

**Oct. 14, 1947.**

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**2,429,159**

# PAPER MONEY SORTING AND COUNTING MACHINE

Filed Sept. 24, 1945

5 Sheets-Sheet 1

Attorneys

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*Fig. 2.*

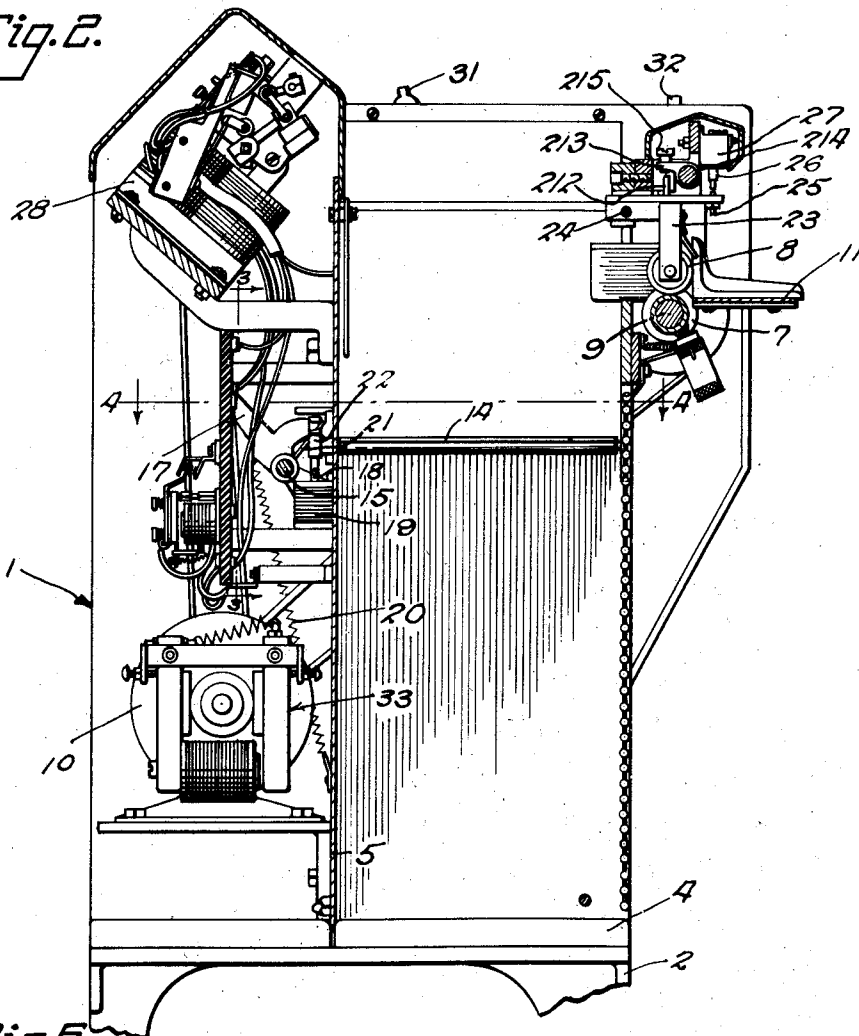
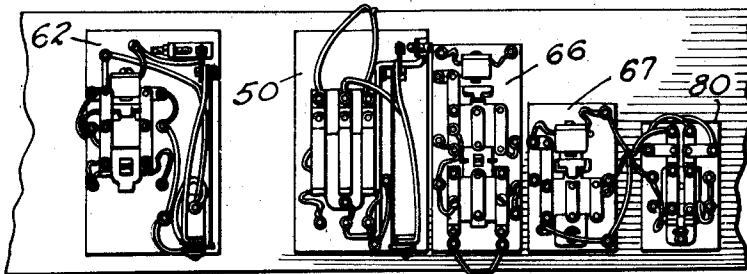


*Fig. 6.*



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*Fig. 3.*

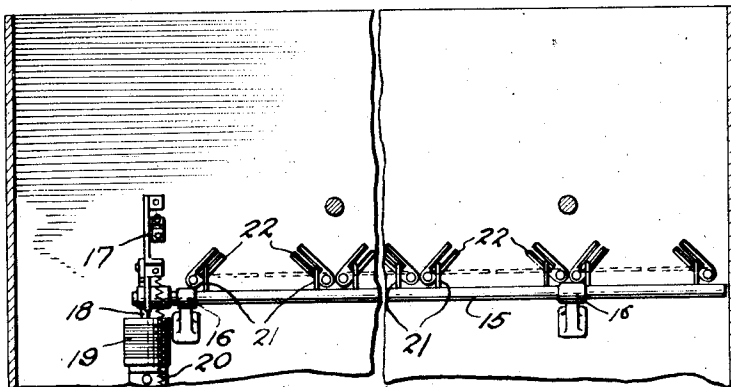
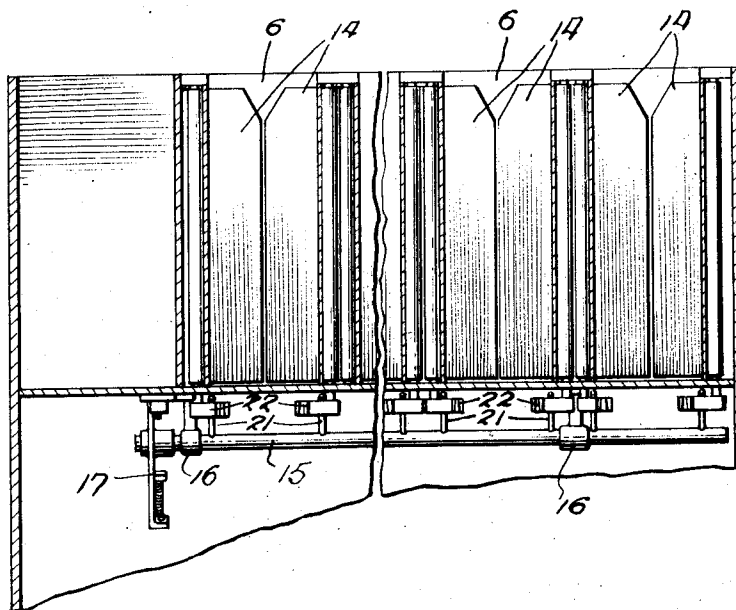


*Fig. 4.*



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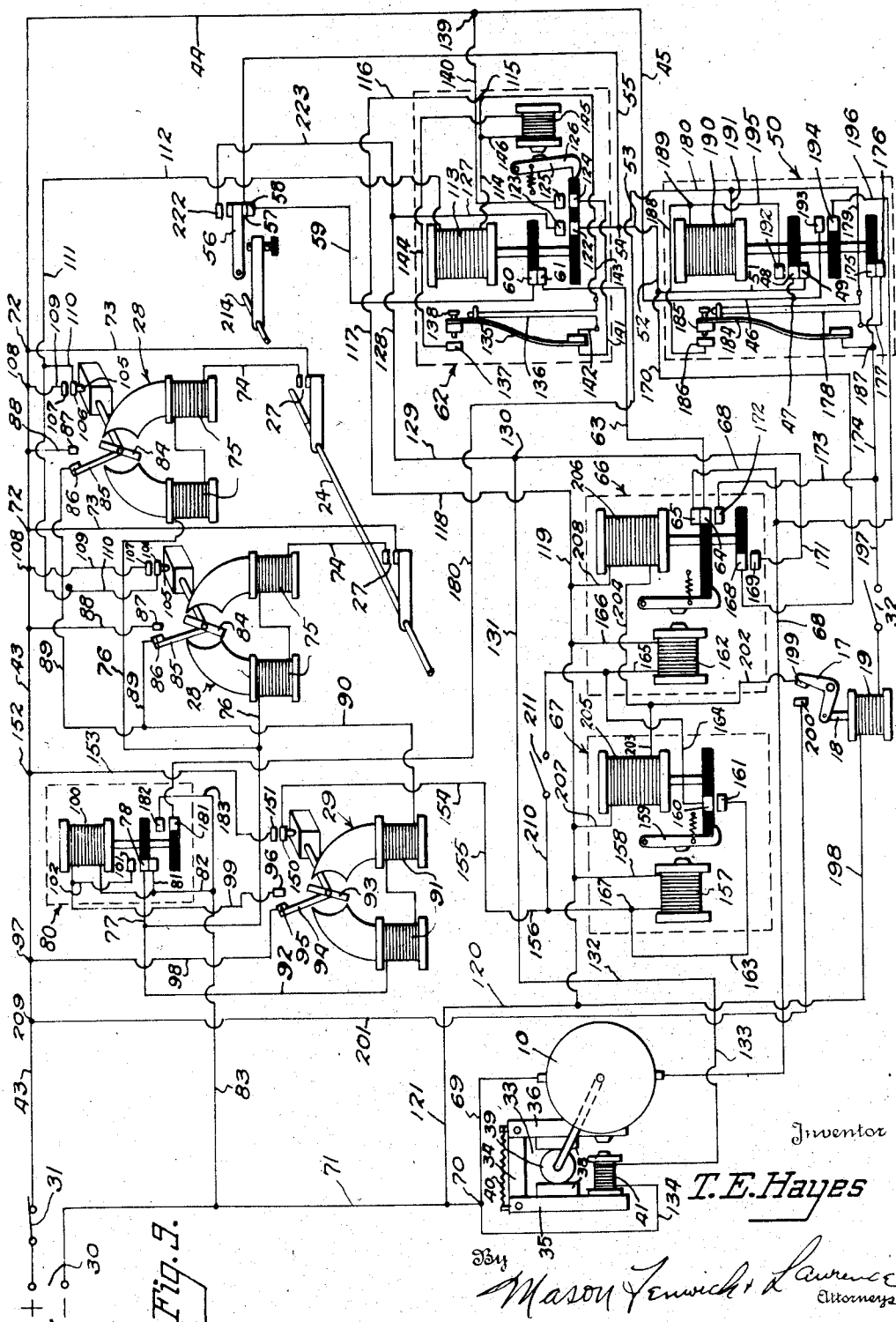
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# PAPER MONEY SORTING AND COUNTING MACHINE

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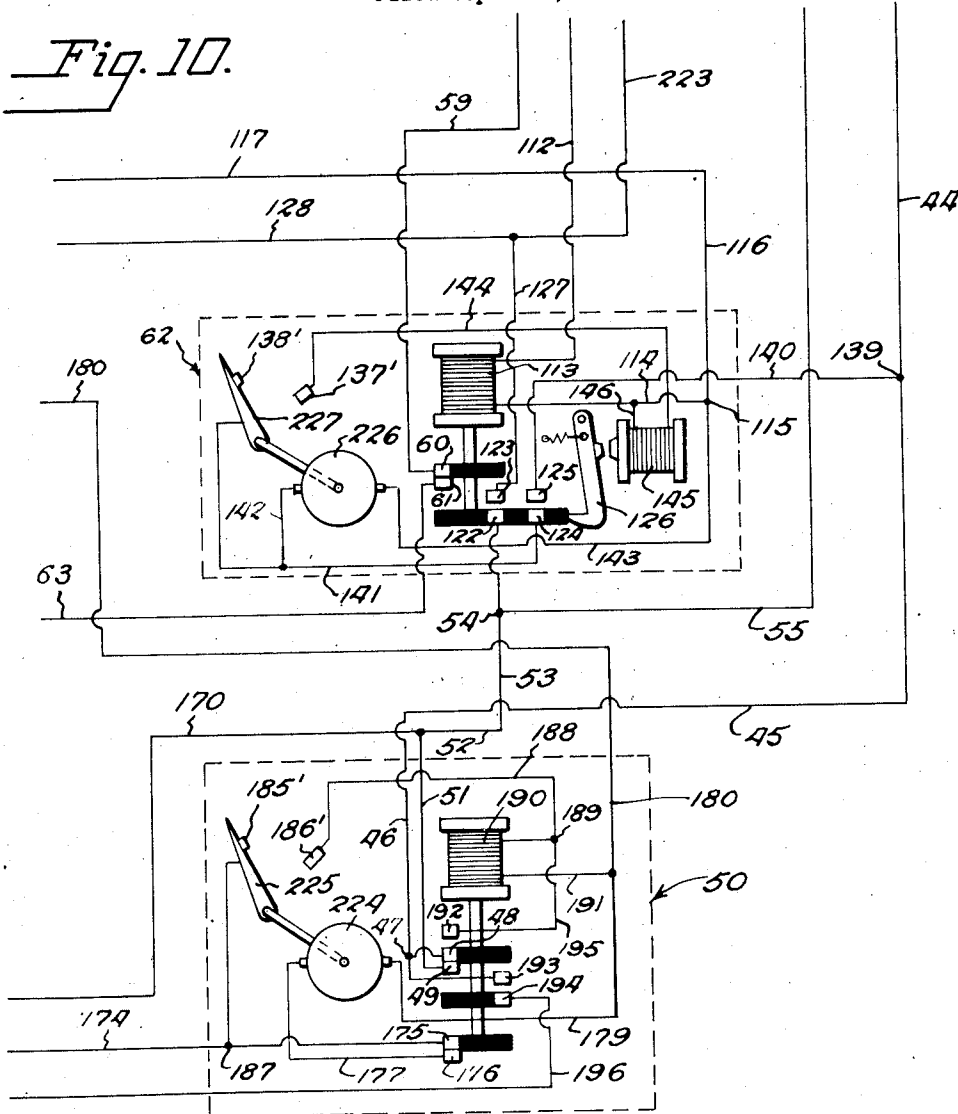
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*Fig. 10.*



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## UNITED STATES PATENT OFFICE

2,429,159

## PAPER MONEY SORTING AND COUNTING MACHINE

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Application September 24, 1945, Serial No. 618,185

19 Claims. (Cl. 235—92)

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This invention relates to machines for use in sorting and counting paper money and is an improvement over the machines disclosed in Patent No. 2,271,394 and copending application Serial No. 588,939.

The primary purpose of this invention is to provide certain improvements in such machines whereby the operation of the machine becomes more foolproof, and the operator is compelled to follow a specific routine in its operation so that in the event of error relatively few bills will be involved and the task of locating the error proportionately reduced.

Another object of the invention is to provide a machine of this type wherein a number of the operations formerly performed by the operator are automatically performed by the machine, with automatic timed pauses in the operation to indicate to the operator that certain desired results have been achieved.

Previous machines have been designed to complete a cycle of operation when one hundred bills have been fed to the machine, but it is frequently desirable to work with smaller groups. It is an object of the present invention, therefore, to provide a bill counting machine incorporating means whereby the machine may be selectively set to complete its cycle of operation when one hundred bills or a fractional part thereof have been fed into the machine.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

In the drawings which accompany and form a part of the following specification, and throughout the several figures of which the same characters of reference have been employed to designate identical parts:

Figure 1 is a perspective view of a machine embodying the principles of the present invention;

Figure 2 is a vertical transverse sectional view through the machine;

Figure 3 is a vertical section taken on the line 3—3 of Figure 2;

Figure 4 is a horizontal section taken on the line 4—4 of Figure 2;

Figure 5 is a vertical section taken through the housing shown at the right of Figure 1;

Figure 6 is an elevational view of a panel located at the rear of the machine and carrying certain relays;

Figure 7 is a detail view of one of the register disks in the piece counter shown in connection with a switch closing member;

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Figure 8 is a similar view of a register disk of the totalizer;

Figure 9 is a diagrammatic view of the electrical circuits employed in the machine; and,

Figure 10 is a partial diagrammatic view showing a modified type of timing device in conjunction with delayed-action relays employed as piece-counter 100 bill stop and totalizer 100 bill control.

Paper money is received at the Federal Reserve Banks, from their member banks, in stacks of one hundred bills, or as is sometimes the case with twenty-dollar bills in stacks of fifty, with a paper band or strap encircling the bills, the strap having marked thereon the amount of money within the strap. Under existing regulations, Federal Reserve banks may issue paper money, but when these Federal Reserve notes have been in circulation and are taken in to a Federal Reserve bank they can be put into circulation again only by the issuing bank. When a Federal Reserve bank receives the above-mentioned straps of bills from its member banks, the bills must not only be counted to check the forwarding bank's count, but the bills must be sorted in accordance with the banks of issue. With the machine of the present invention, both of these operations are performed simultaneously.

Referring in detail to the several figures of the drawing, the reference character 1 designates in general a cabinet which is mounted upon a suitable stand 2.

A plurality of vertical partitions 3 are arranged in parallel relation upon the base 4 and against a back wall 5, forming a series of compartments 6, the horizontal cross-section of said compartments being of approximately the same size and shape as a bill, and adapted for the accumulation of stacks of bills, one bank of issue to each compartment.

A plurality of pairs of bill-feeding rolls 7 and 8 are arranged one pair at the upper forward end of each compartment. The lower rolls 7 of each pair are mounted upon, and driven by, a common shaft 9 (see Fig. 2), from a belt and pulley connection to the electric motor 10. A shelf 11 extends horizontally in front of said series of compartments and has its upper surface at about the level of the line of contact between the rolls 7 and 8, said shelf being suitably supported between said compartments by angle brackets, and being slightly concave in a transverse direction. The concave shape of the shelf, along with the fact that the outer flanges of the rolls 7 are of somewhat larger diameter than the middle of said rolls, causes the bills

fed to the machine to assume a trough-like shape, stiffening the bills so that they will shoot between the rollers in a shape-retaining condition, assuring the bills stacking themselves in the compartments full length.

The compartments 6 are divided horizontally near the top by a pair of shelves 14 which are hinged from the partition 3 with their free longitudinal edges meeting in the middle. When bills are fed into the compartments they accumulate upon the shelves 14 until all of the bills in a strap have been sorted and the count verified, at which time the bills are dumped into the lower part of the compartments.

Means are provided for dumping all of the compartments simultaneously, comprising a horizontal rock shaft 15, carried in suitable bearings 16, having fixed at one end a rocking lever 17 connected to the movable pole-piece 18 of a solenoid 19. A spring 20 normally holds the rock shaft in inactive position with the hinged shelves 14 all closed.

The shaft 15 is provided with a series of pins 21, one for each shelf. Said pins engage in slots of levers 22 fixed to the hinge pintles of shelves 14, so that when the shaft is rocked upon energization of the solenoid 19 all of the levers 22 are depressed, dumping the contents of the upper parts of all of the compartments into the lower parts of said compartments.

Referring again to the feed rolls, the roll 8 is rotatably mounted in the downwardly extending bifurcated end of a tilting support 23 fixed to a shaft 24. Said support at its free end carries an adjusting screw 25 which operates the plunger 26, which actuates the hidden contacts of a micro-switch 27 to bring them together when the plunger is pressed upwardly. Said switch is closed by the slight upward movement of the tilting support produced by the thickness of a single bill passing between the said rolls and lifting the roll 8. The micro-switch controls a number of circuits, one of which causes the actuation of a piece-counter 28 associated with the compartment to which said switch belongs, and through the piece-counter the actuation of a totalizer 29. It will be understood that there is a similar micro-switch for each compartment. The piece-counters and totalizer are of conventional form, such as is shown in the patent to Veider, 1,480,738, granted January 15, 1924.

The machine is electrically operated, being plugged into the house service lines at the point indicated at 30 in Fig. 9. Upon closing the main switch 31, the motor 10 starts and continues running throughout the sorting operation, rotating the pairs of feed rolls 7 and 8. There are three eventualities during the sorting and counting operation in which the motor will be automatically stopped. One of these is when one hundred bills, a "strap," have been registered on the totalizer 29. Upon the count of one hundred the motor will stop, indicating to the operator that a "strap" has been counted. After a predetermined slight pause the motor will start to pass the one hundredth bill from between the feed rolls into its compartment, and then again stop. This gives the operator an opportunity to check the "strap" just sorted. The shelves 14 are then dumped by pressing a switch button 32, and the motor again starts. When one hundred bills have been accumulated in any one of the various compartments the motor stops momentarily to indicate that a "strap" has been accumulated, and, after a slight pause, starts again. The pause in opera-

tion, if desired, may be accompanied by the lighting of a signal light over the particular compartment (not shown). The operator will place a separator in the compartment to segregate the one

hundred bills already counted from those to follow. The third circumstance which causes the motor to stop is when anything having a thickness greater than a single bill, for instance, two bills at once or a folded bill, are presented between the feed rolls 7 and 8. In this case the motor stops to enable the operator to remove the obstruction. The motor circuit, therefore, has four normally closed gaps in series, one of which is opened responsive to the hundred count on the totalizer 29, the second to cause the second stop of the motor incident to the hundred count on the totalizer, the third responsive to the hundred count on any of the piece-counters 28, and the fourth which is responsive to the insertion between the feed rolls of anything having a thickness greater than a single bill.

When any one of the above-mentioned eventualities are reached and the motor circuit broken, it is desirable to prevent over-running, or coasting, of the motor. A brake 33 is provided for the motor consisting of a fixed transverse bar 34 having pivotally depending pole pieces 35 and 36 on opposite sides of the armature shaft 37 with diametrically opposed brake shoes 38 adapted to bear frictionally upon a disk 39 on said armature shaft, normally biased away from said disk by a spring 40 and brought together by an electromagnet 41 fixed to one pole piece below said shaft and within attracting distance of the outer pole piece. Adjusting screws 42 enable the pole pieces to be so set relative to the disk as to immediately equalize the pressure on both sides of the disk when the electromagnet is energized. Whenever the motor circuit is broken, the brake circuit is immediately energized to apply the brake to bring the motor to a standstill. Although the action of the brake is very rapid, there is purposely provided a slight lag in its operation for a purpose to be described more fully hereinafter.

By referring to the diagram shown in Fig. 9, the motor circuit can now be traced. Starting with the plus side of the line at the plug 30, current flows through the main switch 31, lines 43, 44, 45 and 46 to the point 47, through normally closed contacts 48, 49 of relay 50, through lines 51, 52 and 53 to the point 54, and through line 55 to the movable arm of the double-bill switch 56. The current then passes through the double-bill switch contacts 57, 58, through line 59 and the normally closed contacts 60, 61 of the piece-counter hundred bill stop relay 62. Current is then carried through line 63 to the normally closed contacts 64, 65 of relay 66, which with its companion relay 67 serves as the totalizer hundred bill stop. The circuit is then completed through line 68 to the motor 10, and from the motor through line 69 to the point 70, and then through line 71 to the minus side of the line.

Thus it will be seen that the motor circuit may be broken by separation of the contacts 48, 49 of relay 53, by separation of the contacts 57, 58 of the double-bill switch, by separation of the contacts 60, 61 of the piece-counter hundred bill stop, or by separation of contacts 64, 65 of relay 66 of the totalizer hundred bill stop.

With the motor running, the machine is ready for the sorting and counting to begin. As bills are fed to the rolls 7 and 8 of the various compartments, the rolls are separated, actuating the respective micro-switches 27 to energize the

piece-counter of that compartment. When a micro-switch 27 is actuated, a circuit is closed through positive line 43 to point 72, through line 73, the closed micro-switch 27, line 74, counter coils 75, line 76, and line 77 to the normally closed contacts 78, 79 of counter relay 80. From contact 79 current passes through lines 81, 82, and 83 to the negative line 71 completing the circuit. This will cause the armature 84 of the piece-counter which is located between the pole pieces of the counter solenoid to rotate to the right, or clockwise, as viewed in Fig. 8.

The piece-counters are of the type which make the count as the counting arm is moved upward when the armature coils are energized, and the counting arm must completely return to its inactive position before it can count again. As disclosed in my copending application, Serial No. 588,939, hereinbefore referred to, and shown herein in Fig. 2 and diagrammatically in Fig. 9, the movement of the armature 84 serves also to move a switch arm 85 closing contacts 86, 87 and establishing a circuit to the totalizer. By this arrangement, the piece-counters are assured of making a count before the totalizer is energized, thus eliminating any possibility of the totalizer actuating to make the count and the piece-counter failing to do so. This definitely assures any mistake which may be made being caught during the handling of the bills of the particular strap being counted, so that no more than one hundred bills can be involved in any necessary re-count.

When the piece-counter has been energized and the armature 84 and arm 85 have been moved closing contacts 86, 87, the circuit to the totalizer is established through wires 43, 88, contacts 87, 86, wires 89, 90, totalizer coils 91, wires 92, 77, contacts 78, 79, and wire 81, 82, 83 to the negative line 71. This will cause the totalizer armature 93 to move to a position in readiness to make the count. In the present invention, the totalizer is identical to the piece-counters and serves as a totalizer for the reason that when any of the piece-counters operate they close the above-described circuit to the totalizer so that the totalizer counts once for each operation of each piece-counter.

The totalizer 29 also has an arm connected to its armature shaft, and the arm 94 closes contacts 95, 96 when the coils of the totalizer are energized and the armature moves between the pole-pieces. The closing of contacts 95, 96 establishes a circuit through the counter relay 80, causing the relay armature to move, breaking the circuit to the piece-counter and totalizer, thus permitting both the piece-counter and totalizer to complete the count. This circuit comprises line 43 to the point 97, line 98, contacts 95, 96, line 99, relay coil 100, lines 82, 83 to the negative line 71. This will energize coil 100 drawing up its armature and separating contacts 78, 79 interrupting the circuits to the piece-counter and totalizer coils.

The purpose of simultaneously breaking these circuits immediately upon placing the piece-counter and totalizer in counting position is to take care of mechanical lag in the counter mechanism while the bill is still between the rolls so that the counters will always be in readiness to make a new count upon presentation of another bill. A skilled operator will feed the bills to the machine so rapidly that frequently there will be less than one-quarter of an inch gap between the bills. Naturally, this would give insufficient time for the piece-counter and totalizer to return to

their inoperative positions before being again energized. One might complete its return and the other fail to do so. In either event there would be a miscount. However, with this arrangement the counters return to a position of rest before the bill passes from between the rolls and while the micro-switch 27 is still closed. The speed of the bill passing between the rolls and the speed of operation of the piece-counter, totalizer and counter relay is so timed that the count will be made on both piece-counter and totalizer, and the relay energized and actuated by the time approximately one and one half inches of the bill has passed through the rolls. Thus the counter arms will remain at rest during the time the major portion of the bill is passing through the rolls. Another reason for simultaneously breaking these circuits is to prevent a false count due to dirt or other foreign particles being between a pair of rolls at the time the machine comes to rest due to the insertion of a double bill, the hundredth bill in a compartment, or the hundredth bill for the totalizer. The machine is so timed that the count will be completed and the counter circuits broken before the machine is stopped due to the above-mentioned causes. As the counters operate upon separation of the rolls .002 of an inch or more, any foreign particle having that thickness adhering to one of the rolls would cause the counter of that compartment to operate if the rolls stopped with the foreign particle along the line of contact between the rolls. Therefore, it is necessary for the relay 80 to establish a holding circuit to prevent contacts 78, 79 from reclosing until the bill passes from between the rolls, because of the fact that a second count would be made on a single bill if these contacts should close while the micro-switch 27 is closed. When relay 80 is energized contact 78 closes with contact 101. Relay 80 draws very little current in comparison to the coils of the piece-counters and, therefore, sufficient current to operate the relay 80 may pass through the counter coils without actuating the counting mechanism. The holding circuit takes advantage of this fact. The holding circuit comprises line 43 to the point 72, line 73 to micro-switch 27, line 74 to piece-counter coils 75, lines 76, 77, contacts 78, 101, line 102, relay coil 100, lines 82, 83 to negative line 71. Such an arrangement definitely assures the count being completed before the bill passes from between the rolls, thus eliminating the possibility of the piece-counter coils being re-energized before the count is completed.

As mentioned hereinbefore, when one hundred bills have been registered on a piece-counter the motor stops. This pause in operation is only momentary to serve to indicate to the operator that one hundred bills, or a "strap," have been accumulated in one of the compartments. If a signal light is used the compartment will be immediately indicated. If not, a glance at the piece counter figures will show the compartment in question by the indication "00."

It must be borne in mind during the following description that the hundredth bill passing between the feed rolls causes the action which takes place, and that the breaking of the motor circuit will be simultaneous with the closing of the brake circuit, thereby stopping the machine with the hundredth bill between the rolls.

The piece-counters employed in the present invention have two counter wheels, a units wheel and a tens wheel, each bearing the figures "0"

through "9." The tens wheel 103 is provided with a small cam 104 on its periphery located between the numerals "9" and "0," as shown in Fig. 7. This cam serves to raise a plunger 105 to close contacts 106, 107 as the piece-counter changes its count from "99" to "00."

When the hundredth bill is placed between the feed rolls of a compartment, the piece-counter and totalizer will be energized, the counter relay 80 will be energized, breaking the circuits to the piece-counter and totalizer to permit them to complete the count, and the holding circuit through the relay 80 established. With the circuits set up in this manner, the piece-counter tens wheel in turning from "9" to "0" will raise 105 and close contacts 106, 107. This completes a circuit through wire 43 to point 108, wire 109, contacts 107, 106, wires 110, 111, 112 to piece-counter one hundred bill stop relay coil 113, wire 114, to point 115, wires 116, 117, 118, 119, 120, 121 to negative line 71. The energization of coil 113 draws up the relay armature separating contacts 60, 61 to stop the motor, and closes contacts 122, 123 and 124, 125. Relay 62 is of the latch type, and when the armature is drawn up latch 126, under the influence of a spring, drops in place behind the armature to hold the armature in raised position. The closing of piece-counter contacts 106, 107 is only momentary but latch 126 maintains the relay armature in position after the relay coil circuit is broken.

Closing contacts 122, 123 completes a circuit to the motor brake 33 to instantly stop the motor. This circuit follows lines 43, 44, 45, 46 to point 47, contacts 48, 49, lines 51, 52, 53, contacts 122, 123, lines 127, 128, 129 to the point 130, lines 131, 132, 133 to the brake actuating coil 41, line 134 to point 70 and negative line 71.

Relay 62 has a time delay element operating on a thermostatic principle which automatically makes a circuit to withdraw latch 126 to permit the relay armature to drop down, breaking the brake circuit and remaking the motor circuit after a predetermined time interval. The time delay element comprises a spring steel switch arm 135 near the top of which is connected a thermostatic conductor loop 136 which functions as a bridge to tension the switch arm 135 and hold the switch arm out of contact with its companion contact 137. The switch arm carries an adjustable contact point 138. When current flows through the loop 136 the loop becomes heated and expands lengthwise, permitting the switch arm 135 to bend closing the contacts 137, 138. The adjustability of contact 138 permits variation in the time required to close the contacts 137, 138.

As has been described, closing of the circuit through coil 113 of relay 63 separates contacts 60, 61, breaking the motor circuit, closes contacts 122, 123 making the brake circuit, and also closes contacts 124, 125. The closing of these last-mentioned contacts completes a circuit through wires 43, 44 to point 139, wire 140, contacts 125, 124, wires 141, 142, thermostatic loop 136, wires 143, 116, 117, 118, 119, 120, 121, to negative wire 71. This will cause the loop 136 to heat and expand, as described, closing contacts 137, 138. There will then be set up a circuit through wires 43, 44 to point 139, wire 140, contacts 125, 124, wire 141, switch arm 135, contacts 138, 137, wire 144, latch coil 145, wires 146, 114, 116, 117, 118, 119, 120, 121 to negative wire 71. Establishing this circuit will energize coil 145 drawing the latch 126 from locking position with respect to the relay 62 armature, permitting the armature to drop, separating con-

tacts 122, 123 de-energizing the brake, separating contacts 124, 125 de-energizing the latch coil and the thermostatic loop 136 whereupon the loop will cool and shrink separating contacts 137, 138, and closing contacts 60, 61, re-establishing the motor circuit.

Thus it will be seen that upon entry of the one hundredth bill to a compartment the motor will stop momentarily with the bill between the rolls and then automatically restart shooting the bill into the compartment. The pause will give the operator sufficient time to pick up a separator which will be deposited upon the one hundredth bill when it comes to rest in the compartment. As the motor is again running the sorting may be continued.

When the hundredth bill is registered upon the totalizer the cycle of operation is different. The motor stops and the brakes are applied as before, but after the slight pause in operation the motor is started to run only long enough to pass the hundredth bill into its compartment whereupon the motor is again stopped and the brake applied. When the totals have been checked by the operator, the push-button 32 is pressed, dropping the shelves 14 to dump the bills into the lower part of the compartments. The dumping of the shelves resets various relays and restarts the motor. It will also be noted from the following description that the shelves 14 cannot be dumped except at such time as the totalizer registers one hundred bills, and that the flaps must be dumped at this time before further sorting can be done. With the old type machine as shown in the patent and application referred to, it was possible, and the operators sometimes proceeded, to dump the flaps before the totalizer was checked. This often resulted in the tremendous undertaking of recounting one-half day's work or more, as all of the bills in the lower compartment would have to be recounted in order to locate a mistake. With the present lay-out, only when the totalizer reaches one hundred will the circuits be so set that the closing of switch 32 will complete a circuit to the shelf-dumping solenoid.

Totalizer 29 has two cams upon the periphery of its tens wheel 147, one 148 between "9" and "0," and the other 149, between "4" and "5." The cam 148 serves to close contacts 150, 151 as the one hundredth bill passes between the feed rolls, and the cam 149 when the fiftieth bill is between the rolls, as will be explained.

As the fiftieth bill passes between the rolls and the totalizer tens wheel moves from "4" to "5," the cam 149 will close contacts 150, 151, completing a circuit through wire 43 to point 152, wire 153, contacts 151, 150, wires 154, 155, 156, latch coil 157 of relay 67, wires 158, 119, 120, 121 to negative wire 71. This circuit will be closed only momentarily energizing latch coil 157, to draw up latch 159 to permit the relay armature to fall closing contacts 160, 161 setting up a circuit to the latch coil 162 of relay 66 to be closed when cam 148 of the totalizer tens wheel closes contacts 150, 151.

As the hundredth bill passes between the feed rolls cam 148 closes contacts 150, 151 completing the following circuit: wire 43 to point 152, wire 153, contacts 151, 150, wires 154, 155, 156 to point 167, wire 163, contacts 161, 160, wires 164, 165, latch coil 162, wires 166, 119, 120, 121 to negative line 71. This circuit also receives only a momentary impulse sufficient to energize the latch coil and withdraw the latch permitting the armature of relay 66 to drop, separating

contacts 64, 65 and interrupting the motor circuit. At the same time contacts 168, 169 are closed, setting up a circuit to the brake through wires 43, 44, 45, 46 to the point 47, contacts 48, 49, wires 51, 170, contacts 168, 169, wire 171 to point 130, wires 131, 132, 133, brake coil 41, wire 134 to point 70 and negative wire 71.

As previously explained, the period of inactivity of the motor is a short, timed interval. To accomplish this, when contact 64 of relay 66 leaves contact 65 it closes with contact 172. This establishes a circuit through wires 43, 44, 45, 46 to point 47, contacts 48, 49, wires 51, 52, 53 to point 54, wire 55, double-bill relay contacts 57, 58, wire 59, piece-counter one hundred bill stop relay contacts 60, 61, wire 63, contacts 64, 172, wires 173, 174, contacts 175, 176 of time-delay relay 50, wire 177, thermostatic loop 178, wires 179, 180 to contacts 181, 182 of the counter relay 80 (which is energized through the holding circuit described as the hundredth bill is held between the feed rolls), and wires 183, 83 to negative line 71.

Current passing through loop 178 will cause it to expand allowing switch arm 184 to move closing contacts 185, 186. When this occurs, the following circuit is completed: wires 43, 44, 45, 46 to point 47, contacts 48, 49, wires 51, 52, 53 to point 54, wire 55, contacts 57, 58, wire 59, contacts 60, 61, wire 63, contacts 64, 172, wires 173, 174 to point 187, switch arm 184, contacts 185, 186, wire 188 to point 189, relay coil 190, wires 191, 180, contacts 181, 182, and wires 183, 83 to negative line 71. Completion of this circuit will energize the relay coil 190, drawing up the relay armature, thus interrupting the brake circuit by separating contacts 48, 49, establishing a relay holding circuit by closing contacts 48, 192, re-establishing the motor circuit by closing contacts 193, 194, and breaking the circuit through the thermostatic loop and switch arm 184 by separating contacts 175, 176.

The relay holding circuit just referred to comprises wires 43, 44, 45, 46 to point 47, contacts 48, 192, wire 195 to point 189, relay coil 190, wires 191, 180, contacts 181, 182, and wires 183, 83 to negative line 71. This circuit will maintain the armature lifted until the motor has passed the hundredth bill from between the rolls.

The new motor circuit is established through wires 43, 44, 45, 46, contacts 193, 194, wires 196, 68, through the motor, wire 69 to point 70 and the negative wire 71. When the motor starts the feed rolls begin to revolve and the hundredth bill is moved from between the rolls into its compartment. As soon as this occurs the micro-switch 27 opens, breaking the holding circuit to the counter relay 80, permitting the relay armature to fall. The contacts 181, 182 will separate, breaking the holding circuit to the relay 50 and the armature of this relay will fall separating contacts 193, 194, breaking the motor circuit. At the same time the closing of contacts 48, 49 will reestablish the break circuit previously described.

At this stage of the operation, the operator will check the results of the count and, if correct, dump the shelves 14 to drop the bills into the bottom of the compartments. When the operator presses the button 32 to dump the shelves the following circuit is set up: wires 43, 44, 45, 46 to point 47, contacts 48, 49, wires 51, 52, 53 to point 54, wire 55, contacts 57, 58, wire 59, contacts 60, 61, wire 63, contacts 64, 172, wires 173, 197, switch 32, solenoid 19, wires 198, 120,

121 to negative wire 71. The energization of the solenoid 19 will rock lever 17 as described dumping the shelves.

Lever 17 carries a contact 199 which closes with contact 200 when the lever is in shelf-dumping position, to establish a circuit to reset relays 66 and 67, and reestablish the original motor circuit. This circuit comprises wire 43 to point 209, wire 201, contacts 200, 199, wire 202, the branch wires 203, 204 to the relay coils 205, 206 from the coils through wires 207, 208 to wire 119, then through 120, 121 to 71. The energization of the two coils 205, 206, cause them to draw up their respective armatures whereupon the latches under the influences of their springs latch the armatures in raised position. This resets the entire circuit into its original condition and a fresh strap of bills can be opened and sorted.

As stated hereinbefore, twenty-dollar bills are sometimes forwarded in straps of fifty. It is desirable in such instances to have the machine stop when fifty bills have been registered on the totalizer. To make this possible the two relays 66, 67 are connected into the circuit in parallel as well as in series, with a normally open switch in the parallel connection to the relay 66. By this means the two relays will function simultaneously, if desired, by closing the switch, rather than sequentially as when hundred bill straps are being sorted. This is accomplished by connecting a bridging wire 210 to the lines 156 and 165, with a switch 211 in the line. By closing switch 211 the two relays will function together when either the cam 148 or cam 149 closes contacts 150, 151. As the normal function of relay 67 is to prepare the circuit for relay 66, the relay 67 does no work when the switch 211 is closed, even though it continues to operate.

In the earlier patents and pending application previously mentioned, the machine was equipped with means to stop the motor and apply the brake if more than a single bill attempted to pass through the feed rolls simultaneously. The present double bill mechanism is considerably simplified over that formerly used, and so arranged in the circuit that if a double bill should also be the hundredth bill in a compartment the machine will stop as usual for a hundredth bill, but the machine will not restart after a brief pause and the operator will know that a double bill is between the rolls and must be withdrawn by hand.

The bifurcated arm 23 carries a pin 212 which strikes a lever 213 mounted upon a shaft 214 when the arm 23 is lifted more than that caused by the passage of a single bill through the rolls. An adjusting screw 215 is carried by the lever 213 so that the free movement of arm 23 before moving lever 213 may be varied. At one end of the machine, shaft 214 carries a two-piece lever 56 composed of arms 216 and 217 pivoted together at 218 and yieldingly held to operate as a single lever by means of spring 219. Contact 57 is carried at the end of the lever and is normally closed with contact 58. When the lever is rocked contact 57 breaks with 58 and makes contact with 222. It has already been shown that contacts 57, 58 form part of the normal motor circuit, and it is evident, therefore, that when the lever 56 is lifted the motor circuit is broken. The closing of contacts 56, 222 establishes a circuit to the brake, through wires 43, 44, 45, 46 to point 47, contacts 48, 49, wires 51, 52, 53 to point 54, wire 55, contacts 57, 222, wires 223, 128, 129 to point

130, wires 131, 132, 133, brake coil 41, wire 134 to point 70 and negative wire 71.

In Fig. 10, a slightly modified type of timing device is shown associated with relay 50 and piece-counter hundred bill stop relay 62. With the heating element shown in Fig. 9, room temperature will cause variation in the timed pause incident to the operation of relays 50 and 62. While this may not be serious, it is not conducive to the machine being operated at its highest efficiency at all times. If an exact timed interval is desired, the timer shown diagrammatically in Fig. 10 may be used. This is the well-known motor-operated timer which closes a circuit when the motor has run a predetermined period. In its simplest diagrammatical form the timer for relay 50 is shown to comprise a motor 224 and a movable hand 225 operated by the motor and carrying a contact 185' to close with contact 186' when the motor has run a predetermined period. The motor is connected in the circuit in exactly the same manner as the heating element 178 shown in Fig. 9. In other words, the motor has its binding posts connected to wires 177 and 179. Contact 185' takes the place of contact 185 carried by the arm 184 in the previously described form, and contact 186' is the same as contact 186 of the first form. The timer in relay 62 comprises a motor 226 connected to wires 142 and 143, and a movable arm 227 carrying a contact 138' to close with contact 137'. The balance of the circuits shown in Fig. 10 are identical to those shown in Fig. 9 and operate in the same manner.

In the foregoing, the entire operation of the machine has been given in connection with the various mechanisms and circuits which carry it out, but it is thought that a restatement of the operation will set it out more clearly. As stated before, closing switch 31 will start the motor to revolve the feed rolls 7 and 8. The operator standing before the machine will break the band on a strap of bills and begin feeding the bills to the rolls, sorting the bills as to bank of issue, or other desired separation, each bill being fed to the rolls of the compartment allotted to the bank of issue of that bill. Should two bills inadvertently be fed to the rolls simultaneously the machine will stop. The operator seeing that none of the counters register one hundred will know the cause of stoppage and withdraw the bills from the rolls. One bill will be placed in the compartment, for the counter and totalizer will have operated, and the remaining bills fed to the rolls in the usual manner.

When one hundred bills have accumulated in any one compartment, the machine will stop with the hundredth bill between the feed rolls. The operator will see that one hundred bills have been registered on the counter of that compartment and will pick up a separator to place in the compartment. By this time the machine will have automatically started and passed the hundredth bill into the compartment. The separator is then placed upon the pile of bills and the sorting continues.

When the totalizer reaches one hundred or "00," for the count is repetitive, the machine pauses in its operation with the hundredth bill between the rolls. Usually the operator will have fed the last of the bills in the strap into the machine, but if the operator has bills remaining in his hand there has been a miscout or more than one hundred bills were in the strap. In either event the operator will have a check on the bills sorted. After a very slight pause, the machine

starts up to pass the hundredth bill into the compartment and again stops. After the check has been made the operator presses button 32 dropping the shelves 14 to dump the bills into the lower portion of the cabinet. Pressing button 32 sets into motion a number of operations which, after dumping the bills, resets the various circuits and restarts the motor for further sorting.

While I have in the above described what is believed to be a preferred and practical embodiment of the invention, it is to be understood that this is by way of example only, and that various changes may be made within the scope of the appended claims.

Having thus fully described my invention, I claim:

1. In a machine for sorting and counting paper money, a plurality of bill-receiving compartments, separable bill-feeding means associated with each compartment, a piece-counter associated with each compartment, an electrical operating circuit for each piece-counter including a switch operable upon the separation of said bill-feeding means, a totalizer, an operating circuit for said totalizer including circuit-closers associated with and operable by said piece-counters upon actuation of the said counters, a circuit-controlling relay, an operating circuit for said relay including a circuit-closer associated with and operable by said totalizer upon actuation of said totalizer, said relay having normally closed contacts separable upon energization of the relay and forming part of said piece-counter and said totalizer operating circuits, whereby said piece-counter, said totalizer and said relay circuits are energized sequentially upon insertion of a bill into said bill-feeding means and said piece-counter and said totalizer circuits are broken simultaneously upon actuation of said relay.

2. In a machine for sorting and counting paper money as claimed in claim 1, said circuit-controlling relay having normally open contacts, closed upon energization of said relay, forming part of a holding circuit for said relay, said holding circuit including the switch operable by said bill-feeding means, whereby said relay will remain energized and said piece-counter and said totalizer circuits will remain broken while a bill remains between the said bill-feeding means.

3. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, bill-feeding means associated with each compartment, a motor to operate said bill-feeding means, a piece-counter for each compartment operable upon insertion of a bill into said bill-feeding means, in combination; means associated with said piece-counter operable upon said counter reaching a predetermined count to stop said motor, a timing element in circuit with said motor-stopping means energized upon actuation of said motor-stopping means, a release switch controlled by said timing element, said switch being in circuit with said motor-stopping means to release said motor-stopping means to restart said motor after a predetermined interval.

4. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, bill-feeding means associated with each compartment, a motor to operate said bill-feeding means, a totalizing-counter common to all compartments operable upon a bill being inserted into any of said bill-feeding means, in combination; means associated with said totalizing-counter to stop said motor upon said counter reaching a predetermined count, a timing ele-

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ment in circuit with said motor-stopping means energized upon actuation of said motor-stopping means, a circuit-closer controlled by said timing element, and means to restart said motor including said circuit-closer as a part thereof.

5. In a machine for sorting and counting paper money as claimed in claim 4, holding means to retain said motor-restarting means in motor-operating position, said holding means releasable upon the bill causing said predetermined count disengaging said bill-feeding means.

6. In a machine for sorting and counting paper money as claimed in claim 4, holding means to retain said motor-restarting means in motor-operating position, said holding means releasable upon the bill causing said predetermined count disengaging said bill-feeding means, tiltable money-supporting shelves in each of said compartments, shelf-dumping means in circuit with said motor-stopping means when said motor-stopping means is in motor-stopping position, and a manually operable switch to close said shelf-dumping circuit.

7. In a machine for sorting and counting paper money as claimed in claim 4, holding means to retain said motor-restarting means in motor-operating position, said holding means releasable upon the bill causing said predetermined count disengaging said bill-feeding means, tiltable money-supporting shelves in each of said compartments, shelf-dumping means in circuit with said motor-stopping means when said motor-stopping means is in motor-stopping position, and a manually operable switch to close said shelf-dumping circuit, said shelf-dumping means including a circuit closer, a resetting circuit for said motor-stopping means including shelf-dumping circuit-closer, whereby said motor-stopping means will be reset upon actuation of the shelf-dumping means.

8. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, separable bill-feeding means associated with each compartment, a motor to operate said bill-feeding means, a piece-counter associated with each compartment, a totalizing-counter common to all compartments, a counter circuit controlling relay, operating circuits for all of said counters, an operating circuit for said relay, said relay and piece-counter circuits including a switch operable upon the separation of said bill-feeding means by the insertion of a bill, and a holding circuit for said relay including the said switch in combination; normally open contacts on said relay closed during energization of said holding circuit, a circuit closer associated with and operable by said totalizing-counter upon reaching a predetermined count, a latch relay having normally closed contacts forming part of a circuit to the said motor, a circuit including said circuit-closer and the latch coil of said latch relay, whereby the latch will be withdrawn and the motor contacts separated to stop the motor upon reaching a predetermined count on said totalizing counter.

9. In a machine for sorting and counting paper money as claimed in claim 8, normally open contacts on said latch relay, a delayed-action relay including a timing element, a circuit including said latch relay normally open contacts and said timing element, a circuit-closer controlled by said timing element and comprising part of a circuit including the delayed-action relay coil, whereby said coil will become energized after a predetermined time interval, and normally open

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contacts carried by said delayed-action relay included in a circuit to said motor, said contacts being closed when said delayed-action relay coil is energized to restart the motor.

10. In a machine for sorting and counting paper money as claimed in claim 8, normally open contacts on said latch relay, a delayed-action relay including a timing element, a circuit including said latch relay normally open contacts and said timing element, a circuit-closer controlled by said timing element and comprising part of a circuit including the delayed-action relay coil, whereby said coil will become energized after a predetermined time interval, and normally open contacts carried by said delayed-action relay included in a circuit to said motor, said contacts being closed when said delayed-action relay coil is energized to restart the motor, a holding circuit for said delayed-action relay coil including the normally open contacts of said counter circuit controlling relay, whereby the said holding circuit for the delayed-action relay coil will be broken when the bill engaging the bill-feeding means has passed from the bill-feeding means.

11. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, bill-feeding means associated with each compartment, a motor to operate said bill-feeding means, a piece-counter for each compartment operable upon insertion of a bill into said bill-feeding means, in combination; a circuit-closer associated with and operable by each of said piece-counters upon said counters reaching a predetermined count, a delayed-action latch relay comprising a coil, an armature, a latch to hold said armature in one position, a latch coil to withdraw said latch, and a timing element, said relay having normally closed and normally open contacts, a circuit to said relay coil including said circuit closer, a circuit to said motor including said normally closed contacts of said relay, whereby said motor circuit will be broken when one of said counters reaches a predetermined count, a circuit including said normally open contacts, and said timing element, a circuit closer controlled by said timing element, a circuit including said timing element controlled circuit closer, said normally open contacts and said latch coil, whereby the said latch will be withdrawn and the motor circuit reestablished after a predetermined interval.

12. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, separable bill-feeding means for each compartment, a motor to operate said bill-feeding means, a brake for said motor, and a piece-counter associated with each compartment operable upon separation of said bill-feeding means, in combination, double-bill detecting means comprising a movable switch arm, a pair of spaced contacts, one of said contacts being normally closed with said switch arm and forming part of a circuit to said motor, the other of said contacts being normally open with said switch arm and forming part of a circuit to said brake, and means to rock said switch arm upon the separation of said feed means beyond a predetermined amount.

13. In a machine for sorting and counting paper money as claimed in claim 12, said switch arm comprising two pivoted members yieldingly held in alignment.

14. In a machine for sorting and counting paper money having a plurality of bill-receiving

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compartments, separable bill-feeding means for each compartment, a motor to operate said bill-feeding means, and a totalizing-counter common to all compartments operable responsive to separation of said bill-feeding means, in combination; tiltable bill-supporting shelves in each of said compartments, means to dump said shelves, a solenoid to operate said shelf-dumping means, a circuit for said solenoid having at least two normally open switches, means associated with said totalizing counter and operable by said counter when said counter reaches a predetermined count to close one of said switches, the other of said switches being closed manually.

15. In a machine for sorting and counting paper money as claimed in claim 14, said means associated with said totalizing-counter operable to stop said motor, means to restart said motor, and a circuit closer operable by said shelf-dumping means in circuit with said motor restarting means.

16. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, separable bill-feeding means for each compartment, a motor to operate said bill-feeding means, a totalizing-counter common to all compartments operable responsive to separation of said bill-feeding means, in combination; a circuit for said motor including normally closed contacts, means to open said contacts, a circuit to said contact-opening means having at least two open switches, means to close one of said switches upon the said totalizing-counter reaching a predetermined count, and means to close the other

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of said switches upon said totalizing-counter reaching a second predetermined count.

17. In a machine for sorting and counting paper money as claimed in claim 16, a bridge-wire across one of said switches, a manually operable switch in said bridge-wire whereby the circuit to said motor-circuit contact-opening means may be closed when said totalizing-counter reaches each of its predetermined counts.

18. In a machine for sorting and counting paper money having a plurality of bill-receiving compartments, separable bill-feeding means for each compartment, a motor to operate said bill-feeding means, a totalizing-counter common to all compartments operable responsive to separation of said bill-feeding means in combination; a pair of latch relays, the armatures of both of said relays being normally lifted in latched position, the armature of one of said relays having normally closed contacts in circuit with said motor, the armature of the other said relay having normally open contacts in circuit with the latch coil of said first named relay, a circuit closer associated with said totalizing-counter and operable by said counter upon said counter reaching a predetermined count in circuit with said second-mentioned relay latch coil and said normally open contact of said second-mentioned relay.

19. In a machine for sorting and counting paper money as claimed in claim 18, a bridge wire across the normally open contacts of said second-mentioned relay, and a normally operable switch in said bridge wire.

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