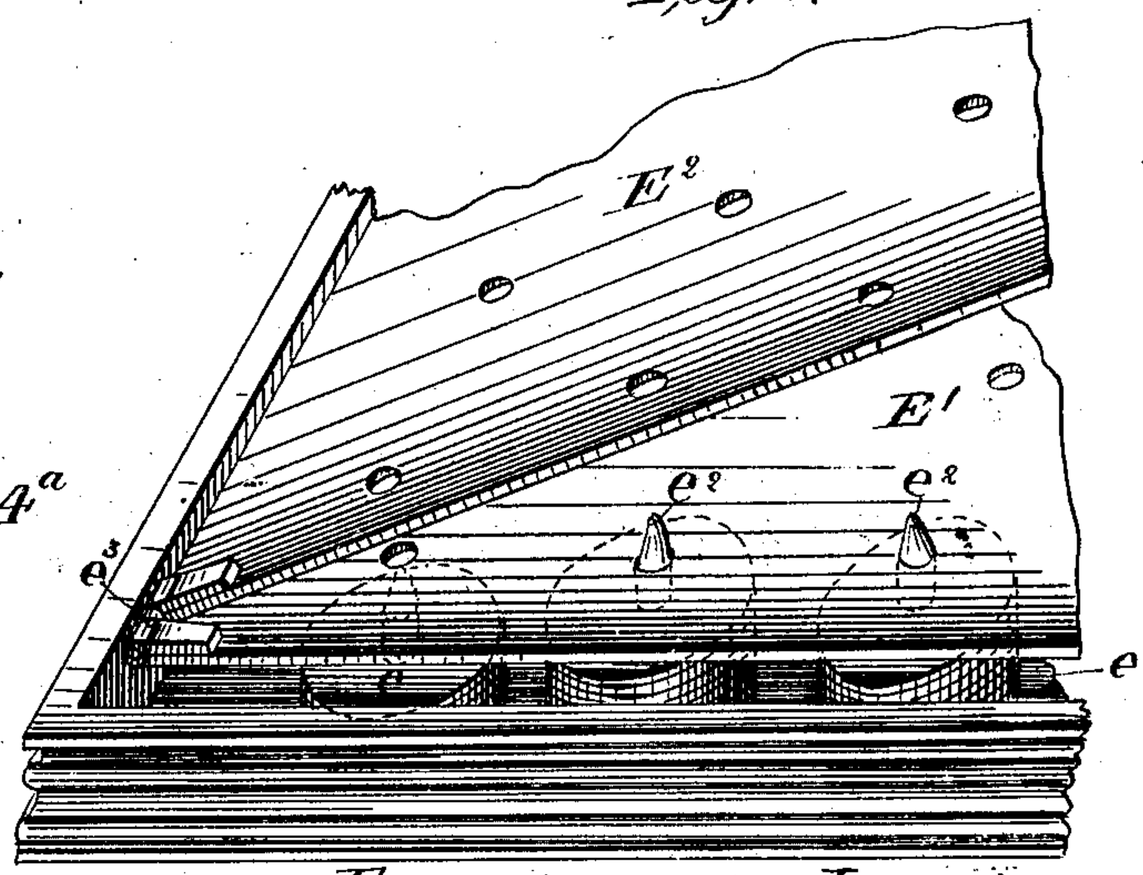


Fig. 5.



F

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(No Model.) 6 Sheets—Sheet 2.

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MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

Fig. 7

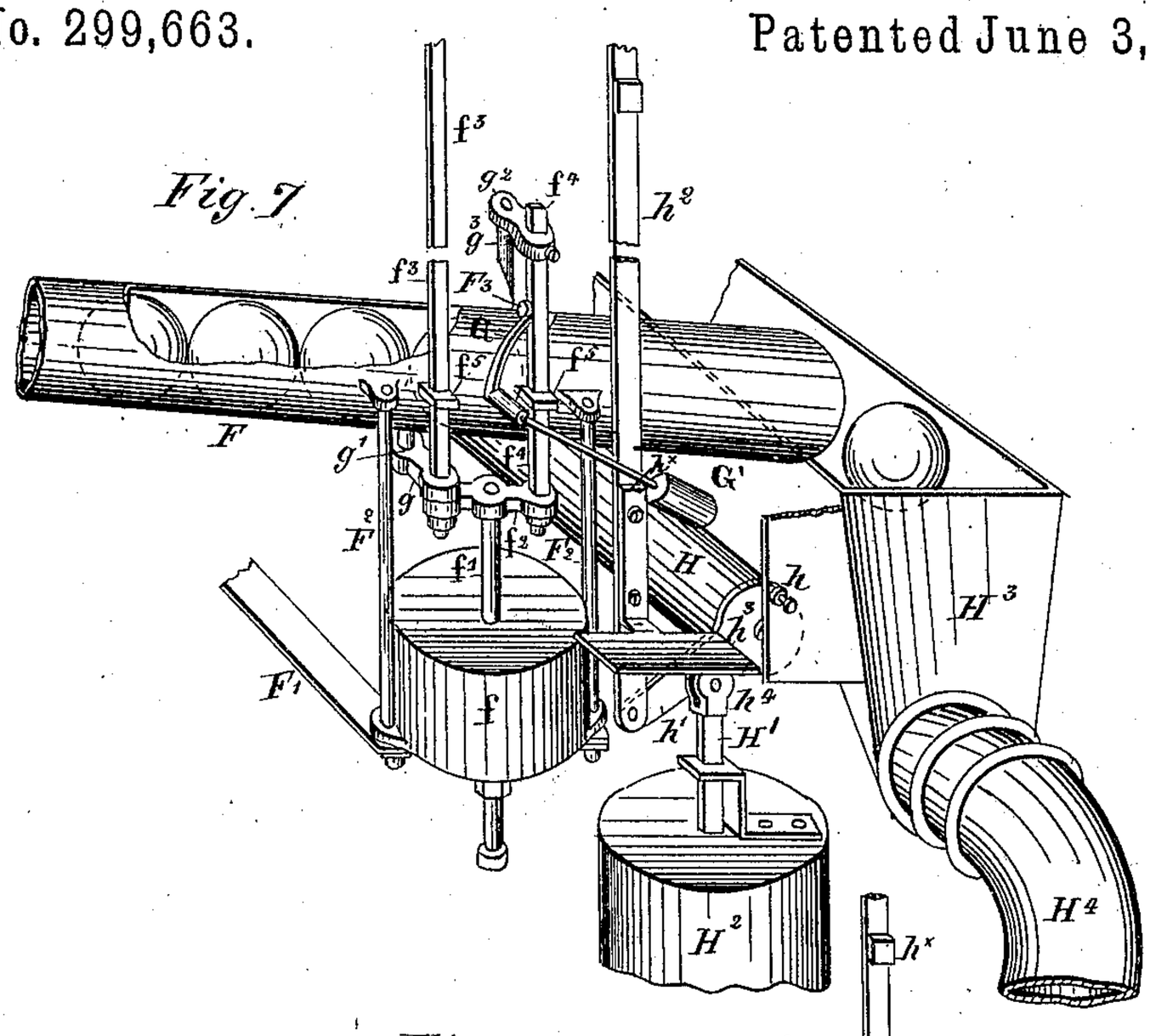
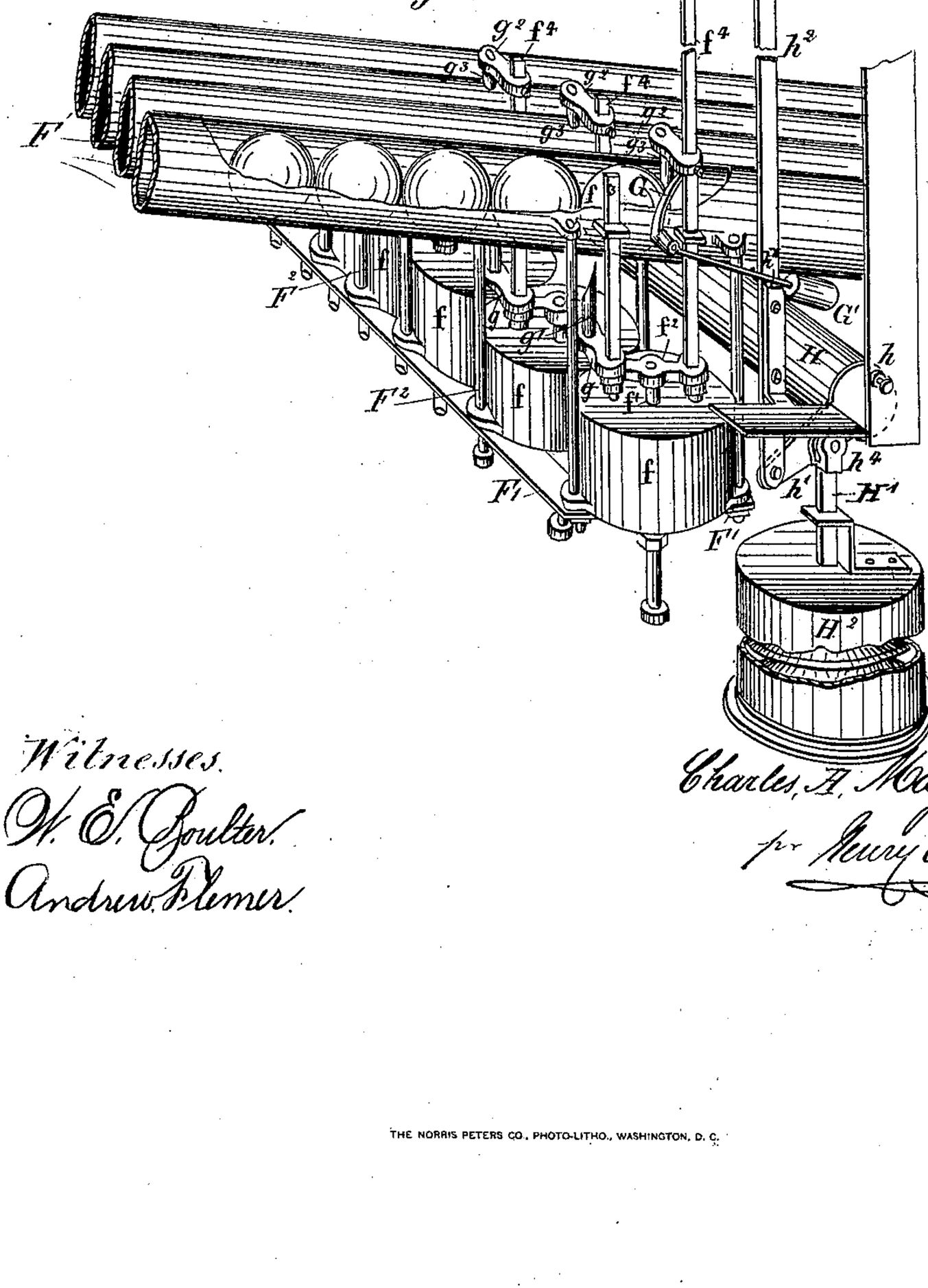


Fig. 6.



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(No Model.) 6 Sheets—Sheet 3.

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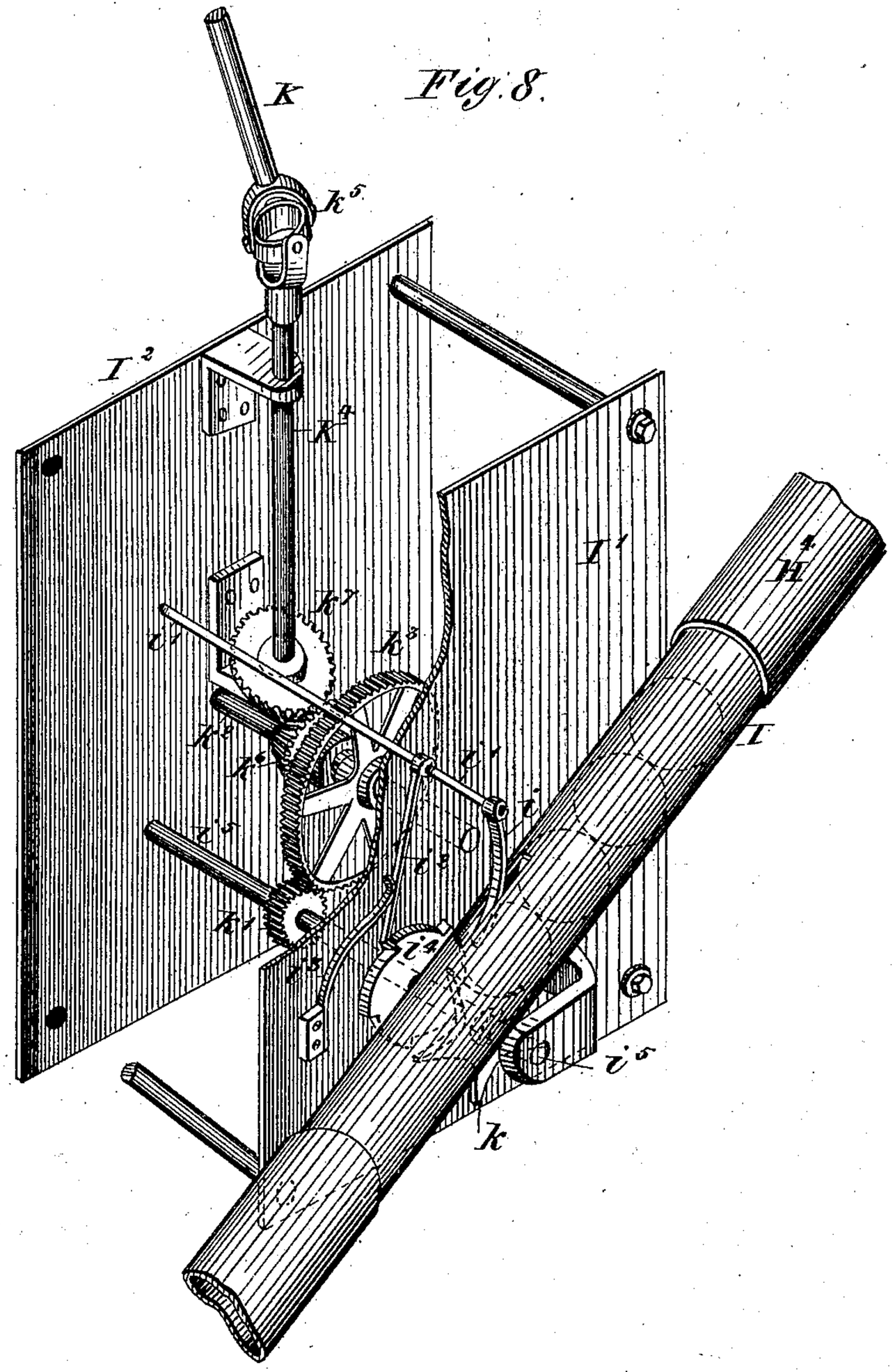
MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

Fig. 8.



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6 Sheets—Sheet 4.

C. A. MAYRHOFER.

MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

Fig. 9.

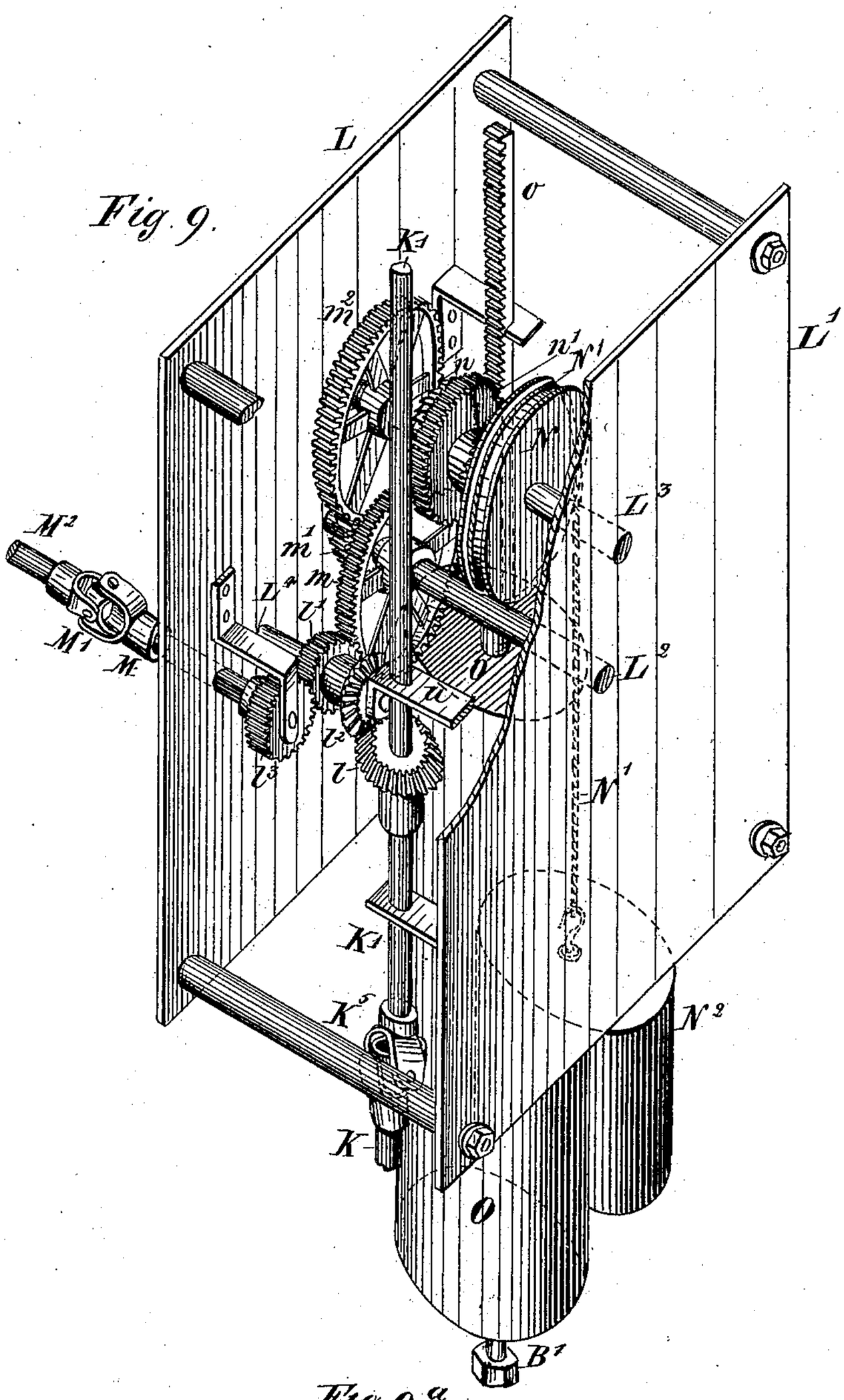
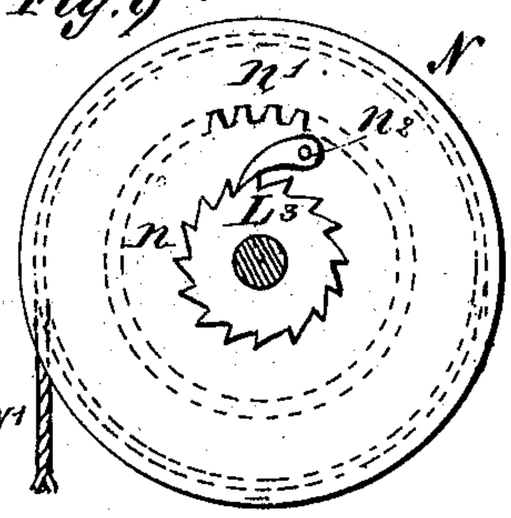


Fig. 9ª



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6 Sheets—Sheet 5.

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MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

Fig. 10.

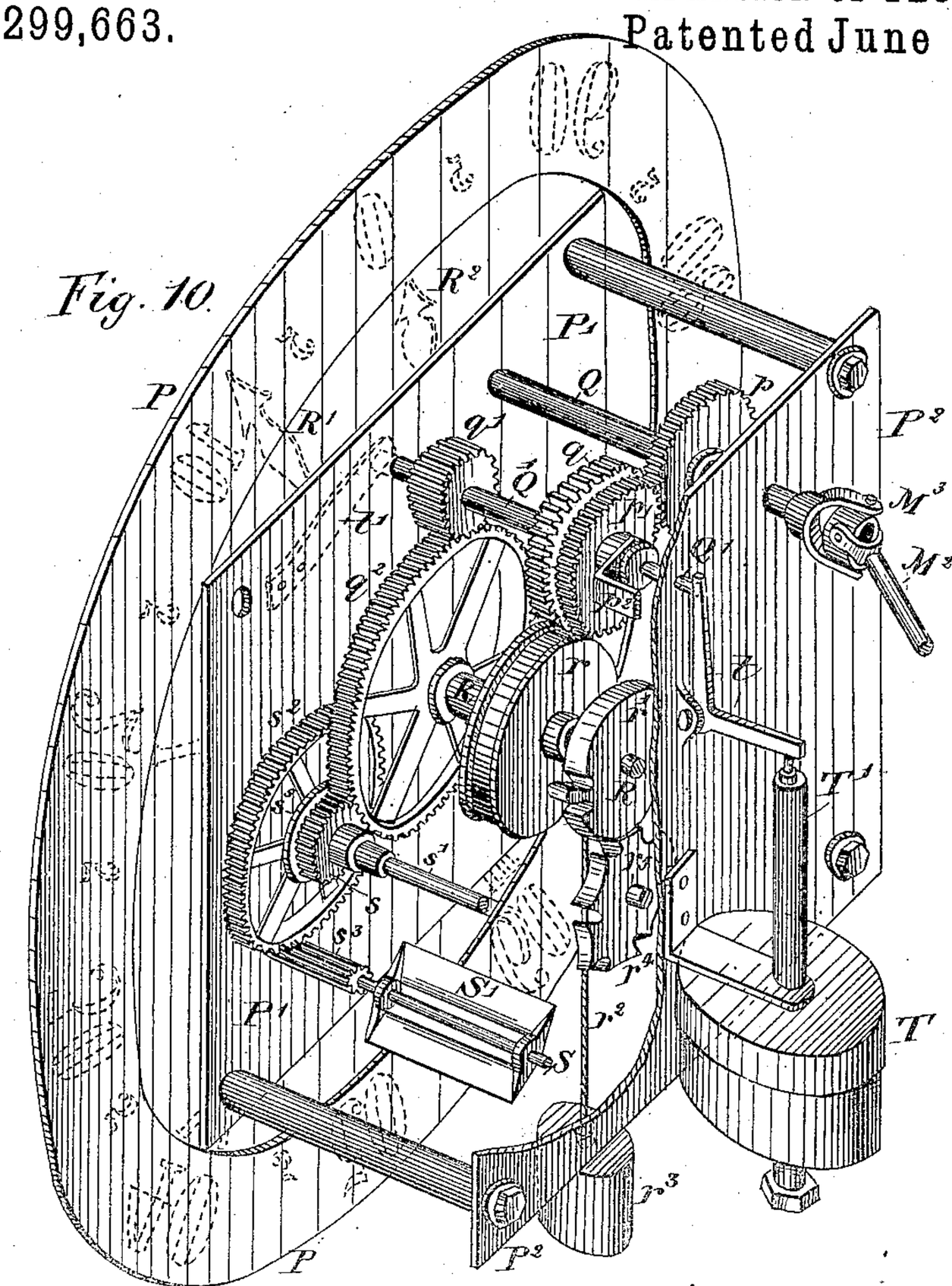


Fig. 11.

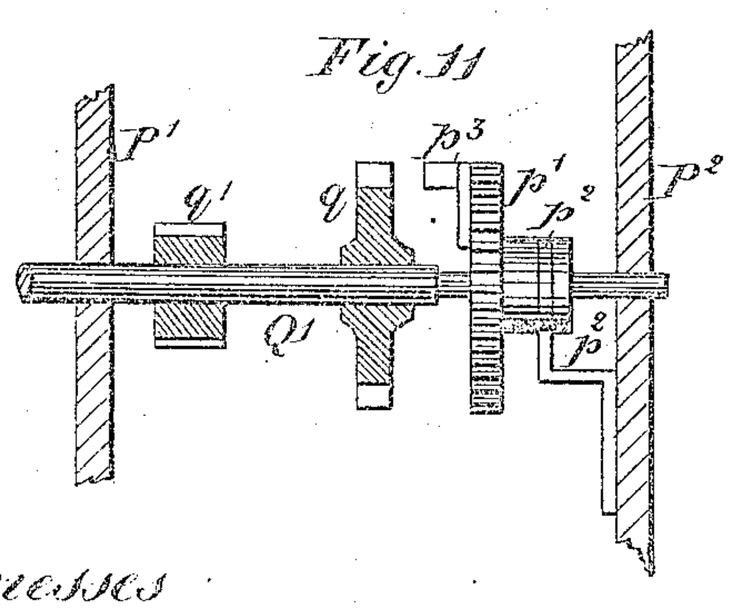
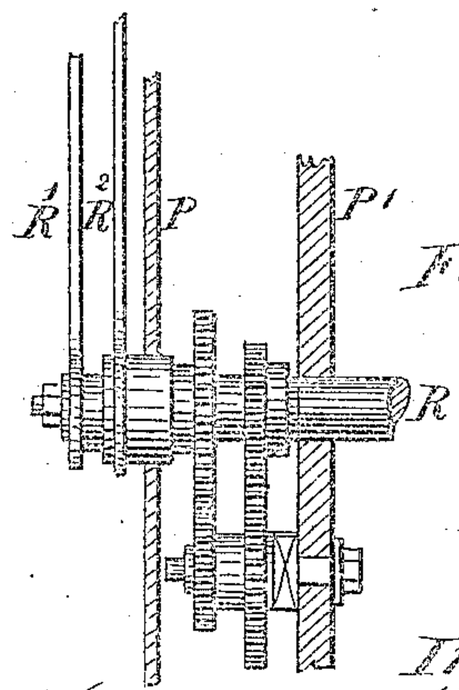


Fig. 12.



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MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUIDS.

No. 299,663. Patented June 3, 1884.

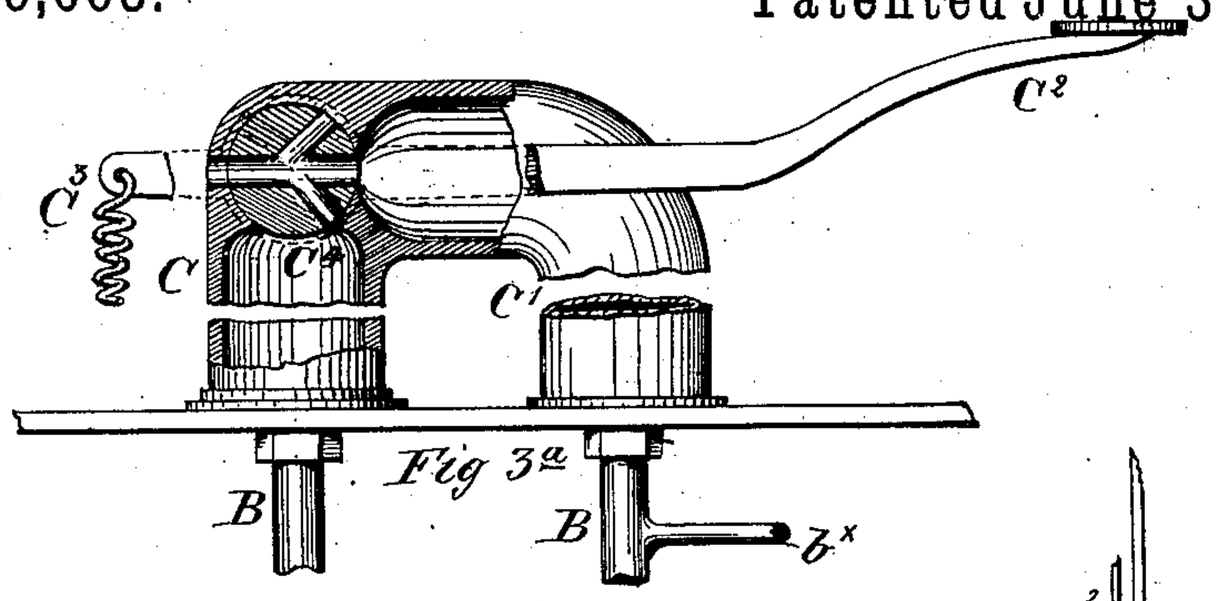

Fig 3a

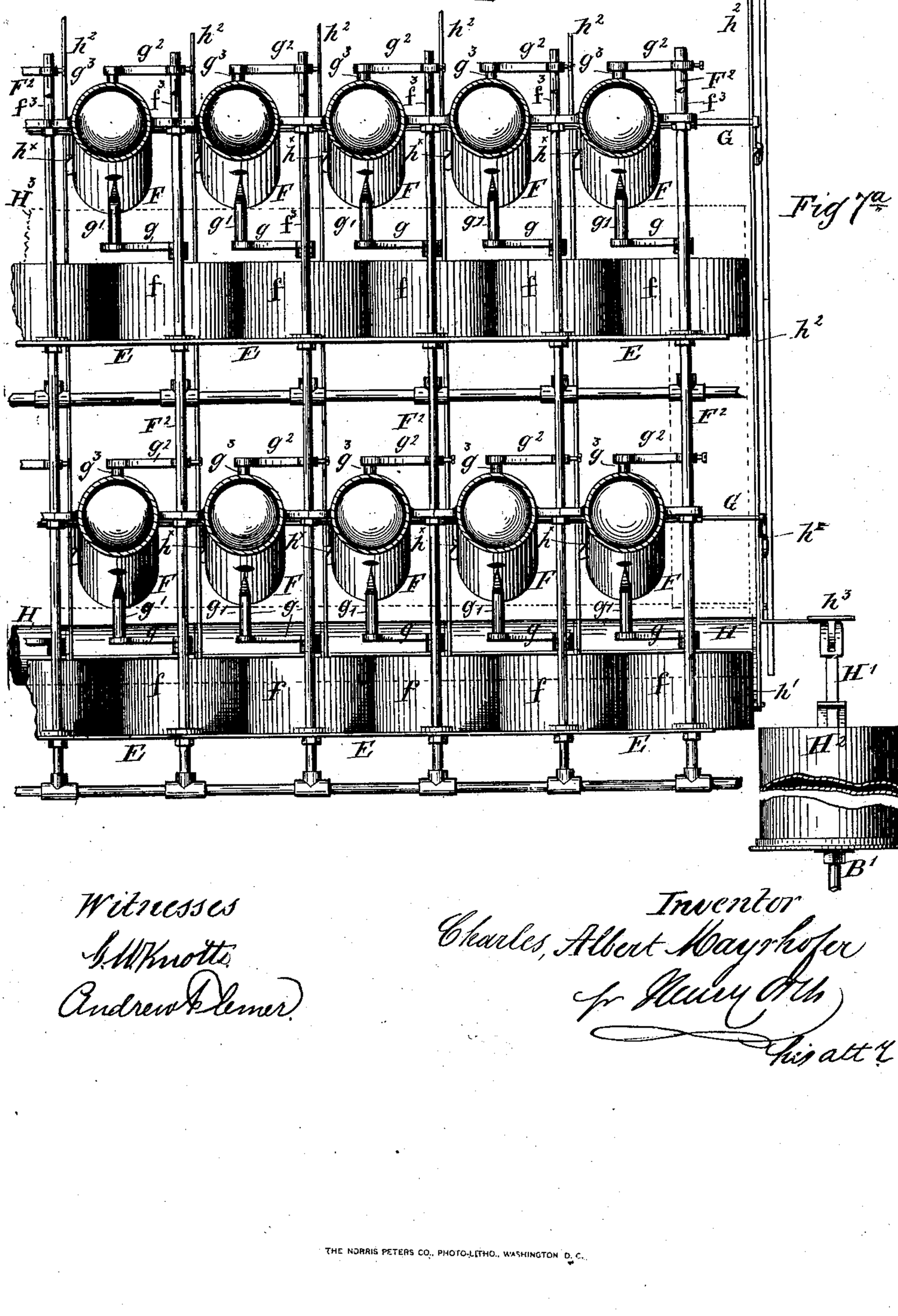

Fig 7a

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UNITED STATES PATENT OFFICE.

CHARLES ALBERT MAYRHOFER, OF VIENNA, AUSTRIA-HUNGARY, ASSIGNOR TO ROBERT I. LANGSTAFF-HAVILAND, OF SAME PLACE.

MECHANISM FOR AUTOMATICALLY CASTING AND RECORDING BALLOTS ACTUATED BY THE PRESSURE OR EXPANSION OF FLUID.

SPECIFICATION forming part of Letters Patent No. 299,663, dated June 3, 1884.

Application filed February 6, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES ALBERT MAYRHOFER, a subject of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Nether Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Mechanisms for Automatically Casting and Recording Ballots Actuated by the Pressure or Expansion of a Fluid; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My present invention relates to a novel system of balloting or voting, whereby the votes are automatically cast, counted, and registered, and whereby a permanent record of the votes is obtained, together with the name of the voter and the character of the votes cast by him. The system is more especially designed for use by bodies politic, assemblies, or other bodies where the choice of the body is expressed by ballot; and the invention has for its object, first, to facilitate the casting of ballots by yeas and nays without liability to mistakes or confusion, and to expedite the counting of such ballots; second, to place within the control of the voter appliances—such as a key or keys or valve-levers—by the manipulation of which a ballot is cast (either affirmative or negative, at the will of the voter) permanently recorded upon a sheet of paper, so that on inspection of the record it will not only disclose the number and character of the ballots cast, but also by whom such were cast; third, to cause each individual ballot to be automatically counted and such counts automatically transmitted to registering devices and registered in view of all the voters present, and the totality of ballots cast visibly indicated thereby; fourth, to prevent a voter from repeating his ballot, not only so far as the permanent record of such votes and the indication thereof of the party by whom the ballots were cast may disclose, but by devices beyond the control of the voter, whereby he is effectually prevented from repeating his ballot during the voting.

The invention consists in a system of balloting comprehending a recording or registering mechanism, whereby the ballots cast are automatically recorded, one by one, in view of all the voters present; mechanism for counting said ballots automatically and one by one and transmitting the count to the registering mechanism; mechanism for automatically casting each ballot and causing said ballot to be counted and registered, said ballot-casting mechanism being operated by the pressure or expansion of a fluid; keys or levers for operating valves under the control and at the disposition of each voter, located in proximity to his seat or upon his desk, by the manipulation of which his ballot is cast, whether this be yea or nay, counted, and registered, and a suitable fluid main or mains and distributing-pipes for conducting the fluid admitted thereto from such main to the ballot casting and recording mechanisms.

The invention further consists in mechanism not within the control of the individual voter, whereby he is prevented from repeating his vote during the balloting, and, in combination therewith, of-ballot casting or delivering appliances operated by the pressure or expansion of a fluid.

The invention further consists in mechanism whereby each vote cast is individually counted and the count transmitted to a registering mechanism, and, in combination with said counting and registering mechanism, of a relay or auxiliary power to insure the proper transmission of the count to said registering mechanism.

The invention further consists in devices or appliances operated pneumatically, whereby a permanent record of the votes cast and by whom cast is obtained, said devices being operated by the pressure or expansion of a fluid.

The invention further consists in devices or appliances within the control of the officer selected to conduct the balloting, or whose duty it is to conduct such balloting and announce the number of ballots cast, whereby he is enabled, when all the members have voted, to

place the various mechanisms in their normal condition ready for a second ballot, and this by means of a single key or valve lever located in proximity to or upon the desk of such officer, said mechanism being operated by the pressure or expansion of a fluid.

The invention further consists in certain details of construction of the various appliances, and in their combination and co-operation, whereby the desired results are obtained, all as hereinafter fully described.

Before describing the various mechanisms whereby the votes are cast, counted temporarily and visibly recorded, a permanent record thereof made, and the parts replaced in their normal condition ready for another ballot after all the ballots have been cast, I would remark that two sets of mechanisms are employed for effecting the above results—one for the yea or affirmative votes, and one for the nay or negative votes. Said mechanisms are, however, identical in construction and operation. It will therefore be sufficient to enable those conversant with this branch of the art to describe one set of appliances in order that the construction and operation of the other set may be fully understood; and as an illustration of the practical working of the system I will describe the same in its relation to compressed air as the prime motor, though any other fluid may be used, and the power exerted by the pressure or expansion thereof applied as a prime motor.

I would further remark that both sets of mechanism or appliances are or may be supplied with compressed air from the same main provided with suitable branches or arranged in circuit, and that the compressed air may be supplied to such main by any suitable compressor.

I would further remark that, although separate mechanisms are employed for the affirmative and negative votes, each voter is provided with a duplicate key or valve lever located in proximity to his seat or upon his desk, whereby he is enabled to cast either an affirmative or a negative vote, without, however, being able to cast either of said votes a second time during the same ballot, and that by means of a single key or valve lever the presiding officer controls both sets of mechanisms, and is enabled to place the same in their normal condition after each ballot, the pneumatic conduit whereby the compressed air is conducted to the operative devices of one set of mechanisms being also connected with the operative devices of the other set of mechanisms. The registering-dials upon which each vote is registered, and whereby the totality of votes cast is indicated, may be placed side by side, for convenience of inspection, in some conspicuous place in the hall or chamber in which the voting takes place, and in view of all the voters. And, further, that the pneumatic actuating devices employed by preference are bellows, and that wherever such are employed they are of like construction, though bellows of any other suitable construction or pistons or analogous mechanical devices may be employed.

I will now proceed to describe the several mechanisms employed for casting, counting, registering, and pneumatically recording one kind of votes, from which the like mechanisms whereby like results are obtained for the other kind of votes will be readily understood, reference being had to the accompanying drawings, in which—

Figure 1 is an isometrical view of the double voting-key for each voter. Fig. 2 is a vertical transverse section of the same. Fig. 3 is an isometrical view of the key under the control of the officer presiding over the balloting, and Fig. 3^a is a sectional detail view thereof. Fig. 4 is a vertical transverse section of one of the power-bellows shown in its distended state, and Fig. 4^a is a top plan view thereof. Fig. 5 is an isometrical view of the devices whereby a permanent record of the votes cast is obtained. Figs. 6 and 7 are isometrical views of the ballot casting or ejecting mechanism. In the former figure the parts are shown in their normal position, and in the latter figure in the position they assume after a ballot has been cast. Fig. 7^a is an end view showing the arrangement of ball-holders in vertical parallel series. Figs. 8, 9, and 10 are isometrical views of the co[illegible]ng and transmitting mechanism, the auxiliary power or relay for the transmission of the count, and the registering mechanism, respectively. Figs. 9^a, 11, and 12 are detail views of parts of the mechanisms shown in Figs. 9 and 10.

The double keys under the control of each voter for casting his ballots are arranged upon any convenient support in proximity to his seat or upon his desk, and as both keys are the same in construction and operation, it will be sufficient to describe one of them.

Referring to Figs. 1 and 2, A indicates a valve-casing secured to a suitable base-plate, and divided into two chambers, 1 and 2, by a partition, 3. From the lower chamber extends a short pipe, A′, by means of which and a connecting-pipe, A^2, communication is established between said lower chamber, 2, of the valve-casing A of one key and the corresponding chamber of the other key, so that compressed air is at all times present in the lower valve-chamber of both keys, the short pipe A^2 of one of the keys only being connected by means of a pipe, A^3, with a compressed-air main or branch thereof. The valve-casing contains a valve, a, that has its seat on the under side of the partition 3, whereby the communication between the two chambers 1 and 2 is normally cut off, the valve being held to its seat by a coiled spring, a^3, on the valve-stem a^2, which spring bears against the button a' on said stem and on the upper face of the valve-casing, as plainly shown in Fig. 2. The upper chamber, 1, is connected with an eduction-pipe, A^4, and

when pressure is applied to the valve-button and the valve forced downward from its seat the compressed air in chamber 2 passes through the valve-port in partition 3 into chamber 1 of the casing A, and thence into the eduction-pipe A^4 of said chamber, the latter pipe being connected with the pneumatically-operated ballot delivering or casting devices, and the devices whereby a permanent record is obtained corresponding with this particular valve, and hereinafter to be described.

Since compressed air is employed as a power for actuating the ballot-casting appliances, it is evident that means should be provided for exhausting the air from the actuating medium after a ballot has been cast, to replace the actuating device in its normal condition for the next ballot. To effect this automatically the valve-stem a^2 is made hollow, and has two ports, 4 and 5, respectively, which ports, when the valve is in its normal position upon its seat, will establish communication between the chamber 1 and the outer air through the valve-stem, as shown in Fig. 2; but when the valve-stem is depressed to open the port in the partition 3 the ports 4 and 5 will both be within chamber 1 of the valve-casing, and the compressed air entering from chamber 2 will be prevented from escaping except by pipe A^4.

In practice I prefer to surround the valve-stem with a sleeve, 6, around which the spring a^3 is coiled, said sleeve extending nearly to the under side of the button, but sufficiently far from it to allow the compressed air to escape between the sleeve and button when the valve a is on its seat, as shown in Fig. 2. By means of this construction the compressed air, after having done its work, is on the release of the button at once exhausted from the conducting-pipe A^4, or branch thereof, and the device which serves to actuate the ballot ejecting or casting appliances returned to its normal position of rest.

In the description of the objects of the invention, as well as in the statement of invention, I have referred to means whereby the casting of a second ballot cannot take place while a ballot is being taken. It is therefore necessary that means should also be provided to place the ballot-casting device in condition for use after each ballot. This I effect by means of a key under the control of the presiding officer, which key not only serves to automatically effect the desired purpose, but also to bring both sets of mechanisms into their normal condition after a ballot has been taken, and to automatically wind up such of the mechanisms as require winding up, and finally return the indicator-hands of both dials to their starting-points, or zero. This key or valve and lever I will now describe, with the remark that, although differing in construction, its operation is precisely the same as that of the voters' keys above described, to likewise admit compressed air from a main or from a branch thereof to suitable conduits, and from the latter to devices by means of which certain mechanisms are brought into action, as hereinafter described.

Referring to Fig. 3, C C′ indicate a two-branch or bent pipe provided at the head of branch or leg C with an ordinary three-way cock. The leg C is connected by a pipe, B, with the compressed-air main, and the leg or branch C′ is connected to a distributing-pipe, B′, for conducting the compressed air to the devices operated thereby when the valve is manipulated.

To the plug C^4 of the three-way cock or valve is connected an operating-lever, C^2, the ports of said plug being so arranged that when the lever C^2 is in its normal position, as shown in full lines in Fig. 3, the communication between branch C′ and branch C is cut off and the communication between branch C′ and the outer air established, whereby the compressed air in the distributing-pipes and actuating devices is automatically exhausted and said devices returned into their normal positions of rest, as will be presently explained. When, however, said lever is depressed to the position shown in dotted lines in said figure, the communication between said branches is established, and compressed air passes from the main or its branch to the distributing-pipes and actuating devices, to set in operation certain mechanisms hereinafter described. A spiral spring, C^3, connected with the rear extension of the lever, serves to carry the latter to its normal position whenever depressed and released. In order that the lever may be held down long enough to enable the compressed air to do its work, I employ the following devices: On its under side the lever C^2 is provided with a slotted plate or hasp, c^2, adapted to automatically engage a hook or catch, c^4, formed on the vertical arm of a bell-crank lever, c. This lever is pivoted in suitable lugs, c^3, upon a cylindrical casing, b, containing a bellows, b', (shown in dotted lines in said Fig. 3,) the horizontal arm of said lever projecting into the casing b over the bellows-head b^2, and said bellows b' is connected by a branch pipe, b^5, with the compressed-air-distributing pipe B′. It is obvious that when the lever C^2 is depressed the hasp c^2 will engage the nose or hook c^4 of the bell-crank lever c, the horizontal arm of which is preferably made a little heavier than the vertical arm thereof. In this position of the lever C^2 the compressed air from B passes freely into B′, and thence to the pneumatic devices that serve to actuate certain mechanisms. The said air at the same time passes into bellows b', which is gradually distended vertically until, when nearly fully distended, the head b^2 thereof comes in contact with the horizontal arm of the bell-crank lever, and a slight further upward movement of the bellows tilts or trips the bell-crank lever out of engagement with the hasp c^2, whereby the key-lever C^2 is released, and automatically returned by the spring C^3 into its nor-

mal position. (Shown in full lines in Fig. 3.) When in this position the distributing-pipes are placed in communication through the three-way valve with the outer air, as stated, and the compressed air is exhausted from said pipes, the bellows b' collapses, and the parts will have assumed their normal positions. If the bellows employed for the release of the lever C^2 corresponds in proportions with the bellows that actuate the various mechanisms, it is evident that the lever C^2 will not be released until said mechanisms have been set in operation. The arrangement is such that the release of the lever C^2 and the exhaust of the air take place either simultaneously with or a moment after said mechanisms have been actuated. By means of the described valve and lever C^2, the various mechanisms of the system are placed under the complete control of the presiding officer, and in practice I preferably inclose the parts in a suitable casing, as shown in Fig. 2, secured to the desk of said officer, or to some convenient support in proximity to his seat.

I have hereinbefore stated that, as a means for actuating certain parts of the various mechanisms of the system, I employ, by preference, bellows, and that these are all of the same construction, such bellows varying only in dimension according to the work they have to perform. Referring to Figs. 4 and 4^a, these bellows are composed of a series of superposed rubber disks, D, having a central annular aperture, said disks being united to one another at that point (preferably) by means of a metallic eyelet, d, though they may be connected together in any other manner, as by overseaming or cementing, or otherwise. The peripheral edges of each couple of disks are similarly connected by means of a metallic grooved clamping-ring, d', in the groove of which said edges are firmly held to form an air-tight structure, and by this means I obtain cylindrical bellows of great flexibility and strength. The top and bottom of the bellows are formed by metallic disks D' D^2, respectively, the peripheral edges whereof are turned over to form an annular groove, in which the outer peripheral edge of the disks D are clamped or otherwise secured by means of rivets or cement to form tight joints. In practice I employ light sheet metal for said heads D' D^2. The lower head, D^2, is provided with means for connection with the compressed-air-distributing pipe or a branch pipe thereof.

The air-pipe A^4, connected with the upper chamber, 1, of the valve-casing A of the voters' keys, serves to simultaneously conduct compressed air admitted thereto, as above set forth, to the mechanisms whereby a permanent record of the ballots is obtained, and to the ballot delivering or casting mechanism of either set, by depressing one or the other of the keys, according as the voter desires to cast an affirmative or a negative vote.

I will now describe the appliances whereby a permanent record is obtained, referring to Fig. 5 of the accompanying drawings. These appliances are absolutely noiseless in their functions, and I locate the same either in proximity to the desk or seat of the presiding officer, or I arrange them within said desk. The essential features of these devices consist in a series of small bellows arranged in parallel rows—one bellows for each voter, the upper head or top plate of which carries centrally a perforator—such as a conical pin, or a stud or small style—which, when the bellows are distended, comes in contact with and perforates a sheet of paper stretched above said bellows. These sheets of paper are preferably ruled in columns corresponding to the number of voters, each column being headed with the name or the number of the seat, or both, of each person entitled to vote. As shown, the bellows are arranged in series or rows, side by side, in a suitable box, E, or within the desk of the presiding officer; or such box may be located at any other suitable point in the hall or chamber where the voting takes place, as the record cannot readily be tampered with without detection, though as a precaution the parts may be locked and the key placed in charge of the presiding officer or other person, this record being a check upon the registering devices, with which it must tally, besides serving as a permanent record.

As stated, each bellows e is provided with a perforator, e^2, formed on or secured to the upper head thereof. Above the bellows e, and hinged to the box or other suitable support, lies a metallic plate, E', having a number of perforations corresponding with the number of bellows e, said perforations being arranged to register with the perforators of the bellows. Upon the hinge-pin e^3 of the plate E', and above the latter, is hinged a second plate, E^2, similarly provided with perforations, which register with those of plate E', said two plates constituting the clamp between which the sheet of record-paper is smoothly and firmly clamped, so that when any one or more bellows are distended by the compressed air admitted thereto by the depression of a key or keys the perforator or perforators e^2 will penetrate the holes of plates E' and E^2 and perforate the interposed sheet of paper.

It is evident that when one or more voters depress one of their keys compressed air is admitted to the distributing-pipe A^4 thereof, and conducted by the latter or by a branch connected therewith to the bellows corresponding with such key. The bellows is distended vertically, and a perforation or permanent record is made in the column of the sheet of paper corresponding to the key or keys depressed, and as said columns also indicate the particular voter, or the number of his seat, whose key has been depressed, the record-sheet will indelibly show not only the number of ballots cast, whether yea or nay, according

to the key depressed, but also by whom such ballots were cast. In this manner the sheet of each ballot may be preserved as a permanent record, and such sheets, if desired, bound in volumes.

The casting of the ballots is effected by means of metallic balls, and the counting and temporary registering of said ballots is effected by said balls actuating a counting mechanism, the work of which is transmitted to registering devices in full view of all the voters, whereby the ballots as they are cast are temporarily registered.

I will now describe the mechanism for casting the metallic ballots, which I will denominate "ballot casting or delivering mechanism." There is a ballot-casting mechanism for the ballot holder or receiver of each voter, said holder containing any desired number of metallic balls. The number of balls for the affirmative and negative casting devices of each voter will depend on the number of votes that may be taken in a given period of time, to avoid the labor and loss of time necessary to replace the balls into their holders after every vote taken, so that any number of votes may be taken—say, for instance, in a day's session—without replenishing the holders or receivers. This mechanism is constructed and operated as follows:

Referring to Figs. 6 and 7 and 7ª, F F indicate a series of tubes—one for each voter—said tubes being open at each end and inclining toward their open discharge ends, to allow the metallic balls to traverse the tubular holders by gravity when released. These tubular holders F are or may be arranged either in horizontal or vertical parallel rows, or both, each of them being provided with perforated lugs or ears, from which is suspended, by means of suspension-rods F^2, either a shelf or two transverse rails, F'. Upon the cross-rails F' are secured, by means of the suspension-rods F^2, a series of bellows-casings, *f*, containing each a bellows, the number of which corresponds to the number of tubular holders F, each of said bellows being in communication with the compressed-air conduit A^4 or a branch thereof.

To the upper disk of each bellows, and at the center thereof, is secured a short rod, *f'*, that passes through the top of the casing *f*, and carries at its outer end a cross-head, f^2. To one arm of this cross-head is secured a guide-rod, f^3, and to the other a like rod, f^4. These guide-rods slide in and are guided by slotted lugs f^5, secured to the ball-holder F. The shorter guide-rod, f^3, also carries immediately above the cross-head f^2 a laterally-projecting arm, *g*, to the free end of which is secured a pin, *g'*. The holders F are each provided with an aperture corresponding in location to that of the pin *g'*, which, when the cross-head f^2 is carried upward toward the tube, penetrates into the latter. This pin is beveled from the point downward and rearwardly, and by preference has its beveled face formed slightly concave, and serves to retain the balls within the tube, when a ball in front of it is allowed to escape. The longer guide-bar, f^4, carries also at its upper free end a laterally-projecting arm, g^2, to which is attached a like retaining-pin, g^3, that penetrates into the tube F from above, and serves to retain the balls in the tube after one of them has been discharged and the bellows assume their normal position—that is to say, when the air is exhausted from the bellows on the release of the voter's key and the bellows collapse, as above described.

By means of the mechanism described, it will be seen that when a voter depresses one of his keys, and compressed air is admitted to the bellows appropriate to such key, said bellows will be distended vertically, thereby elevating the bars f^3 f^4. The retaining-pin g^3 of the latter bar will move away from the front ball of the series. At the same time, however, the pin *g'* of bar f^3 will have passed between said front ball and the next succeeding, to retain the remaining balls of the series in the tubular holder, while the front ball is allowed to escape. On the release of the voter's key, the air is exhausted from the bellows, and said bellows will necessarily return to its normal position ready to cast the next ball, and in this manner the ballot could be repeated as many times as there are balls in the holder. To prevent this I provide means whereby the ejecting or releasing devices are locked into position after the release of a ball and before the parts return to their normal position, and combine therewith appliances for allowing said parts to return to their normal position. The latter appliances are, however, not under the control of the voter, but under that of the presiding officer, as hereinbefore stated, and are set in operation by means of the key under his control, as will be presently explained.

The devices for locking the parts into position after the release of a ball are constructed and operated as follows, still referring to Figs. 6 and 7:

Upon each tube is pivoted a locking-pawl, G, provided with a weighted arm, G', extending at right angles therefrom. The guide-bar f^4 has upon the side facing the pawl G a lug, F^3, with which said pawl engages by gravity, when, by the distention of the bellows, the cross-head, with its guide-bars f^3 f^4, is raised and holds the latter in their elevated position. Of course it will be understood that the space between the retaining-pins *g'* g^3 is such that the pin *g'*, on penetrating into the tube, will pass between two balls; or, in other words, the space between the two pins is equal to the diameter of the balls employed. As long as the parts described are in their normal position, as shown in Fig. 6, the upper pin, g^3, lies within the tube F in front of the balls, and holds them against displacement, the free end of the pawl G lying in contact with the bar f^4 above the lug F^3. If, now, a voter, depresses a key and sends the compressed air

to the bellows of a given tube, the bellows is at once distended, causing the cross-head f^2, and with it the guide-rods f^3 f^4 and their pins g' g^3, to rise, the latter pin gradually moving away from the first or front ball of the series, while the pin g' is gradually moving between said ball and the next succeeding one, until the bellows has been sufficiently distended and the guide-bars elevated to carry the pin g^3 clear of the first or front ball, which is thus released, the pin g' having at the same time passed in front of the second ball, to hold the series of balls remaining in the holder from escaping therefrom. During this upward movement of the pins the pawl G rides freely on the bar until said pawl has passed the lug F, which takes place at the moment the front ball is released. The air being now exhausted from the actuating-bellows, the tendency of the parts is to descend; but the pawl abutting against the lug F^3 holds said parts in the position described until released. The lower open ends of the tubes F are arranged over a trough or hopper, H^3, which is also inclined from one end to the opposite discharge end, to which latter is connected the transmitting-tube H^4, Fig. 7. As the balls are released, as above described, they fall into said hopper, and from thence roll into the transmitting-tube H^4, that conducts them to the counting mechanism.

As above stated, the mechanism for releasing the pawl G from the ball-ejecting devices is under the control of the presiding officer, who, after all the votes have been cast, is alone enabled to return said ball-casting devices to their normal position, ready for the next vote. This is effected by the depression of the key or lever C^2, whereby the ejecting devices of the entire series of ball-holders return simultaneously into their said normal positions through the instrumentality of the following mechanism, whether said tubes are arranged in parallel series horizontally or vertically, or both:

H^2 indicates a bellows-casing containing a bellows which is in communication through the three-way valve C^1 of the key C^2 with the compressed-air main or the outer atmosphere, according to the position occupied by the key C^2, and consequently by the valve-ports. When the lever C^2 is depressed to admit compressed air from the main to the pipe B' or a branch thereof, said air passes to the bellows in casing H^2. The upper head of the bellows carries centrally an actuating-rod, H', in the upper end of which is preferably pivoted an anti-friction roller, h^4. Upon the roller rests a plate, h^5, that has an arm formed at right angles thereto, by means of which said plate is secured to a tripping-rod, h^2. The upper face of the plate-arm, as shown in Figs. 6 and 7, forms a bearing, h^x, upon which the weighted arm G' of the pawl G rests. These tripping-arms—one for each ball-holder of the horizontal series—extend upward along the superposed series, where, at suitable points, they are similarly provided with bearings or abutments, upon which rests the weighted arm G' of the pawl G of each of the superposed ball-holders. The lower end of the tripping-rods h^2 are pivoted to a crank-arm, h', secured to a shaft, H, located below and extending across the lower horizontal row of tubes F near their discharge ends. The shaft H is pivoted eccentrically on trunnions or pins h in suitable bearings formed in the supporting-frame or in hangers or other suitable supports. When compressed air is admitted to the bellows in casing H^2, and said bellows distends vertically, the rod H' lifts the plate or abutment h^5, and with it the tripping-arm h^2, and as said arm is connected with shaft H, the latter is partially rotated, thereby rotating all the crank-arms h', to which the tripping-arms h^2 of the remaining series of ball-holders are pivoted, and whereby said arms are simultaneously moved vertically. The upward motion of the tripping-arms h^2 also raises the weighted arms G' of the pawls G, which movement causes the pawls to be disengaged from the stop F^3, allowing all the bellows in casings f to collapse simultaneously and carry with them the rods f^3 f^4, by which movement the pins g' will release the series of balls in their respective holders, the balls remaining therein rolling forward the distance equal to the diameter of one ball, to be arrested by the pins g^3, when the parts will again have assumed the position in which they may be controlled from one of the voters' keys.

The ball-holders F may, as stated, be arranged in horizontal or vertical parallel series, or both, in any suitable supporting devices, so as to incline toward their open discharge end, and the balls are introduced into the tubes by hand; and, if desired, each tube may be provided at the feed end with a suitable feed-hopper, to facilitate the introduction of said balls into their respective tubes. In practice I cause the balls, after they have done their work, to be automatically conducted to a common collecting-box secured in proximity to the feed end of the ball-tubes F, from which box the balls may be conveniently fed to their respective holders. The balls, after leaving their tubes, roll along the trough H^3 to its discharge end, and from thence pass one by one into a conduit, H^4, that conducts the balls to the counting mechanism, or to a tube, I, of said mechanism, which I will now describe, referring to Fig. 8 of the drawings. The continuation of the tube H^4, or the tube I, connected therewith, to which the balls are delivered by said tube H^4, is arranged in an inclined position, and is provided upon its opposite sides with a longitudinal slot, the slot in the upper face lying a little in rear of the slot in the lower face. An arbor, i^5, is mounted below the tube in suitable bearings formed in the plates I' I^2 of the counting mechanism, and in a bracket secured to the former plate.

Above the tube I is mounted a second arbor, i', in suitable bearings formed in said

plates I' I², and said arbor carries at its outer end a lever, *i*, that projects into the tube I through the slot in its upper face. The lever *i* is preferably curved, as shown, and its free end extends down into the tube sufficiently to lie in front of the ball behind it and immediately in rear of the star-wheel *k*. The arbor *i'* also carries a pawl, i^2, the free end of which is held in engagement with the teeth of a ratchet-wheel, i^4, by means of a spring, i^3. The lower arbor, i^5, carries a star-wheel, *k*, that projects into the tube I through the slot in lower face of said tube. Said arbor i^5 also carries the ratchet-wheel i^4, above referred to, and a transmitting-pinion, *k'*, whereby the rotation of the star-wheel is transmitted to the train of gearing to be presently described. When these devices are in their normal position, as shown in Fig. 8, the pawl i^2 is held by the spring i^3 in engagement with the ratchet-wheel i^4.

The construction of the teeth of the star-wheel is such as to accommodate one of the balls between each two teeth, and it is so arranged relatively to and within the tube that only one ball at a time is allowed to pass and rotate the star-wheel on its passage. Each ball, therefore, will rotate the star-wheel a distance equal to that between its teeth. The ratchet-wheel i^4 has the same number of teeth as the star-wheel *k*, and, as shown, each has five teeth. As the balls pass under the lever *i* the latter is raised, and with it the pawl i^2, against the tension of the spring i^3, thus liberating the ratchet-wheel i^4 each time a ball passes from under said lever *i*. The ball then comes in contact with one of the teeth of the star-wheel *k*, and the latter is rotated. When the forward tooth, against which the ball presses, has turned sufficiently to allow the ball to roll freely along the tube past the star-wheel, the tooth in the rear has risen to hold the succeeding ball or balls, thus causing the lever *i* to drop in front of said ball or balls under the tension of the pawl-spring i^3, which also carries the pawl i^2 again into engagement with the teeth of the ratchet-wheel, to arrest for a moment only the rotation of said star-wheel. It will be seen that by means of this construction the ratchet i^4, pawl i^2, and lever *i* form an escapement operated by the pressure of the balls, which thus escape from the tube one by one, and impart to the star-wheel *k* a step-by-step rotation, which is transmitted to the registering mechanism. As stated, the star-wheel has five teeth. Each ball will therefore impart to the arbor i^5 one-fifth of a revolution, which is transmitted by pinion *k'* to a gear-wheel, k^5, mounted upon an arbor, k^2. The latter also carries a bevel-pinion, k^6, which transmits the rotation of the gear-wheel k^5 to a like pinion, k^7, mounted upon the lower end of a vertical transmitting-shaft, k^4, that is provided at its upper end with a universal joint or coupling, k^5, by means of which it is coupled to the transmitting-shaft K, connected with the registering mechanism or a relay. To rotate the star-wheel step by step, and to transmit its rotation to the train of registering-gearing, a given power must be exerted upon said star-wheel by the metallic balls.

It will be apparent from what has been said of the arrangement and construction of ball-casting devices that the power exerted by the balls is a variable one, depending entirely upon the number of balls contained in tube I.

Although the mechanism is so arranged relatively to the weight of the metallic balls that one of the latter will actuate the star-wheel on its passage through to tube, yet it may happen that such pressure may be insufficient to rotate the wheel and transmit the movement to the registering mechanism. To avoid all danger of a stoppage in the counting mechanism, and to make this mechanism sufficiently sensitive to operate under the slightest pressure exerted thereon, I employ an auxiliary power derived from what I term a "relay and regulating or governing mechanism," whereby the movements of the star-wheel are uniformly and regularly transmitted to the registering devices. This relay and governing or regulating mechanism is clearly shown in Fig. 9 of the accompanying drawings, and I will now describe the same in detail.

As above stated, the transmitting-shaft K of the counting mechanism is coupled to a transmitting-shaft, K', by means of a universal coupling or joint, k^5, said shaft passing into the relay-box, where it is supported in suitable bracket-bearings between the walls L and L' of said box. The shaft or spindle K' carries a bevel-pinion, *l*, that meshes with a like pinion, l^2, on a short arbor, that has its bearings in the wall L of the box and in a bracket, *u*, extending from the wall L', which bracket *u* also serves as a bearing for the spindle K'. The arbor L^4 of pinion l^2 carries a pinion, *l'*, that meshes with a like pinion, l^3, mounted upon a horizontal arbor, M, coupled by means of a universal joint or coupling, M', with a transmitting-shaft, M^2, coupled by a like coupling, M^3, to the main arbor Q of the train of registering-gearing. If desired, the transmitting-shafts may be dispensed with, and the movement of the counting and relay mechanisms transmitted directly to the registering mechanism through an extension of arbors K and M in place of arbors K' Q, as will be readily understood. When the devices are located sufficiently close to each other—as, for instance, in the same box—this direct connection may be readily effected; but, in view of the arrangement of the ball-casting devices and the location of the registering-dials to expose the latter to the view of all the voters, it may be found impracticable to locate these mechanisms sufficiently close together to effect a direct connection. The pinion *l'* also gears with a wheel, *m*, mounted on a transmitting-

arbor, L^2, that carries a pinion, m', which latter gears with a wheel, m^2, on arbor L^3. The latter arbor carries a ratchet-wheel, n, with which engages a pawl, n^2, pivoted upon the side of a pinion, n', which latter may be formed of one piece or rigidly connected with a grooved pulley, N, both loosely mounted on a shaft, L^3. To the pulley N is secured a rope or chain or other flexible support, N', from which is suspended a weight, N^2. The tendency of this weight is to rotate the shaft L^3 through the medium of the pawl n^2 and ratchet-wheel n in one direction, the latter being rigidly connected with the shaft L^3. The pinion n', that carries the pawl n^2, meshes with a vertical rack-bar, o, secured to the upper disk of a bellows inclosed in a casing, O, through the head of which the rack-bar o projects.

As stated, the weight N^2, which is the auxiliary power applied, exerts its power to operate the shaft L^3 and train of transmitting-gearing in a given direction—namely, in the direction necessary to transmit the movements of the star-wheel k of the counting mechanism to the registering mechanism and rotate the hands thereof in the desired direction. Thus, when the pawl i^3 of the counting mechanism releases the ratchet i^4, Fig. 8, the weight N^2 of the relay exerts its power upon the train of gearing to transmit the movements of the star-wheel k, through its shaft i^5, the transmitting-shaft K, and the relay-shaft K', to the registering mechanism through shaft M or the coupled shafts M M^2 Q, thereby supplying any deficiency in the power exerted upon the star-wheel by a ball or a number of balls until the pawl i^2 has again been brought into engagement with its ratchet-wheel i^4 after the passage of a ball over the teeth of the star-wheel k. It will be seen that by means of this peculiar arrangement of mechanism an auxiliary power is provided which will be brought into action precisely at that moment when one of the balls is actuating the star-wheel, said power being transmitted to the transmitting-gear by shaft L^3 through the medium of the pulley N and the pinion n', which are locked to said shaft by the pawl n^2 of pinion n' and the ratchet-wheel n. During the positive or operative movement of the pulley N and pinion n', the cord N' gradually unwinds from pulley N, and the rack-bar o gradually descends with the bellows toward the bottom of casing O. The length of the cord N' corresponds to the greatest number of ballots the apparatus is capable of recording, and unwinds from the pulley step by step, so that the weight will not cease to exert its power until all the ballots are cast. To avoid the labor of winding up the cord N' by hand after each ballot, I have provided means whereby such cord may be automatically wound up from a point distant therefrom, as in this case from the desk of the presiding officer through the medium of his key or valve lever C^2, by the depression of which compressed air is admitted into the bellows in casing O, whereby the rack-bar o is carried upward to rotate the pulley or drum N in the proper direction through the medium of the pinion n', the other mechanism of the relay being unaffected, for the reason that when the pulley and pinion rotate in the direction in which the weight is wound up the pawl n^2, that locks the pinion to shaft L^3, rides freely over the teeth of the ratchet n. It will therefore be seen that when the presiding officer depresses the key C^2 to return the ballot-casting mechanism and the mechanism whereby a permanent record thereof is obtained into their normal position the auxiliary power is simultaneously returned to its operative position, the bellows being in communication with the compressed-air-distributing pipe B', or a branch thereof.

In order to enable every voter to observe and note the casting of the ballots, I provide a registering mechanism, to which the movements of the star-wheel of the counting mechanism are transmitted by the relay, and said movements are transmitted by the train of gearing of such registering mechanism to an index or indexes or hands moving upon a dial, whereby the votes are indicated as they are cast, and whereby the totality of the votes cast is finally shown. To avoid any liability to error or dispute in or as to the totality of votes registered, the registering mechanism is arranged to register the votes from 1 upward, as it would be inconvenient to note the totality of votes cast at each ballot, as well as a source of error, were the registering mechanism constructed to continually record units, hundreds, and thousands, as is the case in such mechanisms of usual construction. To avoid the difficulties referred to, I provide means within the control of the presiding officer only whereby the indicating-hands are automatically returned to a starting-point or zero. This registering mechanism, by which the ballots are registered as each ball cast from the ball-tubes actuates the counting mechanism, is illustrated in Fig. 10, in which P indicates a dial, preferably of such dimensions as to render it conspicuous, so that each voter can follow the movement of the indicator-hands over said dial. The latter is secured to two supporting-plates, P' P^2, serving also as supports for the entire operating mechanism thereof, which is preferably inclosed in a suitable casing.

As above stated, the transmitting-shaft M^2 is coupled to an arbor, Q, by means of a universal coupling. This arbor Q carries a pinion, p, that meshes with a similar pinion, p', mounted loosely upon an arbor, Q', arranged to be displaced endwise or in the direction of its longitudinal axis in its bearings, said pinion p' being held against displacement with the shaft by a forked bearing, p^2, secured to the back plate, P^2, of the train of registering-gearing, as plainly shown in Fig. 11. The pinion p' has secured to its front face a lock-

ing dog or tooth, p^3, adapted to engage the teeth of a gear-wheel, q, rigidly mounted on shaft Q', thus causing the shaft and wheel q to rotate with the pinion p'. The rotation of the shaft Q' is transmitted by means of a pinion, q', to a gear-wheel, q^2, on a shaft, R, said pinion being of sufficient transverse diameter to permit the longitudinal displacement of the shaft Q' without being thrown out of gear with wheel q^2. The shaft R projects through and beyond the outer face of the dial-plate, and carries in front of said plate a hand, R', that indicates the units, and in rear of the hand R' the shaft R carries another hand, R^2, that indicates the hundreds, said dial having one hundred equidistant divisions. The movement of the unit-hand is transmitted to the hand R^2 by means of transmitting-gearing, (shown in Fig. 12,) arranged between the dial P and the supporting-plate P' for the train of gearing, and as such mechanism is well known it will not be necessary to describe the same in detail. The shaft R, that carries the hands and wheel q', also carries a pulley or drum, r, and a cam, r', having one tooth. Upon the drum is wound a rope, r^2, from the free end of which is suspended a weight, r^3. The rope or cord is wound upon the drum by and during the operation of the registering mechanism, said drum being, however, disengaged from the mechanism to cause the rope under the power exerted by the weight to unwind therefrom as soon as all the votes are registered, to bring the hands R' and R^2 to their normal positions—that is to say, to the zero or starting point, as will be presently explained.

Upon a pin, r^5, secured to the supporting-plate P^2, is mounted a star-wheel, r^4, with the teeth of which engages the tooth of the cam r', whereby said star-wheel is rotated a distance equal to that between its teeth at each rotation of the shaft R.

In the apparatus illustrated in the drawings the mechanism is so proportioned as to register five hundred votes, for the recording of which the shaft R makes five complete revolutions, the star-wheel r^4 being provided with six teeth, of which one is a locking or stop tooth, and an equal number of interspaces, with which the cam-tooth engages. The peripheral segments of five of these teeth are concave, and correspond with the convex periphery of the cam r', while the peripheral section of the sixth tooth, or that located between the sixth and first interspaces, is convex, so that when the tooth of the cam-wheel lies in the sixth interspace between the teeth of the star-wheel during the operation of winding the convex surface of said tooth acts as a brake or stop to arrest the rotation of the shaft, the same taking place when the star-wheel is rotated in a reverse direction to bring the hands to their starting-point when the tooth of the cam r' lies in the first interspace between the teeth of the star-wheel, and when in this position the indicating-hands will both stand at zero on the dial. By means of this arrangement it will be seen that if the vote is a unanimous one the index-hands will be automatically held against movement after all the ballots are cast, and when the said hands are returned to zero after each ballot their movement will be automatically arrested as soon as they stand at that point. In this manner I provide means whereby the hands are held stationary after the full number of ballots is cast, and prevent said hands from being carried beyond the starting-point or zero graduation on their return to that point.

To avoid too great a strain upon the train of gearing in its reverse movement under the power exerted by the weight r^3, and to regulate and control this movement, the gear-wheel q^2 meshes with a pinion, s, loosely mounted upon an arbor, s', which latter also carries a gear-wheel, s^2, and a ratchet-wheel rigidly mounted thereon. The pinion s is provided with a locking-pawl arranged to engage the teeth of the ratchet, the arrangement being such that during the rotation of the shaft in one direction to register the votes the pawl will ride over the teeth of the ratchet; consequently the pinion s will rotate idly upon its shaft; but when the shaft R is rotated in a reverse direction under the impulse of the weight the pawl will lock the pinion s to the shaft s' and cause the two to rotate together. The arrangement of locking-pawl is in this case absolutely the same as the arrangement shown in detail in Fig. 9^a with reference to the relay mechanism and its return to its normal condition, and as said parts are plainly shown in said figure I have deemed it unnecessary to again show them in detail, the ratchet and pawl being in Fig. 10 hidden from view by the pawl-disk s^5, formed on or secured to the pinion s. The shaft s' also carries a gear-wheel, s^2, that meshes with a pinion on the shaft S, which latter carries the regulating-fly S', whereby the rotation of the train of gearing in the negative direction is rendered uniform and too great a strain upon said gearing avoided. It will therefore be understood that the shafts s' s^3 remain at rest during the positive or registering movement of shaft R.

As soon as the recording of the votes is effected the hands of the registering mechanism are brought back to their normal positions pneumatically, as follows: A bellows contained in a casing, T, secured to the supporting-plate P^2, is in communication with the compressed-air conduit B'. To the upper disk of the bellows is secured an actuating-rod, T', upon the upper end of which lies the horizontal arm of a bell-crank lever, t, the vertical arm whereof is in contact with the end of the longitudinally-movable shaft Q', said lever t being pivoted between suitable lugs formed on or attached to the rear face of the plate P^2. When the compressed air is admitted from the main to the pipe B' by the depression of the lever C^2, as above described, a portion of the com-

pressed air passes into the bellows contained in casing T, whereby the latter is distended vertically and the rod T′ raised. This upward movement of the rod tilts the bell-crank lever *t*, the vertical arm of which forces the shaft toward the dial against the tension of a spring, *t′*, (shown in dotted lines,) that, when the lever *t* resumes its normal position, serves to return the shaft to the position it occupied before being displaced by said lever. This forward movement of the shaft Q′ disengages the gear-wheel *q* from the locking dog or tooth p^3 on pinion *p′*, as shown in Fig. 11, which latter is held against longitudinal movement with the shaft by the retaining forked bearing p^2, as above set forth, thus permitting the shaft to rotate freely, and allowing the weight to exert its power upon the shaft R and unwind the cord from the pulley *r*, as above set forth, to return said parts as well as the hands to the position they occupied before the balloting commenced. As soon as the compressed air has done its work the valve-lever C^2 is automatically released and resumes its normal position, cutting off the communication between the compressed-air main and the conduits B′ and its branches, and establishing communication between the latter and the outer air. The compressed air in the bellows in case T will therefore be exhausted and the bellows will collapse or descend, carrying down the rod T′, and allowing the spring *t′* to push the shaft Q′ back to its normal position, whereby the wheel *q* will again be locked to pinion *p′* by the locking-dog p^3, placing the registering-gear in condition to be operated by the counting mechanism, or through said mechanism by the relay.

From the description of the construction and operation of the several mechanisms employed for casting a ballot of a given character, and their connection and combination with the means whereby said mechanisms are set in operation or returned to their normal conditions, their co-operation will be readily understood and need no further description; and as both sets of mechanisms for the affirmative and negative votes are, as hereinbefore stated, alike both in construction and operation, a few remarks will suffice for the thorough comprehension of the co-operation of the two sets of mechanisms. Bearing in mind that the several mechanisms of the two sets—namely, the ballot-casting mechanism, the mechanism whereby a permanent record is obtained, the counting and registering mechanisms, and the relay or auxiliary transmitting-power interposed between the latter two mechanisms for the affirmative and negative balloting—are connected by a system of compressed-air-distributing pipes common to both sets of mechanisms with the key or valve lever under the control of the presiding officer, and that the ballot-casting and permanent-recording appliances for the affirmative and negative votes are connected by a separate system of distributing-pipes with corresponding keys or valve levers or stems under the control of the voters, (two such keys for each voter,) and, further, that the compressed air is supplied to the key under the control of the presiding officer and to the two keys under the control of each voter from the same main or branches thereof, the co-operation of the two systems will be clearly understood. Finally, I would have it understood that I do not desire to limit myself to the details of construction as shown and as hereinbefore described, as such may be varied. For instance, any other suitable construction of bellows than that shown having the required flexibility to promptly answer to the pressure of the compressed air may be employed.

Other means than those shown and described may be employed for utilizing the power exerted by a ball in its passage down an inclined plane and applying said power to the mechanical devices described to produce a record thereof, and, as stated, the transmitting-shaft of the several instruments may be connected directly with or from a continuation of the operating shaft or arbor operated from such transmitting-shaft.

Instead of tubular ball holders and conduits, other forms of ball holders and conduits may be employed—as, for instance, a semi-cylindrical trough, or a trough or holder of other form in cross-section, open at top and suitably slotted at bottom; or a suitable guideway may be formed of wires, slats, or other materials.

Instead of the bellows, pistons working within suitable piston-casings may be employed; and instead of operating the various actuating appliances or bellows or pistons by means of compressed air, as stated, it is obvious that these may be operated by the power exerted by the pressure or expansion of any other suitable fluid.

It is also evident that, instead of employing perforators whereby a permanent and indelible record is obtained, the bellows may be provided with type indicating either the name of the voter or the number of his seat, or both, and that, by means of inked ribbons or an inked sheet of fabric, the bellows or pistons may be made to permanently record in print the nature of the ballot and by whom such ballot is cast; also, that, instead of a weight, spring power may be applied in both the relay and registering mechanism, and the same results obtained.

I have in the construction of the system endeavored to select those forms and mechanical devices by which I thought the best results would be obtained, and I prefer as much as possible to shield the operative parts from access thereto of foreign substances—such as dust, &c.—whereby the rapid or instantaneous functions may be impaired, and for this purpose I have selected tubular ball-holders to prevent access thereto of dust, and I propose to in-

close the same in a suitable casing or box, as well as all the other mechanisms of the system for a like purpose.

I am aware that the combination of devices by the operation of which a ballot is cast and a count and permanent record thereof is made is not new, and I do not desire to claim such a combination, broadly, or the combination of said devices with a train of registering-gearing for recording each ballot cast and the totality of said ballots. I am not aware, however, that these mechanisms or combination of mechanisms have, before my invention, been operated by the pressure or expansion of a fluid, or that devices have been used whereby the permanent record is obtained by a perforator.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a system of balloting, the combination of mechanism whereby a ballot is cast or delivered from a holder or receiver, and mechanism whereby a permanent or indelible record of the ballot cast or delivered from the holder is made, said parts being operated by the pressure or expansion of a fluid, with a key or valve, on the depression of which a ballot is cast or delivered from its holder and a permanent record thereof made by the power exerted by the pressure or expansion of the fluid.

2. In a system of balloting, the combination of mechanisms whereby ballots differing in nature (affirmative and negative) are cast or delivered from their holders or receivers, and mechanisms whereby a permanent or indelible record is made of the ballots cast or delivered, said mechanisms being operated by the pressure or expansion of a fluid, with a compound key lever or valves, on the depression of which an affirmative or negative ballot is cast or delivered from their respective holders and a permanent record thereof made by the power exerted by the pressure or expansion of a fluid.

3. In a system of balloting, the combination of mechanism whereby a ballot is cast or delivered from a holder or receiver, and mechanism whereby a permanent record of the ballot cast or delivered and by whom cast is produced, said parts being operated by the pressure or expansion of a fluid, with a key lever or valve, on the depression of which the ballot is cast or delivered from its holder and a permanent record thereof and by whom cast is made by the power exerted by the pressure or expansion of such fluid.

4. In a system of balloting, the combination of mechanisms for casting or delivering ballots differing in nature (affirmative and negative) from holders or receivers, and mechanisms for producing a permanent record thereof and showing by whom such ballots were cast, said mechanisms being operated by the pressure or expansion of a fluid, with compound key levers or valves for controlling the fluid actuating medium, whereby ballots differing in nature may be cast or delivered from their holders and a permanent record thereof simultaneously produced, such record showing the totality of votes, their nature, and by whom cast.

5. In a system of balloting, the combination of mechanism for casting or delivering a ballot from a holder or receiver with appliances for locking said ballot-delivering mechanism out of operation, to prevent the casting of a second ballot until said ballot-delivering mechanism is released from the locking appliances, said appliances being operated by the pressure or expansion of a fluid.

6. In a system of balloting, the combination of mechanism for casting or delivering a ballot from a holder or receiver, a key or valve lever, on the depression of which a ballot is delivered from said holder, and appliances for automatically locking the ballot-delivering mechanism out of operation after the delivery of a ballot, with a key or valve lever for releasing the locking appliances from the ballot-delivering appliances by the power exerted by the pressure or expansion of a fluid, for the purposes described.

7. In a system of balloting, the combination of mechanism for casting or delivering a ballot from a holder adapted to be operated by the pressure or expansion of a fluid, and a key or valve lever for controlling the fluid operating medium, with mechanism set in operation by the ballot cast or delivered, whereby said ballot is counted, as and for the purposes set forth.

8. In a system of balloting, the combination of mechanism whereby a ballot is delivered from the holder by the power exerted by the pressure or expansion of a fluid, and mechanism actuated by the delivered ballot, whereby the latter is counted, with appliances for locking the ballot-delivering mechanism out of operation after a ballot has been delivered without locking the counting mechanism out of operation, for the purposes specified.

9. In a system of balloting, the combination of mechanism whereby a ballot is delivered from a holder or receiver, mechanism whereby a permanent record of such ballot is made, said mechanism being operated by the pressure or expansion of a fluid, and mechanism whereby the delivered ballot is counted, with a key or valve lever, on the depression of which said mechanisms are simultaneously set in operation, for the purposes specified.

10. In a system of balloting, the combination of mechanism whereby a ballot is cast or delivered from a holder and operated by the pressure or expansion of a fluid, and a suitable fluid main and distributing pipe, the latter being connected with said mechanism, with a valve interposed in the main and distributing-pipe, whereby the communication between the two is established or cut off, for the purposes specified.

11. In a system of balloting, the combina-

tion of mechanism operated by the pressure or expansion of a fluid, whereby a ballot is cast or delivered from a holder, a suitable conduit connected therewith, and a fluid-main, with a valve interposed between said main and conduit, whereby the communication between the main and conduit can be established and cut off and the fluid in the latter exhausted, for the purposes specified.

12. In a system of balloting, the combination, with mechanism whereby a ballot is cast or delivered from a holder, mechanism whereby a permanent record of the delivered ballot is simultaneously produced, both operated by the pressure or expansion of a fluid, and a suitable distributing-pipe and main connected together and with said mechanism, of a valve interposed in the main and distributing pipe or pipes, whereby communication between the two is established or cut off and the fluid exhausted from the distributing-pipe, for the purposes described.

13. In a balloting system, the combination of mechanism whereby a ballot is cast or delivered from a holder, mechanism whereby a permanent record of the delivered ballot is simultaneously produced, appliances for operating said mechanisms by the pressure or expansion of a fluid, a suitable fluid distributing pipe or pipes and main, and mechanism actuated by the delivered ballot, whereby said ballot is counted, with a valve interposed in said main and distributing-pipe, whereby the fluid is admitted to the distributing-pipe from the main to actuate the ballot-delivering and permanent-record-producing mechanisms, whereby a ballot is delivered from its holder, a permanent record thereof made, and the ballot counted simultaneously, for the purposes specified.

14. In a balloting system, the combination of mechanism whereby a ballot is cast or delivered from a holder, mechanism whereby a permanent record of the ballot delivered is simultaneously produced, and appliances for operating said mechanism by the pressure or expansion of a fluid, with a valve for admitting compressed air to the actuating appliances, and through which valve said compressed air is exhausted after having done its work, for the purposes specified.

15. In a balloting system, the combination of mechanism whereby a ballot is cast or delivered from a holder, appliances for operating such mechanism by means of compressed air, and a valve for admitting compressed air to and exhausting the same from said operating appliances, and mechanism for automatically locking the ballot-delivering mechanism out of operation after a ballot has been delivered, with a bellows or its equivalent for operating the locking devices by means of compressed air, to release said ballot-delivering mechanism, for the purposes set forth.

16. In a balloting system, the combination of mechanism whereby a ballot is cast or delivered from a holder, a bellows or piston for actuating said mechanism, a valve for admitting a fluid to and exhausting it from said bellows, and mechanism for automatically locking the ballot-delivering mechanism out of operation, with a bellows or piston for actuating the locking-out mechanism and a valve for admitting a fluid under pressure to and exhausting the same from the latter bellows, for the purposes described.

17. In a balloting system, a ballot-holder containing a number of ballots, combined with mechanism operated by the pressure or expansion of a fluid for releasing said ballots one at a time and delivering the same from the holder.

18. In a balloting system, a ballot-holder containing a number of ballots, combined with mechanism operated by the pressure or expansion of a fluid for releasing the ballots one at a time, and with a key or valve lever for setting the ballot-delivering mechanism into operation from a point distant from such mechanism, for the purposes described.

19. In a balloting system, the combination of ballot-holders arranged in parallel horizontal series, mechanism operated by the pressure or expansion of a fluid, whereby a ballot is cast or delivered from the holders, a valve for each holder, whereby the fluid is controlled, and appliances for automatically locking the ballot-delivering mechanism of the holders out of operation, with mechanism whereby all the ballot-delivering devices are simultaneously released from the locking appliances, for the purpose stated.

20. In a balloting system, the combination of ballot-holders arranged in horizontal and vertical parallel series, mechanism for each holder operated by the pressure or expansion of a fluid, whereby a ballot is cast or delivered from the holders, a valve for each holder for controlling the fluid, and appliances for automatically locking the ballot-delivering mechanism for each holder out of operation, with mechanism operated by the pressure or expansion of a fluid, whereby the ballot-delivering mechanisms of the series of holders are simultaneously released from the locking-out mechanism, for the purposes specified.

21. In a balloting system, the combination of ballot-holders arranged in horizontal or vertical parallel series, or both, operated by the pressure or expansion of a fluid, mechanism for each holder whereby a ballot is cast or delivered from said holders, a valve for each holder for controlling the fluid and exhausting the same from the ballot-delivering mechanism, and appliances for each holder whereby the latter mechanism is automatically locked out of operation after the delivery of a ballot from a holder, with mechanism operated by the pressure or expansion of a fluid, whereby the ballot-delivering mechanisms of all the holders are simultaneously released from their locking-out appliances, and a valve for admitting the fluid to and exhausting the same from

the releasing mechanism, for the purposes specified.

22. In a system of balloting, the combination, with a ballot-holder, mechanism operated by the pressure or expansion of a fluid for casting or delivering a ballot therefrom, and mechanism actuated by the released ballot to count the same, of a registering mechanism for making a visible record of the ballot cast or delivered from the holders, operated by the counting mechanism.

23. In a system of balloting, the combination, with the mechanism whereby the ballots are counted, of a relay or auxiliary power transmitting mechanism to transmit the movements of the counting mechanism, for the purposes stated.

24. In a system of balloting, the combination, with a ballot-holder, mechanism for casting or delivering a ballot therefrom, mechanism actuated by the ballot delivered from the holder for making a count thereof, and mechanism operated from the counting devices to make a visible record of the ballot cast or delivered from the holder, of an auxiliary power or relay interposed between the counting and registering mechanism, for the purposes stated.

25. In a system of balloting, the combination of the following elements: a series of ballot-holders, mechanism operated by the pressure or expansion of a fluid to cast or deliver the ballots therefrom, a counting mechanism operated by the ballots, a registering mechanism operated from the counting mechanism, mechanism to automatically lock the ballot casting or delivering appliances out of operation, and mechanism operated by the pressure or expansion of a fluid to release said appliances after a vote has been taken, for the purposes specified.

26. In a system of balloting, the combination of the following elements: a series of ballot-holders, mechanism for casting or delivering the ballots therefrom, mechanism operated by the ballots delivered from the holder to transmit a count thereof, a registering mechanism operated from said counting mechanism, a relay or auxiliary power operated by a weight to transmit the movements of the counting mechanism to said registering mechanism, and appliances for automatically winding up the weight after each ballot, for the purposes stated.

27. In a system of balloting, the combination, with a series of ballot-holders, mechanism to cast or deliver the ballots therefrom, mechanism operated by the ballots delivered from the holders, whereby a count of such ballots is made, a registering mechanism operated from the counting mechanism, and a relay or auxiliary power operated by a weight for transmitting the count made by the counting mechanism to the registering mechanism, of appliances for automatically winding up the weight of the relay and automatically and simultaneously returning the registering-indexes to their starting-point, for the purposes described.

28. In a system of balloting, the combination, with the mechanism whereby the ballots are registered and appliances for returning the index hand or hands thereof to their starting-point, of mechanism operated by the pressure or expansion of a fluid, whereby the appliances for returning the said hand or hands to their starting-point are set in operation, as described, for the purposes specified.

29. In a system of balloting, the combination and co-operation of the following elements: a series of ballot-holders, mechanism operated by the pressure or expansion of a fluid, whereby a ballot is cast or delivered from said holders, mechanism to lock the ballot-delivering devices out of operation after the delivery of a ballot, mechanism whereby a count of the ballots is effected, mechanism for registering the count, mechanism for transmitting the count to the registering devices, mechanism operated by the pressure or expansion of a fluid, whereby a permanent record of each ballot cast is obtained, and appliances operated by the pressure or expansion of a fluid for simultaneously releasing the ballot-delivering mechanism, for the purposes specified.

30. In a system of balloting, the combination of the following elements: a series of ballot-holders, mechanism for casting or delivering a ballot therefrom, and mechanism whereby a permanent record of each ballot cast is simultaneously obtained, said parts being operated pneumatically by means of a valve or key interposed in the compressed-air main and the delivering or distributing pipes, whereby the compressed air is admitted to and exhausted from the latter pipes, mechanism for automatically locking the ballot casting or delivering appliances out of operation after the delivery of a ballot, mechanisms whereby a count of each ballot is made and registered, and an intermediate auxiliary transmitting power or relay to transmit the count to the registering mechanism, said locking-out mechanism, relay, and registering mechanism being arranged in a pneumatic circuit and operated pneumatically and simultaneously by means of a valve lever or key, whereby the compressed air is admitted to operate said devices and exhausted from said distributing-pipes after the automatic and simultaneous release of the ballot-casting devices, the return of the registering devices to their normal position, and the return of the auxiliary power to its operative condition, for the purposes stated.

31. In a system of balloting, the combination of the following elements in duplicate: a series of ballot-holders, mechanism to cast or deliver a ballot therefrom, mechanism to lock the ballot-casting devices out of operation after a ballot has been cast, mechanism for automatically producing a permanent record of each ballot cast, mechanism for producing a count, and mechanism for temporarily regis-

tering each ballot and indicating the totality of ballots cast, said duplicate elements being arranged in two pneumatic circuits, one of which circuits is under the independent control of each voter, whereby by means of valves or keys he may cast an affirmative or negative ballot, and is prevented from casting such ballot a second time during the taking of a vote, the second circuit being under the control of a single person, whereby by means of a single valve said person is enabled to return all the duplicate mechanisms automatically and simultaneously into their operative or normal conditions, or to their initial or starting point, as described, for the purposes stated.

32. The ballot casting or delivering mechanism, consisting, essentially, of ball-holders arranged in series with their longitudinal axes inclined in the same direction, and containing each a number of balls, and controlling devices operated by the pressure or expansion of a fluid, consisting of co-operating retaining-pins arranged in front of each other and operating to release the balls from their holders one at a time, as and for the purposes specified.

33. The ball casting or delivering mechanism, consisting, essentially, of ball holders or receivers containing a number of balls each, and arranged in horizontal or vertical parallel series, or both, in combination with controlling appliances operated by the pressure of a fluid controlled by a valve consisting of two co-operating retaining-pins arranged in different horizontal planes, the free ends of which move simultaneously in reverse directions, whereby a ball is released by one pin and the remaining balls of the series held in check by the other when the pins move in one direction, and the remaining balls released by the check-pin and checked by the releasing-pin when said pins move in a reverse direction, substantially as described, for the purpose specified.

34. The combination of an inclined tubular ball-holder, F, adapted to contain a number of balls, and provided with slots in opposite sides, in combination with a bellows, carrying bars f^4 g, and the pins g' g^3, arranged to move in the plane of the said slots and penetrate into said tubular ball-holder when the bellows is distended, substantially as described, for the purpose specified.

35. The combination of the inclined tubular ball-holder, slotted on opposite sides, with a bellows, the rod f', cross-head f^2, arm g, bars f^3 f^4, the arm g^2, and the pins g' g^3, said parts being arranged for co-operation substantially as described, and for the purposes specified.

36. The combination, with an inclined ball-holder and the arm g^2 and bar f^4 of the ball casting or delivering devices thereof, arranged for operation as set forth, of a gravity pawl or stop for automatically locking the bars against downward movement when in an elevated position, as described, for the purpose stated.

37. The combination, with a tubular, slotted, and inclined ball-holder, the pins g' g^3, and the bar f^4, having lug or abutment F^3, of the gravity-pawl G, said parts being arranged for co-operation substantially as described, for the purposes specified.

38. The combination, with the ball-holder adapted to contain a number of balls, mechanism to release said balls one at a time, and mechanism for locking the releasing devices out of operation when a ball has been released, of appliances for disengaging the locking devices from the releasing mechanism, consisting of a bellows carrying an actuating-rod, a tripping-bar in the path of said rod, and actuated thereby, and an abutment on said bar in the path of an arm of the locking-pawl, operating to trip the latter, as described, for the purposes specified.

39. The combination, with the bar f^4, its arm g^2, the pin g^3, and the lug F^3, of the pawl G, its arm G', the bar h^2, plate h^3, abutment h^x, and a bellows or piston connected with said bar h^2, said parts being arranged for co-operation substantially as and for the purposes specified.

40. The combination, with ball-holders arranged in vertical or horizontal series of parallel rows, or both, each holder having a locking-pawl, G G', pivoted thereto, the bar f^4 of the ball casting or delivering mechanism, the lug F^3, and arm g^2 of said bar, of a bellows carrying a rod, H', the shaft H, and a tripping-bar, h, for each ball-holder, each of said bars h having one or more abutments, h^x, and a plate, h^3, and the cranks h', that connect the bars with said shaft, said parts being arranged for co-operation substantially as described, for the purposes specified.

41. The combination, with a ballot-holder, mechanism operated by the pressure or expansion of a fluid for casting or delivering the ballots therefrom, and a fluid conduit and main, of a valve interposed between said conduit and main, consisting of a valve-casing divided by diaphragm in two chambers, 1 2, the former connected with the conduit and the latter with the main, a valve having a hollow stem provided with valve-ports 4 and 5, and operating to open or close a port in the diaphragm 3 of the casing, as described, for the purposes specified.

42. The combination, with two independent eduction-pipes and a supply-main, of a compound valve interposed between the main and said pipes, composed of two valve-casings, each divided horizontally into two chambers, 1 and 2, by a diaphragm, 3, the former chambers being in communication with the eduction-pipes, and the latter with each other through a connecting-pipe, and with the main through one of said chambers, 2, substantially as and for the purposes specified.

43. The combination of the valve-casing A, divided into chambers 1 and 2 by a partition or diaphragm, 3, having a valve-port, the valve a, its hollow stem a^2, having ports 4 and

5, the button a', and coiled spring a^3, with the pipes A^2 A^3 A^4, said parts being arranged for co-operation substantially as described, for the purposes specified.

44. The appliances whereby a permanent record of the ballots is produced, consisting of a series of pistons or bellows, *e*, each provided with a perforator, e^2, and arranged in parallel rows, in combination with hinged clamping-plates E' E^2, having perforations that register with the perforators e^2, between which a sheet of paper extending over all the perforators and in the path thereof may be clamped, and suitable conduits for supplying the motive fluid to said bellows, as described, for the purposes specified.

45. The combination, with the supply-pipe B, eduction-pipe B', and the bent pipe C C', connected therewith, of a three-way valve or cock, C^4, a valve-lever, C^2, and means for locking said lever in position to establish communication between pipes B C and B' C', and appliances to automatically release the lever to shift the valve, substantially as described, for the purpose specified.

46. The combination, with fluid supply and distributing pipes and a valve interposed in said pipes, of mechanism to lock the lever in position to establish communication between said pipes, and appliances operated by the pressure or expansion of the fluid admitted to the distributing-pipe to release the lever and shift the valve, substantially as and for the purposes set forth.

47. The combination, with a fluid supply and distributing pipes and a valve interposed in said pipes, of mechanism to lock the valve in position to establish communication between said pipes, and appliances operated by the pressure or expansion of the fluid admitted to the distributing-pipe to release the same, shift the valve to cut off said communication, and establish communication between the distributing-pipe and the outer atmosphere, substantially as described, for the purposes set forth.

48. The combination, substantially as herein described, of a fluid-main, a distributing-pipe, a valve interposed in said pipes and operating to establish or interrupt the communication between the two pipes, appliances for automatically locking the valve in position when the communication between the pipes is established, and appliances for automatically interrupting said communication by the pressure or expansion of the fluid admitted from the main to the distributing-pipe, for the purposes described.

49. The combination, substantially as herein set forth, of a fluid-main, a distributing-pipe, a three-way valve interposed in said pipes, appliances for automatically locking the valve into position when set to establish the communication between the pipes, and appliances for automatically interrupting said communication and placing the distributing-pipe in communication with the outer atmosphere by the pressure or expansion of the fluid admitted from the main to the distributing-pipe, for the purposes described.

50. The combination, with the pipes B B', the bent pipe C C', the valve C^4, and valve-lever C^2, provided with a hasp or slotted plate, c^2, of the pivoted gravity bell-crank lever *c*, the vertical arm of which has a catch, *c'*, arranged to engage the slot of plate c^2 when the lever C^2 is depressed, said parts being arranged for co-operation substantially as described, for the purposes set forth.

51. The combination, with the pipes B B', the bent pipe C C', the valve C^4, lever C^2, slotted plate c^2, the pivoted gravity bell-crank lever *c*, and the catch *c'* thereof, of the bellows or piston *b'*, connected with pipe B' and operating to tilt or trip the bell-crank lever, substantially as described, for the purposes specified.

52. The herein-described mechanism for producing a count of the ballots, which consists in the combination, with an inclined ball-conduit and a train of suitable transmitting-gearing, of the escapement composed of the shaft i^5, carrying a transmitting-pinion, *k'*, the ratchet-wheel i^4, and star-wheel *k*, and the shaft *i'*, carrying the pawl *i* and spring-pawl i^2, said parts being arranged for co-operation substantially as described, for the purposes set forth.

53. The combination, with the tubular inclined ball-conduit, slotted on opposite sides, the star-wheel *k*, ratchet i^4, pinion *k'*, shaft i^5, the pawl *i*, the spring-pawl i^2, and shaft *i*, of the transmitting-gear k^3 k^6 on shaft k^2, and k^7 on shaft k^4, said parts being constructed and arranged for co-operation substantially as described, for the purpose specified.

54. The herein-described relay, consisting of a transmitting-gear operated by a prime motor, and an auxiliary driving-gear operated by an independent power to assist in driving said transmitting-gearing, and, in combination therewith, of appliances to wind up the auxiliary power by the pressure or expansion of a fluid, substantially for the purposes specified.

55. The combination, with the transmitting-gearing l l^2 l' l^3, operated by a prime motor, of the auxiliary gearing m m' m^2, the winding-drum N, and weight N^2, said parts being arranged for co-operation substantially as and for the purposes set forth.

56. The combination, with the shaft L^3, ratchet *n*, rigidly secured to said shaft, the winding-drum N and pinion *n'*, connected together and loosely mounted on the shaft, and the pawl n^2, pivoted on the side of the pinion in position to engage the teeth of the ratchet, whereby said pinion and drum are locked to the shaft and rotate therewith, of the rack-bar *o*, connected to a bellows or piston and meshing with the pinion *n'*, whereby said pinion and the winding-drum are rotated without rotating the shaft L^3, said parts being arranged for

co-operation substantially as described, for the purposes specified.

57. In a system of balloting, a counting mechanism, a relay for transmitting the movements of said counting mechanism, a registering mechanism for registering the operation of the counting mechanism as transmitted thereto by the relay, and rigid transmitting-shafts coupled to the motor-shafts of the relay and the recording mechanisms and to the transmitting-shaft of the counting mechanism by means of universal couplings, whereby said mechanisms may be located at a distance from each other, as described.

58. The herein-described registering mechanism, consisting of a suitable train of registering-gearing, a hand or hands operated thereby, and appliances for stopping said train of gearing, returning the hands to their starting-point, and placing the registering mechanism in condition for operation by the pressure or expansion of a fluid, for the purposes specified.

59. The herein-described registering mechanism, consisting of a suitable train of registering-gearing, and, in combination therewith, of appliances operated by the pressure or expansion of a fluid, whereby the operation of said mechanism is arrested independently of the power from which it is driven, for the purposes specified.

60. In a registering mechanism, a train of gearing and a hand or hands operated thereby, in combination with appliances for automatically returning the hand or hands to their starting-point by the pressure or expansion of a fluid, as described, for the purposes specified.

61. The combination, substantially as described, of a train of registering-gearing, a hand or hands operated thereby, mechanism for returning the hands to their starting-point, and mechanism for controlling the return movement of said hands and their operating devices, consisting of a train of gearing and a fly.

62. The combination, with the shaft R of the registering mechanism, the gear-wheel q^2, the winding-drum r, cam r', and star-wheel r^4, of the shaft Q, pinion q^2, gear-wheel q and q', the latter having a laterally-projecting locking-tooth and loosely mounted upon the shaft and held against longitudinal movement therewith, and means whereby said shaft is displaced longitudinally in its bearings, substantially as described, for the purposes set forth.

63. The combination, with the shaft Q′, the gear-wheel q, rigidly secured thereto, and the gear-wheel p', loosely mounted thereon and held against longitudinal movement therewith, said wheel p' being provided with a locking-tooth adapted to engage the gear-wheel q, of the bell-crank or angle lever t and a bellows or piston, whereby said lever is made to displace the shaft Q′ longitudinally by the pressure or expansion of a fluid.

64. The combination, with the shafts M^2 Q, coupled together by means of a universal coupling, the pinion p, shaft R, and gear-wheel q^2, of the shaft Q′, pinion q', gear-wheel q, the gear-wheel p', provided with a locking-tooth, p^3, in engagement with the gear-wheel q, and means, substantially as described, for displacing shaft Q′ longitudinally to throw the wheels $q\,p'$ out of engagement, said parts being constructed and arranged for co-operation substantially as described, for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES ALBERT MAYRHOFER.

Witnesses:

JAMES RILEY WEAVER,

HENRY DAVIDS.