Feb. 19, 1963 S. W. MIDDLEDITCH 3,077,983

BANKNOTE HANDLING MACHINE

Filed March 28, 1960 7 Sheets-Sheet 1

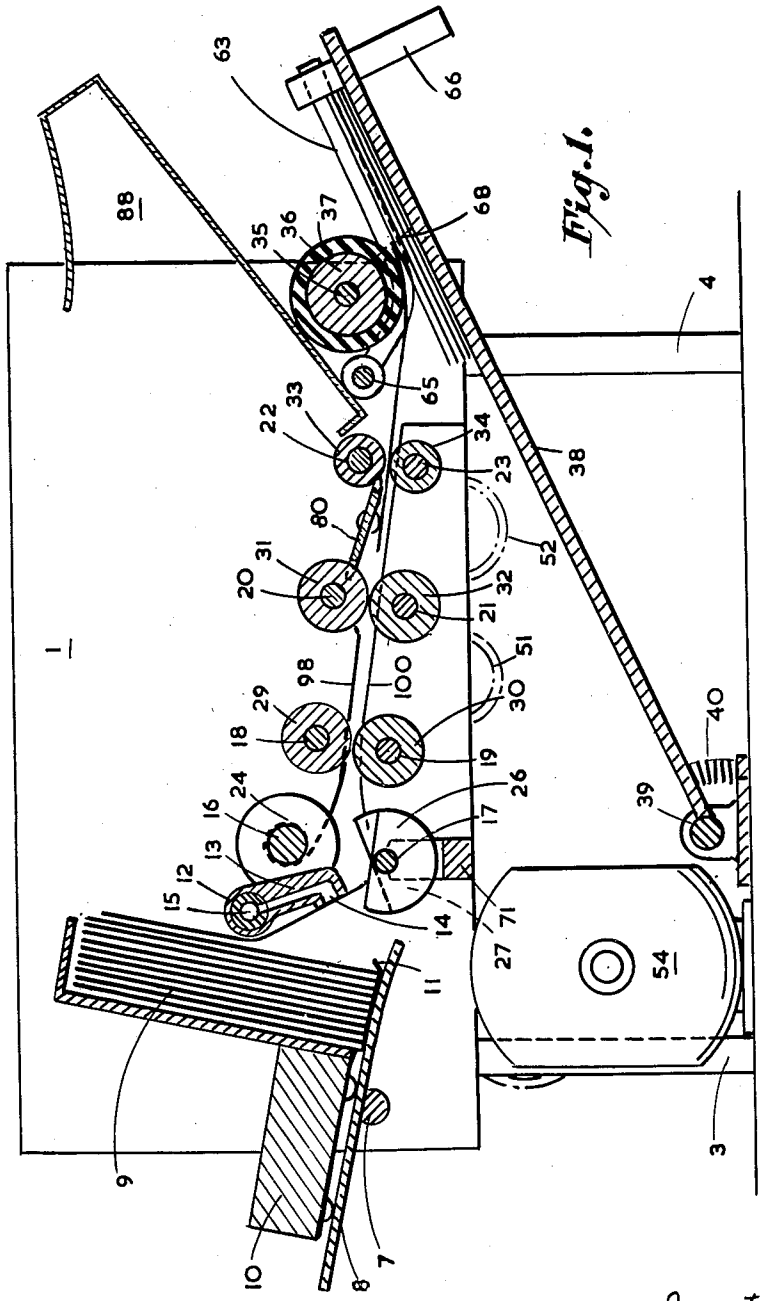

Fig. 1.

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BANKNOTE HANDLING MACHINE

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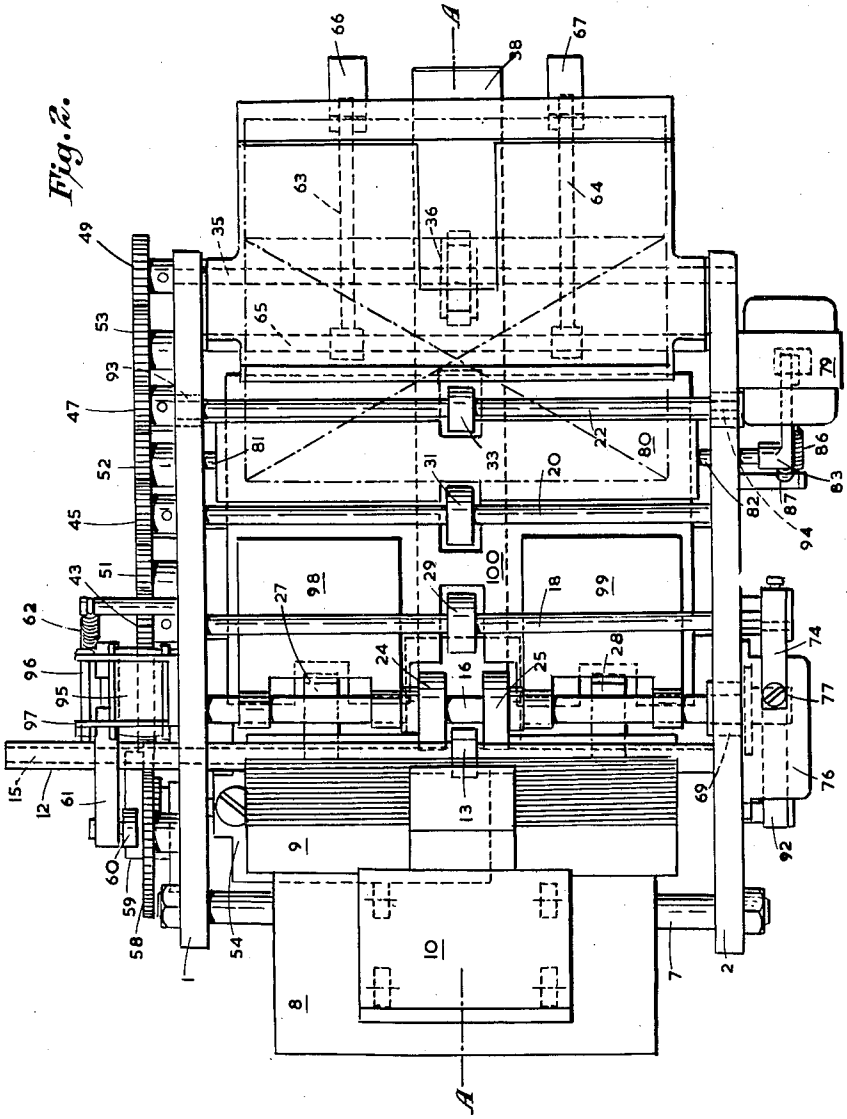
Fig. 2.



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Filed March 28, 1960 7 Sheets-Sheet 3

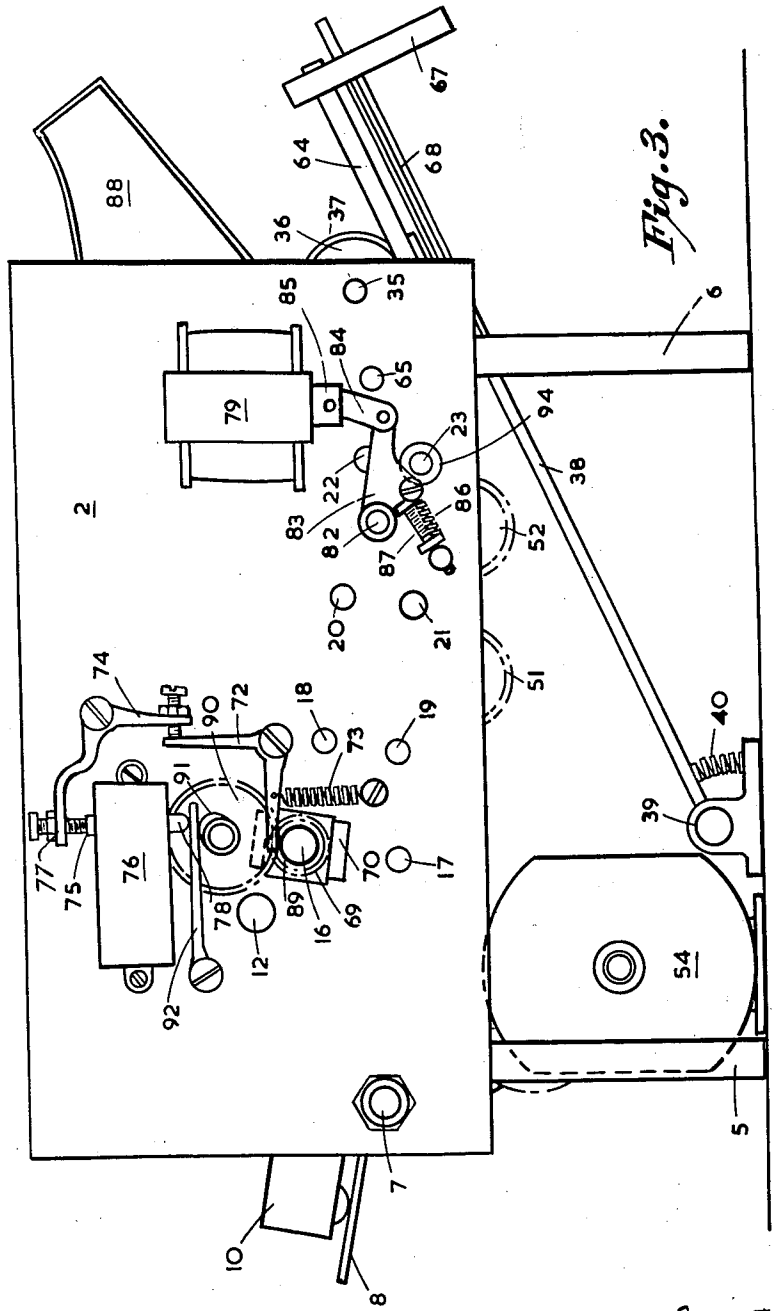

Fig. 3.

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BANKNOTE HANDLING MACHINE

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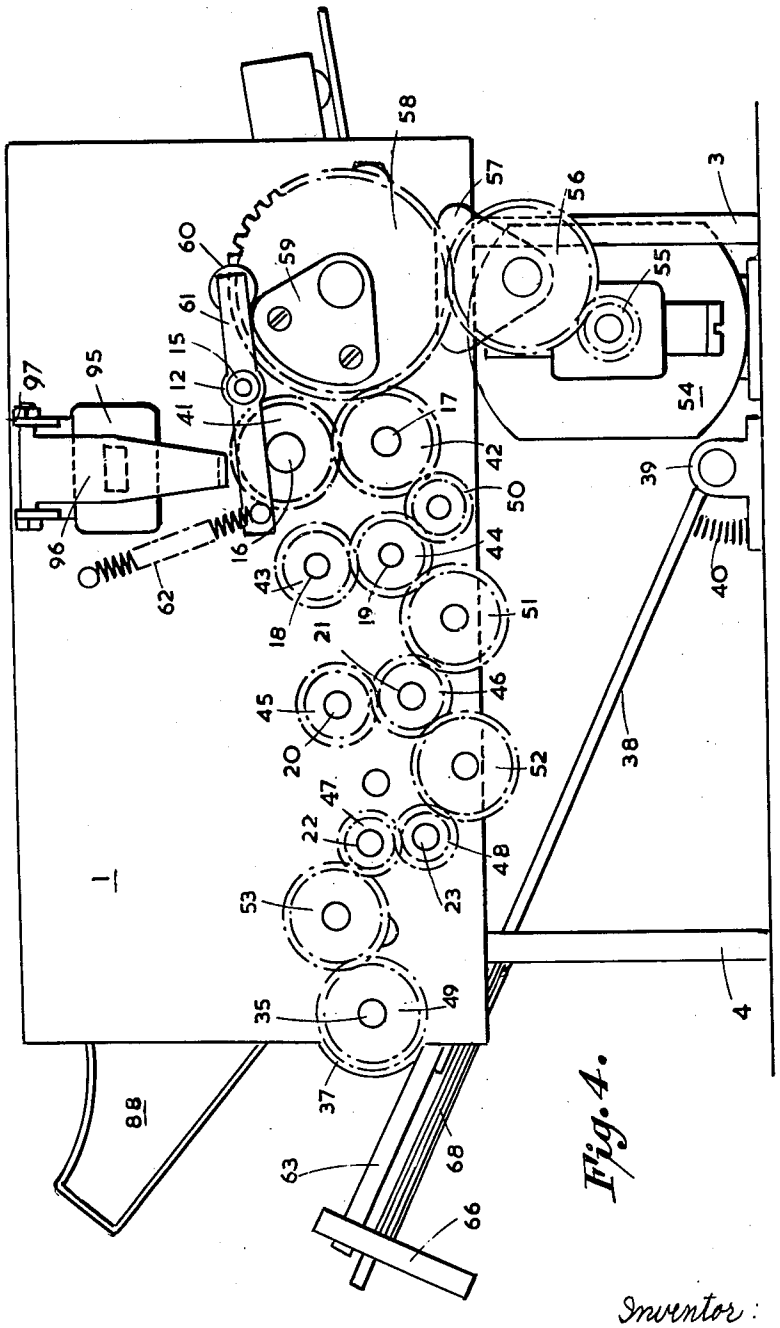

Fig. 4.

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BANKNOTE HANDLING MACHINE

Filed March 28, 1960 7 Sheets-Sheet 5

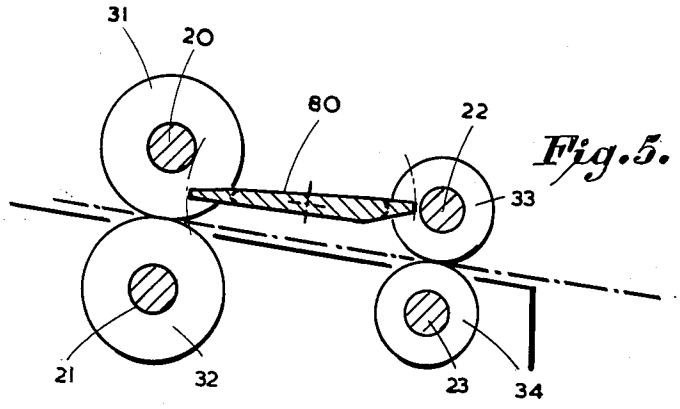

Fig. 5.

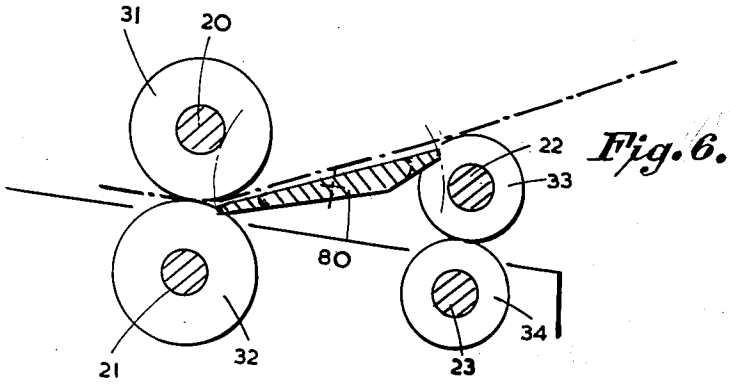

Fig. 6.

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BANKNOTE HANDLING MACHINE

Filed March 28, 1960 7 Sheets-Sheet 6

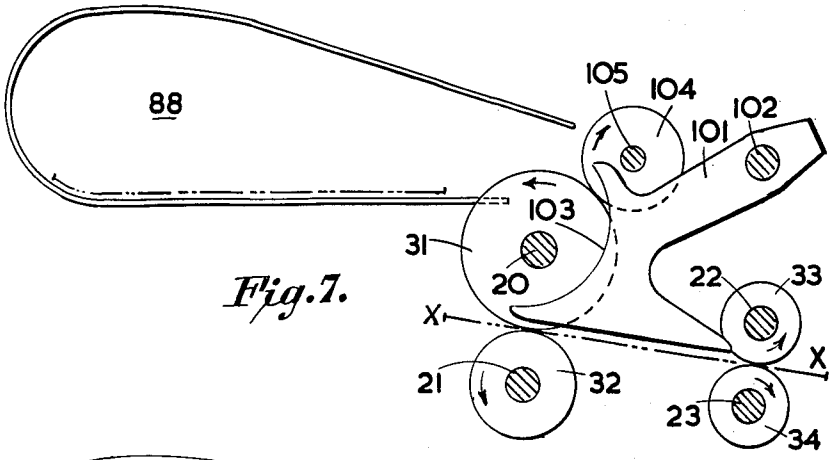

Fig. 7.

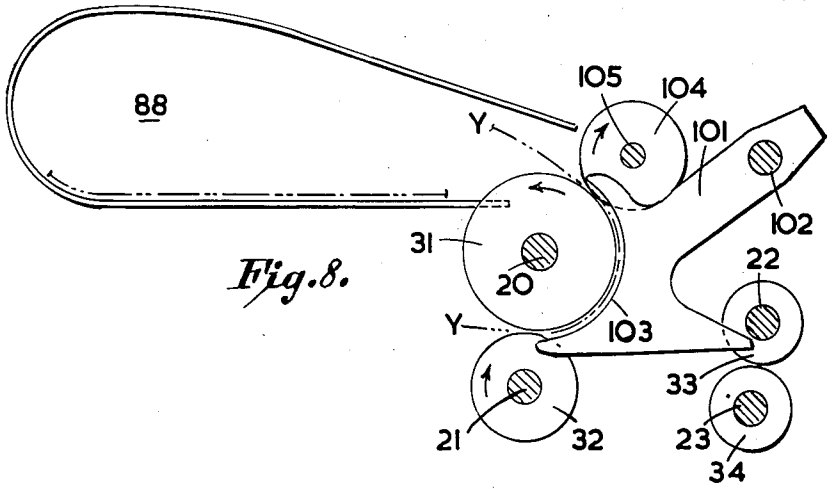

Fig. 8.

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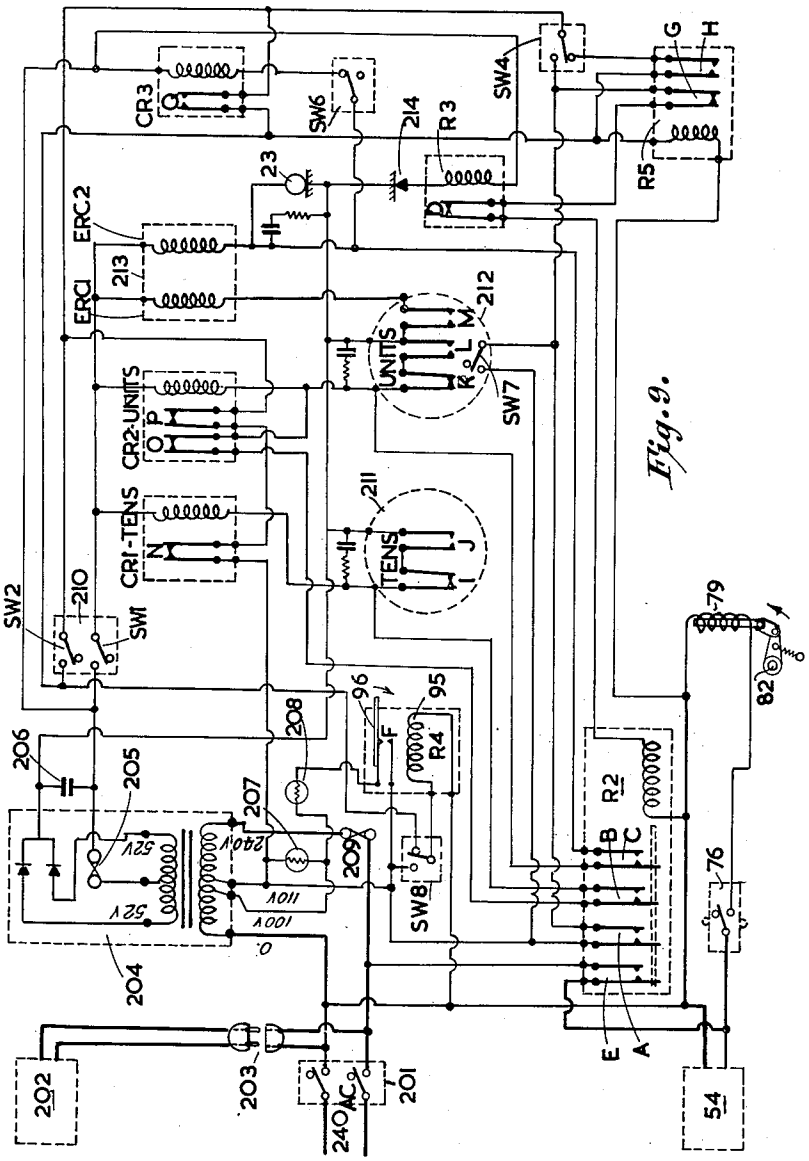

Fig. 9.

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United States Patent Office 3,077,983 Patented Feb. 19, 1963

3,077,983

BANKNOTE HANDLING MACHINE

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Claims priority, application Great Britain Apr. 2, 1959
7 Claims. (Cl. 209—73)

This invention relates to machines for the high speed handling and counting of sheets of paper; in particular but not exclusively, it relates to machines for handling and counting bank notes in such a way that an accurate predetermined number of notes can be taken from a stack, for example for the making up of wage packets or the issuing of notes in banks.

Existing machines for counting bank notes and producing stacks of predetermined numbers have the disadvantage that they do not operate at a rate high enough to remove doubts that counting cannot be performed as or more quickly by experienced clerks or tellers. Machines are known for example utilising pneumatic means for feeding sheets into counting machines and constructed in such a way that it is necessary to break the suction before a note can be fed entirely into the machine with the result that the overall speed of operation of the apparatus is reduced. In addition a known method of collecting counted notes comprises a hopper into which sheets are fed by gravity, and arrangements of this kind limit the speed at which notes can leave the machine because time must be allowed for each note to settle in the hopper before the next one leaves the machine unless the condition in which notes leave the apparatus is of no consequence.

According to this invention a machine for the high speed handling of sheets of paper comprises sheet supporting means, at least one pair of co-acting power driven primary feed rollers, oscillatory means, in connection with a continuous source of vacuum, for feeding sheets sequentially from said supporting means to said primary feed rollers, at least two pairs of co-acting power driven secondary feed rollers, arranged with their nips in a substantially straight line with that of the primary feed rollers, means for detecting, during the passage through the nip of said primary feed rollers, or through the nip of any but the final pair of secondary feed rollers, a sheet or sheets exceeding a predetermined thickness, and rejecting means, arranged in the feed path of said sheets before the final pair of secondary feed rollers, adapted to be influenced by said detecting means so as to prevent a sheet or sheets from entering the nip of the final pair of secondary feed rollers, whereby sheets are taken one at a time from the sheet supporting means by said oscillatory means and fed through the nip or nips of the primary feed rollers, but only sheets having a thickness not exceeding a predetermined thickness are fed through the nips of all the pairs of secondary feed rollers.

The machine according to this invention is particularly suitable for counting bank notes as they are fed from a stack through the machine; preferably the notes are stacked on edge on the sheet supporting means and means are provided for counting the notes passed through the nip of the final pair of secondary feed rollers before being collected.

Preferably the sheet feeding member oscillates in an arcuate path between the sheet supporting means and the first of the primary feed rollers.

Electrically operated means may be provided for cutting out the drive to the primary and secondary feed rollers and oscillating means when a predetermined number of sheets or notes have passed the counting means.

The collecting means preferably comprises a platform provided with a stop and a power driven friction wheel adapted to deliver sheets or notes leaving the last pair of secondary feed rollers to said platform.

Means may be provided in association with the sheet or note supporting means for cutting out the drive to all driven members of the machine when all the sheets or notes have been removed from said supporting means.

The rejecting means is preferably pivotally mounted so as to be capable of movement from an inoperative to an operative position, electrically operated means being provided for preventing sheets or notes being fed to the primary feed rollers when said rejecting means is in its operative position.

One embodiment of a machine according to this invention is shown in the drawings, in which FIGURE 1 is a sectional elevation on the centreline AA of FIGURE 2, FIGURE 2 is a plan view, FIGURE 3 an elevation of one side, FIGURE 4 an elevation of the other side; FIGURES 5 and 6 illustrate diagrammatically and to a larger scale two operative positions of a particular part of the machine, FIGURES 7 and 8 illustrate an alternative arrangement to that shown in FIGURES 5 and 6, whilst FIGURE 9 shows a schematic layout of the electrical circuit.

Referring to the drawings, the machine includes a pair of main frame plates 1 and 2 mounted on four vertical columns 3, 4, 5 and 6, and transversely braced by a cross stay 7 provided with nuts at its extremities to maintain the main frame plates in parallel relationship. An inclined sheet supporting platform 8 adapted to carry a stack 9 of notes, arranged on edge, is provided above the cross stay 7 and a weighted member 10, fitted with freely running wheels, is placed on the platform 8 in order to provide a constant end thrust against the rear side of the stack 9, the centre of which rests upon the top of an angled projection 11 in such a manner as to retain lightly the central bottom edge of the foremost note in the stack.

A hollow shaft 12, with its ends journalled in the frame plates 1 and 2, extends across the width of the machine and carries at its centre a suction arm 13 provided with a suction orifice 14 and a duct, which connects the orifice with a drilled bore 15 within the shaft.

Pairs of shafts 16 and 17, 18 and 19, 20 and 21, and 22 and 23 extend across the machine and the ends of the shafts are journalled in the frame plates 1 and 2. The pairs of shafts are spaced one from another and the line between the centres of each shaft of each pair is at right angles to a line which is substantially parallel to the inclined sheet feeding platform 8. The shaft 16 carries pairs of spaced rollers 24 and 25 mounted rigidly thereon one at each side of and at an equal distance from the centre line of the machine, and the shaft 17 carries four rollers or discs having interrupted peripheries due to having cut away portions of substantially D-shaped formation; the discs are arranged in pairs and two of these discs are arranged to co-act with the rollers 24 and 25 and one is shown in FIGURE 1 at 26. The rollers 24, 25, 26 constitute the primary feed rollers. The other two discs 27 and 28 are provided to give an upward motion to the bottom edge of the note, by contacting with the surface of the cut-away portion and thereby assuring that curled edges of the notes are passed within the roller system. They are spaced equally on each side between the discs of the first pair of discs 26 and the main frame plates, and are arranged in lagging phase relationship to the other discs as shown in FIGURES 1 and 2.

The shafts 18 and 19, 20 and 21, 22 and 23 carry at

their centres rigidly mounted co-acting secondary feed rollers 29 and 30, 31 and 32, 33 and 34 respectively.

Shaft 35 carries a central collecting roller 36 provided with a rubber friction ring 37 in a groove in its periphery in close proximity to a collecting platform 38, the lower end of which is pivoted in a bearing 39, rigidly mounted beneath the machine and caused to bear against the friction surface of the roller 36 by means of a spring 40.

The shafts 16 and 17, 18 and 19, 20 and 21, 22 and 23, and 35 are all adapted to be positively driven by means of gears 41, 42, 43 and 44, 45 and 46, 47 and 48, and 49 respectively as shown in FIGURE 4. The gear train includes idler gears 50, 51, 52 and 53 between gears 42, 44, 46, 48 and 47 and 49. The pitch-circle-diameter of all gearing is arranged to coincide with the diameter of the rollers mounted on the respective shafts to maintain a constant linear velocity to notes passing through the machine. At the collecting stage however, it is preferable that the velocity is slightly higher to assist in satisfactory note stacking; this is achieved by providing the friction pulley 36 with a larger diameter than the pitch-circle-diameter of the driving gear wheel 49. The driving mechanism comprises a fractional-horse-power motor 54, carrying a pinion wheel 55 meshing with an idler gear 56, which is mounted on a bracket 57 and meshes with a gear wheel 58, which in turn meshes with the gear 42 on shaft 17. The gear wheel 58 is arranged to provide the driving mechanism for the shaft 12 which carries the suction arm 13; this is done by means of a cam 59, rigidly attached to the gear wheel 58, and a roller follower 60 journalled at the end of a lever 61, which is attached rigidly to the shaft 12. A return spring 62 is connected to the main frame plate 1 and to the opposite end of the lever 61 in such a manner as to ensure that the roller follower 60 maintains contact with the cam profile when the machine is working.

The delivery mechanism includes a pair of prong like arms 63 and 64 rigidly mounted on a stationary shaft 65, extending between the frame plates of the machine, and provided with stop bars at their extremities at 66 and 67. The arms 63 and 64 are positioned outwardly and equidistant from the friction roller 36, and arranged to extend slightly below the bottom periphery of the roller; therefore, by the upward thrusting force of the spring arm 38, a bowing effect is imparted to the notes in the collecting stack 68.

The apparatus is designed to feed and count sheets of a predetermined thickness and means for detecting the passage of a sheet or sheets having a total thickness in excess of the predetermined thickness is provided by allowing for upward movement of the shaft 16 with its journal block 69 in the main frame plate 2. The block 69 is so constructed that the block and the shaft 16 are free to rise under the action of excess pressure in parallel guide surfaces of an opening 70 cut into the main frame plate 2 as shown in FIGURE 3. Rigidity of the lower shaft 17 is ensured by means of a series of spaced half bearing blocks 71, which support it at intervals along its length. A bell crank 72 is connected to the frame plate 2 in such a way that one of its arms rests upon the end of the shaft 16 and is adapted to be moved thereby against the action of a spring 73 which is connected to the arm and to the main frame plate. The other arm of the bell crank 72 is adapted to co-act with one arm of a second bell crank 74, the other arm of which is adapted to depress the upper contact 75 of microswitch 76 in the event of the passage of a sheet exceeding the predetermined thickness. Adjustments to the bell crank systems can be made in accordance with the required predeteminded thickness by means of a set screw and lock nut 77.

The microswitch 76 is of the type having a double ended operating plunger and it requires an impulse at the upper contact 75 to "make" the circuit and an impulse at the lower contact to "break" the circuit. The circuit includes a solenoid 79 which is adapted to operate rejecting or deflector means in accordance with variations in the circuit which are brought about by the said means. The rejecting means comprises a deflector plate 80 mounted between the rollers 31 and 32, and 33 and 34 in a rigid fashion on a pair of stub axles 81 and 82 journalled in the frame plates 1 and 2. The axle 82 is arranged to pass through the frame plate 2 and carries an operating lever 83 connected by a link member 84 to the slidable armature 85 of the solenoid 79. A return spring 86 is connected to the main frame plate 2 and to lever 83 in order to return the deflector plate 80 to its normal position when the solenoid is not energised, and in addition an adjustable stop 87 is provided to control the extent of the return of the lever upon de-energisation of the solenoid. FIGURE 5 shows the deflector plate which has an approximately wedge shaped cross section and a bottom trailing edge chamfered slightly and notched where necessary to clear the rollers 31 and 33 is shown in its normal position and in FIGURE 6 in its deflected position where it rejects a note by deflecting it from between the nip of the rollers 31 and 32 away from the nip of the rollers 33 and 34 and into the hopper 88. It is necessary to provide at least two pairs of secondary feed rollers after the primary feed rollers 24 and 26 in order to allow sufficient time for the detecting means to influence the rejecting means in the event of the passage of a sheet or sheets exceeding the predetermined thickness. In addition, means are provided to ensure that a rejected note is passed completely clear of the deflector plate 80 before the latter returns to its normal position; these means comprise a gear pinion 89 rigidly mounted to the shaft 16 and loosely meshing with a 2:1 ratio gear wheel 90 mounted on the frame plate 2 and carrying a cam 91, which is adapted to move a lever 92, which is connected to the frame plate 2, in such a way that the lower contact 78 of the microswitch is operated upwardly to break the circuit. The gear wheel 90 is in constant mesh with the pinion 89, but the teeth profile allows sufficient freedom to permit the pinion to rise and thereby mesh deeper, when an excess thickness passes between the nip of the primary feed rollers 24 and 26. It is therefore apparent that the cam 91 is also in constant contact with the lever 92, but can only influence the bottom plunger 78 of the microswitch 76 when it is in the "make" position.

With reference to the alternative form of rejecting mechanism shown in FIGURES 7 and 8, multiple notes or notes exceeding a predetermined thickness, which therefore are to be rejected, are turned through approximately 180° and fed into the hopper 88 mounted above the first pair of secondary feed rollers. The rejecting mechanism comprises a plurality of blade-like members 101 rigidly mounted on a common operating shaft 102, journalled in the main frames of the machine and connected by an arm and linkage similar to parts 83, 84 (FIGURE 3) to the operating solenoid 79 as already described. The upper secondary feed roller 31, mounted on the shaft 20, is larger than in the first example and has a diameter slightly less than the radiused concave face 103 of the member 101. An auxiliary, driven roller 104 is mounted on a shaft 105 in the position as shown to assist in the handling of notes during deflection. In FIGURE 7 the rejecting mechanism is in the inoperative position and a satisfactory note XX is passing between the rollers 31, 32 and counting rollers 33 and 34. In FIGURE 8 the solenoid has caused the shaft 102 and the member 101 to move to the position as shown thereby to intercept the faulty note YY, which may be seen passing round the periphery of the roller 31 guided by the concave faces 103, and entering the hopper 88 for subsequent removal. In the manner as already described, the deflector is returned to its normal position after the requisite time delay.

The sheets passing through the nip of the last pair of

secondary feed rollers 33 and 34 are counted by means of an interruption of the continuity of an electric circuit completed through the surface of the rollers. The mating surface of one of these rollers may advantageously be provided with a series of fins or grooves to assist in the removal of dirt and dust particles thereby improving electrical reliability. The shaft 23, carrying the roller 34, is insulated from the apparatus by means of bushes 93 and 94 mounted in the frame plates 1 and 2, but is connected electrically via the frame of the machine, to a digital counter unit to be described below when no note is presented between the counting rollers 33 and 34.

Alternatively the counting may be carried out by arranging the passing of a note through the rollers 33 and 34, to influence the blade of a microswitch.

If it is required to issue a predetermined number of notes, use is made of the mechanism shown in FIGURE 4, which includes an electro magnet 95 mounted on the frame plate 1 and a ferrous catch plate 96 suspended from a bracket 97, which is also connected to the frame plate 1. A number of telephone type dial units may be used to control the electro magnet 95, a separate unit being provided for "units," "tens" etc. In addition to the dial units, an electro magnetic digital counter unit is included in the circuit to the dial unit and to the counting rollers of the machine. The catch plate 96 is normally clear of the lever 61, which controls the oscillation of the suction arm 13, but when the electro magnet 95 is energised the plate 96 swings inwards towards the frame and over the lever 61, thereby preventing the oscillating suction arm from returning and hence the removal of further notes from the stack. The number of notes which the machine is required to produce is the "run-back" on the telephone type dial units and the circuit is so arranged that the dialled numbers of the digital counter unit are reduced by impulses produced by the counting rollers of the machine until such time as the correct number of notes have passed through the machine; when this happens the electro magnet 95 is energised. The circuit also includes means to start the motor 54 when the dialling is completed and also to stop it when the correct number of notes has been delivered. Should the number of notes required exceed that present in the stack at any particular time, the machine will stop after all the notes have been removed from the stack but the digital counter will record the quantity of notes outstanding.

To assist in the rapid handling of notes through the machine, guide plates 98, 99 and 100 are provided above and below the stream of passing notes to discourage creased corners from fouling the multiplicity of driving shafts. These are cut to clear the respective rollers where necessary. When the machine is working, a continuous source of vacuum is connected to the open end of the shaft 12 and thence to the suction orifice 14. The electric motor 54 is then switched on, with the result that the suction arm 13 oscillates rapidly backwards and forwards between the stack of notes and a position adjacent the nip of the rollers 24 and 26. Each time the suction orifice 14 meets the foremost or adjacent sheet in the stack, the lower part of the sheet is drawn over the angled projection 11 and bent away from the stack in the direction of stacking as the suction member moves towards the nip of the rollers 24 and 26, and 25 and 27. At the end of the travel of the oscillating suction arm 13, the note is fed into the nip of the rollers 24 and 26, 25 and 27, which are rotating in opposite directions, the rollers 26 and 27 being so phased that a clearance, into which the end of a note is fed, is provided beneath the rollers 24 immediately before the curved surfaces of the rollers co-act. The sheet is pulled from the stack across the face of the suction orifice 14 and is fed through the rollers 24 and 26, 25 and 27, 29 and 30, 31 and 32, and 33 and 34 and thereafter beneath the friction collecting roller 36 on the top of the collecting platform 38, where it comes to rest against the end stops 66 and 67. As the sheet passes between the rollers 33 and 34, it interrupts the flow of current in the counting circuit and the passage of the note is recorded on the digital counter. This operation continues all the time the motor is running until all the sheets in the stack have passed through the machine or the pre-selected number of notes has been counted. As the sheets build up on the collecting platform 38, the latter is depressed against the action of the spring 40 and the sheets are finally arranged in a neat pile at the top of the platform 38 beneath the prong-like members 63 and 64. However, if two sheets are stuck together and are fed between the nip of the rollers 24 and 26, 25 and 27 this fact is detected by the deflection of the shaft 16 in the manner already described, with the result that the deflector plate 80 is tilted in such a way that the sheet passing between the rollers 31 and 32 is deflected above the roller 33 and into the hopper 88.

Alternative embodiments of the collecting unit may include a plurality of driven frictional rollers with or without cut-away sections in their peripheries. In addition, this roller or rollers may be mounted below the path of the notes. In this instance the platform 38 will be replaced by a fixed platform with an end stop member and a light-weight arm arranged to bear on the first note delivered. By this means, subsequent notes will be added to the underside of the stack and the arm will rise with the top note.

Referring now to FIGURE 9, the electrical circuit includes the following principal components:

201—Double-pole switch to isolate the apparatus from the mains current supply.

202—Vacuum motor.

203—Plug and socket to enable the vacuum motor to be readily disconnected.

204—Transformer/rectifier unit for supplying an output of 52 volts D.C. for the operation of the counter units from the secondary connections and having also auto-wound primary tappings giving an output of 110 volts A.C. for the operation of the various relays etc. and a further tapping of 100 volts which, when connected with the 110 volt tapping, will provide a low voltage supply of 10 volts for the illumination of the two pilot lights.

205—D.C. output fuse.

206—Smoothing capacitor connected across the 52 volt D.C. output.

207 and 208—Pilot indicator lights.

209—Mains fuse to protect the primary windings of the transformer/rectifier.

210—Ganged single-pole switch consisting of sections SW1 and SW2 arranged to be manually operated simultaneously to positions "select" or "count" according to the desired function of the machine. The diagram shows the switch in the latter position, which in effect isolates certain of the electrical components.

54—Fractional horse power electric motor for driving the oscillating suction arm, primary and secondary feed rollers and collecting roller, through the main gear train of the machine.

76—Microswitch arranged to be operated by a note or notes or excess thickness as already described.

79—Solenoid operating deflector plate.

R2—Multi-contact relay incorporating four pairs of contacts E, A, B and C arranged to be closed simultaneously by the energisation of the magnet coil.

R4—Single contact relay including magnet coil 95 arranged when energised to attract an armature 96 to arrest the oscillating suction arm and also close a pair of contacts F.

R5—Double-contact relay having pairs of contacts G and H in the closed and open positions respectively. These positions are reversed upon energisation of the magnet coil.

211—Dial unit operative when the switch 210 is in the "select" position for dialling the desired number of "tens" of notes that are required to be delivered by the machine. Two pairs of contacts, J and I, are included within the unit; contacts J are arranged to be in the open position and are closed immediately after dialling commences, and contacts I are broken intermittently by the run-back of the dial and in accordance with the number dialled.

212—Dial unit having a similar function to 211 employed for selecting the "units" figure required. This includes contacts K and L that perform in a similar manner to contacts I and J respectively and an additional pair of contacts M which operate similarly to contacts J and L. Also incorporated in this unit is a microswitch SW7 arranged momentarily to close during the end of run-back of the revolving dial. Condensers and resistors are connected across the contacts of both 211 and 212 as shown, to reduce sparking.

CR1—Single-figure counter unit, to indicate "tens" including a magnet coil arranged to advance a ratchet wheel, carrying a numeral drum, one increment per pulse received by the magnet coil. A projection on the ratchet wheel, is phased so that it will close a pair of contacts N, when the numeral drum indicates zero, but which remains open in all other positions.

CR2—Single-figure counter unit similar to CR1 to record "units" but including two pairs of contacts O and P, both of which are closed when the numeral drum indicates zero as above.

213—A four-digit checking counter having a magnet coil ERC2 arranged to advance the total by one unit per pulse. In this instance the "carrying" figures are mechanically transferred to their adjacent numeral wheels automatically. A second coil ERC1 is also incorporated within this counter to zero the numerical total when energized.

23—The counting shaft carrying the roller 34 insulated from the main frames of the machine by insulated bushes 93 and 94 (FIGURE 2). As previously described, electrical continuity will exist between this shaft and the frame when no note is present between the counting rollers. A condenser and resistor are connected in parallel to the counting rollers to minimise arcing.

214—A pair of contacts connected in the circuit to stop the machine when the feed stack of notes is exhausted. This consists of an insulated contact mounted within the feed plate bearing against the most rearward note in the stack and which is arranged to press against a stationary earth contact thereby to complete a circuit and so stop the machine when the last note has been fed from the stack.

CR3—An accumulative counter unit that may be manually reset to zero when desired. It also incorporates a pair of contacts Q, normally in the open position, but arranged to be closed by a suitable projection on the appropriate numeral wheel thereby to stop the machine at multiples of one hundred.

SW4—Spring-loaded, single-pole 2-position switch shown in its static position. It may be manually depressed momentarily when 210 is in the closed position to enable the machine automatically to count and issue a hundred notes without the necessity to operate the dial units.

SW6—A manually operated spring loaded switch normally in the closed position. Each depression of this switch will break the continuity of the current supply and thereby feed an extra pulse to the counter unit CR3 to compensate for any rejected notes incurred during a run.

SW8—A two-position spring-loaded single-pole switch normally in the position as shown operated by a resilient arm on the deflector shaft 82 when the deflector is in the diverting position. The effect of this is to energise the coil 95 of the relay R4 which in turn will attract the armature 96 and so arrest the oscillating suction arm for one cycle and thereby ensure that the following note is delayed in entering the roller system, and/or no further notes enter the system as long as deflector shaft 82 is kept in the deflecting position.

General Mode of Operation of Machine

Upon closing the mains supply switch 201, current will flow to the vacuum pump motor 202 via the plug and socket 203, and also to the primary windings of the transformer/rectifier 204 via the fuse 209. The 10 volt tapping of the transformer will pass current to the pilot light 207 to indicate continuity of supply. It is first assumed that it is desired to issue a predetermined quantity of notes; therefore, the switch 210 must be set to the "select" position.

The member 10 (FIGURE 1) is moved backwards to allow the insertion of a supply of notes on the supporting platform 8 and in doing so the contacts 214 are broken and it is then possible to start the machine after the following procedure has been carried out.

It is first necessary to ensure that the counter units are returned to zero, in which position contacts N, O and P, will be closed and continuity will be completed from the 110 volt tapping of the transformer, via contacts N and P; closed switch SW2; switch SW8 in the position as shown; magnet coil 95 of relay R4 and thence to the mains supply. The energization of the coil 95 will close the contacts F which will in turn complete the 10 volt circuit to the pilot light 208, and indicate that dialling may proceed. At the same time a further circuit is completed, as previously described as far as switch SW2 and then on to the magnet coil of relay R5 and back to the mains supply. With the mains current switched on, the above mentioned circuits will only be completed when both "tens" and "units" counters are in the zero positions. The desired quantity of notes is now dialled on the two dial units starting with the "tens" figure if a two-figure quantity is required.

The sequence of dialling will now be described for the "tens" unit 211. Upon turning the dial clockwise, the contacts J will close thus energizing the coil in CR1 and, upon releasing, will run-back in an anti-clockwise direction to the stop and in so doing a series of current breaks at contacts I will cause the magnet coil in CR1 to advance the ratchet wheel together with the numeral drum, to record the appropriate number, and the contacts N will be opened. When the dial finally returns to its stop, the contacts J will be broken and the magnet coil of CR1 de-energised.

A similar procedure will occur when the "units" number is dialled and pulses will cause the counter CR2 to indicate the appropriate number, and contacts O and P will open; also contacts M will close and open again to operate the zero resetting relay coil ERC1 of counter unit 213 to ensure this counter is set at zero before counting commences. In addition, the final run-back of the "units" dial will momentarily close switch SW7, which will start the driving motor of the machine by completion of the following circuit: 110 volt tapping on transformer/rectifier; switch SW7; closed contacts G of relay R5; closed contacts D of relay R3; magnet coil of relay R2 and thence back to the mains supply. The effect of the energization of the magnet coil in R2 will cause contacts E, A, B and C to close simultaneously with the result that the mains current supply is completed to the driving motor 54 via the contacts E, and also that the 110 volt supply to the relay coil in R2 will be maintained via contacts A after switch SW7, in dial unit 212, returns to its normally open position. Notes will now be drawn from the stack by the oscillating suction arm 13 and fed into the primary and secondary feed rollers as previously described. Satisfactorily notes will pass between the counting rollers 33 and 34 and a mo-

mentary break in the 52 volt D.C. circuit will occur at the shaft 23 at the passing of each note.

As the machine continues running, each pulse from the counting rollers 33 and 34 will cause the magnet coils ERC2 and CR3 to increase the counters 213 and CR3, one unit and via the closed contacts C of relay R2, the magnet coil in CR2 will cause the "units" counter to decrease.

If a one-figure quantity has been selected (viz. using dial unit 212 only) the contacts O and P will close upon the numeral wheel in CR2 reaching zero and will stop the machine in the manner that will be described later. Alternatively, if a "tens" and "units" quantity has been selected, the contacts will momentarily close when the "units" counter passes zero, but the machine will continue running as the contacts N, in CR1 will still be open. In addition, the contacts O will also momentarily close and a single pulse will be transmitted via the contacts B in R2 to the "tens" counter CR1 and decrease this through one increment. It should be noted that as counting proceeds the numeral showing in CR2 will reduce from the quantity as dialled, by one increment per count, and in a similar manner the "tens" numeral in CR1 will decrease by one increment on each pulse from the contacts O in CR2.

When the selected quantity of notes has passed through the rollers 33 and 34, the counter units CR1 and CR2 will both indicate zero and contacts N and P will be closed and the 110 volt circuit will be thereby completed to energise the coil 95 in relay R4 and close the contacts F to light the pilot light 208 and also to arrest the movement of the oscillating suction arm. At the same instance the second circuit to the magnet coil in relay R5 is completed and, when this coil is energised, the contacts G will open and thus the continuity of current supply to the relay coil R2 will be broken with the result that contacts E, A, B and C open, thus stopping the driving motor 54. The machine is now in a set condition for the dialling and issuing of further quantities of notes, and will continue to run until the last note in the stack has been fed, after which a circuit will be completed between contact 214 and the frame of the machine. This circuit will energise the magnet coil in relay R3 which will open the contacts D and break the circuit to the relay R2 and thus stop the machine in a similar manner as already described.

In the event of feeding multiple or folded notes into the machine, the excess thickness will cause a deflection of the shaft 16, carrying the upper gauging primary feed roller 24, in the manner as already described, which will close the contacts of the microswitch 76 to allow mains current to energise the rejector solenoid 79 to cause diversion of the said notes. The opening of this switch is mechanically delayed to allow the deflected notes to clear the deflector plate. During operation of the solenoid 79, the two-position switch SW8 changes over by means of a leaf spring (not shown) on the deflector shaft. The effect of this is to energise momentarily the solenoid 95 in R4 and arrest the oscillating suction arm for at least one cycle to provide a gap in the following flow of notes until the deflector plate has been fully returned to the straight-through or non-operative position. At the same instant the contacts F will momentarily close and flash the pilot light 208. A further purpose of arresting the oscillatory suction arm during deflection is that, if a damaged note should become entangled in the deflector mechanism, the flow of notes will be held back until the machine is switched off and the tangled note released.

The method of operation to enable the machine to count or issue quantities of a hundred notes without dialling will now be described. The dial units CR1 and CR2 must first be zeroised and the selection switch 210 then opened to the "count" position as shown in the diagram to isolate the dialling units etc. by means of switches SW1 and SW2. The accumulative counter CR3 must be manually reset to zero, if necessary. Upon momentarily closing the spring loaded switch SW4, the following 110 volt circuit will be completed: 110 volt tapping of transformer; closed contacts N and P; switch SW4; closed contacts G of relay R5; closed contacts D of relay R3; magnet coil of relay R2 and thence to the mains supply. The contacts E, A, B and C will simultaneously close when the magnet coil of R2 becomes energised and the driving motor will start.

Upon release of the switch SW4, continuity of the current supply to the magnet coil of R2 will be maintained via the closed contacts A and the machine will continue to run.

As the notes pass through the counting rollers, breaks of current continuity will occur in the 52 volt D.C. circuit to the accumulative counter CR3 and upon this registering 99½ a projection will close the contacts Q momentarily and two circuits will be completed in the 110 volt supply to de-energise the relay R2 and thereby stop the driving motor and thus arrest the oscillating suction arm. These two circuits take the following common path from the 110 volt tapping on the transformer; the closed contact N and P of CR1 and CR2 respectively to the contacts Q; through Q to energise the relay coil of R5 and back to the mains supply. This will cause the breaking of the contacts G and stop the motor in the manner as already described and also closes the contacts H. In the latter circuit, the contacts will pass current to the arrester arm magnet coil 95 in relay R4. It should be noted that as the 100th note leaves the counting rollers, continuity is again maintained between the rollers and the energisation of the magnet coil of CR3 will advance the counter by a half to register the correct total of 100.

Upon depressing the switch SW4 for a further issue of a hundred notes continuity through the contacts H of relay R5 is broken and the coil of R5 becomes de-energised and the cycle is repeated. The operations of the contacts for stopping the machine, when the supply of notes is exhausted and also for rejecting notes of multiple thicknesses are identical to the first example described for selecting desired quantities of notes.

To compensate for deflected notes in the accumulative total counter, a spring-loaded switch SW6 is provided to enable the operator manually to advance the counter according to any faulty notes that may be finally added to the batch.

What I claim is:

1. A machine for the high speed feeding of sheets of paper comprising means for supporting a stack of sheets on edge, with the sheets substantially vertical; a pair of power driven feed rollers one of which has a deeply cut away periphery, which rollers coact intermittently to provide a nip in a plane approximately at right angles to the plane of the sheets in the stack; an oscillatory sucker arm in continuous fluid communication with a source of vacuum; and means for operating said oscillatory sucker arm to move in an arcuate path between the foremost sheet and said feed rollers whereby each sheet is adhered to said sucker arm in turn adjacent one edge, and is turned into the space between the one feed roller and the cutaway periphery of the other and the feed rollers thereafter coact to pull the sheet from the sucker arm and to feed it between them.

2. A machine as claimed in claim 1 in which the collecting means comprises a platform provided with a stop and a power driven friction wheel adapted to deliver notes leaving the last pair of secondary feed rollers to said platform.

3. A machine as claimed in claim 2 including means for driving the friction wheel at a peripheral velocity greater than that of the primary and secondary feed rollers.

4. A machine as claimed in claim 1 in which means is provided in association with the sheet or note supporting means for cutting out the drive to all driven mem-

bers of the machine when all the sheets have been removed from said supporting means.

5. A machine as claimed in claim 1 in which the rejecting means is pivotally mounted so as to be capable of movement from an inoperative to an operative position, electrically operated means being provided for preventing sheets being fed to the primary feed rollers when said rejecting means is in its operative position.

6. A machine according to claim 1 including sheet rejecting means in the path of sheets fed by said feed rollers; detecting means comprising a roller mounting shaft, a journal block mounting one end of said shaft for rotation, a fixed guide mounting said journal block for movement toward and away from a sheet passing in contact with the shaft mounted roller, and means operable in response to movement of said journal block in said guide caused by contact of a sheet exceeding a predetermined thickness with said shaft mounted roller for operating said rejecting means.

7. A machine as claimed in claim 1 in which electrically operated means are provided for cutting out the drive to the primary and secondary feed rollers and oscillatory means when a predetermined number of notes have passed the counting means.

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