

Jan. 27, 1942.

T. E. HAYES

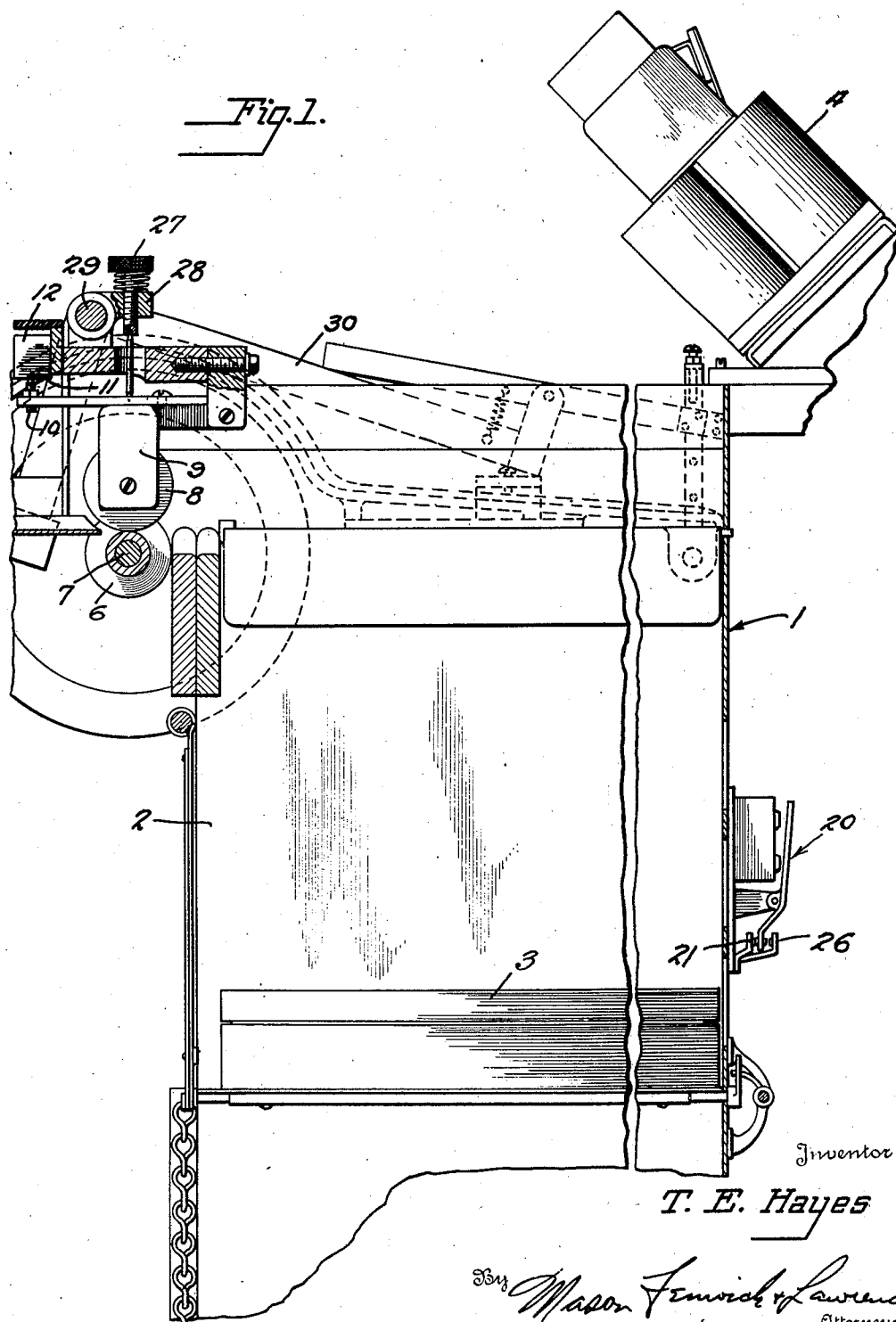
2,271,394

PAPER MONEY COUNTER

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2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

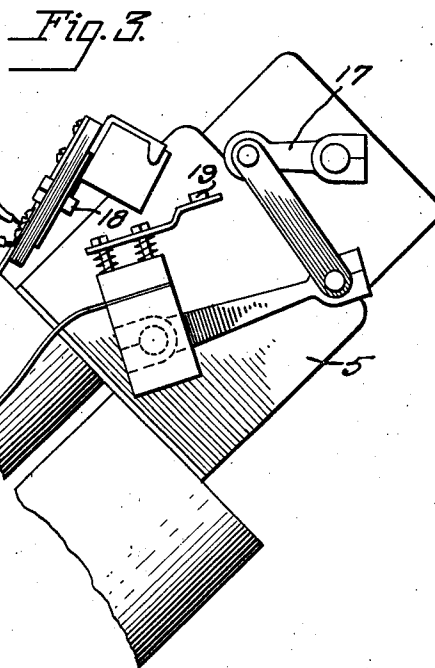
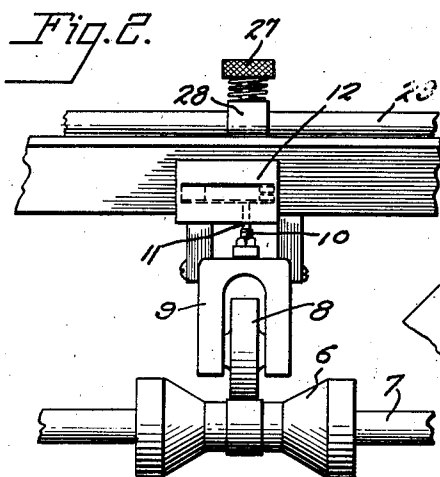
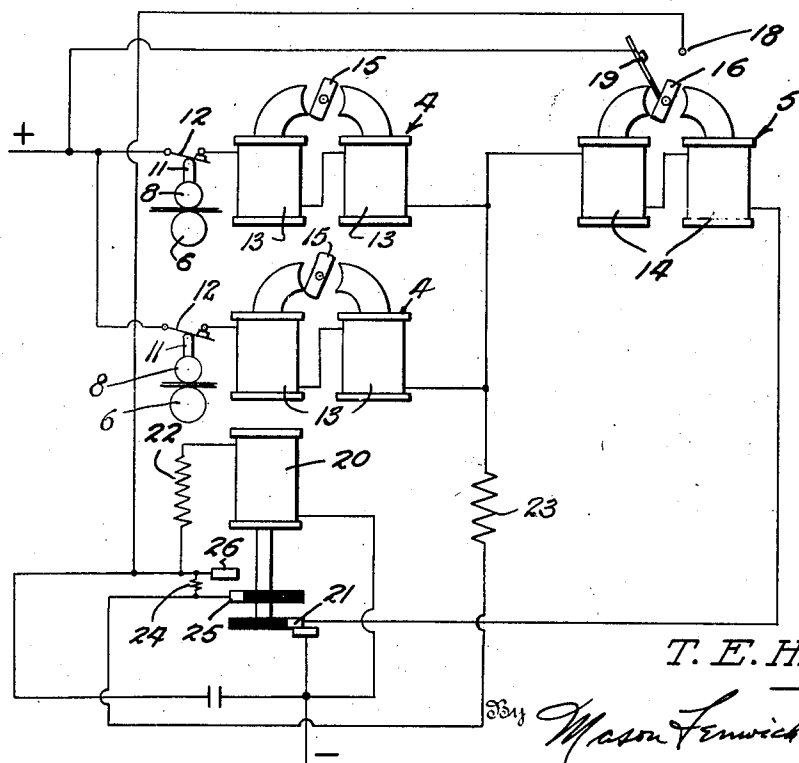


Fig. 4.



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PAPER MONEY COUNTER

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3 Claims. (Cl. 235—92)

This invention relates to machines for assorting and counting paper money.

In banking establishments, it is desirable that the paper money handled, be assorted and arranged in packages or bundles each of a predetermined number of bills. Generally, one hundred bills are stacked together and bound by a strap of paper, the strap carrying a notation of the sum of money in the stack, and an identification of the person responsible for the assembling and counting of the stack. Such a stack is commonly designated a "strap."

Paper money received by banks in packages or straps must be assorted and also accurately counted, to check the correctness of the amount noted on the strap.

Paper money received in loose or unstrapped condition must also be accurately assorted and counted into stacks, and each stack strapped with a notation on the strap, of the amount in the strap, and of the person responsible for the counting. By such counting of either unstrapped bills or strapped bills, or both, the total amount or sum of paper money handled, is ascertained and verified, and errors in the notations on the straps definitely associated with the persons responsible for the same.

The assorting of paper money in the packages or "straps" usually puts in each strap only bills of the same denomination.

The performance entirely by hand of such work as the assorting and counting of paper money requires, involves assorting and counting as separate operations, involves much time, and is correspondingly expensive. To reduce the expense, and to avoid the errors found to be inevitable in the hand counting and assorting of paper money, it has been proposed to provide machines for doing that work, such a machine being described in the patent to Ernest P. Schneider, No. 2,004,835, granted June 11, 1935.

In such a paper money counting and assorting machine as that to which the said patent relates, and which represents the most advanced type of machine up to the present time, there is a row of receiving bins, one for each denomination of bill, a plurality of solenoid operated counters, one for each bin, and a master counter for all the bins, also solenoid operated.

There is a pair of normally contacting rolls at the front of each bin, one roll of each pair being driven, to which rolls the bills are presented manually, and between which they are fed to the bins, the upper roll being elevated by the passage of a bill a distance equal to the thick-

ness of the bill. The raising of the upper roll actuates a micro-switch which closes a circuit simultaneously through the solenoid controlling the individual counter associated with that particular bin, and the solenoid controlling the master counter. Energization of the solenoids draws the armatures of the counters into their potential position to register a count as soon as they are released.

It follows from the above description that the solenoids remain engaged during the entire passage of the bill between the rolls, the count being registered upon the opening of the circuit of the solenoids immediately after completion of the passage of the bill. The registration of the count does not follow instantaneously after the bill has passed, for there is an inherent electrical lag attending de-energization of the solenoids, and a mechanical lag inherent in the elements of the counters themselves, so that there is an appreciable time interval between the instant the rolls come together after the passage of the bill, and the operation of the counter, which at the speed at which the machine is normally run, may equal a distance of as much as five-eighths of an inch in the path of travel of the bill.

Under the conditions above related, the speed of sorting and feeding the bills to the machine is greatly slowed down, for the person who is feeding the bills to the rolls must be sure that the bills are not presented closer to one another than five-eighths of an inch, else the counter solenoids will be re-energized before the mechanical and electrical lag has been overcome, so that the armatures will be drawn down again to their potential position before the count of the previous bill has been registered.

The object of the present invention is to enhance the speed capacity of the machine by causing the de-energizing of the counter solenoids during the passage of the bill between the rolls so that the lag, the operation of the counter, and the restoral of the counter armature to normal repose position, all occur while the bill is passing between the rolls and not after its passage, so that the armatures are in readiness to be drawn to their potential position immediately upon re-energization of the counter solenoids without the necessity of allowing any space interval between the presentation of the successive bills.

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 in which the same characters of reference have been employed throughout the several figures to identify the same part:

Figure 1 is a side sectional view through a paper money sorting and counting machine embodying the principles of the invention, only so much of the structure being shown as is necessary to an understanding of the invention;

Figure 2 is a front elevation showing the feed rolls and the micro-switch actuated thereby;

Figure 3 is a side elevation of the master counter showing portions of the solenoids for operating the same; and

Figure 4 is a diagrammatic view of the electrical lay-out and instrumentalities essential to the invention.

Referring now in detail to the several figures, the numeral 1 represents in general the counting machine which has the general rectangular form of a cabinet and is divided from front to back by suitable partitions into a plurality of collecting bins, one of which is shown at 2. These bins are of suitable cross-sectional area to permit the free fall of the bills, and to cause them to stack in a substantially even manner, as indicated by the stack of bills 3 shown in the bottom of the bin. In the actual machine there are a plurality of bins, arranged side by side, but inasmuch as the invention is fully illustrated by reference to a single bin, only one is shown. A solenoid operated counter 4 is associated with each bin, and a master counter 5, also solenoid operated, counts in common, for all of the bins. In front of each bin is a pair of rolls, the lower roll 6 of each pair being driven by means such as the common shaft 7, which extends along the front of the machine. The upper roll 8 of each pair normally rests upon the central part of the lower roll 6 and is mounted in a stirrup 9, which has a limited up and down movement and is provided with a stud 10 which moves against the plunger 11 of a micro-switch 12. Figure 2 indicates in broken lines and somewhat diagrammatically, the internal construction of the micro-switch showing that the plunger 11 presses against one of two normally open contacts, bringing them together. The contacts, when open, are only a very small fraction of an inch apart. A bill is presented endwise to the rolls, the narrow central portion of the roll 6 causing the bill to assume a concave form so that it will pass between the rolls as a rigid body. The rolls will be separated from one another during the passage of the bill by an amount equal to the thickness of the bill, which will cause the stud 10 to push the plunger 11 against the switch, closing the contacts.

Figure 4 shows that the micro-switch 12 is in a series circuit with the solenoids 13 and 14 of both the individual and master counters and with the line current so that when the micro-switch 12 is closed the solenoids 13 and 14 are simultaneously energized and the respective counter armatures 15 and 16 are moved to a position bridging the poles of the solenoids, thus moving the counter arm 17 to a potential position with respect to the counter operating mechanism so that when said counter arms are released the counters will be operated. It is obvious that when a bill is introduced between the rolls 6 and 8, Figure 4, the micro-switch 12 will remain closed during the entire passage of the bill between the rolls. Ordinarily, that is to say, in machines as heretofore employed, the current would flow through

the closed switch 12 and through both the solenoids 13 and 14 and to ground so long as the switch 12 remains closed, that is to say, during the entire period of passage of a bill between the rolls. All this time the arms 17 of the counters would be held in potential position and not until the bill had completely passed between the rolls and the latter had come into contact with one another would the de-energization of the solenoids of the counters take place through opening of the micro-switch 12. After the opening of said switch, there is an appreciable time interval before the solenoids 13 and 14 can become de-energized and before the armatures 15 and 16 can move the actuating arms 17 of the counters sufficiently to have operated the counters. If another bill is presented to the rolls 6 and 8 so quickly after the preceding bill as to separate the rolls and close the switch 12 before the solenoids 13 and 14 have had time to completely de-energize and before the mechanical lag in the counter mechanism has been overcome, the micro-switch will again be closed and the solenoids 13 re-energized before the counter mechanism has had the opportunity to register the count of the preceding bill. This makes it necessary that the one who is feeding bills into the machine shall wait a sufficient time after the complete passage of the preceding bill to assure that the parts have returned to their normal repose position ready to repeat their counting function. With the drive shaft 7 feeding the bills through at the normal rate of speed, it is found that the one who feeds bills to the machine must not present the bills closer than within about five-eighths of an inch of one another. This decidedly slows down the operation of the machine.

By the present invention, the circuit made by the closing of the micro-switch 12 is immediately broken while the bill is still running through between the rolls 6 and 8, so that the period of lag both electrical and mechanical in the counter mechanism, and the count registering movement of the arm 17 are both completed while the bill is still running between the rolls, so that when the bill finally completes its passage between the rolls, the solenoids 13 and 14 will be in readiness to be again re-energized, and the arms 17 will be in a position of repose in readiness to be drawn to its potential position through energization of the solenoids.

The means which I have provided for accomplishing this function comprises a pair of auxiliary contacts 18 and 19 mounted on the master counter, the contact 18 being stationary and the contact 19 being movable. These contacts, when closed, establish a circuit through a relay 20. Said relay has a contact 21 which normally closes a gap in the circuit which energizes the solenoids 13 and 14 when the micro-switch is closed by the passage of a bill. When the micro-switch 12 first closes, the relay 20 is unenergized and full current from the line passes through the micro-switch, through the solenoids 13 and 14 to ground. This movement oscillates the armatures of the counters, placing the arms 17 in potential position. This movement also closes the contacts 18 and 19, establishing a circuit from the line through said contacts and through the relay 20. Said relay when energized, withdraws the contact 21 from the micro-switch circuit, opening that circuit, de-energizing the solenoids 13 and 14, causing the arms 17 to actuate the counting mechanism to register a count on both the individual and the master

counter, the count registering movement of the arm 17 of the master counter breaking the contacts 18 and 19.

It is observed that when the micro-switch 12 initially closes, an alternative circuit is provided which is established from the line through the micro-switch, through the solenoid 13 and to the relay 20 through three resistances 23, 24 and 22, thence to the line. The aggregate value of these resistances is such that very little current at this time flows through the relay solenoid 20 through this alternative path, not enough either to draw or hold the armature of said relay solenoid, and not enough to actively energize the solenoid 13 which actuates the counter.

It will not do, however, for the relay 20 to become de-energized immediately after its energization by the opening of the contacts 18 and 19, for the armature of the relay would drop, causing the contact 21 to close the gap in the micro-switch circuit, and the latter being still closed through the passage of the bill, the solenoids 13 and 14 would become again energized, operating the counting mechanism and thus registering two or more counts for a single bill.

To prevent this eventuality, I have provided a holding circuit through the relay 20, which is established when the contacts 18 and 19 close and the armature of the relay 20 lifts, but which is not broken when the contacts 18 and 19 separate. It will be observed from the diagram in Figure 4 that the circuit established through the relay 20 by the closing of the contacts 18 and 19 includes only a single resistance 22 so that the current may be regarded as a powerful current capable of actuating the relay 20 to draw its armature upwardly, considering the position of parts in the diagrammatic figure.

When the armature of the relay 20 is in its uppermost position, the contacts 25 and 26 are closed, which cuts out the resistance 24 so that current continues to pass through the relay by way of the alternative path through the solenoid 13 and through two resistances 22 and 23. This current is not enough to cause the relay 20 to attract its armature, but it is enough to cause the relay to hold on to its armature. Consequently, when the contacts 18 and 19 are broken through the de-energization of the solenoids 13 and 14, the relay 20 is not de-energized; therefore, it is impossible for more than one count to be made by the counter during the passage of a single bill.

Thus, during the passage of a bill between the rolls 6 and 8, the solenoids of the counters are first energized, placing the counter arms 17 in a potential position. Energization of said solenoids causes an immediate energization of the relay 20, which in turn causes immediate de-energization of the counter solenoids, causing a count to be registered upon the individual and master counters, but the relay 20 remains energized during the entire passage of the bill, as a safeguard against the duplication of the count. Then when the bill has completely passed through between the rolls 6 and 8 and said rolls have come together, opening the micro-switch, the circuit through the relay 20 is broken and the relay armature returns to its normal position in which the gap in the energizing circuit of the counter solenoids is again closed. Everything is now in readiness for a repetition of the counting operation, so that the person feeding bills into the machine need give no concern to the matter of

how fast to feed the bills to the rolls. They may be fed as close to one another as possible, without fear of a miscount or a duplicate count, it being understood, of course, that the bills must be fed so as to allow some space between successively fed bills.

The adjusting screw 27 in Figure 1 determines the clearance between the rolls 6 and 8, necessary to close the contacts of the micro-switch. If this clearance is set to the thickness of the one bill and two bills are fed in, overlapped, the micro-switch will, of course, close, but the upward thrust against the adjusting screw which is carried by the rocker arm 28 tilts the rocker arm about the pivot 29, operating brake mechanism 30, which will stop the motor, not shown, by means of which the feed rolls 6 are driven.

While I have in the above description disclosed what I believe to be a preferred and practical embodiment of the invention, it will be understood to those skilled in the art that the specific details as shown and described are by way of example, and not to be construed as limiting the scope of the invention as defined in the appended claims.

What I claim is:

1. In a paper money counting machine of that type comprising a plurality of bill-receiving bins, a solenoid actuated counter individual to each bin, a master counter common to all the bins operating simultaneous with any individual counter, a pair of normally contacting separable feed rolls adjacent each bin, one roll of each pair being driven, switches individual to said bins, in series circuits with the corresponding individual counters and said master counter, each switch being actuated to close a circuit through the corresponding individual counter and said master counter responsive to the separation of the corresponding rolls by the thickness of a bill introduced between said rolls, whereby said counters are set in position to register a count as soon as said counters are de-energized, the combination with the individual and master counter circuits of means responsive to the movement of the master counter when energized, for de-energizing said counters immediately following their energization, while the switch which closes the counter-energizing circuit is still closed and the corresponding rolls are still separated by a passing bill, whereby the registration of the count both on the corresponding individual counter, and the master counter will have been completed an appreciable time interval before the rolls come together again in readiness for the counting of another bill.

2. In a paper money counting machine of that type comprising a plurality of bill-receiving bins, a solenoid actuated counter individual to each bin, a master counter common to all the bins operating simultaneous with any individual counter, a pair of normally contacting separable feed rolls adjacent each bin, one roll of each pair being driven, switches individual to said bins, in series circuits with the corresponding individual counters and said master counter, each switch being actuated to close a circuit through the corresponding individual counter and said master counter responsive to the separation of the corresponding rolls by the thickness of a bill introduced between said rolls, whereby said counters are set in position to register a count as soon as said counters are de-energized, the combination with the individual and master counter circuits, of means responsive to the movement of the

master counter when energized, for de-energizing said counters immediately following their energization, while the switch which closes the counter-energizing circuit is still closed and the corresponding rolls are still separated by a passing bill, whereby the registration of the count both on the corresponding individual counter, and the master counter will have been completed an appreciable time interval before the rolls come together again in readiness for the counting of another bill, said means comprising a relay solenoid and line connection in series therewith and with a normally open switch responsive to movement of said master counter, and closed when said master counter is in potential counting position, an armature for said relay solenoid, and a switch in series in said master counter energizing circuit operated by said armature when the relay solenoid is energized for de-energizing the master counter circuit and the circuit of the individual counter which is in series therewith.

3. In a paper money counting machine of that type comprising a plurality of bill-receiving bins, a solenoid actuator counter individual to each bin, a master counter common to all the bins operating simultaneous with any individual counter, a pair of normally contacting separable feed rolls adjacent each bin, one roll of each pair being driven, switches individual to said bins, in series circuits with the corresponding individual counters and said master counter, each switch being actuated to close a circuit through the corresponding individual counter and said master counter responsive to the separation of the corresponding rolls by the thickness of a bill introduced between said rolls, whereby said counters are set in position to register a count as soon as said counters are de-energized, the combination with the individual and master counter circuits of means responsive to the movement of the master counter when energized, for de-energizing said counters immediately following their energization, while the switch which closes the counter-energizing circuit is still closed and the corre-

sponding rolls are still separated by a passing bill, whereby the registration of the count both on the corresponding individual counter, and the master counter will have been completed an appreciable time interval before the rolls come together again in readiness for the counting of another bill, said means comprising a relay solenoid, an armature operated by said solenoid and two circuits for said solenoid, the current in one circuit having strength to draw the armature of the solenoid, and the other normally having current of insufficient strength either to draw or hold said armature, but at times having strength to hold but not to draw said armature, the first mentioned solenoid circuit including in series, line connections, the solenoid and a normally open switch responsive to movement of said master counter, and closing when said master counter is in potential counting position, a switch in series in said master counter energizing circuit opened by said armature when said first mentioned relay solenoid circuit is energized, for de-energizing the master counter circuit and the individual counter actuating circuit in series therewith, said second mentioned solenoid circuit including in series line connections, the counter actuating switch, the counter actuating solenoid, the relay solenoid, and aggregate resistance sufficient to reduce the current through said circuit to a strength insufficient either to energize the counter actuating solenoid or to draw or hold the relay solenoid armature, and having a normally open branch shunting a portion of said resistance, and a switch in said shunt branch closed by said armature when the armature moves to open the first mentioned armature-controlled switch, for short-circuiting the said portion of said resistance, increasing the current through said circuit to armature holding strength but not to counter solenoid actuating strength, whereby the counter actuating circuit is maintained broken during the remaining period of the passage of a bill between said feed rolls.

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