A. VON BARTH.

COUNTING MACHINE.

APPLICATION FILED MAY 29, 1908.

1,046,428.

Patented Dec. 10, 1912.

5 SHEETS—SHEET 1.

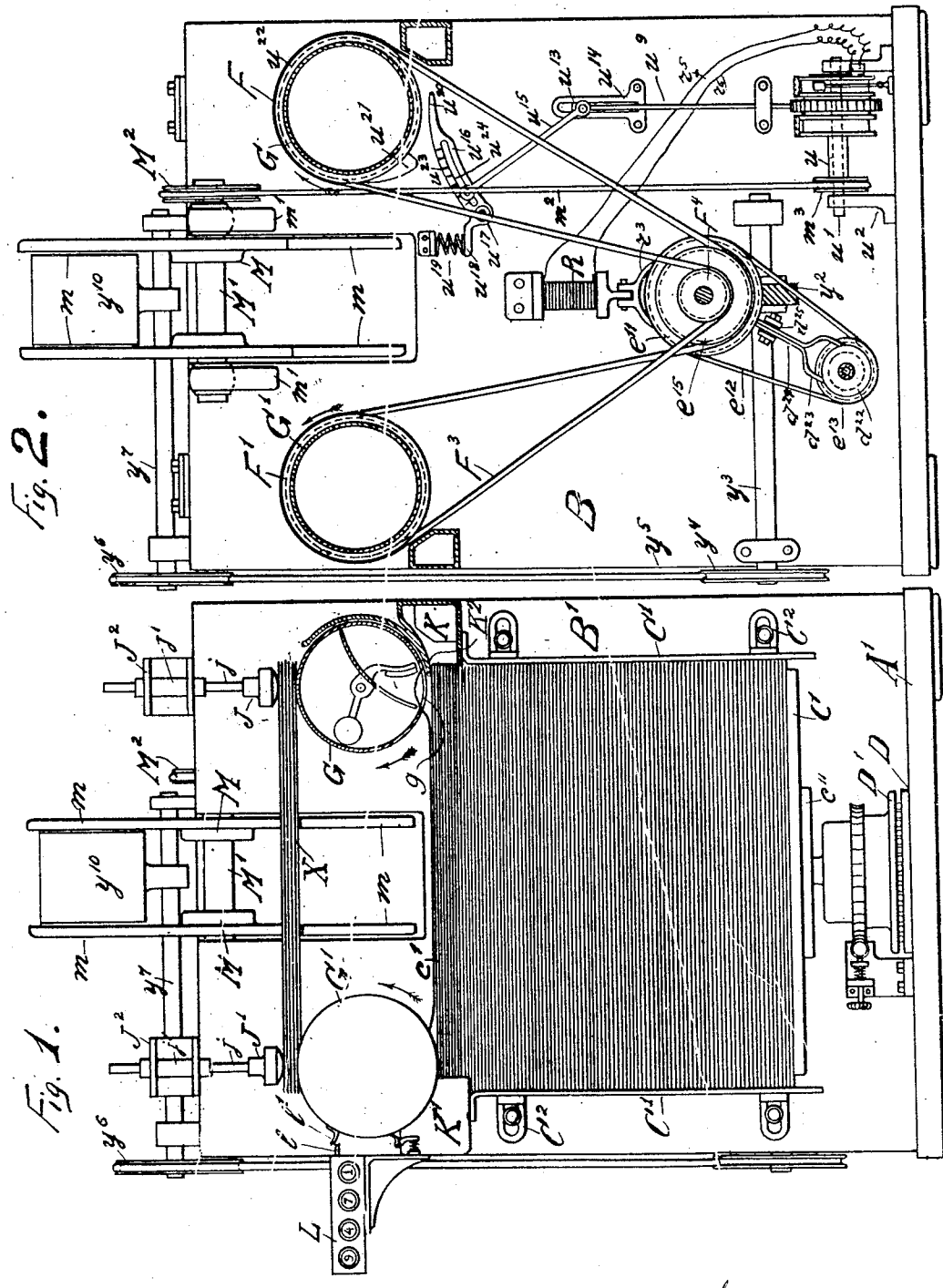

Fig. 2.

Fig. 1.

Witnesses:

L. C. Morrison

Elizabeth B. Kemp

Arthur von Barth
Inventor

By his Attorney
Donald Campbell

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5 SHEETS—SHEET 2.

Fig. 4.

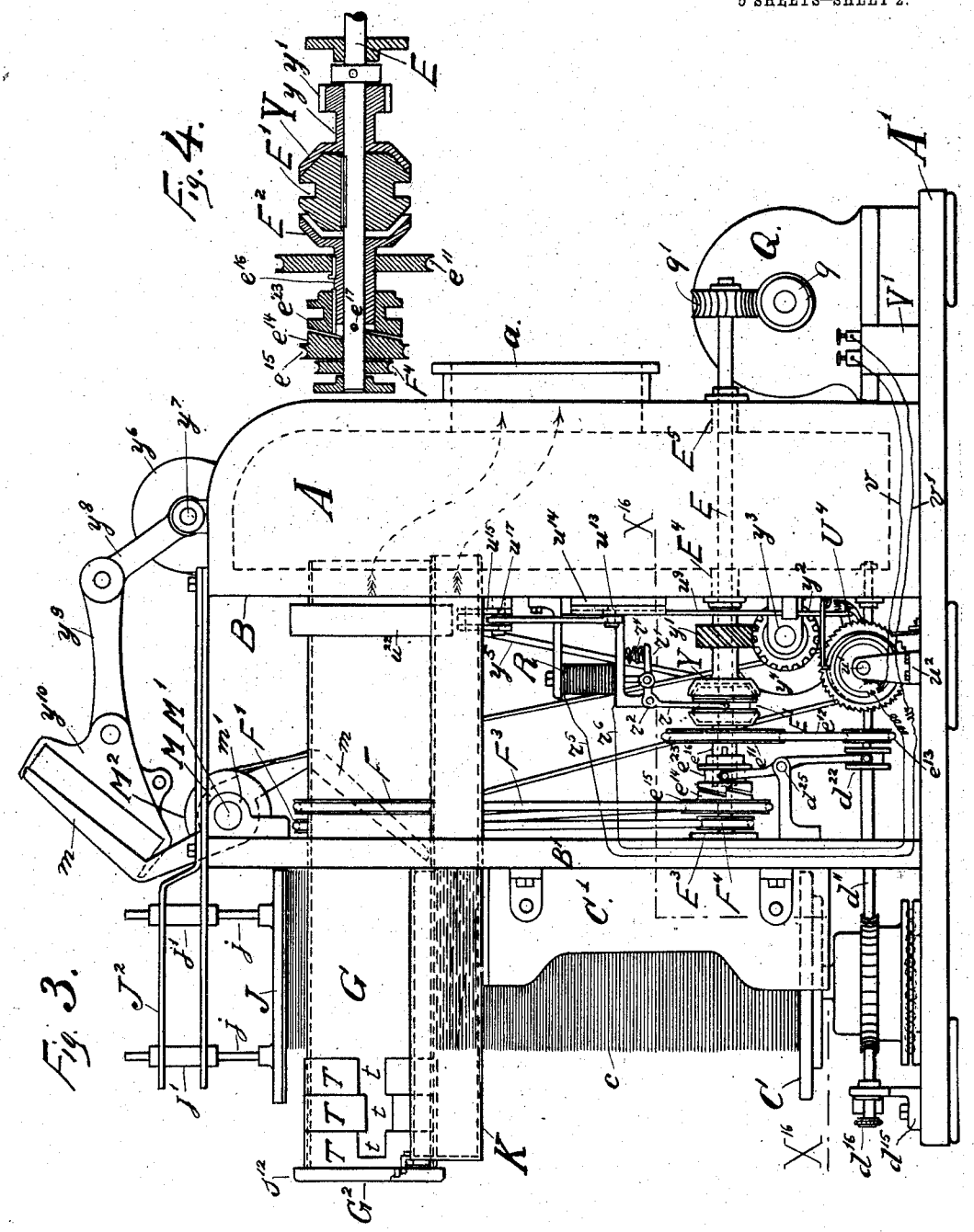

Fig. 3.

Witnesses:

E. F. Thomson

Elizabeth B. Krieg

Inventor

By his Attorney

Donald Campbell

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5 SHEETS—SHEET 3.

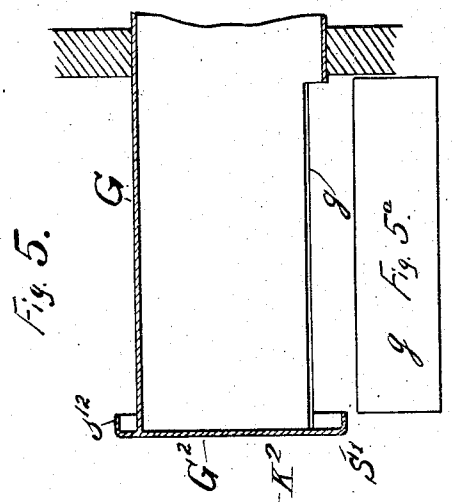

Fig. 5.

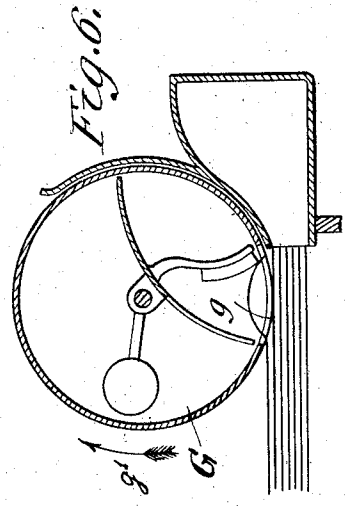

Fig. 6.

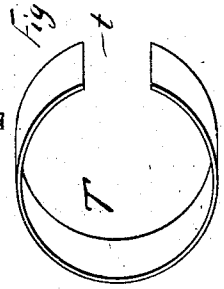

Fig. 7.

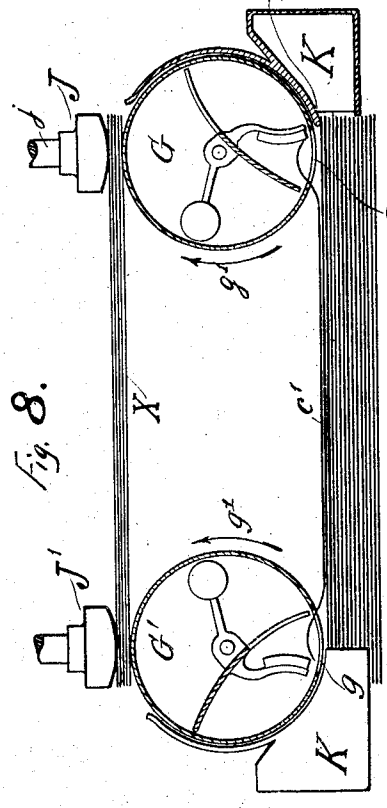

Fig. 8.

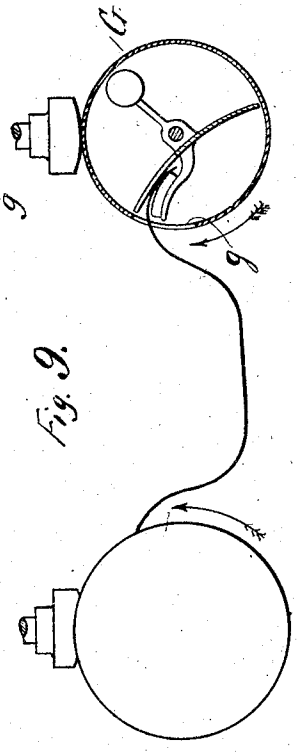

Fig. 9.

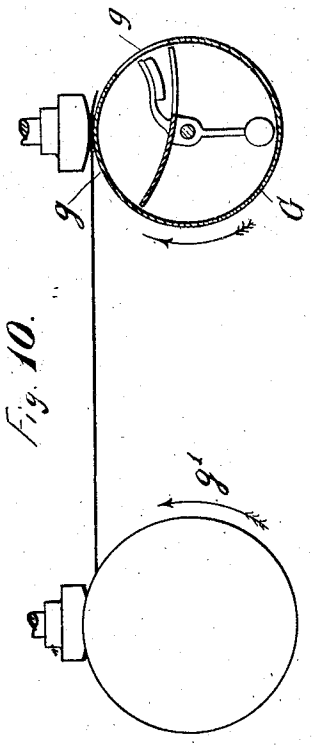

Fig. 10.

Witnesses:

L. E. Morrison

Elizabeth B. Berry

Arthur von Barth

Inventor

By his Attorney

Donald Campbell

A. VON BARTH.

COUNTING MACHINE.

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5 SHEETS—SHEET 4.

Fig. 12.

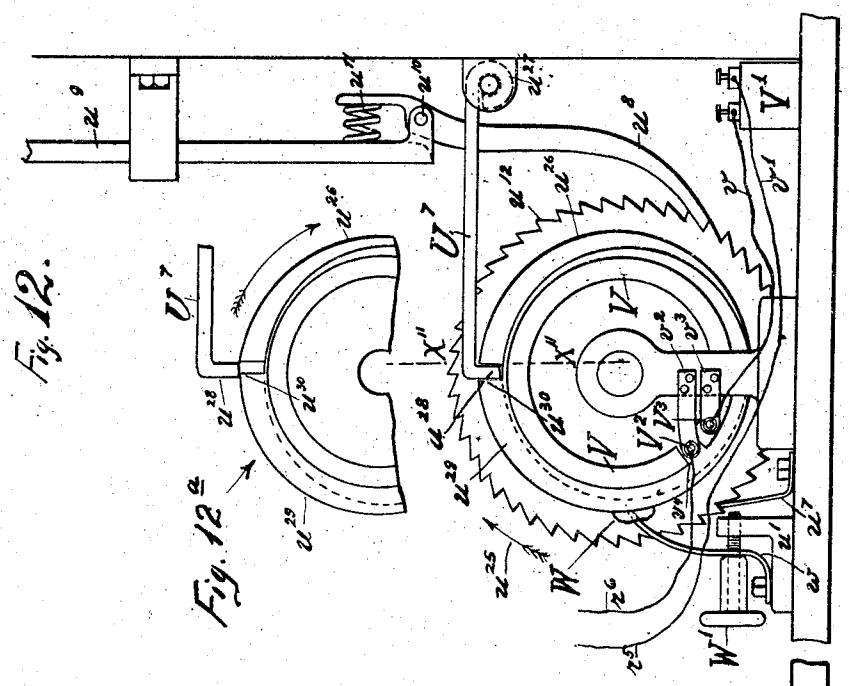
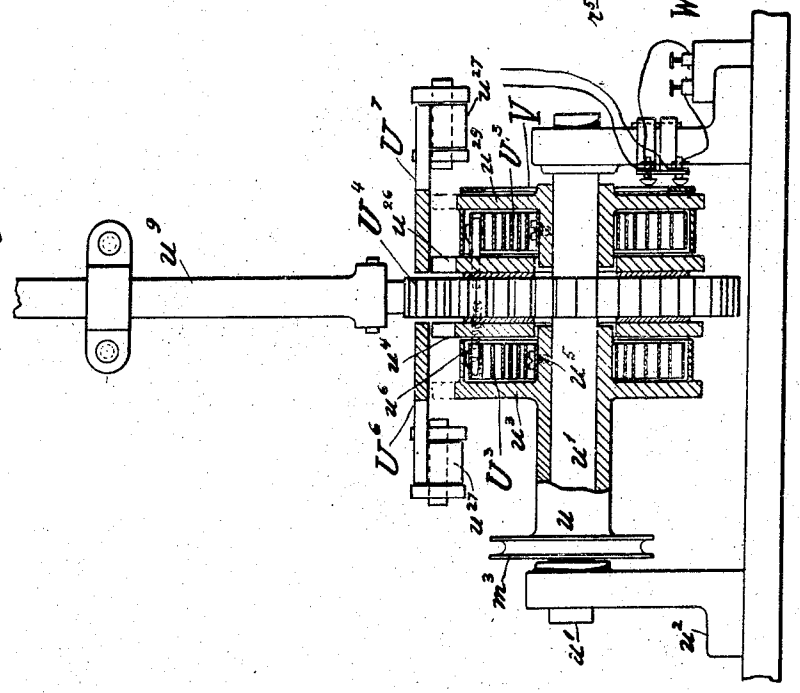


Fig. 12a

Fig. 11.



Witnesses:

L. C. Thomasson

Elizabeth B. Brieg

Arthur von Barth
Inventor

By his Attorney
Donald Campbell

A. VON BARTH.

COUNTING MACHINE.

APPLICATION FILED MAY 29, 1908.

1,046,428.

Patented Dec. 10, 1912.

5 SHEETS—SHEET 5.

Fig. 14.

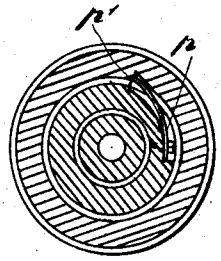


Fig. 15.

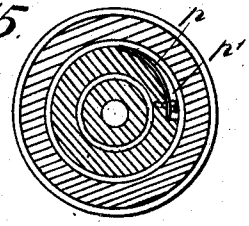


Fig. 13.

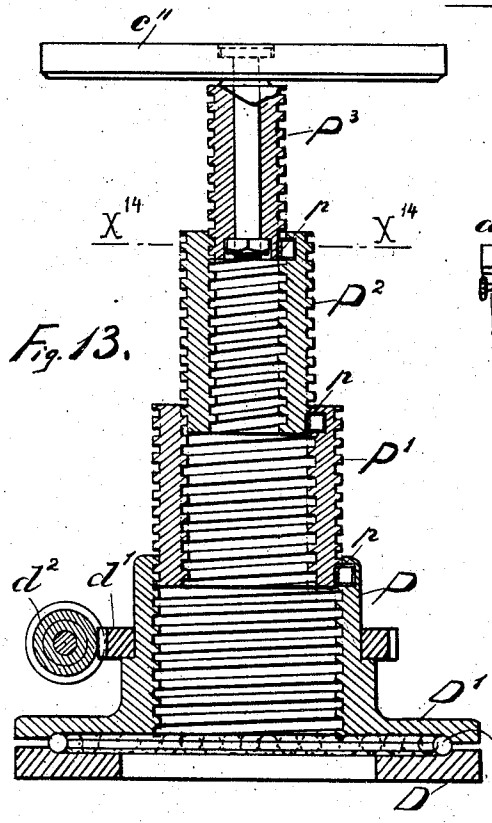


Fig. 16

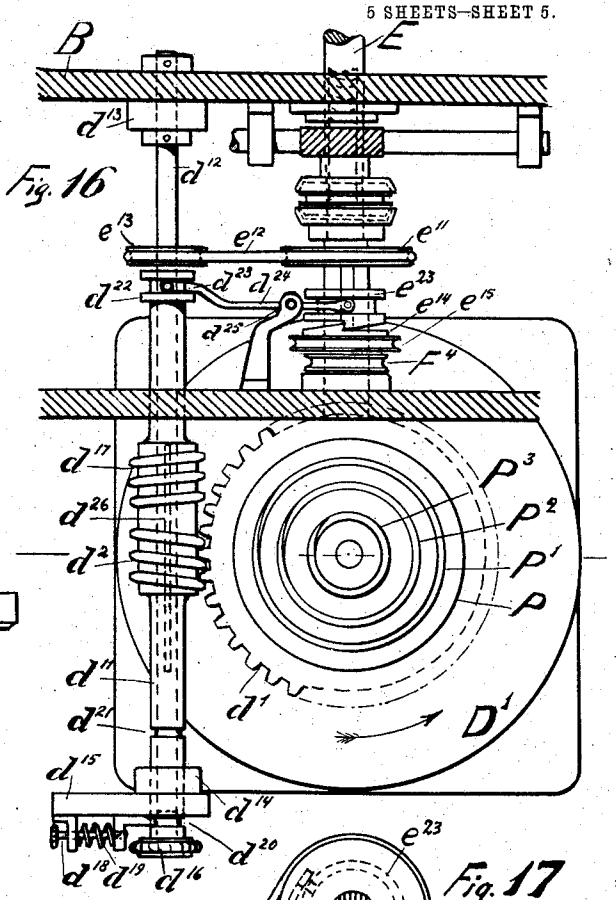
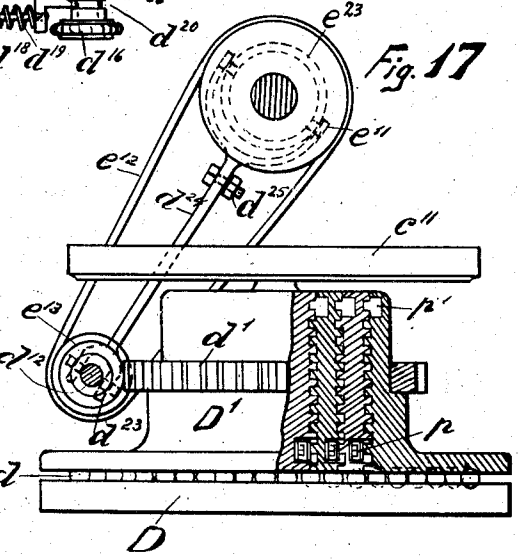


Fig. 17



Witnesses:

L. E. Morrison

Elizabeth B. Burg

Arthur von Barth
Inventor

By his Attorney
Donald Campbell

UNITED STATES PATENT OFFICE.

ARTHUR von BARTH, OF NEW YORK, N. Y.

COUNTING-MACHINE.

1,046,428. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed May 29, 1908. Serial No. 435,631.

To all whom it may concern:

Be it known that I, ARTHUR von BARTH, a citizen of the United States, residing in the city of New York and State of New York, formerly in the city of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Counting-Machines, of which the following is a specification.

My invention relates to counting machines and more particularly to machines for counting paper money such as currency bills, although it may be equally useful for other kinds of bills or other paper or similar objects which need to be counted.

I will first describe one form in which my invention may be embodied and will then set forth the novel features thereof in the claims.

In the accompanying drawings which form a part of this specification, Figure 1 is a front elevation of a counting machine embodying my improvements; Fig. 2 is a front elevation of the same machine shown in Fig. 1, but with the front wall B′ removed so as to show certain of the interior mechanism; Fig. 3 is a side elevation of the same; Fig. 4 is a central vertical section of certain details, namely the lefthand end of the main driving shaft E and all of the clutches, pulleys and other parts connected thereto; Fig. 5 is an enlarged horizontal sectional view of the front end of one of the rotating suction cylinders; and Fig. 5ª indicates the shape of the slot therein; Fig 5ª is a detail view showing merely the outline or shape of the slot *g* of the rotating cylinder shown in Fig. 5; Fig. 6 is an end view of the same partly broken away to show the interior; Fig. 7 is a perspective view of one of the rings for adjusting the cylinder slots; Fig. 8 is an enlarged view of certain parts shown in Fig. 1 including the two rotating cylinders, one of which is shown in section; this figure showing the cylinders about to raise one of the bills from the top of the column; Figs. 9 and 10 are diagrammatic views illustrating the subsequent action of the cylinders upon the bill, the nast named figure showing the bill as having been raised to the higher level, namely that of the top of the cylinders; Figs. 11 and 12 show a front sectional view and a side elevation respectively of certain portions of the interior mechanism disclosed in Fig. 2, as will be hereinafter explained; Fig. 12ª is a detail view showing some of the parts which are in Fig. 12 but in a different stage or position, namely at the end of a complete revolution of the ratchet; Fig. 13 is a sectional elevation of the table feeding mechanism; Fig. 14 is a horizontal section taken on the plane x^{14}—x^{14} of Fig. 13; Fig. 15 is a similar section taken with the parts in a different position; Fig. 16 is a top view of certain of the details taken on the broken line x^{16}—x^{16} of Fig. 3; and Fig. 17 is an elevation, partly in section and with certain parts removed, illustrating the manner in which the table feeding mechanism is driven from the main shaft.

Similar letters of reference designate corresponding parts in the several figures of the drawings.

A represents the main suction chamber in which a suction or partial vacuum may be maintained in any suitable way, and for convenience I have shown an opening at *a* which may be connected with a source of suction.

A′ represents any suitable base upon which the chamber A is supported.

B represents the front wall of the chamber A and in front of the wall B is a second wall B′ between which walls is contained certain mechanism hereinafter to be described.

C represents a table preferably horizontal and whose purpose is to support in bulk the bills or other objects to be counted, said bills being shown at *c* as piled up one upon the other forming a column. As bills are removed from the top of the column the table C is to be moved upwardly a corresponding amount and for this purpose I have employed the following convenient mechanism. Beneath the table and resting on the base A′ is a stationary roller bed D above which supported by rollers *d* is a rotating member D′ having a gear or teeth at *d′* driven by a worm d^2 whose connections will be hereinafter described. This worm is best shown in Fig. 16. It is mounted on a sleeve d^{11} which is turn is mounted on or surrounds a shaft d^{12}, and the sleeve and shaft are compelled to rotate together by means of a key shown at d^{26} in dotted lines. The shaft d^{12} has bearings at d^{13} in the wall B, and at d^{14} in the standard d^{15}. As a matter of fact it is the sleeve d^{11} that has its bearing at d^{14} since

the said sleeve surrounds the shaft d^{12} and extends outwardly beyond the end of said shaft to the point where at d^{16} a handle or button is provided. This button is for producing endwise sliding movements of the sleeve for a purpose which will hereinafter appear.

I will now describe the connection between the shaft d^{12} and the main driving shaft E. In the normal operation of the machine a number of the parts mounted on shaft E are caused to rotate with it, and among these is the pulley e^{11}. Around said pulley passes a belt e^{12} which in turn passes around a second pulley. e^{13} mounted directly upon the shaft d^{12} before mentioned.

The rotation of the member D′ effects the gradual elevation of the table C by means of a series of four or more or less screw cylinders indicated in Fig. 17 as nested within each other and which in turn are designed by screw action to elevate as the member D′ rotates.

I will now describe the table feeding or elevating mechanism which is driven by the worm d^2 previously referred to. Referring now to Figs. 13 and 17, the worm d^2 and the gear d' already referred to, are seen in engagement with each other. Said gear is connected fast to the lowermost of a series of screw cylinders P, P′, P², P³, which are capable of being nested, one within the other as indicated in Fig. 17, or of being projected one from the other for the purpose of elevating the table as seen in Fig. 13. Assuming the four screw cylinders to be snugly nested one within another, as indicated in Fig. 17, and assuming the gear d' to rotate in the direction of the arrow in Fig. 16, it will be seen that gradually the table c^{11} carried at the top of the uppermost screw cylinder, will rise. As the pitch of each of the screw cylinders is the same, it is immaterial which one of them begins to rise first. It is important, however, that none of them shall rise to a point where it could disengage the one below it, and therefore I have provided stop devices at p which may be described as follows. In Fig. 17 each of the screw cylinders is shown as provided with a small flat spring p at its lower and outer circumferance, and at the upper and inner circumference each of them is shown as provided with a recess at p'. The spring and recess are so arranged that when one of the cylinders has risen to the limit the spring will engage in the recess, as clearly indicated in Figs. 13 and 14, so that no further rotation is possible as between the two cylinders in which this engagement has taken place. Figs. 14 and 15 very clearly show the relative arrangement of the springs p and recesses p' in their two positions, namely in Fig. 14 the spring being engaged in the recess and in Fig. 15 the spring of one cylinder being merely engaged against the screw threads of the other cylinder.

I will now describe how the table is to be brought back to its lower level after the machine has been operated so long as to have raised it to the position shown in Fig. 13. To accomplish this I have provided a means of reversing the action of the parts previously described; thus at d^{17} is shown a worm similar to worm d^2 previously described but with its convolutions directed in an opposite manner. Like the worm d^2, the worm d^{17} is mounted on the sleeve d^{11}, but unlike worm d^2, the worm d^{17} is ordinarily idle. At the outer extremity of the sleeve d^{11} is the button d^{16} that has already been referred to. When the button d^{16} is pulled outwardly so as to slide the sleeve d^{11} lengthwise, it will be seen that this will withdraw the worm d^2 from out of engagement with the gear d', and will instead substitute the worm d^{17} so as to place the latter in engagement with said gear. Means are provided for locking the sleeve d^{11} in either of its two positions, namely a bolt d^{18} which is pressed by a spring d^{19} and serves to engage in a circumferential notch d^{20} or another notch d^{21} depending on whether the button is in its inward or in its outward position.

When the worm d^{17} is engaged with the gear d' the rotation of the shaft d^{12} will cause said gear to revolve in a direction the reverse of its ordinary motion so that the different screw cylinders are caused to descend and become again nested one within the other; or in other words, resume the position shown in Fig. 17. It is obvious that during the time that the table is being lowered as just described, there can be no counting or other operations of the machine carried on, and I have therefore provided that at such times the general action of the machine ceases; thus referring to Figs. 3, 16 and 17, it will be seen that on the sleeve d^{11} is provided a grooved collar d^{22}, and the groove of this collar is engaged by the yoked end d^{23} of a lever d^{24} which is pivoted near its middle to a fixed part of the machine at d^{25}, and its other end is yoked in such a way as to engage with a grooved collar e^{23} which is keyed to and slides upon a sleeve member e^{16} surrounding the main driving shaft E. Referring to Fig. 3 it will be seen that when the sleeve d^{11} is pulled to the left by means of the button d^{16} it will carry with it the grooved collar d^{22} and the lower end of the lever d^{24}, thereby throwing the upper end of said lever to the right. This in turn carries the grooved collar e^{23} to the right disengaging it from the member e^{14} which is connected to the pulley e^{15} that

drives the counting mechanism. In this way the parts e^{23} and e^{14} are separated so that during the downward movement of the table the counting mechanism ceases its operation. In Fig. 4 a pin e^{17} is shown passing through shaft E and holding sleeve e^{16} and member e^{14} in place.

The main driving shaft E, which has already been referred to, may be mounted in any convenient location, but I prefer to locate it, as shown, between the vertical walls B and B′ which are separated considerably from each other to accommodate the various mechanisms placed between them. For convenience the driving shaft is made to pass through the chamber A, having bearings in the walls thereof, and the outer end of said shaft is motor driven by a motor Q through a worm q and a worm wheel q', the latter mounted on the shaft E. Said shaft also has a bearing at its forward end at E^3 and the bearings in the walls of chamber A are indicated at E^4, E^5. Mounted on the shaft E is a clutch, and this may be of any well known form although I prefer that which is illustrated and described, in which there is a clutch part E′, Figs. 3 and 4, which is capable of sliding relatively to the shaft and has a key connection with the shaft so that the clutch part E′ will continuously rotate with the shaft; said clutch part cooperating with a clutch part E^2 in such a way that the two can engage and disengage for the purpose of causing certain mechanisms to operate or cease operating.

For the purpose of moving the clutch part E′ to the right or to the left, I prefer to employ a bell crank lever whose arms r and r' join with each other at the pivotal point r^2. The arm r is yoked at its lower end as seen at r^3, Fig. 2, so as to straddle the clutch part E′ and engage in the annular groove therein. As the normal position of the parts, when the machine is in full operation, is with the clutch part E′ to the left, a spring r^4 may be employed tending to continually press on the bell crank lever to keep the part E′ to the left. For the purpose of moving the clutch part E′ to the right any suitable means may be employed, such for example as a magnetic means, and for this purpose I have shown a solenoid R suitably mounted in a fixed position in the frame of the machine, and having as usual an armature, which armature is connected to the bell crank arm r' as seen in Fig. 3. This solenoid is one of great strength and is adapted to receive at the proper times electrical currents of sufficient power to cause the armature to draw within the solenoid and with such force as to overcome the spring r^4 and cause the clutch part E′ to move toward the right.

r^5 and r^6 are the two wires leading to the solenoid, the connections of the other ends of the said wires to be described hereinafter.

I will now describe the driving of the suction cylinders. Reference has already been made to pulley e^{15} which is mounted so that it will at certain times rotate with the main driving shaft E. A belt F^3 engages said pulley and it passes upwardly therefrom on either side, as best indicated in Figs. 2 and 3, and over pulley wheels F and F′ connected to the two suction cylinders, said belt then passing around said pulleys downwardly and finally around a loose guide pulley F^4, which for convenience may be located on the same shaft as pulley e^{15}. It will be understood that the pulley and belt are only illustrative of a connection that may be used, and obviously a sprocket and chain may be substituted to the same effect. As seen in Fig. 3 the pulley F is shown to the right of the pulley F′ since they must be offset relatively to each other to allow the different portions of the belt to pass from one wheel to the other.

The mechanism above described sufficiently shows how the suction cylinders are driven, and it will also be apparent from Fig. 2 that they will rotate in opposite directions. I will now describe the suction cylinders themselves. One of them is marked G and the other G′. Each of them consists of a hollow cylindrical casing which is so fitted as to be capable of rotation, and for which any kind of bearing may be employed, although for convenience I have caused the walls B and B′ to serve as such bearings. Each cylinder projects forwardly from the wall B′ and the two cylinders are so spaced apart that the distance between their centers will be somewhat less than the length of the bills; this arrangement being adequate for slight variations in bills of usual sizes, although adjusting means may be added for regulating the distance between the cylinders. I have shown means for adjustment of the two vertical walls marked C′, C′, between which the ends of the column of bills pass as it ascends, such adjusting means consisting of a slotted projection C^2 with bolts or screws engaging the slots to hold them in the desired position. The table C being somewhat shorter than the length of the bills, passes upward easily between the walls C′, C′.

Returning now to the description of the suction cylinders, each of them, in front of the wall B′, is provided with a lengthwise extending slot or opening g, as seen in Figs. 1, 8, 9 and 10. The shape and length of the slot g are indicated in Fig. 5^a. The rear end of each suction cylinder, it should be stated, is in open communication with the suction chamber A or other source of suction, so that air is continuously passing inwardly from the slots g when the machine is in op-

eration. The cap G^2 at the forward end of each cylinder prevents leakage and loss of suction at that point.

Within each of the suction cylinders, for example the cylinder G shown in Fig. 5, is certain mechanism for serving the purpose about to be described, although other mechanism might be employed to the same end. The mechanism which I have herein shown comprises a grasping device and a means for operating it at the proper time. It will be understood that the cylinders rotate in the direction of the arrows g'. Looking at Figs. 1 and 8, it will be seen that each cylinder as it rotates will have its slot or opening g brought directly over one end of the uppermost bill c', and the two cylinders are relatively arranged so that their two slots will simultaneously take their positions above the two ends of said uppermost bill. Referring to Figs. 1 and 8, the slots are seen in the position just described. In this position the suction acts in such a way as to cause the ends of the bills to rise upwardly and be drawn inward toward the interior of each cylinder. This action only takes place upon the uppermost bill for reasons that will more fully appear hereinafter. After the ends of the bill are slightly raised in this fashion and the rotation of the cylinders continues, the result is that the grasping device will be brought into play to mechanically grasp each end of the bill, retaining its grasp while the cylinders continue to rotate, as seen in Fig. 9, and finally in Fig. 10 where the bill has been lifted from off the column and raised to the level of the upper cylinder sides.

I will now describe the grasping device shown in the figures of the drawings. S represents an interior sleeve of generally circular form but cut away at one side as indicated in Figs. 6, 8, etc. This inside sleeve is formed integral with or connected to the cap G^2 already mentioned, and the cap therefore constitutes a convenient means for removing and replacing the sleeve. The sleeve S fits within the rotating cylinder G but the fit is not so close as to preclude easy revolution of one within the other. The sleeve S may be said in a general way to rotate in the same direction as the sleeve G, but it does not rotate in harmony therewith since on the contrary it has rotary motions relative to the cylinder. s represents a beaded edge extending lengthwise of the sleeve along one side of the slot or cut away portion thereof, and this beaded edge is one of the two members which mechanically grasp the bill at the proper time. The other member is the projection s', which may be in the nature of an apertured diaphragm having longitudinal air openings at s^2 so as to permit the suction to act as will be plainly understood from Fig. 8. Referring now to Fig. 6 the interior side s^5 of the member s' near the point where said member is connected to the rotating cylinder G, is of such construction as to cooperate with the beaded edge s already referred to. In Fig. 6 the wall s^8 and the bead s are disengaged from each other, but they are capable of becoming engaged in the manner illustrated in Figs. 9 and 10, this engagement serving to grasp or pinch the end of the bill between parts s and s^3. It has already been stated that the relative movement between the sleeve S and the cylinder G is a movement of rotation. To control this movement I have provided a spring S', one end being connected at s^4 to the cap G^2 which is integral with the sleeve S, and the other end of the spring being connected at s^5 with the rotating cylinder G. The tendency of the spring is to contract and thereby draw the parts from the position shown in Fig. 6 to the position shown in Fig. 9. In other words the tendency is to close the grasping device causing the bead s and the wall s^8 to approach and contact each other. To cause the operation of these parts at the proper time I have provided an exterior device comprising a projection s^6 on the cap G^2 and a movable projection s^7 adapted to cooperate with said projection s^6. The projection s^7 is capable of yielding under excessive stress and to bring this about I have constituted it as a part of a small lever pivoted at s^8 and having an arm s^9 engaged by a spring s^{10}, the spring tending to keep the device s^7, s^8, s^9 in the position seen in Fig. 6

During the continued rotation of the rotating cylinder G in the direction of the arrow, the projection s^6 will be brought into contact with s^7, the latter blocking or stopping the former and causing the cap G^2 together with the inside sleeve S to come to a stop. Of course the rotating cylinder G keeps on its movement with the result that the parts are brought to the position seen in Fig. 6, namely with the bead s considerably removed from the wall s^3. This is also the position seen in Fig. 8, and in that position the parts are ready to receive the ends of the topmost bill drawn inwardly by suction. After the parts have reached the position of Fig. 6 and the cylinder G keeps rotating, the edge s^{11} of the sleeve will come in contact with the diaphragm s^2 and this contact will prevent any further relative movement. At this stage the spring s^{10} will yield permitting movement of the projection s^7 and thereby permitting the projection s^6 to pass by s^7, this in turn releasing the cap G^2 and sleeve S so that the spring S' now under strong tension will come into play to restore the parts to their grasping position, namely that shown in Figs. 9 and 10. In this movement the bead s travels toward the wall s^3 and the bill end having already been drawn

in as seen in Fig. 8, is caused to be pinched or grasped, as seen in Fig. 9, between the wall s^3 and the bead s. In this way a mechanical grasping is effected at each end of the bill so that it is securely and infallibly raised from the column to the upper position indicated at X in Fig. 8. As seen in this figure, the bills are also straightened or pulled lengthwise by the action of the grasping device. The tension of the grasping device is not so great but that the bill will slip out at the proper time permitting the cylinder to continue its rotation preparatory to removing the next bill c' of the column and transferring it as before. The spring S', it should have been stated, is accommodated within the flange s^{12} formed at the outer circumference of the cap G^2.

For regulating the slot g, whose shape is seen in Fig. 5^a, I may employ one or more rings or partial rings such as that shown at T, Fig. 7, which are cut away or recessed at t. By slipping one or more of these rings over each rotating cylinder, as seen for example in Fig. 5, the operator is enabled to adjust the rings so as to lengthen or shorten the slot g as may be required if the length of the bills being counted should vary.

J, J' represent two pressers each located axially above the respective suction cylinders and each fitted with two plungers j, this being a convenient device, said plungers extending upwardly through vertical guides or sleeves j', which guides or sleeves are in pairs and are supported in any desired way, for example through the standards J^2. I prefer to rely on gravity for causing the downward action of said pressers, although this may be aided by springs or levers. Each presser is intended to lift gradually as the pile of bills between the cylinders and pressers increases in thickness.

The operation will now be better understood. The uppermost bill c' which has been lifted by the cylinders, assumes the position shown at X in Fig. 8, whereupon its ends become engaged between the pressers J, J' and the circumference of the cylinders G, G', and are held there. Of course the next bill that is similarly shifted from beneath to above the cylinders will come in contact not with the pressers J, J', but with the lower surface of the preceding bill. By this arrangement any number of bills may one at a time be transferred from the column c of bills beneath the suction cylinders to the position just described above said cylinders. As the bills accumulate in the last named position the pressers J, J' will correspondingly rise until the proper number of bills has been collected at this position.

I will now describe an auxiliary suction chamber or box which I preferably use in assisting the above described operations and preventing inaccuracies and accidents. K, K' represent the suction boxes, one being located adjacent to but lower than each of the suction cylinders. They are best shown in Fig. 8. The ends of the column c of bills as the column rises, pass between the boxes K, K'. Incidentally the upper wall K^2 of the suction boxes is shown as extending in a curved manner at k upwardly so as to largely inclose or cover the outward cylinder sides so as to minimize the waste of suction. The rear ends of the suction boxes K, K' pass through the walls B, B' and in that way or in any other convenient way are made to connect with a source of suction. Thus the walls of the suction boxes after passing through the wall B extend directly into the main suction chamber A. The suction in the boxes K, K' has a very important function in preserving all of the bills except the uppermost one in a straight, horizontal position, and this is done by the endwise pulling action which the suction exerts on each individual bill. Of course the strong suction in the cylinders G, G' acting vertically upon the face of the uppermost bill is sufficient to draw said uppermost bill out of the boxes K, K', but the suction in the latter precludes any but the uppermost bill from being displaced by the suction in the cylinders, and indeed if more than one bill should become accidentally elevated the continual inward flow of air into boxes K, K', and the pull exerted thereby would serve to immediately straighten out again and restore to flat position all of the bills except only the uppermost one, which is the only one under the direct influence of the suction in the cylinders. The action of the suction boxes is not to produce a vacuum between the uncounted bills and cause the bills to adhere to each other, but on the contrary its action is to cause a continued flow of air which passes from the outside between the several uppermost bills and thence endwise into the suction boxes. This prevents adhesion and enables a more perfect separation and removal of the topmost bill without danger of accidentally separating two bills at one time.

Counting dials or other counting devices of any desired species may be employed, and for convenience I have shown a series of four such dials which are connected to each other in a usual manner that does not need to be described. An indicator L of this kind is, as shown, provided with a movable lever l and to actuate this lever I have provided a pin or projection l' which rotates with the cylinder G' and serves to strike lever l at each rotation of the cylinder. In this way the indicator counts one for each bill transferred by the cylinders.

As an adjunct or auxiliary mechanism I illustrate the following. M represents an extracting device for removing from be-

tween the cylinders and the pressers any desired number of counted bills. It is convenient, especially in banks, to bundle the bills in bundles of, say, one hundred and this device is intended to operate as soon as one hundred bills have been transferred from the position beneath to the position above the cylinders. The device M is a rotary device intended to rotate a half revolution at each operation, and it comprises duplicate extracting arms m each of which is adapted to rise between the cylinders and gage the bundle of bills above the cylinders and cause said bills to be removed to a point where the same may be secured together or bundled either by machine or by hand. The shaft M′ rotating about bearings m' forms a support for the extracting arms m and permits the rotation thereof as described. As seen in Fig. 1 the extremities of the arms m clear the topmost of the bills c sufficiently to prevent conflict. The arms m are seen with a bend or shoulder near their middle which gives their lifting or extracting portion the proper direction and position to engage beneath and lift the bills collected at X. The continued rotation of the extractor carries the bundle of bills upward and outward as will be clear in Fig. 3, and the bundle of bills being so lifted may be removed by hand or may be taken in charge by a subsequent mechanism for automatically bunching and securing the same together. In order to operate this extracting device at the end of a certain number of rotations of the cylinders the following mechanism may be employed. On the shaft M′ is a pulley M^2, Fig. 2, and engaged with said pulley is a belt m^2 which passes downward and around a pulley m^3 intended to be driven at the proper time for the purpose of operating the extracting mechanism. This pulley m^3 is mounted on a sleeve u, which in turn surrounds a short auxiliary shaft u' mounted in fixed bearings u^2 on the base plate A′ of the machine. The position of the auxiliary shaft u' and the mechanism connected with it is seen in Fig. 3 to be between the walls B and B′, and is seen in Fig. 2 to be at the righthand side of the machine. Figs. 11 and 12 show this part of the mechanism in enlarged view and will be best for the purpose of description. The means that immediately drives the sleeve u and thereby operates the extractor, is a coil spring U^3, said spring being located between a flange u^3 formed on the sleeve and a disk u^4 which is secured fast to a ratchet wheel U^4, which is fast upon the shaft u'. The coil spring u^3 has its inner end connected at u^5 to the sleeve u and has its outer end fastened to a pin indicated at u^6 which is fixed to and passes through the disk u^4 and the ratchet wheel U^4.

The ratchet U^4 is the means which drives the mechanism now being described and this ratchet in turn is driven as follows. It has a fixed pawl u^7 which prevents it from rotating backward. It also has a movable pawl u^8 connected to a reciprocating rod u^9, said pawl and rod being connected together in a yielding manner through a pivot u^{10} and spring u^{11} which acting together permit the pawl to ride over the teeth u^{12} of the ratchet U^4. Referring back now to Fig. 2 the upper end of the rod u^9 is connected to a crosshead u^{13} which runs vertically in a guide u^{14} fixedly secured to the wall B. The reciprocation of the rod u^9 is effected through a link u^{15} also connected to the crosshead u^{13} and at its other end connected to a lever u^{16} pivoted at u^{17}. This lever is of a peculiar form and may be termed an arc-lever. It has a short extension u^{18} acted upon by a spring u^{19} tending to maintain it in the normal position seen in Fig. 2. At the other end the lever u^{16} is provided with a finger u^{20} intended to be struck at every revolution of the cylinder G by a projection u^{21} provided on a ring u^{22} secured to the rotating cylinder at its rear end, as seen in Fig. 3.

The link u^{15} is adjustable with respect to the lever u^{16} as indicated in Fig. 2, there being a graduated scale u^{23} and a slot u^{24}, the end of the link engaging at different points in said slot by a thumb screw or other convenient means. It will be seen that by adjusting the link end along the slot u^{24}, the throw of the link and thereby the amount of reciprocation of the rod u^9 may be adjusted. This adjustment is a valuable feature inasmuch as it enables the pawl u^8 on each movement to pass over two or three or four teeth of the ratchet as may be desired, and in this way regulation is afforded as to the number of bills to be included in each bundle. With one adjustment one hundred rotations, for example, of the cylinder G will cause the operation of the extractor, and with another adjustment fifty revolutions, for example, will cause such operation, and in this way the action of the machine may be altered as desired by the user.

From the above it will be seen that the ratchet U^4 rotates with a step by step movement in the direction of the arrow u^{25} Fig. 12. It has already been stated that the ratchet U^4 and the disk u^4 are connected to one end of the coil spring U^3, and in this way the rotation of the ratchet serves gradually to wind the spring and put it under tension. During this winding of the spring the sleeve u with its flange u^3 must be held stationary and this is effected by means of a drop dog U^6. There is a similar drop dog U^7 on the opposite side of the ratchet, Fig. 11, and the side view of each of the dogs may be understood from the illustration of

dog U^7 in Fig. 12. The dog U^6 is provided with a bearing u^{27} fixed to the frame and it has at its forward end a downward projection u^{28} not seen in Fig. 11, this projection u^{28} being the means that holds the sleeve u and the flange u^3 from rotating during the winding of the coil spring U^3. The construction of the flange or disk u^3 is similar to that of the flange or disk u^{29} on the opposite side of the ratchet, and such construction may be seen by reference to the side view Fig. 12 in which a shoulder u^{30} is seen at the upper side, said shoulder pressing by the force of the spring against the projection u^{28}; and each of the disks or flanges u^3 u^{29} has its circumference of a spiral form beginning from the foot of the shoulder and expanding as seen in Fig. 12 until at the end of a revolution it comes to the top of said shoulder.

The above description shows that the two flanges u^3 and u^{29} are held in the position indicated in Fig. 12 by means of the drop dogs U^6, U^7 against the tension of the coil springs U^3, U^3. Periodically it is necessary to release the flanges u^3, u^{29} and as will appear they are simultaneously released. The release is effected by the disks u^4, u^{26} already mentioned which are not circular disks but have a spiral outline the same as that of the flanges u^3 u^{29} but in the reverse position. In Fig. 12 the right hand portion of the disk u^{26} is seen in full lines and the left hand portion is seen in dotted lines for the reason that it is concealed by the flange u^{29}. Obviously as the ratchet gradually completes a revolution the dog U^7 is slowly raised by the disk u^{26} until at the moment that the revolution is complete the parts take the position shown in Fig. 12^a. At this position the dog U^7 has been lifted to its full height and it will then clear the shoulder u^{30} of the flange u^{29}, thus permitting said flange under the influence of the coil spring U^3 to rotate in the direction of the arrow.

The construction and operation of the flange, disk, spring and dog at the lefthand side of Fig. 11 are exactly the same as that at the right, and the description need not be repeated. So far as the parts at the lefthand side are concerned, there is nothing to hinder the action of the spring U^3 and its operation is sudden so that a complete revolution takes place practically instantaneously. It should be stated that the pulley m^3 connected by the sleeve u so as to rotate with the flange u^3, is of only half the diameter of the pulley M^2 connected to the extractor, so that when the sleeve u makes the sudden complete revolution as before described, the extractor will make a sudden half revolution carrying the parts from the position seen in Fig. 3 to a diametrically opposite position. In this way, as before explained, the lowermost of the extractor arms m is thrown suddenly upward after the counting has ceased so as to cause the bills bunched at the point X to be thrown upward out of position and into where they may be taken by hand or may be automatically bundled and secured.

I will now describe how the operation of the extractor is caused to take place in harmony with the operation of the rotating cylinder. The solenoid R has already been described. In the position in Fig. 3, the solenoid is not acting, but on the contrary the spring r^4 is acting to hold the clutch part E′ to the left, in which position as previously explained the cylinders are rotating. When, however, the ratchet U^4 has made a complete rotation and for example one hundred bills have been transferred, the electric circuit through wires r^5, r^6 is completed and this causes the solenoid to operate to shift the clutch, thereby rendering the mechanism to the left idle and stopping the rotation of the cylinders. The control of the electric current is accomplished by a metallic contact strip V mounted to the right of the flange u^{29}, Fig. 11, so as to rotate with said flange. This contact strip is seen in face view in Fig. 12. Any source of electricity such as battery V′ may be employed, and leading from its terminals are two wires v, v'. The wire v' leads to where it connects with the wire r^5 already described. In other words, it connects directly with one pole of the solenoid. The other wire v connects only indirectly with the wire r^6, there being means of making and breaking the continuity of the circuit. This means comprises the metallic contact strip already mentioned. Mounted in front of the strip V are two contact buttons V^2 and V^3 insulated from each other and connected in any suitable manner, as for example by supports v^2, v^3 to a fixed part of the frame. Ordinarily there is no communication between the buttons V^2 V^3, but they are capable of being connected in the following manner. The strip V while circular does not form a complete circle, it being broken away at the point v^4 making a gap sufficient for the purposes to be explained. When the strip is in the position seen in Fig. 12 the buttons V^2 and V^3 are not connected, but when the strip is in any other position the two buttons are connected to each other by reason of their both contacting with the strip. The button V^3 has the wire v connected to it while the button V^2 is connected to the wire r^6 leading to one of the poles of the solenoid. With the parts in the position seen in Fig. 12 no electricity is capable of passing from the battery to the solenoid because of the break in the two buttons as explained. This is the normal position of the parts while the rotating cylinders G, G′ are operating. At the time, however, when said cylinders are caused to cease ro-

tating by the throw of the clutch E′, the current will be caused to flow through the solenoid in the following manner.

At the time that the cylinders stop rotating, it will be remembered, the ratchet U^4 has made a complete rotation. This has caused the spring U^3 at the righthand side of Fig. 11 to become wound up to a point of high tension. At the moment of the completion of the ratchet's revolution, the disk u^{26} coming to the position of Fig. 12ª, has caused the dog U^7 to rise and disengage the flange u^{29}. This releases the spring U^3 and allows it to uncoil. The uncoiling of the spring, however, and the revolution of the flange u^{29} are controlled or restricted by means of a friction device W pressed by a spring w against the circumference. By means of this the uncoiling of the spring causes the flange u^{29} to slowly revolve, and said flange carrying the contact strip V the said contact strip will slowly revolve from its normal position of Fig. 12 to the extent of a complete revolution. The moment this revolving commences the contact button V^2 is brought above and in contact with said strip V so that both of the buttons V^2 and V^3 then rest on the strip and are in communication with each other. This serves to complete the circuit from the battery V′ to the solenoid R which excites the solenoid, lifts its armature and throws the clutch E′ from the active position of Fig. 3 to the idle position of Fig. 4.

The friction of the device W may be regulated in extent by a thumb screw W′ turning in a threaded bearing w', its shank passing through an aperture in the spring w. The farther inward the thumb screw is turned, the harder will be the tension of device W and the more slowly will the flange u^{29} rotate.

While it does not form a part of the present invention and is not fully illustrated or described herein, I propose to employ automatic mechanism for receiving and securing into a bundle the bunch of counted bills that have been extracted by extractor M; and I propose that this mechanism shall come into operation during the time that the cylinders are idle, that is to say during the time that the flange u^{29} is making its slow revolution as previously explained. Referring to Fig. 3, certain parts are shown and may be described to this extent, namely that Y indicates a clutch part opposite to clutch part E^2, and which operates by friction when the central clutch part E′ is disengaged from E^2 and moved toward the right as in Fig. 4. The member Y is formed on a sleeve y, to which also is connected a gear y' having its teeth set at forty-five degrees and coöperating with a similar gear y^2 set at right angles to y' and mounted on a short shaft y^3 rotating in fixed bearings in the machine. As seen in Fig. 2 the shaft y^3 extends to the outside of the machine at the left and is there provided with a pulley y^4 that is connected by a belt y^5 to a pulley y^6 of the same diameter, which in turn is mounted on a shaft y^7 suitably supported in the machine, and it is with this shaft that I propose to drive the bundling mechanism, the details of which I will not refer to. The parts marked y^8, y^9 and y^{10} relate to this but their further connections and operations will be omitted and reserved for further application to be filed by this applicant.

I do not wish to limit myself to any of the details of construction except in those claims which are specifically directed to detail, and in the broad claims herein I desire to protect the broad principles involved without respect to the form of the mechanism illustrated.

What I claim and desire to secure by Letters Patent is:

1. In a machine of the kind described, mechanism for engaging by both its ends the topmost of a column of bills to be counted, and transferring it bodily to where the counted bills are retained, and for then similarly transferring the next succeeding bills of said column, means for retaining in a bunch the bills so transferred, and a device for counting or indicating the number of such transferring operations.

2. In a machine of the kind described, mechanism including a pair of suction devices for engaging by its ends the topmost of a column of bills to be counted, and transferring it bodily to where the counted bills are retained, means for retaining in a bunch the bills so transferred, and a device for counting or indicating the number of such transferring operations.

3. In a machine of the kind described, mechanism including a constantly rotating device for engaging the topmost of a column of bills to be counted, and bodily transferring it to where the counted bills are retained, means for retaining in a bunch the bills so transferred and a device for counting or indicating the number of such transferring operations.

4. In a machine of the kind described, mechanism including a pair of suction cylinders and a grasping device for each cylinder, for engaging by its ends the topmost of a column of bills to be counted, and transferring it bodily to where the counted bills are retained, means for retaining in a bunch the bills so transferred, and a device for counting or indicating the number of such transferring operations.

5. In a machine of the kind described, mechanism including a pair of oppositely rotating suction cylinders and a grasping device for each cylinder, for engaging by its ends the topmost of a column of bills

to be counted, and transferring it to where the counted bills are retained, means for retaining in a bunch the bills so transferred, and a device for counting or indicating the number of such transferring operations.

6. In a machine of the kind described, mechanism including a pair of oppositely rotating suction cylinders and a grasping device for each cylinder, for engaging by its ends the topmost of a column of bills to be counted, and transferring it to where the counted bills are retained, means comprising pressers coöperating with said cylinders for retaining in a bunch the bills so transferred, and a device for counting or indicating the number of such transferring operations.

7. In a machine for counting bills or other objects, the combination of suction apparatus for displacing or starting an edge or edges of the foremost object, and a mechanical device coöperating with said suction apparatus for mechanically engaging such edge or edges, and means for operating said mechanical device for separating and removing from the uncounted objects the object so engaged and transferring it to where the counted objects are gathered in a bunch.

8. In a machine of the kind described, the combination of a suction device for displacing or starting an edge portion of the foremost of a series of objects to be counted, a mechanical grasping device connected to said suction device and coming into play after such displacement for grasping said edge portion, means for moving said suction device and thereby transferring said grasping device with such object to where the counted objects are retained, and mechanism for causing said suction device, said grasping device and said transferring means to operate in the order specified.

9. In a machine of the kind described, the combination of a suction device for displacing or starting an edge portion of the foremost of a series of objects to be counted, a wall or surface as K^2 projecting beyond the extreme edges to hold such objects in place and from under which wall the foremost objects may be displaced, a mechanical grasping device coming into play after such displacement for grasping said edge portion on both surfaces thereof, means for transferring said grasping device and with it bodily transferring the object to where the counted objects are retained, and mechanism for causing said suction device, said grasping device and said transferring means to operate in the order specified.

10. In a machine of the kind described, the combination of a suction device for displacing or starting an edge portion of the foremost of a series of objects to be counted, a suction box having a wall K^2 projecting beyond the extreme edges to hold such objects in place, a mechanical grasping device coming into play after such displacement for grasping said edge portion on both surfaces thereof, means for transferring said grasping device and with it bodily transferring the object to where the counted objects are retained, and mechanism for causing said suction device, said grasping device and said transferring means to operate in the order specified.

11. In a machine of the kind described, the combination of a suction device, comprising an apertured suction cylinder for displacing an edge portion of the foremost of a series of objects to be counted, a mechanical grasping device coming into play after such displacement for grasping said edge portion, means for simultaneously rotating said cylinder and transferring said grasping device with such object to where the counted objects are retained, and mechanism for causing said suction device, said grasping device and said transferring means to operate in the order specified.

12. In a machine of the kind described, a suction cylinder, means for rotating it in proximity to the edge of the foremost of the objects to be counted, and within said cylinder an apertured diaphragm coöperating with a moving grasping device; in combination with a moving grasping device.

13. In a machine of the kind described, a suction cylinder, means for rotating it in proximity to the edge of the foremost of the objects to be counted, and within said cylinder an apertured diaphragm coöperating with a moving grasping device; in combination with a moving grasping device having a weight or counterbalance for operating it.

14. In a machine of the kind described, the combination of an apertured suction cylinder for displacing an edge portion of the foremost of a series of objects to be counted, a mechanical grasping device fitted to the cylinder coming into play after such displacement for grasping said edge portion, means for rotating said cylinder and thereby transferring said grasping device with such object to where the counted objects are retained, and mechanism for causing said cylinder, said grasping device and said transferring means to operate in the order specified.

15. In a machine of the kind described, the combination of an apertured suction cylinder for displacing an edge portion of the foremost of a series of objects to be counted, a mechanical grasping device fitted to the cylinder coming into play after such displacement for grasping said edge portion, means for rotating said cylinder and thereby transferring said grasping device with such objects to where the counted objects are

retained, a similar opposed cylinder and grasping device operating at another edge, and mechanism for causing said cylinders, said grasping devices and said transferring means to operate in the order specified.

16. In a machine of the kind described, the combination of a pair of suction cylinders for displacing opposite edge portions of the foremost of a series of objects to be counted, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such object to where the counted objects are retained.

17. In a machine of the kind described, the combination of a table for supporting a column of objects to be counted, mechanism for elevating said table in correspondence with the counting of the objects, a pair of suction cylinders for displacing opposite edge portions of the foremost of such objects, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such object to where the counted objects are retained.

18. In a machine of the kind described, the combination of a table for supporting a column of objects to be counted, mechanism for elevating said table in correspondence with the counting of the objects, a pair of walls, as K^2 against which the topmost object at its opposite ends contacts, a pair of suction cylinders for displacing opposite edge portions of the foremost of such objects, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such object to where the counted objects are retained.

19. In a machine of the kind described, the combination of a table for supporting a column of objects to be counted, mechanism for elevating said table in correspondence with the counting of the objects, a pair of suction boxes having inwardly projecting upper walls against which the column of bills is pressed, a pair of suction cylinders for displacing opposite edge portions of the foremost of such objects, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such object to where the counted objects are retained.

20. In a machine of the kind described, the combination of a pair of suction cylinders for displacing opposite edge portions of the foremost of a series of objects to be counted, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such objects to where the counted objects are retained, and a pair of pressers coöperating with said cylinders for retaining the counted bills between them.

21. In a machine of the kind described, the combination of a table for supporting a column of objects to be counted, mechanism for elevating said table in correspondence with the counting of the objects, a pair of suction cylinders for displacing opposite edge portions of the foremost of such objects, a mechanical grasping device fitted within each cylinder coming into operation after such displacement for grasping said edge portions, and means for oppositely rotating said cylinders and thereby moving said grasping devices with such object to where the counted objects are retained, and a pair of pressers coöperating with said cylinders for retaining the counted bills between them.

22. In a machine of the kind described, the combination of a table for supporting in a column quantities of the bills or other objects to be counted, mechanism for elevating said table in correspondence with the counting of the bills, a pair of walls as K^2 against which the topmost bill at its opposite ends contacts, a pair of rotatable cylinders located above and adapted to operate upon the topmost bill near its ends, each cylinder having a suction opening within which the ends of the topmost bill are drawn, a device within each cylinder for mechanically grasping the bill ends so drawn in, means for rotating said cylinders in opposite directions, whereby the object so grasped may be lifted by its ends, suction passages adapted to be connected with suitable suction producing means in said cylinders, and a counting or registering device operated in harmony with the rotation of said cylinder.

23. In a machine of the kind described, the combination of a table for supporting in a column quantities of the bills or other objects to be counted, mechanism for elevating said table in correspondence with the counting of the bills, a pair of suction boxes having inwardly projecting upper walls against which the topmost bill at its opposite ends contacts, each box having a suction opening whereby the suction may exert endwise pull on a number of bills, a pair of rotatable cylinders located above and adapted to operate upon the topmost bill near its ends, each cylinder having a suction opening within which the ends of the topmost

bill are drawn, a device within each cylinder for mechanically grasping the bill end so drawn in, means for rotating said cylinders in opposite directions, whereby the object so grasped may be lifted by its ends, suction passages adapted to be connected with suitable suction producing means in said boxes and cylinders, and a counting or registering device operated in harmony with the rotation of said cylinders.

24. In a machine of the kind described, the combination of a table supporting in a column quantities of the bills or other objects to be counted, mechanism for elevating said table in correspondence with the counting of the bills, a pair of walls as K^2 against which the topmost bill at its opposite ends contacts, a pair of rotatable cylinders located above and adapted to operate upon the topmost bill near its ends, each cylinder having a suction opening within which the ends of the topmost bill are drawn, a device within each cylinder for mechanically grasping the bill end so drawn in, means for rotating said cylinders in opposite directions, whereby the bill so grasped may be lifted by its ends, a pair of receding pressers located above and acting circumferentially in coöperation with the respective cylinders, whereby as the bill is disengaged from said grasping means during the continued rotation of the cylinders said bill is engaged and retained between said pressers and cylinder circumferences, suction passages adapted to be connected with suitable suction producing means in said cylinders, and a counting or registering device operated in harmony with the rotation of said cylinders.

25. In a machine of the kind described, the combination of a table for supporting in a column quantities of the bills or other objects to be counted, mechanism for elevating said table in correspondence with the counting of the bills, a pair of suction boxes having inwardly projecting upper walls against which the topmost bill at its opposite ends contacts, each box having a suction opening whereby the suction may exert endwise pull on a number of bills, a pair of rotatable cylinders located above and adapted to operate upon the topmost bill near its ends, each cylinder having a suction opening within which the ends of the topmost bill are drawn, a device within each cylinder for mechanically grasping the bill end so drawn in, means for rotating said cylinders in opposite directions, whereby the bill so grasped may be lifted by its ends, a pair of receding pressers located above and acting circumferentially in coöperation with the respective cylinders, whereby as the bill is disengaged from said grasping means during the continued rotation of the cylinders said bill is engaged and retained between said pressers and cylinder circumferences, suction passages adapted to be connected with suitable suction producing means in said boxes and cylinders, and a counting or registering device operated in harmony with the rotation of said cylinders.

26. In a machine of the kind described, the combination of a main suction chamber, a suction cylinder closed at one end and having suction openings substantially for the purpose described, means for rotating said cylinders, and bearings formed in said chamber wall for the open end of said cylinder, whereby direct communication is afforded between said chamber and cylinder.

27. In a machine of the kind described, the combination of mechanism for transferring bills singly to where the counted bills are retained, a clutch or device for throwing said mechanism out of operation and a device automatically thrown into play on the operation of said clutch, for removing a bunch of counted bills to where they may be bundled.

28. In a machine of the kind described, the combination of a table for supporting the objects to be counted, means for positively elevating it in harmony with the counting mechanism, mechanism for singly transferring the objects on said table to where the counted objects are retained, and a single shaft for harmoniously operating both said table elevating means and said transferring mechanism.

29. In a machine of the kind described, the combination of a support for a column of objects to be counted, mechanism for elevating said support in correspondence with the counting of the objects, a pair of suction boxes oppositely located at the upper end of said column, and a pair of suction cylinders for displacing opposite edge portions of the foremost object.

30. In a machine of the kind described, the combination of a support for a column of objects to be counted, mechanism for elevating said support in correspondence with the counting of the objects, a pair of suction boxes oppositely located at the upper end of said column, and a pair of suction cylinders for displacing opposite edge portions of the foremost object, together with means for oppositely rotating said cylinders whereby each successive object is bodily removed to where the counted objects are retained.

31. In a machine of the kind described, the combination of mechanism for transferring bills singly to where the counted bills are retained, and a rotating extractor operated intermittently for removing a bunch of counted bills to where they may be bundled.

32. In a machine of the kind described, the combination of mechanism for transferring bills singly to where the counted bills are retained, and a rotating extractor oper-

ated intermittently for removing a bunch of counted bills to where they may be bundled, together with a clutch or device for alternately throwing the transferring mechanism and the extractor into and out of operation.

33. A machine of the kind described, embodying therein a support for a column of sheets to be counted, means whereby said sheets are successively and bodily removed from said column, and a suction device acting at the edges of said column of sheets, whereby air is drawn between succeeding sheets and the removal of more than one sheet at a time is prevented.

34. A machine of the kind described embodying therein a support for a column of sheets to be counted, means whereby said sheets are successively and bodily removed from said column, a counter actuated by said means, a suction device acting at the edges of said column of sheets whereby air is drawn between succeeding sheets and the removal of more than one sheet at a time is prevented, means accumulating or bunching the sheets removed and counted, and means operating at predetermined intervals for removing said accumulated and counted sheets from said last named means.

35. A machine of the kind described embodying therein a support for a column of sheets to be counted, means whereby said sheets are successively and bodily removed from said column, means whereby said support is advanced toward said first named means as each sheet is removed from said support, and a suction device acting at the edges of said column of sheets, whereby air is drawn between succeeding sheets and the removal of more than one sheet at a time is prevented.

In witness whereof I have hereunto set my hand, this 27th day of May, 1908.

ARTHUR VON BARTH.

Witnesses:

W. A. TOWNER, Jr.,

ELIZABETH B. KING.