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[54] **PAPER CURRENCY COUNTING APPARATUS**
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G06m 9/00
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98

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ABSTRACT: A currency counting machine is shown in which bills are fed singly from a stack in a receiving compartment through a counting compartment to a delivery compartment. The counting compartment includes a grounded runway over which bills are conveyed and spaced electrically conductive flexible brushes are mounted on the underside of a removable cover spaced above the runway. The brushes normally contact the runway but the contact is broken by bills passing between the brushes and runway. The passage of bills as sensed by the brushes operate in an electrical control circuit to prevent the flow of bills from the receiving compartment to the counting compartment if bills are not continuously fed, to eject from the counting compartment bills which are improperly spaced, and to register the count of properly spaced bills in counters and a settable predetermined count mechanism.

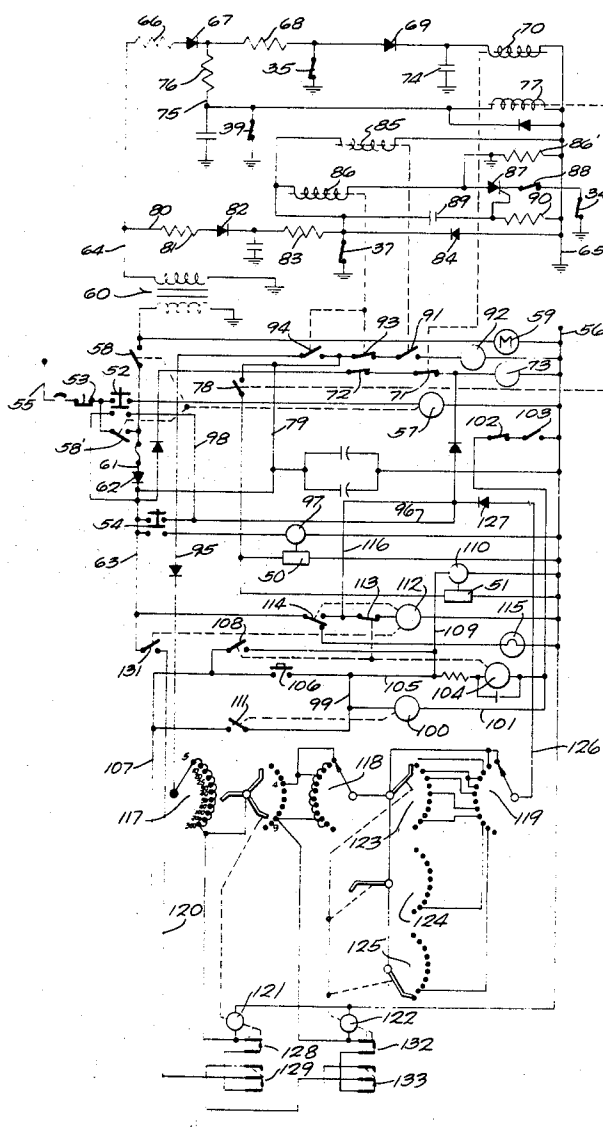
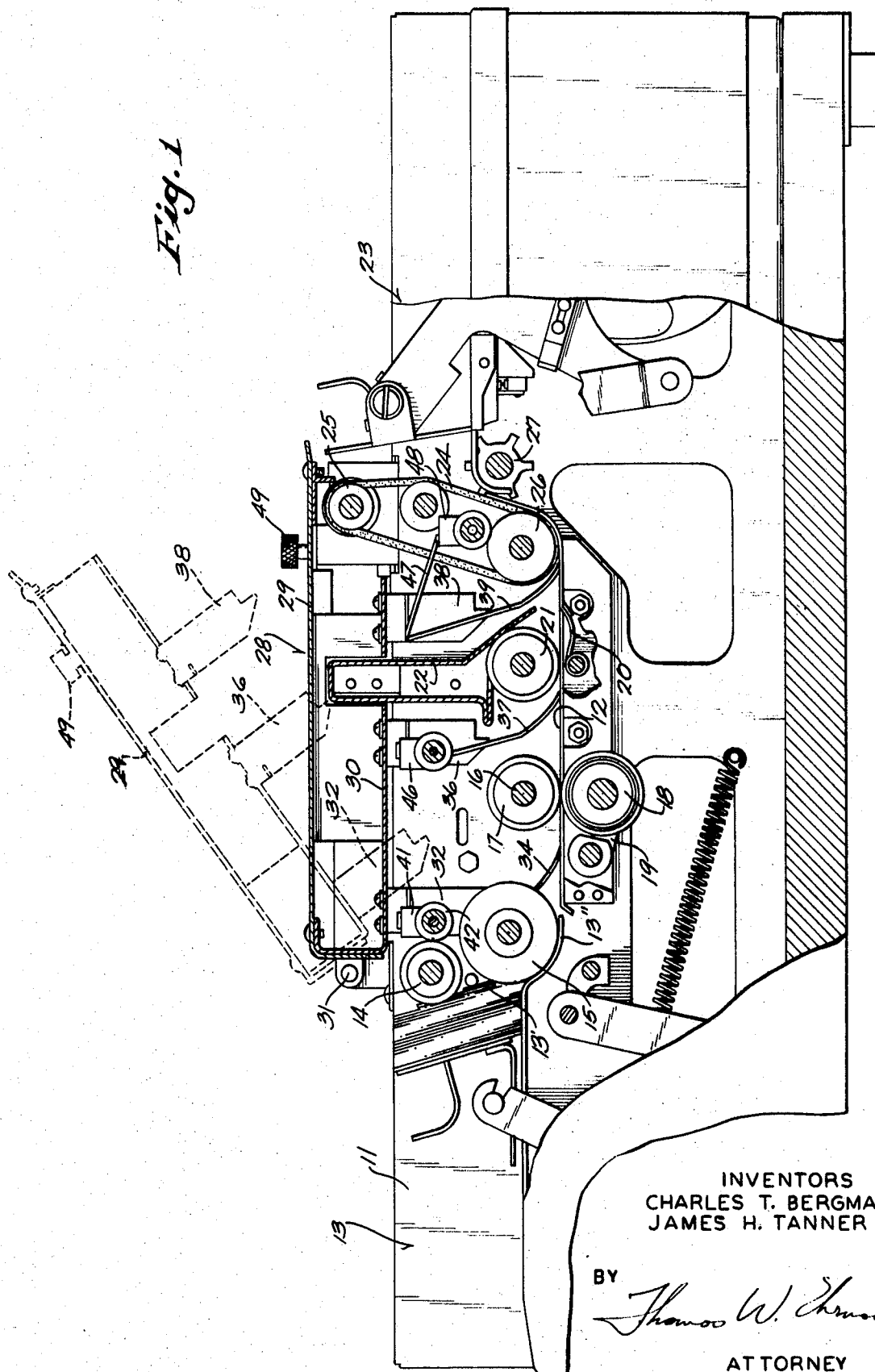


Fig. 1



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Fig. 2

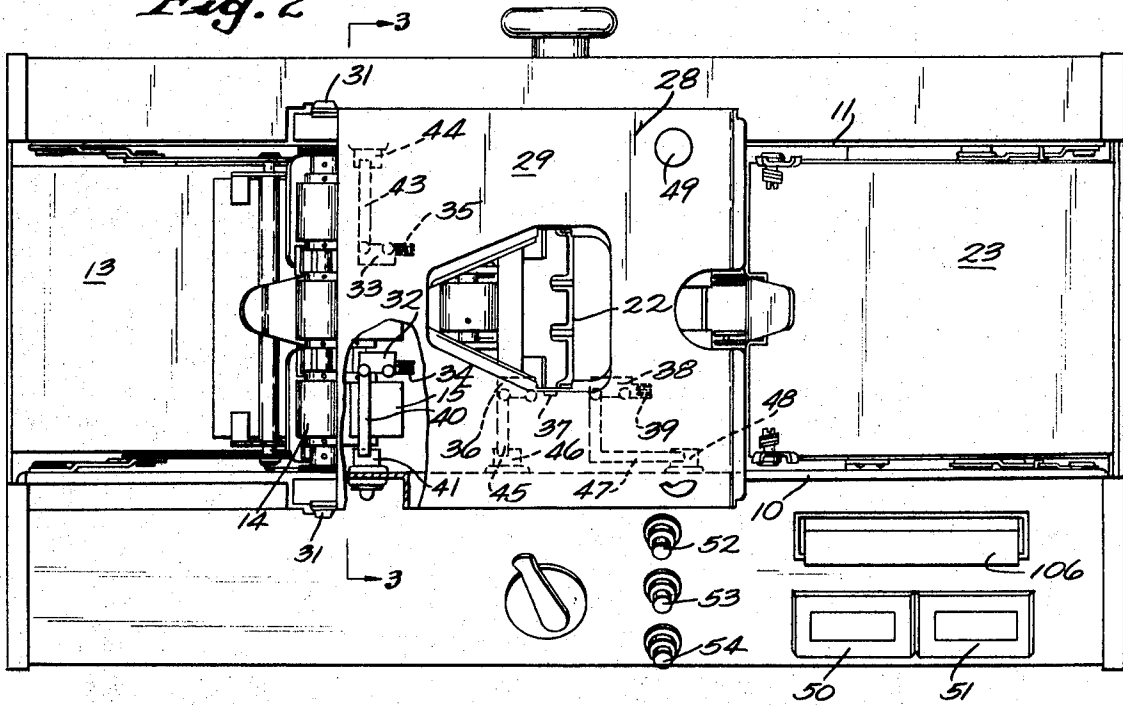
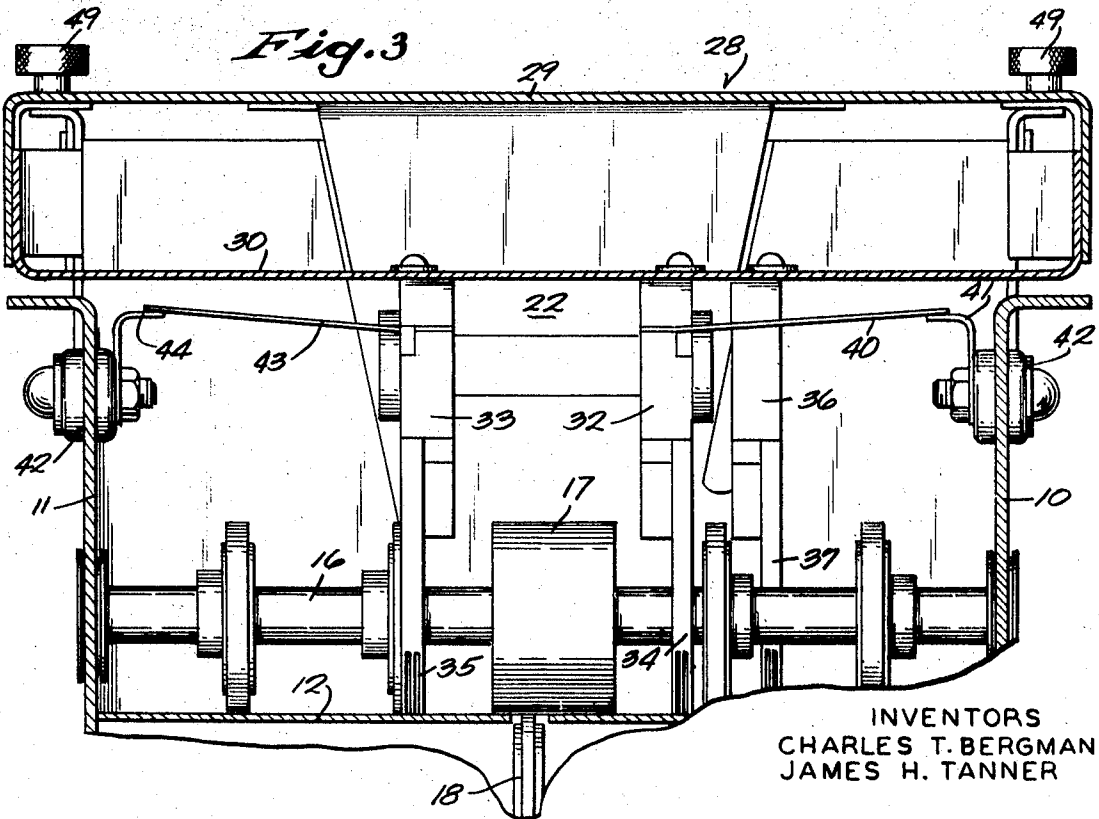
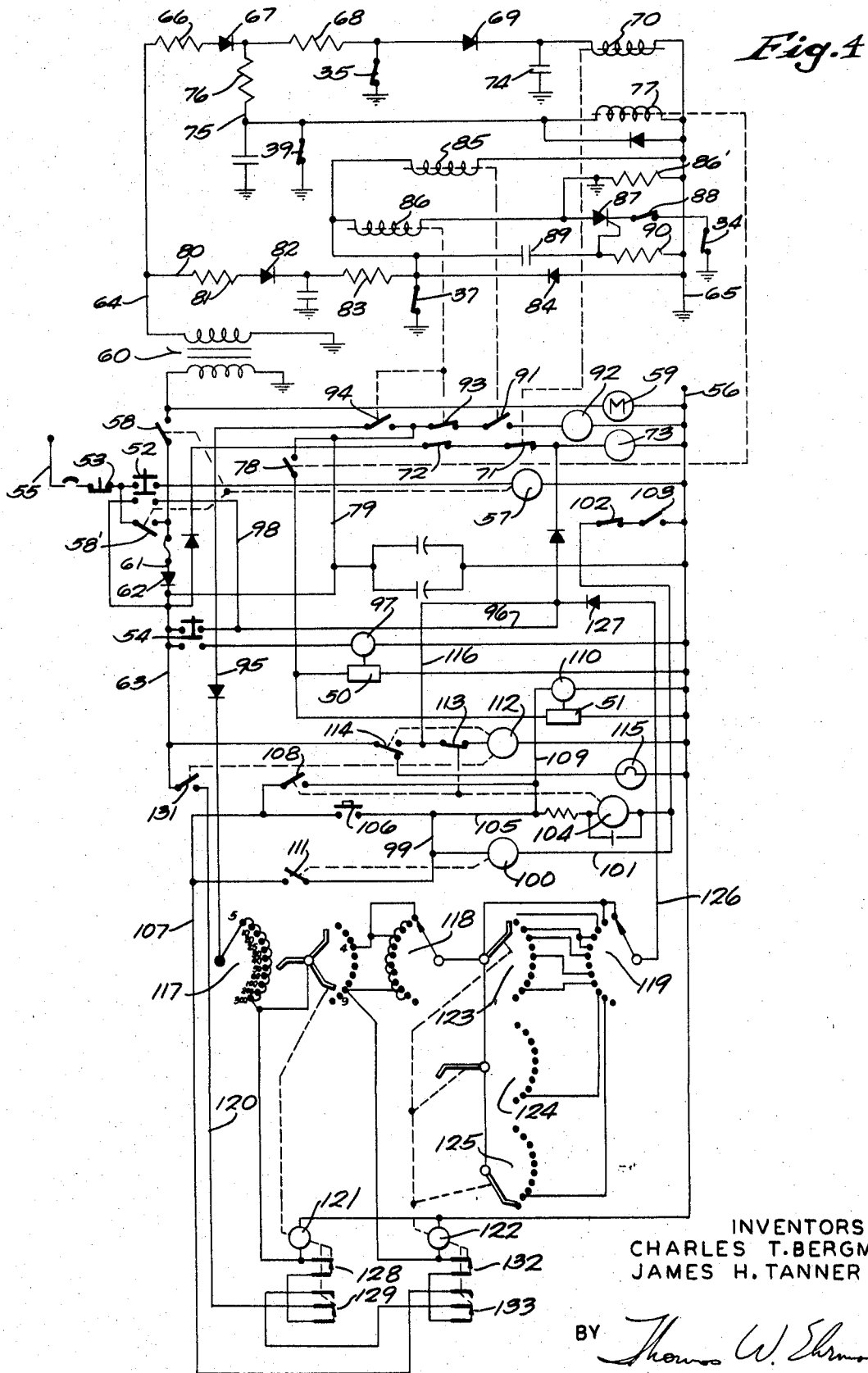


Fig. 3



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PAPER CURRENCY COUNTING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to currency counting machines, and particularly to improvements in counting currency passed through such machines.

Currency counting machines are employed to mechanically count a quantity of bills of a particular denomination, to subdivide a quantity of bills into batches each containing a preselected number of bills, and to verify the count of a strap of bills. In one form of currency counting machine the bills are fed singly from a stack in a receiving compartment through a counting compartment in which the bills are counted and to a delivery compartment. Predetermined count means may be provided which is settable by the operator for the conveying to the delivery compartment of a batch of a particular number of bills. The predetermined count means functions to halt the flow of bills to the counting compartment when the correct number of bills is counted for conveying to the delivery compartment. The machine may also have counters on which the total and batch count of bills are visually indicated.

It is obvious that to be effective such a machine must provide an accurate count of bills. Heretofore, the passage of bills through the counting compartment has been sensed by rollers which operated through a mechanical linkage to activate a microswitch. It is the principal purpose of this invention to provide a very sensitive means for sensing the passage of bills in the form of a flexible brush in contact with runway means over which the bills travel through the counting department. The runway means may take the form of a runway plate forming the floor of the counting compartment or the form of an insert in such a runway plate. The brush is in electrical contact with the runway means and the passage of a bill is sensed by the breaking of the contact between the brush and the runway means.

Such brushes provide very sensitive bill sensing and may be employed to sense the passage of bills for registering the count on counters, for providing signals to predetermined count means in batch counting, for insuring that bills are properly spaced as they are fed through the counting compartment, and for preventing the operation of the mechanism from feeding bills when the continuous feeding of bills is interrupted by a malfunction or at the end of a count of a batch of bills.

SUMMARY OF THE INVENTION

The invention comprises the combination with a currency counting machine having a receiving compartment for receiving bills as a stack, a counting compartment, a delivery compartment, feeding means for removing bills singly from the stack and feeding the bills to the counting compartment, conveying means for conveying bills through the counting compartment to the delivery compartment, and an electrically actuated counter, of a runway means in the counting compartment over which bills are conveyed by the conveying means, a flexible brush normally in electrical contact with the runway means, and an electric circuit including the brush and runway means for controlling the actuation of the counter to register a count each time the contact of the brush with the runway means is broken by the passage of a bill. The invention further comprises the use of a pair of additional spaced brushes which sense the spacing of bills being fed through the counting compartment to function through the electric circuit to cause the ejection of improperly spaced bills from the counting compartment. The pair of spaced brushes may also be employed to signal the count of a bill to predetermined batch count means when the bills are properly spaced. Still another brush may be used to sense the absence of continuous feeding of bills to the counting compartment.

The invention also includes the mounting of the brushes on the underside of a removable cover spaced above the runway means with the brushes being in contact with the runway means when the cover is closed and being removed from contact when the cover is opened.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in vertical section through a currency counting machine incorporating the invention;

FIG. 2 is a top plan view of the machine of FIG. 1;

FIG. 3 is a view in vertical section taken in the plane of the line 3-3 of FIG. 2; and

FIG. 4 is a diagrammatic view of the control circuit for the machine of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention will be described as being incorporated in the counting section of a paper currency counter of the general type shown and described in U.S. Pat. No. 3,214,096, issued Oct. 26, 1965 to Arnold R. Buchholz, George V. Johnson and Arnold Krause, and assigned to the assignee of this application. Reference should be had to such patent for a detailed description of the machine.

The currency counting machine includes a counting section defined by front and rear frames 10 and 11 and a central runway 12. The bills to be counted are fed singly from a stack of bills disposed on edge in a receiving compartment, indicated generally by the numeral 13. The endmost one of the stack of bills is fed to the central runway 12 by upper and lower driven feed rollers 14 and 15. A bill first encounters and is engaged by a plurality of conveyor rollers mounted on a driven shaft 16. The shaft 16 also mounts an upper doubles roller 17 which cooperates with a lower doubles roller 18 that extends upwardly through an opening in the central runway 12. The lower doubles roller 18 is supported on a lever arm 19 which is connected by linkage to a doubles detector switch. The passage of a single bill between the doubles rollers 17 and 18 will depress the lower doubles roller 18, but not a sufficient distance to actuate the double detector switch. However, the passage of more than one bill between the rollers 17 and 18 will cause a greater depression of the lower doubles roller 18 and will actuate the doubles detector switch.

As will be explained in greater detail hereafter, actuation of the double detector switch by the passage of more than one bill at a time between the doubles rollers 17 and 18 will energize a doubles solenoid which in turn will cause an arcuate ejector plate 20 to be raised through an opening in the runway 12. Raising the ejector plate 20 will cause the bills to wrap about driven ejector rollers 21 and be diverted upwardly into a chute 22. When the doubles solenoid is not energized, the ejector plate 20 is in a lower position shown in FIG. 1 and the ejector rollers 21 will convey the bills to the next stage of the currency counter. A bill which passes the doubles ejecting stage without incident is next fed to an elevating structure which carries the bill upwardly and deposits it in delivery compartment, indicated generally by the reference numeral 23. The elevating structure includes endless belts 24 engaged about upper and lower driven pulleys 25 and 26. The endless belts 24 cooperate with an upwardly bent end of the central runway 12 to elevate a bill and place it on edge in the delivery compartment 23. A driven spoked wheel 27 assists the elevation of the bill and also causes the lower edge of the bill to be moved away from the belts when the bill has been raised to the level of the delivery compartment.

The passage of bills through the counting section is sensed by flexible brushes which normally make contact with the upper surface of the central runway 12, but which contact is broken by the passage of a bill between the brush and the central runway 12. Specifically, a cover 28 is formed of spaced upper and lower cover sections 29 and 30. The cover sections 29 and 30 are bent at their peripheries and joined together to form the sides of the cover 28. The cover 28 is hinged at its end adjacent the receiving compartment 13 on pivots 31 supported by the front and rear frames 10 and 11. The upper and lower cover sections 29 and 30 have a central opening for access to the top of the chute 22 when the cover is lowered to its closed position shown in solid lines in FIG. 1.

First and second brush holders 32 and 33 are secured to and depend from the underside of the lower cover section 30 ad-

jacent the hinged end of the cover. The brush holders 32 and 33 are formed of an electrical insulating material and mount first and second flexible sensor brushes 34 and 35. The brushes 34 and 35 are mounted at a slight angle from the vertical and are of such length that when the cover 28 is closed the brushes will be flexed to insure that they will contact the central runway 12. The first and second sensor brushes 34 and 35 will make contact with the central runway 12 at a point between the lower feed rollers 15 and the upper doubles roller 17. A third brush holder 36 is mounted on and depends from an intermediate point on the lower cover section 30 and mounts a third flexible sensor brush 37 which is adapted to contact the central runway 12 at a point immediately preceding the position of the ejector rollers 21. Finally, a fourth brush holder 38 is mounted on and depends from the lower cover section 30 and mounts a fourth flexible sensor brush 39 which is adapted to make contact with the central runway 12 at a point immediately preceding the position of the lower pulleys 26.

The brushes 34, 35, 37 and 39 are formed of thin electrically conductive material and the central runway 12 is also formed of an electrically conductive material. The central runway 12 is grounded and each of the brushes 34, 35, 37 and 39 is connected to a source of current. The electrical connection of each of the brushes to the source is accomplished by contact strips which extend from each brush holder and engage contact brackets secured to the frames. Specifically, a contact strip 40 projects transversely from the first brush holder 32 to engage a contact bracket 41 secured to the front frame 10 and insulated therefrom by a rubber grommet 42. A similar contact strip 43 projects transversely of the second brush holder 33 to engage a contact bracket 44 secured to the rear frame 11. A contact strip 45 projects laterally from the third brush holder 36 to engage a contact bracket 46 secured to the front frame 10 and an L-shaped contact strip 47 engages a contact bracket 48 mounted on the front frame 10. Each of the contact strips is relatively thin so that it can flex and make a good contact with its respective contact bracket when the cover 28 is closed. The contact strips are, of course, electrically connected to its respective brush within the holder.

The cover 28 is made removable to permit access to the counting section if a bill becomes fouled in any of the rollers. It can also be seen that lifting the cover 28 will remove the brushes from engagement with the central runway 12 and will break the electrical connection between the brushes and the source connected to the contact brackets. The cover 28 is normally retained in its lower position by a pair of screws 49 which threadably engage lateral extensions of the front and rear frames 10 and 11.

The currency counting machine has a total counter 50 mounted on a front cover which will register the total count of bills passing through the counting section. In addition to counting the currency fed therethrough, the machine also includes provision for automatically counting batches of bills of a predetermined quantity, which quantity may be selected by the operator. That is, the count may be selected by positioning a count selector switch also located on the front cover, and the embodiment illustrated is adapted for predetermined counting in batches of 5, 10, 20, 25, 30, 40, 50, 60, 100, 200 and 300 bills or for continuous counting. The count within each preselected batch is registered on a batch counter 51. Push button ON and OFF switches 52 and 53, respectively, are provided together with a push button CLEAR switch 54. The brushes 34, 35, 37 and 39 sense the passage of bills and, as will appear, accomplish the registering of the count on the counters 50 and 51 and the ejection of bills to the chute 22 if double bills are fed through the counting section or single bills are not spaced apart and which would give an incorrect count.

The electrical circuit incorporating the predetermined count mechanism as well as other controls for the apparatus is illustrated in FIG. 4. Power is supplied from an AC source at 115 volts across a pair of input conductors 55 and 56. The coil

of a first relay 57 is connected in series with the normally closed OFF switch 53 and the first stage of the normally open ON switch 52 across the input conductors 55 and 56 so that closing of the ON switch 52 will energize the first relay 57. This will close a relay contact 58 to complete a circuit to energize a motor 59, which drives the rollers and pulleys, and a transformer 60.

A conductor 61 leads from the open side of the input conductor 55 to the anode of a first rectifier 62, and the cathode of the rectifier 62 is connected to a conductor 63. A pair of capacitors 64 are connected in parallel across the input conductor 56 and the conductor 63 whereby a filtered DC current will be supplied to the circuit.

The first relay 57 has another normally open relay switch 58' which is connected in parallel across the first stage of the normally open ON switch 52 whereby closing of the ON switch 52 to energize the first relay 57 will then close the relay switch 58' and connect the circuit to the input conductor 55 through only the OFF switch 53. Thus, the circuit will remain connected to the input conductor 55 after the ON switch 52 is released and until the OFF switch 53 is opened.

The stepdown transformer 60 has one side of its primary windings grounded and the other side connected to the input conductor 55 whenever the ON switch 52 is closed. The secondary winding of the transformer 60 likewise has one end grounded and is connected on its end to a conductor 64. A stepdown in the voltage from a level of 115 volts to about 34 volts, for example, is accomplished by the transformer 60.

The conductor 64 and a grounded conductor 65 form input conductors for the brushes 34, 35, 37 and 39 and mercury wetted relays controlled thereby. A resistor 66, a rectifier 67, another resistor 68, another rectifier 69 and the coil 70 of a first mercury wetted relay are connected in series across the conductors 64 and 65. The second brush 35 is connected at a junction point between the second resistor 68 and the rectifier 69 and, when in contact with the grounded runway 12, the second brush 35 will short out the coil 70 so that it will not be energized. The coil 70 of the first mercury wetted relay controls a normally closed relay contact 71 which is connected in series with a normally closed count-start bar switch 72 in a conductor leading from the conductor 63 to one side of a feed-stop solenoid 73 whose other side is connected to the conductor 56. It will be seen that the feed-stop solenoid 73 is energized when the count-start switch 72 and the relay contact 71 are both closed. When the feed-stop solenoid 73 is energized it moves a feed-stop plate 13' towards the stack of bills and drops a feed runway 13'' from engagement with the lower feed rollers 15 so that bills cannot be fed into the counting section even though the motor 59 is driving the feed rollers 15. The count-start switch 72 is opened to deenergize the feed-stop solenoid 73 so that bills will be fed one at a time to the counting section. As the first bill passes between the second brush 35 and the runway 12 to break the grounded connection, the coil 70 will be energized and a capacitor 74 will be charged. This will hold the relay contact 71 open and keep the feed-stop solenoid deenergized. The momentary reestablishment of the contact of the second brush 35 with the runway 12 in the space between bills will not deenergize the coil 70 because it is held by the capacitor 74. In the event, however, that bills are not continuously fed past the second brush 35, the charge on the capacitor 74 will dissipate to the point where the coil 70 will release the relay contact 71 which will close and energize the solenoid 73.

A conductor 75 leads from a junction point between the rectifier 67 and resistor 68 to the grounded conductor 65 and includes a resistor 76 and a coil 77 of a second wetted mercury relay. The coil 77 controls the operation of a normally open relay contact 78 which when closed will complete a circuit from the conductor 63 through a conductor 79 to one side of each of the total and batch counters 50 and 51. The other sides of the counters 50 and 51 are connected to the input conductor 56. When the fourth brush 39 is in contact with the central runway 12 the coil 77 is shorted out. The passage of

each bill between the fourth brush 39 and the runway 12 will cause the coil 77 to be energized to close the normally open relay contact 78 and thereby provide a pulse to actuate the counters 50 and 51 to add a count thereto.

A further conductor 80 is connected between the conductors 64 and 65 and includes a resistor 81, a rectifier 82, a second resistor 83 and a second rectifier 84 in opposition to the normal flow of current. The third brush 37 is connected to the conductor 80 at a point being between the resistor 83 and the rectifier 84. A coil 85 of the third mercury wetted relay is connected between the conductor 65 and the conductor 80 at the same point. The coil 85 will be energized only when the third brush 37 is out of contact with the central runway 12 by the passage of a bill since the third brush 37 normally connects with ground and shorts out the coil 85.

A coil 86 of a fourth mercury wetted relay is connected between the conductor 80 and the anode of a silicon controlled rectifier 87. The cathode of the silicon controlled rectifier 87 is connectable to ground through a normally closed doubles detector switch 88 and the normally grounded first brush 34. The gate of the silicon controlled rectifier 87 is connected to a junction point between a capacitor 89 and a resistor 90 with the capacitor being connected to the conductor 80 and the resistor 90 being connected to the conductor 65.

The coil 85 of the third relay controls a normally open relay contact 91 which is disposed between the conductor 79 and one side of a doubles solenoid 92. The other side of the doubles solenoid is connected to the input conductor 56. The coil 86 controls a normally closed relay contact 93, also in connection between the conductor 79 and one side of the doubles solenoid 92 and further controls a normally open relay contact 94 between the conductor 79 and a conductor 95.

The points of contact of the first and third brushes 34 and 37, respectively, with the runway 12 are spaced apart a distance greater than the width of a bill. For example, the distance between the brushes 34 and 37 may exceed the width of a bill by one-eighth inch. It is necessary that the bills be properly spaced as they are fed through the counting section so that an accurate count will be produced. As a first bill is fed to the central runway 12 the contact of the first brush 34 with the runway 12 is broken to thereby prevent conduction through the silicon controlled rectifier 87 and thus prevent energization of the coil 86. If the bills are properly spaced, when the leading edge of the first bill contacts the third brush 37 and breaks its connection with ground the trailing edge of the first bill will have passed the first brush 34. Thus, the first brush 34 will be grounded, the silicon controlled rectifier 87 will conduct, and both of the coils 85 and 86 will be energized by the breaking of the grounded contact of the third brush 37. Energization of the coils 85 and 86 will close the relay contact 94 and a pulse will be transmitted from the input conductor 63 through the conductor 79 and the closed relay contact 94 to the conductor 95. At the same time, a circuit is not completed to the doubles solenoid 92 because the relay contact 93 is open.

When the connection of the first brush 34 to the ground is again interrupted by the next bill passing beneath it, the connection through the silicon controlled rectifier 87 to the ground is interrupted. However, although the silicon controlled rectifier 87 is in a blocking condition an alternate circuit is maintained through the coil 86 and a resistor 86' connected between the coil 86 and the conductor 65. Therefore, the coil 86 will remain energized with the voltage across the coil 86 decaying. Before the voltage across the coil 86 drops to a level which would release the relay contacts 94 and 93, the third brush 37 will again be grounded with the runway 12 as the trailing edge of the first bill passes behind the third brush 37 to ground the brush 37 and deenergize the coils 85 and 86. When this occurs, the relay contacts 91, 93 and 94 will return to their normal conditions until the second bill interrupts the connection to ground of the third brush 37 at which time the cycle of action is repeated.

If there is no space between the bills, the first brush 34 cannot be grounded when the first bill interrupts the grounded contact of the third brush so that the coil 86 will not be energized to shift the relay contacts 93 and 94. Only the coil 85 will be energized to close the relay contact 91 to complete a circuit to energize the doubles solenoid 92. As previously described, energization of the doubles solenoid 92 will move the ejector plate 20 upwardly so that the unspaced bills will be directed to the chute 22 and a pulse will not be directed to the conductor 95 and the bills will not be registered in the count. Also, if the bills are insufficiently spaced, the first brush 34 will be contacted by the second bill before the first bill contacts the third brush 37 so that the coil 86 will not be energized and the same result will ensue.

If two bills are fed at once to the counting section, the presence of these double bills will be detected as previously described so that the doubles detector switch 88 will open and the coil 86 cannot be energized to shift the relay contacts 93 and 94. Then, when these double bills interrupt the grounded contact of the third brush 37 only the coil 85 will be energized to energize the doubles solenoid 92 and eject the double bills to the chute 22.

In summary, the second brush 35 is employed to sense the absence of a continuous flow of bills to the counting section. So that such a malfunction will not harm the feeding apparatus, the second brush 35 functions to energize the feed-stop solenoid 73 to shift the feed-stop plate 13' toward the stack of bills and thereby remove the endmost bill in the stack from engagement with the feed rollers 14 and 15. The feed runway 13'' is also moved away from engagement with the lower feed rollers 15. The first and third brushes 34 and 37, respectively, sense the proper spacing of bills being fed through the counting section. When the bills are properly spaced, the brush 37 will function to transmit a pulse to the conductor 95. When the bills are not properly spaced, or when they are doubled, they will be ejected to the chute 22 and not figure in the count. Finally, the fourth brush 39 senses the passage of properly spaced bills and functions to have the count of bills delivered to the delivery compartment registered on the counters 50 and 51.

The push button CLEAR switch 54 has two normally open stages the first of which, when closed, connects the conductor 63 to a conductor 96 that is connected to one side of the feed-stop solenoid 73. The second normally open stage of the CLEAR switch 54, when closed, connects the conductor 63 to one side of a reset coil 97 for the total counter 50, and the other side of the reset coil 97 is connected to the input conductor 56. A conductor 98 connects the conductor 96 to one side of the normally open second stage of the ON switch 52 and the other side thereof is connected to the conductor 63.

One side of the coil of a second relay 100 is connected by a conductor 101 to a normally discharge CLEAR microswitch 102 that in turn connects to a stack follower switch 103. With the switch 102 closed when the delivery compartment is empty of bills, closure of the stack follower switch 103 (indicating that the stack follower of the delivery compartment is in a position to receive bills) completes the circuit for energizing the coil of the second relay 100.

A third relay 104 has its coil connected on one side to the conductor 101 and is connected on its other side through a resistor and a conductor 105 to one side of the normally open start count switch 106. The opposite side of the start count switch 106 is connected to the conductor 107. The second side of the coil of the second relay 100 is connected by a conductor 99 to the conductor 105. A normally open relay switch 108 of the third relay 104 is connected between the conductors 107 and a conductor 109 which leads from the conductor 105 to one side of a reset coil 110 for the batch counter 51. The opposite side of the batch counter is connected to the conductor 56. A normally open relay switch 111 of the second relay 100 is connected across the conductors 107 and 99.

A fourth relay 112 has its coil connected on one side to the input conductor 56 and is connected on its other side through

a normally closed relay switch 113 of the third relay 104 to one pole of a two position relay switch 114 of the fourth relay 112. In its normal position, the relay switch 114 connects a red light 115 across the conductors 63 and 56 and in its actuated position the relay switch 114 connects the coil of the fourth relay 112 across the conductors 63 and 56 when the relay switch 113 of the third relay 104 is in its normal closed position. A conductor 116 connects from a point between the relay switches 113 and 114 to the conductor 96 which leads to the feed-stop solenoid 73.

The count selector switch has three levels 117, 118 and 119 each provided with a switch arm and a plurality of contacts, with the switch arms turning in unison. The arm of a first level 117 is connected to the conductor 95 for receiving pulses upon the closing of the relay contact 94. The contacts of the first level 117 are connected in series to each other and are totally connected to a wiper assembly 120 of a single level stepping switch. The stepping switch is of known construction and of the type in which the wiper assembly 120 sweeps a plurality of contacts, with the wiper assembly 120 advancing after energization of a stepping switch solenoid 121.

The contacts of the stepping switch corresponding to the fourth step of the wiper assembly 120 is connected to the "5" and "25" contacts of the second level 118 of the count selector switch. With the exception of the "5" and "25" contacts of such second level 118, the contacts thereof are connected in series to each other and to the contact of the stepping switch corresponding to the ninth step of the wiper assembly 120. Such ninth contact of the stepping switch is also connected to one side of a solenoid 122 of a second stepping switch.

The second stepping switch has three levels 123, 124 and 125 each of which is swept by a wiper assembly and the wiper assemblies of the three levels includes single arms that are 120° mechanically out of phase. Contacts of the three levels 123, 124 and 125 of the second stepping switch are connected as shown to the third level 119 of the count selector switch. The switch arm of the third level 119 of the count selector switch is connected by a conductor 126 to the anode of a rectifier 127 whose cathode is connected to the junction of the conductors 96 and 116.

As is known, each of the stepping switches includes a self-interrupter switch contact and off-normal switch contacts. The first stepping switch has a self-interrupter contact assembly 128 and an off-normal contact assembly 129. The movable arm of the off-normal contact assembly 129 is connected by a conductor 120 to one side of a normally open relay switch 131 of the fourth relay 112, and the second side of the relay switch 131 is connected to the conductor 63. The second stepping switch also has a self-interrupter contact assembly 132 and an off-normal contact assembly 133. The contact assemblies are connected to each other and to the solenoids 121 and 122 in the manner shown in FIG. 4. When both of the off-normal switch contact assemblies 129 and 133 are in their home positions, a connection of the conductor 107 to the conductor 120 is completed therethrough.

The operation of the currency counter is as follows:

When the push button ON switch 52 is depressed, the first relay 57 is energized thereby closing a hold-in circuit and completing a circuit to energize the motor 59. The motor 59 drives the rollers for the feed of bills through the currency counter. However, the feed of bills is not permitted until a further action by the operator is taken. At the same time the motor 59 and first relay 57 are energized, the feed-stop solenoid 73 is energized to prevent feeding of bills by a circuit which is completed through the second stage of the ON switch 52. The closing of the second stage of the ON switch 52 will also complete a circuit through the conductors 98, 96 and 116 for energization of the fourth relay 112. Energization of the fourth relay 112 will close the relay switch 114 and provide a hold in circuit for the coil of the fourth relay 112 to maintain the feed-stop solenoid energized after the ON switch reopens.

Energization of the coil of the fourth relay 112 also closes the relay switch 131 to initiate recycling of both stepping switches to their initial positions. When the stepping switches have been recycled, the conductor 107 will be connected to the conductor 63 through the relay switch 131, conductor 120, and the off-normal contact assemblies 129 and 133. Then, depressing the start count switch 106 will energize the coil of the third relay 104 and the coil of the second relay 100. The relay switch 111 will close to hold in the second relay 100 and the relay switch 108 will close to hold in the third relay 104. When the third relay 104 is energized, the relay switch 113 will open and the fourth relay 112 will drop out thereby opening the circuit through the relay switch 114 to the feed-stop solenoid. The deenergization of the coil of the fourth relay 112 will also open the relay switch 131 and remove the circuits to the coils of the second and third relays 100 and 104.

The count start bar switch 72 is then opened to open the last remaining circuit to the feed-stop solenoid 73. The feed-stop solenoid 73 is deenergized and the flow of bills to the counting section will begin.

The passage of bills through the counting section will be sensed by the brushes 34, 35, 37 and 39 with the results previously described. Contact with the fourth brush 39 by those bills which pass through the counting section without incident will be registered in the counters 50 and 51. Also, each properly spaced bill will cause the third brush 37 to transmit a pulse through the conductor 95 to the predetermined count means which includes the settable selector switch and units and tens count accumulators in the form of the two stepping switches. The predetermined count means will function as described in the foregoing identified U.S. Pat. No. 3,214,096. At the end of the predetermined count, the conductor 126 will be connected to the conductor 63 through the closed relay contact 94 and the feed-stop solenoid 73 will be deenergized to halt the flow of bills. This is sensed by the first brush 35 so that the coil 70 is deenergized and the feed-stop solenoid is also energized through a closed circuit including the relay switch 71.

A subsequent closing of the CLEAR switch 54 will reset the stepping switches for a subsequent count of a selected batch of bills.

If the selector switch is set for continuous counting, the pulses transmitted to the predetermined count means will not result in accumulation of counts in the stepping switches. Rather, the stacks of bills will be continuously fed through the counting section and the count registered on the counters 50 and 51.

The invention has been described in relation to a preferred embodiment which employs a runway plate 12 with which the flexible brushes normally make contact. However, an electrically conductive insert could be placed within a runway plate to occupy the area of contact of each flexible brush. Such inserts would be disposed level with the top surface of the runway plate and could be grounded to complete the electrical circuit with the brushes. The runway plate would then not need to be connected in an electrical circuit.

We claim:

1. In a paper currency counting machine having a receiving compartment for receiving bills as a stack, a counting compartment, a delivery compartment, feeding means for removing bills singly from said stack and feeding said bills to said counting compartment, conveying means for conveying bills through said counting compartment to said delivery compartment, and an electrically actuated counter, the combination comprising:

electrically conductive runway means in said counting compartment over which bills are conveyed by said conveying means;

a first electrically conductive flexible brush normally in contact with said runway means and which contact is broken by the passage of a bill between said brush and said runway means;

a source of current;

an electric circuit including said brush and said runway means and first electric control means adapted when actuated to connect said counter to said source, said first control means being actuated by the breaking of the contact between said brush and said runway means as each bill passes to record the count of bills on said counter; electrically actuable ejection means in advance of said first brush in said counting compartment and adapted when actuated to divert bills from said counting compartment; and second and third electrically conductive flexible brushes normally in contact with said runway means, said second and third brushes being spaced apart a distance greater than the width of a single bill, said electric circuit including said second and third brushes and a second electric control means adapted to connect said ejection means to said source when said contact of said second brush with said runway means is broken by a bill before the preceding bill breaks the contact of said third brush with said runway means.

2. The combination of claim 1 wherein there is electrically actuable means for halting the feeding of bills to said counting compartment; together with a fourth electrically conductive brush normally in contact with said runway means adjacent said receiving compartment, said electric circuit also including said fourth brush, time-delay means, and third electric control means adapted when not actuated to connect said electrically actuable means to said source to halt the feeding of bills, the breaking of the contact between said fourth brush and said runway means by the passage of each bill therebetween actuating said third control means, and said time-delay means maintaining said third control means actuated for only the normal period of time between the passage of bills past said fourth brush.

3. The combination of claim 2 together with a removable cover spaced above said runway means and wherein said brushes are each mounted on the underside of said cover and depend therefrom to contact said runway means when said cover is in place.

4. The combination of claim 3 wherein said runway means is a runway plate and wherein said counting compartment is defined by said runway plate and spaced front and rear frames, said cover being hinged on said frames, and said brushes each being mounted in an insulated brush holder secured to said cover; together with a flexible contact strip mounted on each holder and connected to a respective brush, said contact strips projecting transversely from said holders towards said side frames, and contacts mounted on said side frames to be engaged by respective ones of said contact strips when said cover is closed, whereby opening of said cover removes the engagement of said contact strips with said contacts to remove said brushes from said electric circuit.

5. In a paper currency counting machine having a receiving compartment for receiving bills as a stack, a counting compartment, a delivery compartment, feeding means for removing bills singly from said stack and feeding said bills to said counting compartment, conveying means for conveying bills through said counting compartment to said delivery compartment, electrically actuable feed stop means for halting the feeding of bills to said counting compartment, electrically actuable ejection means intermediate of said counting compartment and adapted when actuated to divert bills from said counting compartment, and predetermined count means responsive to electrical signals to register the count of bills and to actuate said feed stop means at the end of a predetermined count, the combination comprising:

electrically conductive runway means in said counting compartment over which bills are conveyed by said conveying means;

first and second electrically conductive flexible brushes normally in contact with said runway means in advance of said ejection means, said brushes being spaced apart a distance greater than the width of a single bill;

a source of current; an electric circuit including said brushes and said runway means and connected to said predetermined count means;

and electric control means in said electric circuit adapted to transmit a signal to said predetermined count means when the contact between said second brush and said runway means is broken by a bill and said first brush is in contact with said runway means, and further adapted to connect said source to said ejection means when the contact of said first brush with said runway means is broken by a bill before the preceding bill breaks the contact of said second brush with said runway means.

6. The combination of claim 5 together with a third electrically conductive flexible brush normally in contact with said runway means adjacent said receiving compartment, said electric circuit including said third brush, time-delay means, and second electric control means adapted when not actuated to connect said feed stop means to said source; the breaking of the contact between said third brush and said runway means by the passage of each bill therebetween actuating said second control means, and said time-delay means maintaining said third control means actuated for only the normal period of time between the passage of successive bills past said third brush.

7. The combination of claim 6 together with an electrically actuated counter, a fourth electrically conductive flexible brush normally in contact with said runway means, said electric circuit including said fourth brush and third electric control means adapted when actuated by the breaking of the contact between said fourth brush and said runway means to connect said counter to said source to record the count of the bill on said counter.

8. The combination of claim 7 together with a removable cover spaced above said runway means and wherein said brushes are each mounted on the underside of said cover and depend therefrom to contact said runway means when said cover is in place.

9. The combination of claim 7 wherein said runway means is grounded, and wherein said first electric control means comprises a pair of relays, the coil of each relay being shorted out when said second brush is in contact with said runway means, the coil of one relay being energized whenever the contact of said second brush with said runway means is broken by a bill to close a normally open relay switch in the connection of said ejection means with said source, the coil of the other relay being energized when said first brush is in contact with said runway means and the contact of said second brush with said runway means is broken to open a normally closed relay switch in said connection of said ejection means with said source.

10. The combination of claim 10 wherein said second and third electric control means each comprise a relay the coil of which is shorted out when the third or fourth brush respectively is in contact with said runway means, said coil being energized when the contacts of said third and fourth brushes are broken by the passage of bills.

11. The combination of claim 9 wherein the energization of said coil of said other relay also closes a relay switch to connect said predetermined count means to said source to signal a count of a bill.

12. The combination of claim 11 wherein there is time-delay means associated with the coil of said other relay to maintain the coil of said other relay energized until said second brush again contacts said runway means, to short out such coil.

13. In a paper currency counting machine having a receiving compartment for receiving bills as a stack, a counting compartment, a delivery compartment, feeding means for removing bills singly from said stack and feeding said bills to said counting compartment, means for conveying bills from said counting compartment to said delivery compartment, and electrically actuable means for registering the count of bills conveyed to said delivery compartment, the combination comprising:

spaced front and rear frames in said counting compartment;
an electrically conductive runway in said counting compartment between said frames;
means for conveying bills through said counting compartment over said runway;
a cover hinged to said frames above said runway;
a plurality of spaced electrically conductive flexible brushes mounted on the underside of said cover and depending therefrom, said brushes contacting said runway when said cover is closed and the contact between a respective brush and said runway being broken by the passage of a bill over said runway;
electrical conductor means normally connecting said brushes to a source of current when said cover is closed and adapted to be opened when said cover is raised to thereby open the circuit between said brushes and said

source of current;
and electric control means responsive to the making and breaking of the contacts of said brushes with said runway to control said actuable means.

- 5 14. The combination of claim 13 wherein each of said brushes is mounted in an insulated brush holder secured to the underside of said cover; and wherein said electrical conductor means comprises a flexible contact strip mounted in each brush holder and electrically connected to the brush, said contact strips projecting transversely from said holders toward
10 said side frames, and contacts mounted on said side frames to be engaged by respective ones of said contact strips when said cover is closed, said contact strips disengaging said contacts when said cover is open, said contacts being connected to said
15 source of current.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,582,618 Dated June 1, 1971

Inventor(s) C. T. Bergman and J. H. Tanner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 34	"double detector" should read - doubles detector -
Column 4, line 22	"The stepdown" should read - The step-down -
Column 4, line 27	"stepdown" should read - step-down -
Column 5, line 70	"passes behind" should read - passes beyond -
Column 6, line 39	"to hive" should read - to have -
Column 6, line 53	"normally discharge" should read - normally closed discharge -
Column 10, line 52	"combination of claim 10" should read - combination of claim 9 -
Column 10, line 55	"cold" should read - coils -

Signed and sealed this 16th day of November 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents