

Feb. 2, 1937.

A. VON BARTH

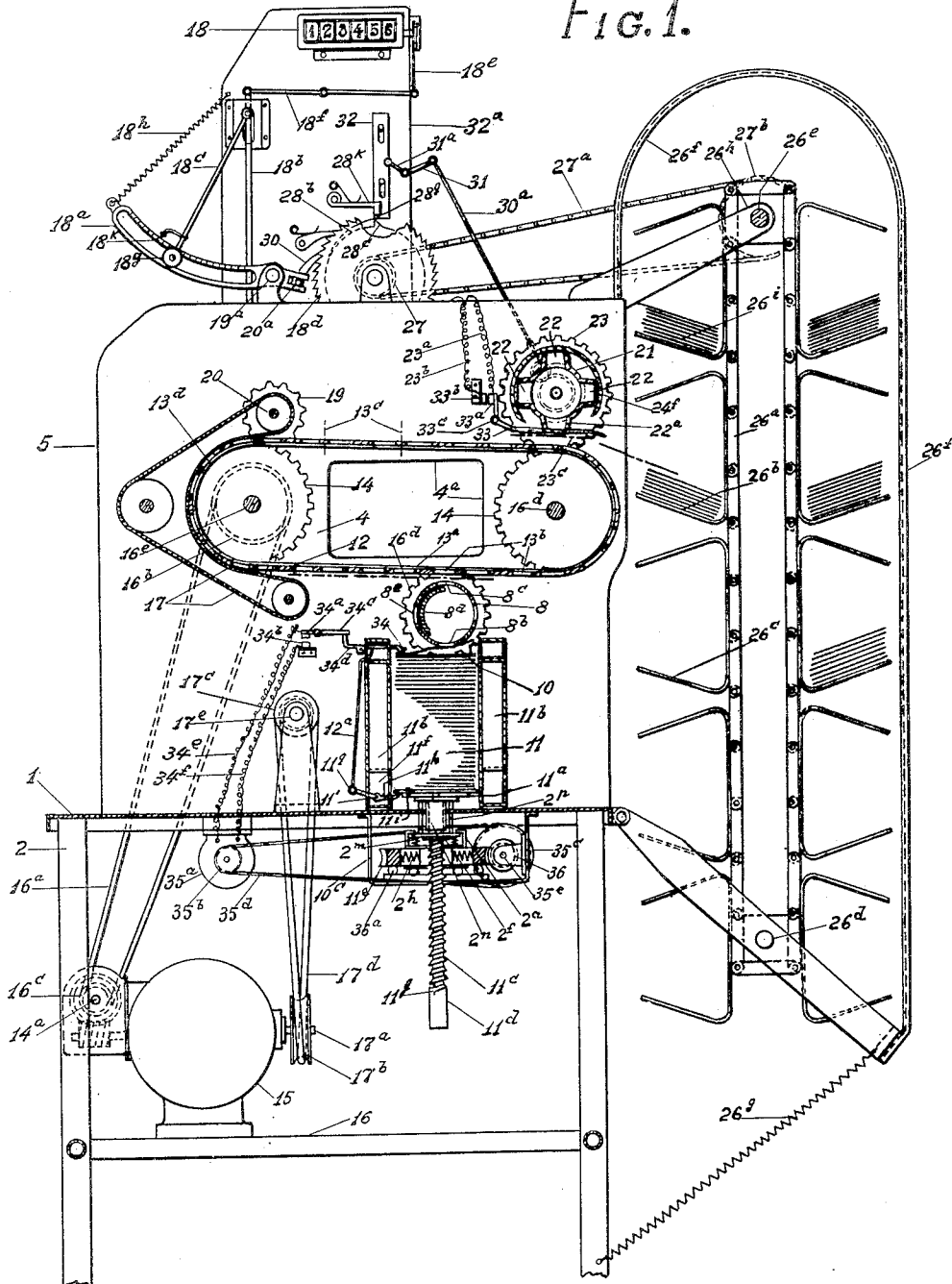
2,069,397

CURRENCY BILL COUNTING AND BUNCHING MACHINE

Filed May 25, 1936

5 Sheets-Sheet 1

FIG. 1.



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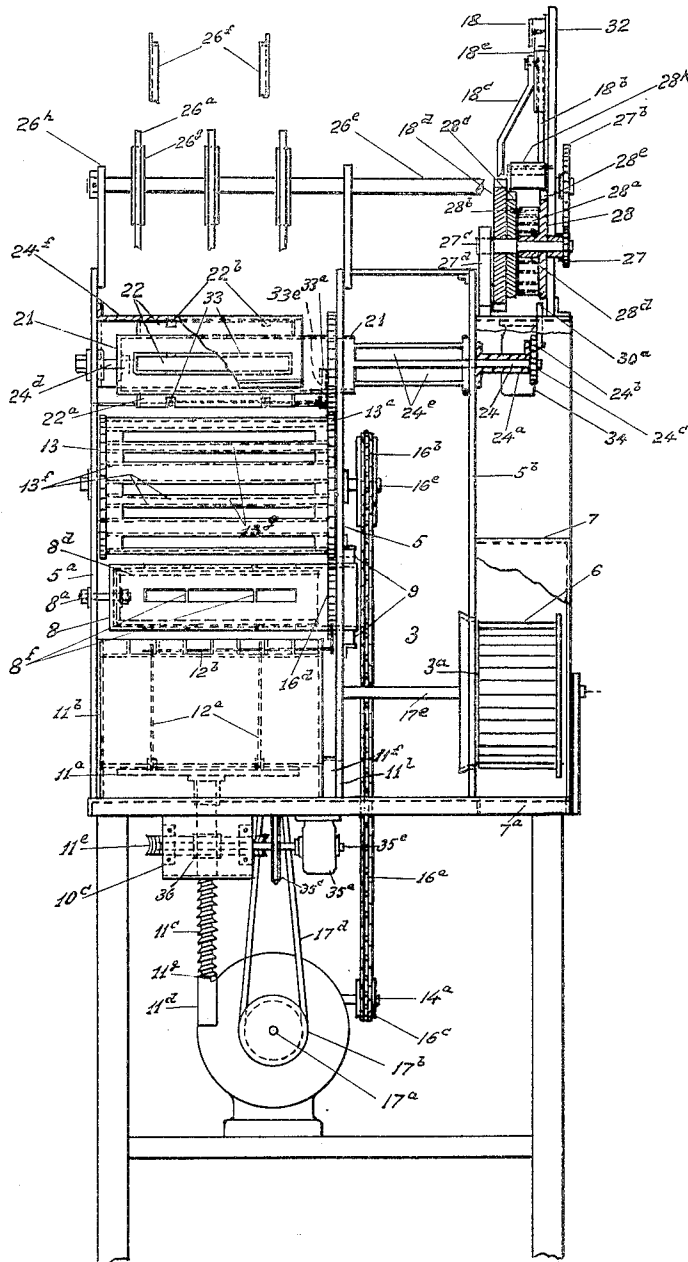
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CURRENCY BILL COUNTING AND BUNCHING MACHINE

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Fig. 2



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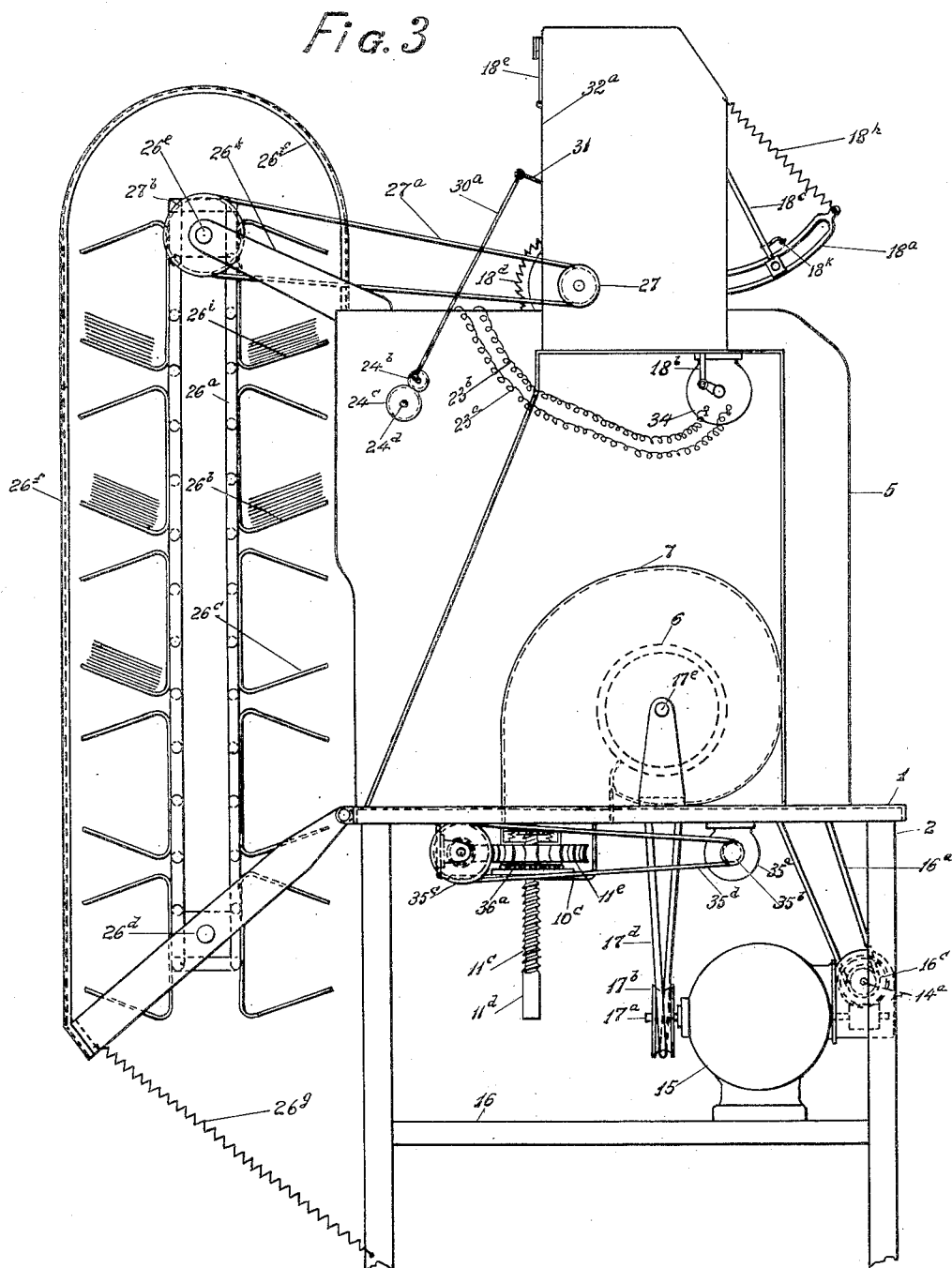
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CURRENCY BILL COUNTING AND BUNCHING MACHINE

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5 Sheets-Sheet 3



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CURRENCY BILL COUNTING AND BUNCHING MACHINE

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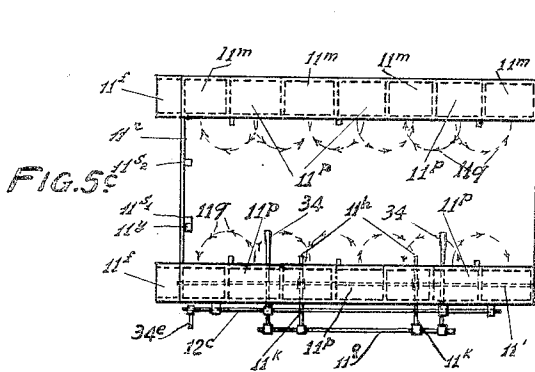


FIG. 5c

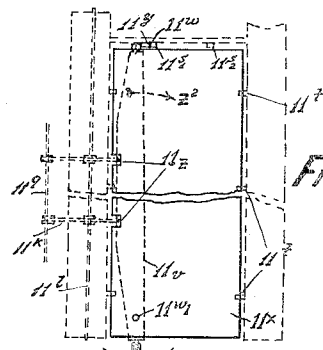


Fig. 5b

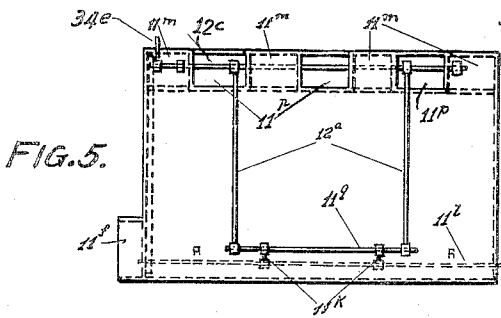
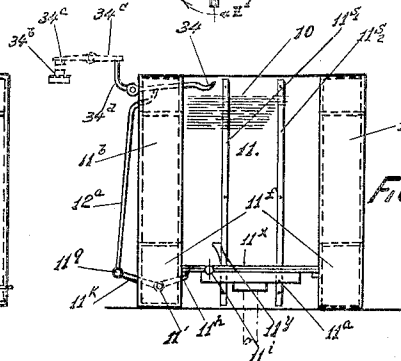


FIG. 5.



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FIG. 6.

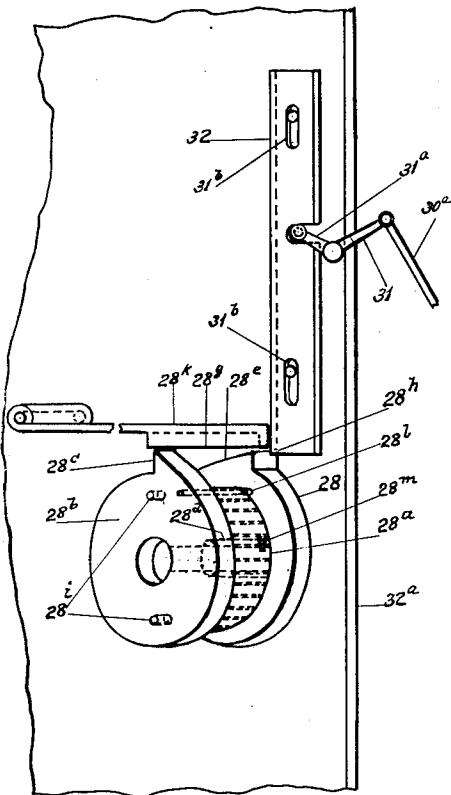


FIG. 7A

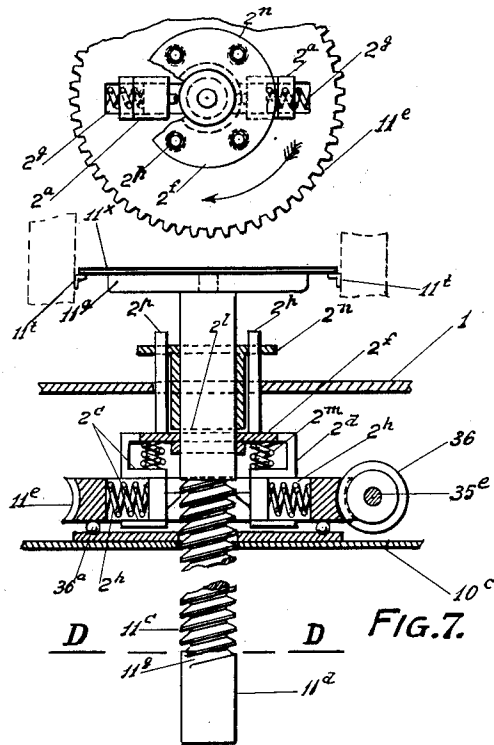


FIG. 8.

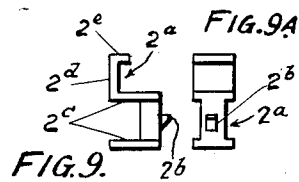
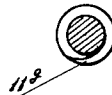


FIG. 9.

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UNITED STATES PATENT OFFICE

2,069,397

CURRENCY BILL COUNTING AND
BUNCHING MACHINE

Arthur von Barth, New York, N. Y.

Application May 25, 1936, Serial No. 81,673

15 Claims. (Cl. 93—93)

My invention relates to counting and bunching machines, and more particularly to a machine for counting and bunching currency bills, although it is equally useful for counting other kinds of bills, or for sheets of paper and similar articles.

An object of the invention is to remove a definite number of bills, one at a time, from an indefinite column or supply thereof and segregate the bills so removed into a plurality of groups or bunches each containing a definite number of bills, each group or bunch being isolated from the other groups or bunches.

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

In the accompanying drawings which form a part of this specification, Fig. 1 is a front elevation of a counting and bunching machine embodying the invention; Fig. 2 is an end elevation from right of Fig. 1, the bunching device being removed so as to clearly show the construction of the machine; Fig. 3 is a rear elevation of the machine; Fig. 4 is a plan view; Figs. 5, 5A, 5B, and 5C disclose the detailed construction of the removable bill compartment, Fig. 5A showing the plate at the bottom of the bill compartment resting upon the top of the bill feeding table; Fig. 6 shows the cam discs and the coiled spring of the bunch controlling mechanism with the ratchet wheel and risers left of the cam disc removed; Fig. 7 is a vertical section of the bill feeding mechanism; Fig. 7A is a plan view, partly broken away, of the bill feeding mechanism; Fig. 8 is a section on the line D—D of Fig. 7; and Figs. 9 and 9A show one of the nut jaws shown in Fig. 7A.

Similar numbers of reference represent corresponding parts in the several figures of the drawings.

A table having a plate 1 and legs 2 affords a support for the entire apparatus. The main suction chamber 3 has openings through the wall 5 thereof into a suction pick-up cylinder, a suction delivery cylinder and the housing for a travelling suction belt, and an opening at 11e in the lower portion thereof extends into the hollow walls 11b of the bill compartment.

The several functioning parts of the machine, as shown in Figs. 1, 2, and 4, are located between the wall 5 and the front wall 5a of the machine.

In the main suction chamber 3, a suction or partial vacuum may be maintained in any suitable way. This chamber may be of any convenient form and may be connected with a rotary

fan 6, Figs. 2 and 3, or other suction apparatus having a casing communicating with the chamber 3 through an opening 3a.

The motor 15 driving the fan and whole machine may be located on a shelf 16, Figs. 1, 2, and 3. The motor 15 may be of back geared type having a cross shaft 14a, for a purpose to be later explained.

A partial vacuum is maintained in the main suction chamber 3 by the fan 6, air being exhausted through the opening 3a and being discharged through the orifice 7a. The fan is driven from the motor shaft 17a by a belt 17d in engagement with pulley 17b and acting upon the fan shaft 17c. In the space outside and below the suction branch 4 and in proximity to the main suction chamber 3, a suction pickup member 8 is located. The front end of said member is supported by a stationary shaft 8a upon which it turns with one end passing through the wall 5 into the suction chamber 3, and being supported on rollers 9, Fig. 2, to permit it to rotate freely. Said suction member is provided with four longitudinal slots or orifices. The upper and the lower slots are shown at 8c and 8b respectively. The rear end of member 8 communicates directly with the middle part of main suction chamber 3, thus forming, through the slots 8c and 8b, an air passage from the outside space above the top of the stack of bills 10 toward the suction fan 6.

This member 8 successively engages and removes bills or other sheets from the top of the stack or column 10, and transfers them to the moving transfer suction member 12. The bills so removed are delivered to a delivery suction cylinder which causes the counting of the bills and their segregation in the pockets of a collecting mechanism. Inside of the suction member 8 is a segmental stationary plate 8d for the purpose of covering any idle slot of said member 8 following the transfer of a bill to the travelling suction member. This prevents waste of suction force.

It is evident that during the rotation of the member 8, when the slot 8b arrives directly above the stack of bills as shown in Fig. 1, a bill will be drawn towards the slot 8b and held by the vacuum. With 180° of turning movement of the member 8, a bill reaches a horizontal position but is still held to the member 8. While the slot is in this position, it is partly covered by the inside stationary plate 8d, thus reducing the effect of air suction. Hence, at this instance, the suction serves only to hold the bill against possi-

ble displacement until said bill has been attracted to the travelling transfer member 12 by suction applied through an approaching slot of said member 12. The member 12 is located and moves above the member 8. The member 12, located and having movement above the member 8, is of an endless belt construction consisting of two link chains 13 and 13a carried by four sprocket wheels 14 mounted on shafts 16d and 16e. Steel rods 13f connect said chains at suitable intervals, Figs. 2 and 4, these rods serving as supports for a continuous fabric cover extending between the chains, and constitute reaches of the belt 12. Said belt is provided at suitable intervals with transverse slots or orifices 13b serving as air suction openings. Between the reaches of said belt a partial vacuum is maintained by the action of the fan 6 through the opening 4a in the wall 5.

While a bill attached to the lower reach of the transfer member 12 is passing between an auxiliary belt 17 and the transfer member 12, it is necessary that the edges of the bill shall not hang down while it is attracted to the belt 12, and that said bill shall bodily adhere to the lower reach of said member. For this purpose, the slots 13b in said belt are arranged in pairs, as shown in Figs. 1 and 4, so that the suction at the slots attracts the portions of the bill nearest both longitudinal edges, thus holding it flat during its transfer from the suction pickup cylinder 8.

The link chains 13 and 13a, in addition to constituting the main part of the belt 12 carrying the bills, actuate those members co-operating with said belt 12. The suction belt 12 is driven from a motor 15 through pulleys 16c and 16b and the belt 16a.

The rotary motion of the suction pickup member 8 is imparted by a sprocket wheel 16d, Fig. 1, at one end of said member 8 which engages the link chain 13a, Fig. 2, of the lower reach of the belt 12.

The peripheral distance between the longitudinal slots of the cylindrical shell of the member 8 is equal to the distance between each pair of slots 13b of the belt 12, Fig. 1, so that these slots at 90° of movement of the member 8, register accurately with the first slot of each pair of slots at the reach of the belt 12. The bill attracted by the member 8 from the top of the column 10 arrives opposite the pair of slots of the lower reach of the belt 12, and consequently is attracted by the suction through these slots and is transferred from said cylinder to said belt while flat, and is carried by said belt to a suction delivery cylinder. The auxiliary belt 17 at the left end of the belt 12 at 13d is to prevent a bill carried by said belt from dropping therefrom while the belt is curved. The belt 17 is moved positively at the same speed as the belt 12. Said movement is effected by a sprocket wheel 19 mounted on the end of the shaft of the roller 20 and engaged by the chain of the upper reach of the belt 12.

The uncounted bills 10 are held in a box or compartment 11, having at its bottom a supporting table 11a.

On each side of the compartment 11 is an auxiliary suction chamber 11b, both suction chambers being connected at their lower portion 11f with the main suction chamber 3 by the opening 11e at the lower portion of the wall 5, Fig. 2. The bill compartment 11, Figs. 1, 2, 5, 5A, 5B, and 5C is provided with two auxiliary suction chambers 11b having at their upper portions,

air suction openings 11m, Figs. 5 and 5C, the purpose of which is to produce at their upper end, adjacent the side edges of the topmost bills, a flow of air having a tendency to create a horizontal circulation of air between the upper two or three bills which will destroy the attraction of the bills to each other caused by static electricity, and separate and maintain them in proper position until the topmost bill is engaged and removed by the suction pickup member 8.

Instead of having the upper end of each auxiliary suction chamber 11b open for the entire length of the bill, it may be open at separated points, as shown by Figs. 5 and 5C. To avoid the creation of vacuum between the bills by the air suction, I provide several alternate openings exposed to the edges of the uppermost bills, affording air suction spaces 11m—11p open to the atmosphere, so that air drawn out through the suction openings 11m is being replaced by the current of atmospheric air passing through the openings 11p, Figs. 5 and 5C, thus creating a circulation of air between the bills as shown by arrows 11q in Fig. 5C. This prevents possible adherence between the bills while the topmost bill is being removed and transferred to the counting and bunching device. However, the particular construction of the previously described compartment holding the stack of uncounted bills, is such that the suction member 8 can pick up no more than one bill at a time. The imperative demand that a machine shall be absolutely reliable in its work in counting and bunching bills, and not a single mistake under any condition shall occur, calls for additional precautionary mechanisms preventing said cylinder from engaging and carrying more than one bill at a time to the counting mechanism and the receiving and bunching device.

I will now describe such precautionary mechanisms:

If the suction pickup member 8, while rotating about its tubular axis, should by any chance attract two adhering bills instead of but a single bill from the top of the stack or column of bills, and these two bills, after completion of one-half of revolution of said member, should be brought to the horizontal position below the belt 12, it is quite evident that the suction transfer member 12, while adjacent these two bills, will attract the outside bill or the one nearest to said belt, leaving the other bill still adhering to the slot 8c of the suction member 8. The suction member or belt 12 holding the bill, moves progressively away from the member 8, travelling as above described towards the auxiliary belt 17 and to the next member 21. The member 8 meanwhile carries the remaining bill, and after making a complete revolution, again restores the bill to a horizontal position and surrenders it to the suction member 12.

The described co-operative motion and action of the two members 8 and 12 affords the first precautionary means for ensuring accuracy of work by the machine.

While the suction members 8 and 12 are in motion, if no bill has been engaged by these members, the requirement arises that the counting and bunch controlling mechanism shall not be actuated, as no bill will be deposited at the bunch receiving unit 26b, Fig. 1.

To so actuate the counter as to meet the above mentioned requirements, I install in the path of travel of the bill, two horizontally suspended stripper levers 33, Fig. 1, attached to a tube or

sleeve 33c, said sleeve being mounted to freely oscillate on a shaft 33d, Fig. 4, fixed between the walls 5 and 5a of the machine.

These levers, located adjacent the lower portion of the member 21, pass through outer portions of the nozzles 22 of a member 21 adjacent the opposite ends thereof, and for this purpose, incisions 22b, Figs. 2 and 4, are provided at the outer portions of these nozzles to keep the lever body flush with the outside edge of the nozzles 22 and permit the member 21 to rotate freely.

At the instant a bill carried by the belt 12 reaches the nozzle 22 of the rotating suction delivery member 21, said bill is drawn by the suction against the nozzle 22 and the two levers 33, being carried ahead by the revolving member 21 until it encounters the arms of the suspended levers 33 causing them to move upwards slightly. Carried by one end of the sleeve 33c, Figs. 2 and 4, is a vertically projecting arm 33e carrying an electric contact 33a co-operating with a second electric contact 33b fixedly mounted adjacent the wall 5, Figs. 1 and 4. These electric contacts 33a and 33b are connected respectively with wires 23a and 23b in circuit with an electric motor 34, Figs. 2 and 3.

When the horizontally suspended levers 33 are engaged by a bill carried by the nozzle 22 of the member 21, they are moved to engage the contacts 33a and 33b to complete a circuit and energize the electric motor 34.

A vertical rod 18b is attached at its lower end to a crank upon the shaft of said motor 34, and at its upper end to a link 18c of the controlling mechanism and also to a rocking lever 18f acting upon a counter.

As the motor 34 is energized, the rod 18b recedes and actuates the counter 18 through the lever 18f and the vertical link 18e, Fig. 1, and at the same time actuates the lever 18a of the bill bunching controller through the connecting link 18c. This actuates the ratchet wheel 18d of the controller mechanism, records that one bill has been deposited at the bill receiving device 26b and partially sets the mechanism for actuating said receiving device.

At the right end of the upper reach of the belt 12, above and in suitable proximity to the same is a delivery suction member 21, said member being tubular and having four longitudinally extending suction nozzles 22, Figs. 1 and 2 at spaced intervals about the outer surface of said member. The right end of the member 21 protrudes through the wall 5 and into the main suction chamber 3, Fig. 2. The extreme left end of the member 21 is keyed to the shaft 24. Said shaft is supported by, and rotates in, a bearing sleeve 24a, Figs. 2 and 4, fixed to the wall 5b. The left end of the member 21 is mounted on a stationary shaft 24d fixed to the wall 5a. The tubular portion of said member 21, positioned within the suction chamber 3, has four large openings 24e through which the sub-atmospheric pressure in said chamber 3 is utilized to cause that nozzle of said delivery member, operative upon a bill, to remove said bill from said transfer mechanism or belt 12 to the collecting mechanism. Only one nozzle is operative at any one time, and this operative nozzle is indicated in Fig. 2 by the numeral 22a.

Outside of the suction member 21, a stationary segmental hood 24f is located, being fixed to the wall 5a of the machine. The function of said hood is to cover the three idle nozzles 22 during

rotation of the member 21, cutting off the suction through said nozzles to prevent waste of energy. One nozzle (22a) only is subject to suction from the chamber 3 and acts upon a bill 23c to be delivered from the belt or to the collecting mechanism.

If, by chance, a pair of slots 13b of the upper reach of the belt 12 carries two bills instead of a single bill, the nozzle 22a of the member 21, when the bills reach it, will remove the upper bill only, while the lower bill, being kept attracted to the reach of the belt 12, will be carried by the belt around and finally surrendered to the nozzle 22a of the member 21. This co-operation between these two members 12 and 21 affords a second precautionary measure against two bills instead of a single bill being delivered by the member 21, and thus a mistake by said member and by the register mechanism is prevented.

To impart rotary motion to the suction member 21, a sprocket wheel 23 is fixedly mounted thereon in proximity to the wall 5. This sprocket wheel 23 engages the link chain 13a of the upper reach of the moving belt 12, thus causing said belt 12 to rotate the member 21.

The circumferential pitch or distance between the nozzles 22 and 22a about the tubular member 21 is equal to the distances between the center lines 13c of each pair of slots 13b of the belt 12, so that the center lines of said slots exactly register with the middle portions of the nozzles 22 and 22a during the rotary motion of the member 21.

The bill removed by the rotating member 21 from the belt 12, by striking the horizontal arms 33 actuates at the same time the bill counter and the bunch controlling device, and is stripped from the nozzle 22a and drops by its own momentum into the bunch receiving unit 26b.

Before proceeding with the description of the bill transferring mechanism, I will explain shortly the arrangement of the bill receiving device. This device 26a consists of a series of bill receiving units 26b vertically suspended upon revolving shafts 26e and 26d.

At the right of the machine, as shown in Fig. 1, said bill receiving units are carried by a chain conveyor and are suspended in such a way that the middle portion of each pocket unit 26b is suitably positioned in front of the member 21 to receive bills successively delivered by said member and accumulate or bunch them. The number of these bill receiving units and their location is shown in Figs. 1, 2, and 4. Movement of said conveyor is periodically imparted by the registering and controlling mechanism acting through the sprocket wheels 27 and 27b and the chain 21a.

I will now describe the construction and action of the controlling and registering mechanism: A coiled spring 28a, Figs. 2 and 6, is firmly attached by its outer end to a cam disc 28b by a bolt 28i, Fig. 6, the cam disc 28b in turn being firmly fixed to the inside or right face of the ratchet wheel 18d, Fig. 2, and the inner end of said spring 28a being fixed to the left end of a sleeve 28d of the cam disc 28. The right end of the sleeve of said cam disc 28 carries a sprocket wheel 27, Figs. 1, 2, and 3. The sleeves 28d on the left and 28f on the right sides of the cam disc 28, Fig. 2, are integral with said cam disc.

When the ratchet wheel 18d, which constitutes the main part of the controlling device, has been repeatedly actuated by the slotted lever 18a through the pawl 30, Fig. 1, to complete a full revolution, this means that a bunch of a pre-

determined number of bills has been segregated and accumulated in a receiving unit 26b, Fig. 1. At this moment, the spring 28a, Fig. 2, becomes fully wound, and a cam riser or ramp-like projection 28c on the circumference of the cam disc 28b, Figs. 2 and 6, raises the locking latch 28k and releases the escapement 28e of the cam disc 28, thus permitting the spring 28a to uncoil and rotate the cam disc 28 one complete revolution until the latch 28k drops and arrests further rotation. The repeated actions, meantime, of the slotted lever 18a keeps the ratchet wheel 18d rotating and again wind the coiled spring preparatory to the next completed bunching of bills, as previously described. The cam disc 28, by the rapid uncoiling of the spring 28a, imparts through the sprocket wheels 27 and 27b and the chain 27a, Figs. 1, 3, and 4, motion to the bill-bunch holding device, moving the conveyor 26a and the bunch holding units 26b upwards to idle position while the next unit 26c is being moved upwards to the bill receiving position.

I will now describe the action of the safety latch 32, by means of which an untimely shifting of the bunch holding unit 26b to idle position is forestalled, the occurrence of which may possibly take place in case of wear of the edge of the escapement 28e of the cam disc 28 and of the edge of the latch 28k.

A sliding safety latch 32, Figs. 1 and 6, is positioned adjacent the escapement 28e, Fig. 6, opposed to the direction of rotation of the cam disc 28, and is slidably movable up and down in bearings fixed to the wall 32a supporting the counter and controlling mechanism. The lower end of said safety latch 32, at the instant the edge 28g, Fig. 6 of the latch 28k clears the edge of the escapement 28e which, at which instant, the uncoiling force of the spring 28a would tend to cause the cam disc 28 to rotate, prevents such action of said spring until said latch 32 is raised by the rotating suction member 21, through gears 24b and 24c, the connecting rod 30a and the bell crank levers 31 and 31a. This delays the spring action by a fraction of a second, allowing time for the main latch 28k to clear the corner 28h, Fig. 6 of the tooth 28e of the cam disc 28, and retarding, by that fraction of time, the rotation of the cam disc 28 and consequently the upward movement of the conveyor bill receiving unit 26b. This permits the deposit of the last incoming bill to complete the bunch of bills in the bill receiving unit 26h before removal of that bill receiving unit to its idle position 26i.

To feed the bills in the compartment 11 upwards, and to maintain the upper level or height of the stack of bills below the suction member 8, I locate, on top of the stack of bills, a member or feeler 34, Figs. 1 and 5, pivotally mounted adjacent the upper portion of the compartment 11. Said feeler is of a bell crank construction, one arm 34 of which protrudes into the bill compartment and rests lightly on top of the stack of bills 10. The other arm 34d is located outside of the bill compartment and is bent upwardly so as to operatively engage an arm 34c of another bell crank lever pivotally mounted on the wall 5 of the machine, its other arm 34a carrying an electric contact.

I will now describe the operating mechanism of the bill compartment 11 shown in Figs. 1 and 5.

At the bottom of the hollow wall 11b of the left side of the bill holding compartment 11, a shaft 11' is positioned. On said shaft are two oscillating bell cranks 11k, the arm 11h of each

of these bell cranks projecting into the bill compartment 11. The other arms 11k of these bell cranks positioned outside of said compartment, are connected to the lower ends of upright rods 12a. The upper ends of said rods 12a are slightly bent and engage below the pivotal member or feeler 34. When the last bill upon the table 11a is removed by the suction member 8, the table 11a drops and the arms 11h of the bell cranks, because of the dropping of the table, are depressed, and the arms 11k are raised to move the rods 12a upwardly.

Below the electric contact 34a attached to one arm of the bell crank 34c, as shown in Fig. 1, another electric contact 34b is fixed to the wall 5. These two contacts make or break a circuit at a certain instant. Each of the contacts 34a and 34b is connected by wires 34e and 34f with an electric motor 35a so as to energize said motor upon the engagement of said contacts.

When the upper ends of the rods 12a, while being raised, lift the pivotal member or feeler 34 from contact with the top of the stack of bills, the arm 34d recedes and permits the arm 34c of the bell crank, by its own weight, to drop, thus causing the contacts 34a and 34b to separate and to break the circuit energizing the motor 35a. To avoid a close contact of the ends of bills in the compartment 11 with the rear wall 11r thereof, two distance bars 11s' and 11s'', Figs. 5A and 5B, are provided. At the lower end of the bar 11s' a cam member 11y is attached, the purpose of which will be explained later.

To facilitate the recharging of the empty bill compartment with a new stack or column of bills to be counted, said compartment is made removable from the machine to permit refilling of the compartment upon a separate table or bench.

Adjacent the bottom of the bill compartment is a loosely fitted bottom plate 11x, said plate being for the purpose of holding and carrying a stack of bills while the bill compartment is removed from the top of the feeding table 11a. The longitudinal edges of said bottom plate rest freely on several small brackets 11t attached to the inner walls of the bill compartment. This bottom plate is located on said brackets at such a height from the bottom of the bill compartment, Figs. 1 and 5A, that when said compartment is being placed in the machine, the bottom plate 11x easily slides over the top of the feeding table 11a. This loose bottom plate 11x is built of two separate plates riveted to each other in such a way that there is clearance or a space between them.

Within said space between these plates, is a plate 11v, said plate being pivoted at 11w adjacent the front portion of the plate 11x. Along one edge of this plate and where the arms 11h of the bell cranks 11k, Fig. 5A, pass through the wall of the bill compartment, incisions 11z are formed. The slide plate 11v, at the instant the feeding table 11a carrying the plate 11x drops to the bottom of the bill compartment, is in a position covering the two incisions 11z, Fig. 5C, and therefore the arms 11h, being struck by the weight of the dropped plate 11z, recede and raise the arms 11k and therethrough the uprights 12a. Consequently, the arms of the pivotal members or feelers 34 are moved to break the electric circuit energizing the motor 35a, thus stopping the bill feeding mechanism.

While a newly filled bill compartment is being positioned in the machine, the attendant operator pushes the hand knob 11i at the one end of the slide plate toward the left (as shown by the ar-

row 2¹, Fig. 5B), thus retracting the slide plate 11v from its obstructing the position in relation to the incisions 11z. This allows the bell crank arms 11h to enter the incisions 11z, causes the crank arms 11k and uprights 12a to recede, and permits the pivotal member or feeler 34 to drop upon the top of the stack of bills 10. When this condition is established, the machine may be operated to bring the top of the stack or column of bills to a level permitting the suction member 8 to act thereon.

The slide plate 11v is provided, toward the rear end of the bottom plate 11x, with a small projection 11w positioned outside of the plate 11. This projection is somewhat shorter than the thickness or the depth of the distance bar 11s'. It does not reach the rear wall 11r, Figs. 5 and 5B, but leaves clearance between the projection 11w and said rear wall for the purpose of permitting free pivotal movement of the slide (as is shown by arrow 2²). This movement of the slide towards the right is limited by the distance bar 11s' when the attendant pushes said knob 11i in the direction of arrow 2¹, Fig. 5B. It is evident that when the rear end of the slide plate 11v with the projection 11w reaches the distance bar 11s', said projection is positioned under the lower portion of the curvature of the cam member 11y. When the portion of the feeding table 11a below the bottom plate 11x starts to move upwardly, the end projection 11w of the slide plate reaches the cam member 11y, and on further upward movement, the slide plate is moved by the curvature of the cam 11y acting upon the projection 11w, slidingly toward the left edge of the plate 11x, and covers the incisions 11z of the plate 11x. This prepares said bottom plate for its next drop to the bottom of the compartment and the resultant action upon the arms 11h and 11k of the bell cranks, as is shown by Figs. 5A and 5C.

I will now describe the construction and operation of the mechanism of the bill feeding table 11a.

Below the table 1 and immediately under the bill holding compartment, is a bracket 10c, Figs. 1 and 2. Mounted in this bracket is a worm gear 11e. A ball bearing 36a is preferably used. Passing through the center of said worm gear is a vertically extending double threaded screw 11c supporting at its upper end, a bill carrying table 11a.

Inside and diametrically located in said worm gear are quadrangular openings 2g, Figs. 7 and 7A. On the upper face of said gear are two oppositely disposed, slidable nut-jaws 2a, having projections 2b thereon adapted to engage opposite sides of the screw 11c. The nut-jaws have upper and lower slide portions 2c which straddle and bear upon upper and lower faces of said worm gear 11e. Each jaw also has an upward projection 2d with horizontal extensions 2e.

In the opening 2g of the worm gear, Figs. 7 and 7A, springs 2h are located, these springs having a tendency to engage the jaws 2a with the thread of the screw 11c. The feed table 11a does not rotate and neither does the arbor 11c supporting it. The threads of the arbor, instead of being square, are beveled at its upper side, as shown by 11c, Figs. 1, 2, 3, and 7. The tooth 2b of each nut-jaw, Fig. 9, has a corresponding shape to that of the thread of the arbor. The peculiar shape of the thread of the arbor 11c and of the teeth 2b of the jaws 2a is such that if an attendant of the machine has a quantity of bills to be counted smaller than is necessary to

permit a full height of the stack of bills in the compartment, he may raise the arbor, holding the table 11a, by hand to secure the desired level of the top of the stack of bills. The movability of the nut-jaws 2b permits the screw to be easily moved upwardly by hand.

When the motor 35a is energized by the engagement of the contacts 34a and 34b, Fig. 1, closing the circuit to said motor, power is transmitted through the pulleys 35b and 35c and the belt 35d to the worm 36, thus turning the worm gear 11e in the direction of arrow, Fig. 7A. The nut-jaws 2a act upon the screw 11c to gradually raise the table 11a supported upon the top of said screw. The feed table 11c raises the stack of bills to compensate for the bills removed by the suction pickup member 8.

When the level of the bills attains the normal height, the pivotal member or feeler 34, Fig. 5B, is also raised, permitting the arm 34c of the bell crank to drop by its own weight, at the same time bringing the contact 34a out of engagement with the contact 34b, Fig. 1, thus breaking the circuit and arresting temporarily the rise of the feed table 11a. It is evident that at the instant that the feed table 11a reaches the highest level and the suction member 8 removes the last bill, the projections 2b of the nut-jaws engage the lower end of the thread of the screw 11c. Between the outside diameter of the inner core of the thread and the outside diameter of the screw 11c, and at the end of said thread, a bevel 11g, Fig. 8, is provided to open the jaws.

This bevel inclined connection between these two diameters of the screw 11c is for the purpose of causing the tooth 2b of the jaw 2a, when it reaches the end of the thread, to slide over the smooth end 11g of the screw and disengage the thread and the nut-jaws 2a.

This disengagement of the thread of the screw 11c supporting the table 11a would not permit the table to drop to the bottom of the bill compartment if the nut-jaws 2a bearing on the worm gear were pressed radially by the springs 2h to again engage the thread of the screw. To prevent the nut-jaws from engaging the thread of the screw 11c, a bushing 2f having a horizontal flange is slidably located on the screw and below the horizontal extension 2e of the nut-jaws 2a. Said bushing 2f, being pressed from below the flange, enters between the extensions 2e of the nut-jaws at the moment the nut-jaw projections 2b, sliding on the smooth end of the screw, recede outwardly on the face of the worm gear 11e, Figs. 7 and 7A.

Another bushing 2n fixed in the top of the table 1 is for the purpose of limiting the sudden upward movement of the flange of the bushing 2f by springs 2m from a position below the horizontal extensions of the nut-jaws 2e while entering between said extensions (as shown in Fig. 7). The horizontal flange of the bushing 2n is used also as a guide for the four short rods 2p which rest on top of the flange 2f of the sliding bushing. While the feed table 11a drops down, its under side strikes the upper ends of the rods 2p (as can be seen in Fig. 1).

These rods, at their lower ends, rest on the top of the horizontal flange 2f of the bushing, sliding on the screw 11c, and when the rods 2p are struck by the table, the flange 2f is depressed.

When the flange 2f is being moved from between the projections 2e of the nut-jaws, said nut-jaws are free to be returned to their original or inward position by springs 2h, and thus

the parts are re-engaged with the thread of the screw 11c.

In addition to the previous description of the bill receiving and bunching mechanism, the parts 26f are two guard bars provided to keep the bunches of bills from being thrown out of the bunch holding units while the conveyor is being suddenly moved. At the lower end of the conveyor, a spring 26g is attached, the purpose of which is to take up slack in the link chains of the conveyor and thereby keep the bill receiving units always in the proper position relatively to the suction member 21.

A tension spring 18h in the registering and controlling mechanism, as described, serves to restore the lever 18a to the initial or starting position following the end of its stroke when acting upon the ratchet wheel 18d.

To prevent a bill adhering to the suction opening of the member 8 being dragged by suction force inwardly of said suction member, two bridges 8f, Fig. 2, are provided. At the bill delivery suction member 21, Figs. 2 and 4, similar action is prevented by the two horizontal levers 33, Fig. 4. At the transverse orifices of the belt suction member 12, the passing of a bill inwardly of said belt is prevented by the narrow middle strip 13g of each pair of orifices, Figs. 1 and 4.

A machine embodying the invention includes therein a collecting mechanism including a sequence of receiving units in which segregated bills are collected or bunched, a compartment adapted to receive a stack of bills, and a transfer mechanism for removing the bills, one at a time, from said bill compartment and delivering them to the receiving units of the collecting mechanism successively. This transfer mechanism consists of a suction pickup cylinder adjacent the top of the stack of bills in the bill compartment, a suction belt above and adjacent said pickup cylinder, and a suction delivery cylinder above and adjacent said suction belt, and adjacent said collecting mechanism.

In this manner, bills are removed one at a time by the pickup cylinder, the suction belt removing each bill from said pickup cylinder and conveying it toward the delivery cylinder, which cylinder removes the bills from the suction belt and throws or delivers them into that pocket of the collecting mechanism adjacent said delivery mechanism at the moment.

Since the bills, while engaged by the suction belt, pass about a curved surface, means are provided for preventing the flexibility inherent to the material of a bill from moving the end of the bill from said belt to an extent to permit air seepage between the bill and the belt.

In conjunction with the above mechanisms, I provide means whereby the collecting mechanism is actuated at predetermined intervals according to the number of bills delivered to a pocket. In other words, this collecting mechanism remains stationary until a given number of bills has been deposited in one of the pockets, whereupon all of the pockets receive movement so as to bring the succeeding pocket into operative relation to the delivery cylinder.

A spring drum is used to actuate the pockets of the collecting mechanism in the manner above described, and this spring drum is actuated to wind the spring, the complete winding of the spring being determined by the number of bills delivered to a pocket. The mechanism for winding the spring is capable of adjustment so as to

vary the number of impulses required to give one full rotation to the spring winding mechanism. This mechanism includes means whereby, upon the completion of one full cycle of the spring winding member by the pawl and ratchet mechanism, the spring will be released so as to impart one full rotation to the member carried by the shaft of the spring and geared to the collecting mechanism and thus impart the desired travel to the pockets of the collecting mechanism by a rapid movement without interrupting the operation of the transfer mechanism.

As heretofore stated, it being desirable to slightly delay the release of the tension of the spring, I employ an escapement mechanism as described, for the purpose of ensuring accuracy in the timing of the actuation of the collecting pockets with the movements of the delivery cylinder.

The means for actuating the spring drum serves three functions: to give a proper direction to the bills when delivering them to a bunch pocket; to ensure a complete separation of the bill from the suction delivery cylinder, and to close a circuit to a motor for actuating the spring winding mechanism.

To ensure the top of the bills in the bill compartment always being within the range of the suction of the pickup cylinder, means as above described are provided by which the stack of bills is intermittently raised as a result of the actuation of a feeler engaging the uppermost bill and operative upon a make and break mechanism controlling the circuit to a motor for imparting movement to the mechanism for raising the stack of bills.

I also provide, in conjunction with the bill compartment, a mechanism which will automatically remove the feeler from above the bill compartment when it becomes necessary to refill this compartment with bills after the last bill has been removed therefrom by the pickup cylinder.

While, in the accompanying drawings, I have shown specific details of construction of the various mechanisms above referred to, it is not my intention to limit the invention to such precise details of construction, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a continuously operating transfer mechanism including means adapted to remove bills one at a time from the top of said stack and deliver it to a pocket in said collecting mechanism, a delivery cylinder adapted to remove each bill from said belt, and a travelling belt adapted to remove bills from said means, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said delivery cylinder into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

2. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plu-

reality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

3. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, said pickup cylinder, said belt and said delivery cylinder each having a sequence of openings about same, said openings being separated by solid portions preventing the bills passing inwardly of said cylinders or said belts, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

4. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, means engaging said belt at the end thereof remote from said collecting mechanism, whereby bills are prevented from flexing away from said belt, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

5. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a traveling suc-

tion belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, a continuously operating source of power, connections between same and said belt, and gearing connecting said belt and said pickup and said delivery cylinders respectively, whereby said belt and said cylinders are operated at the same peripheral speed, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

6. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, a spring drum operatively connected with said mechanism, intermittently operative means whereby energy is accumulated in said spring drum with the successive delivery of bills, means normally holding the energy accumulated in said spring drum, a release member operative upon said last named means, whereby the energy of said spring drum will be applied to said collecting mechanism at predetermined intervals, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the actuation of said intermittently operative means.

7. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, a spring drum, means for accumulating energy in said spring consisting of a ratchet wheel connected with one end of said spring, a rocking lever, a pawl carried thereby, an electro-receptive device, connections between said device and said lever, connections between the other end of the spring of said drum and the mechanism for successively bringing said bunch pockets into operative relation to the transfer mechanism, means normally holding the energy accumulated in said spring drum, a release member operative upon said last named means, whereby the energy of said spring drum will be applied to said collecting mechanism at predetermined intervals, a make and break mechanism controlling the circuit to said electro-receptive device, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism and operative upon said make and break mechanism.

8. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, a spring drum, means for accumulating energy in said spring consisting of a ratchet wheel connected with one end of said spring, a rocking lever, a pawl carried thereby, an electro-receptive device, connections between said device and said lever, connections between the other end of the spring of said drum and the mechanism for successively bringing said bunch pockets into operative relation to the transfer mechanism, means normally holding the energy accumulated in said spring drum, a release member operative upon said last named means whereby the energy of said spring drum will be applied to said collecting mechanism at predetermined intervals, a make and break mechanism controlling the circuit to said electro-receptive device, means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism and operative upon said make and break mechanism, and means for varying the operative effect of said lever to determine the number of bills collected in a bunch pocket.

9. A machine of the character described embodying therein a compartment for a stack of bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, a continuously operating source of power, connections between same and said belt, and gearing connecting said belt and said pickup and said delivery cylinders respectively, whereby said belt and said cylinders are operated at the same peripheral speed, a mechanism including a spring drum for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means, supplemental holding means operative upon said spring drum, means actuated by said delivery cylinder, and connections between said means and said supplemental control mechanism whereby the application of energy stored in said spring drum to said collecting mechanism is determined by and in accordance with the position of said delivery cylinder.

10. A machine of the character described embodying therein a compartment for a stack of bills, a movable bottom plate supporting bills in said compartment, means adjacent the top of said compartment and engageable with the uppermost bill in the stack, a make and break mechanism actuated by said movable member, means operative to raise said plate, a motor operative upon said means, said make and break mechanism controlling the circuit to said motor, a collecting

mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

11. A machine of the character described embodying therein a compartment for a stack of bills, a movable bottom plate supporting bills in said compartment, a pivotal member adjacent the top of said compartment and engageable with the uppermost bill in the stack, a make and break mechanism actuated by said pivotal member, means operative to raise said plate, a motor operative upon said means, said make and break mechanism controlling the circuit to said motor, a member pivotally mounted adjacent the bottom of said compartment and engageable by said bottom plate, connections between said last named pivotal member and said pivotal member adjacent the top of said compartment, whereby said last named pivotal member is made inoperative in relation to said make and break mechanism and moved to one side of said compartment to permit a fresh supply of bills to be delivered to said compartment, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

12. A machine of the character described embodying therein a compartment for a stack of bills, a movable bottom plate supporting bills in said compartment, a pivotal member adjacent the top of said compartment and engageable with the uppermost bill in the stack, a make and break mechanism actuated by said pivotal member, means operative to raise said plate, a motor operative upon said means, said make and break mechanism controlling the circuit to said motor, a member pivotally mounted adjacent the bottom of said compartment and engageable by said bottom plate, connections between said last named pivotal member and said pivotal member adjacent the top of said compartment, whereby said last named pivotal member is made inoperative in relation to said make and break mechanism and moved to one side of said compartment to permit a fresh supply of bills to be delivered to said compartment, said bottom plate having edge recesses through which the pivotal member adjacent the bottom of said compartment is adapted to pass, means whereby said recesses may be opened or closed to make said pivotal member operative or inoperative at will, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism adapted to remove bills one at a time from said stack and deliver each bill to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative rela-

tion to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said
 5 collecting mechanism for controlling the timing of the actuation of said last named means.

13. A machine of the character described embodying therein a compartment for a stack of
 10 bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment having a plurality of spaced openings therethrough and a segmental
 15 shield covering some of said openings, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent
 20 said collecting mechanism and said belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, a mechanism for successively
 25 bringing said bunch pockets of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each
 30 bill as it passes from said transfer mechanism into one of the pockets of said collecting mechanism for controlling the timing of the actuation of said last named means.

14. A machine of the character described embodying therein a compartment for a stack of
 35 bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment, a travelling suction
 40 belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent said collecting mechanism and said belt having a plurality
 of spaced openings therein, and a segmental shield

covering all of said openings excepting the opening operative in relation to said suction belt, whereby bills are removed one at a time from
 5 said stack and each bill is delivered to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets of said collecting mechanism into operative relation
 10 to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said
 15 collecting mechanism for controlling the timing of the actuation of said last named means.

15. A machine of the character described embodying therein a compartment for a stack of
 20 bills, a collecting mechanism including a plurality of bunch pockets, a transfer mechanism consisting of a suction pickup cylinder adjacent the top of said bill compartment having a plurality of spaced openings therethrough, and a segmental
 25 shield covering some of said openings, a travelling suction belt adjacent said pickup cylinder having one end thereof adjacent said collecting mechanism, and a delivery suction cylinder adjacent
 30 said collecting mechanism and said belt having a plurality of spaced openings therein, and a segmental shield covering all of said openings excepting the opening operative in relation to said
 35 suction belt, whereby bills are removed one at a time from said stack and each bill is delivered to a pocket in said collecting mechanism, a mechanism for successively bringing said bunch pockets
 40 of said collecting mechanism into operative relation to said transfer mechanism, intermittently operative means acting thereon, and means engageable by each bill as it passes from said transfer mechanism into one of the pockets of said
 collecting mechanism for controlling the timing of the actuation of said last named means.

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