March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 1

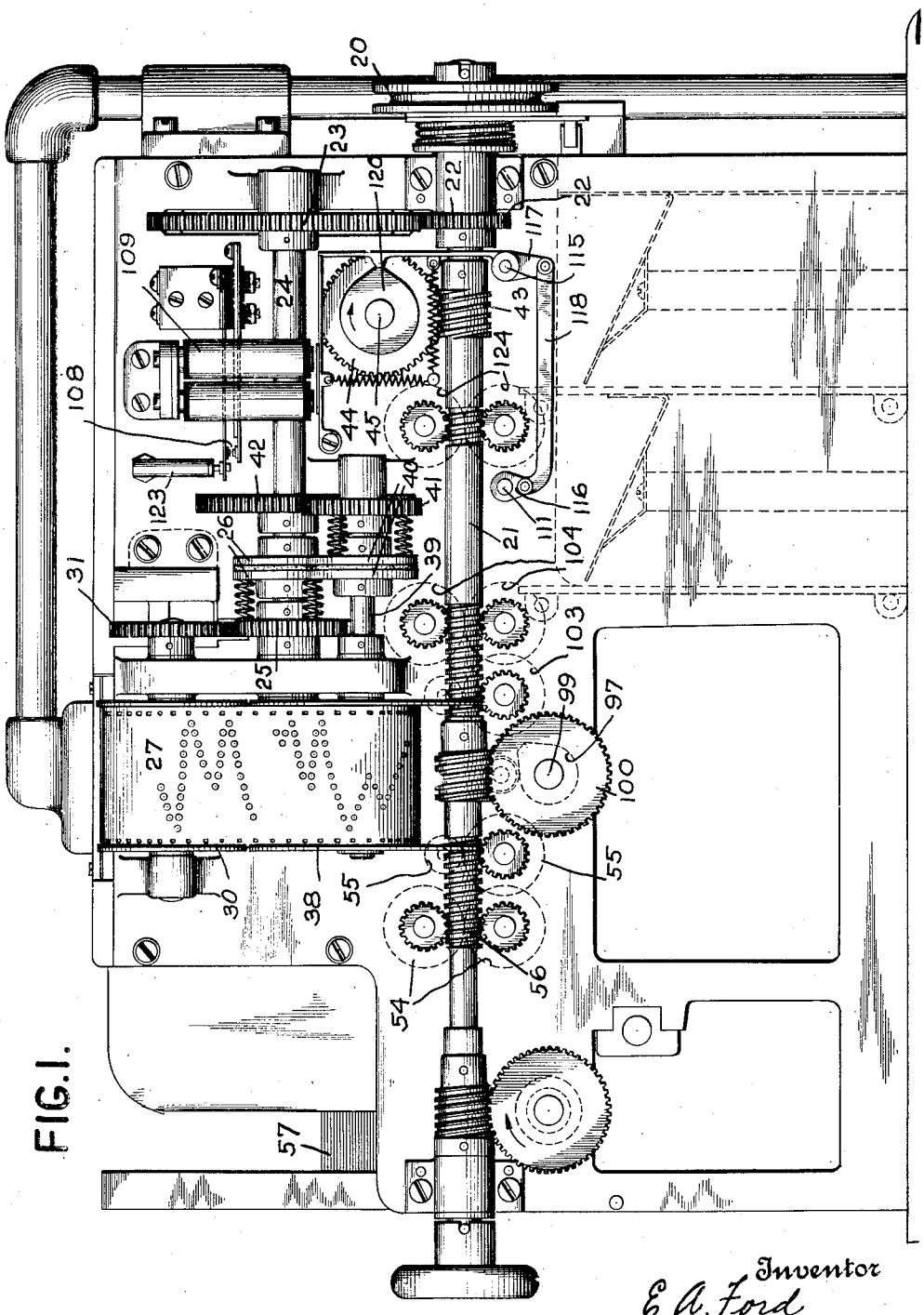


FIG. 1.

Inventor
E. A. Ford
By his Attorney
W. W. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 2

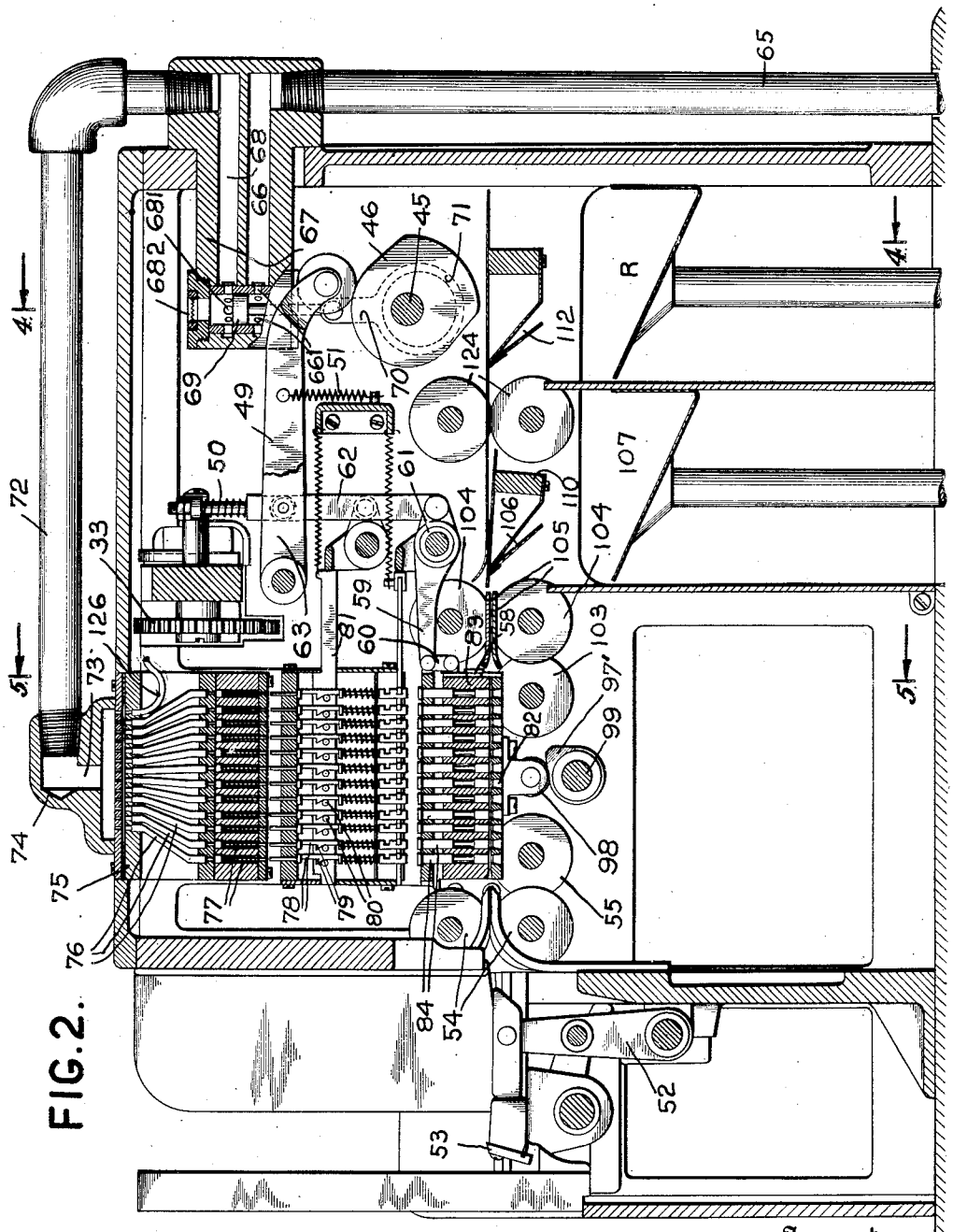


FIG. 2.

Inventor
E. A. Ford
By his Attorney
W. W. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 3

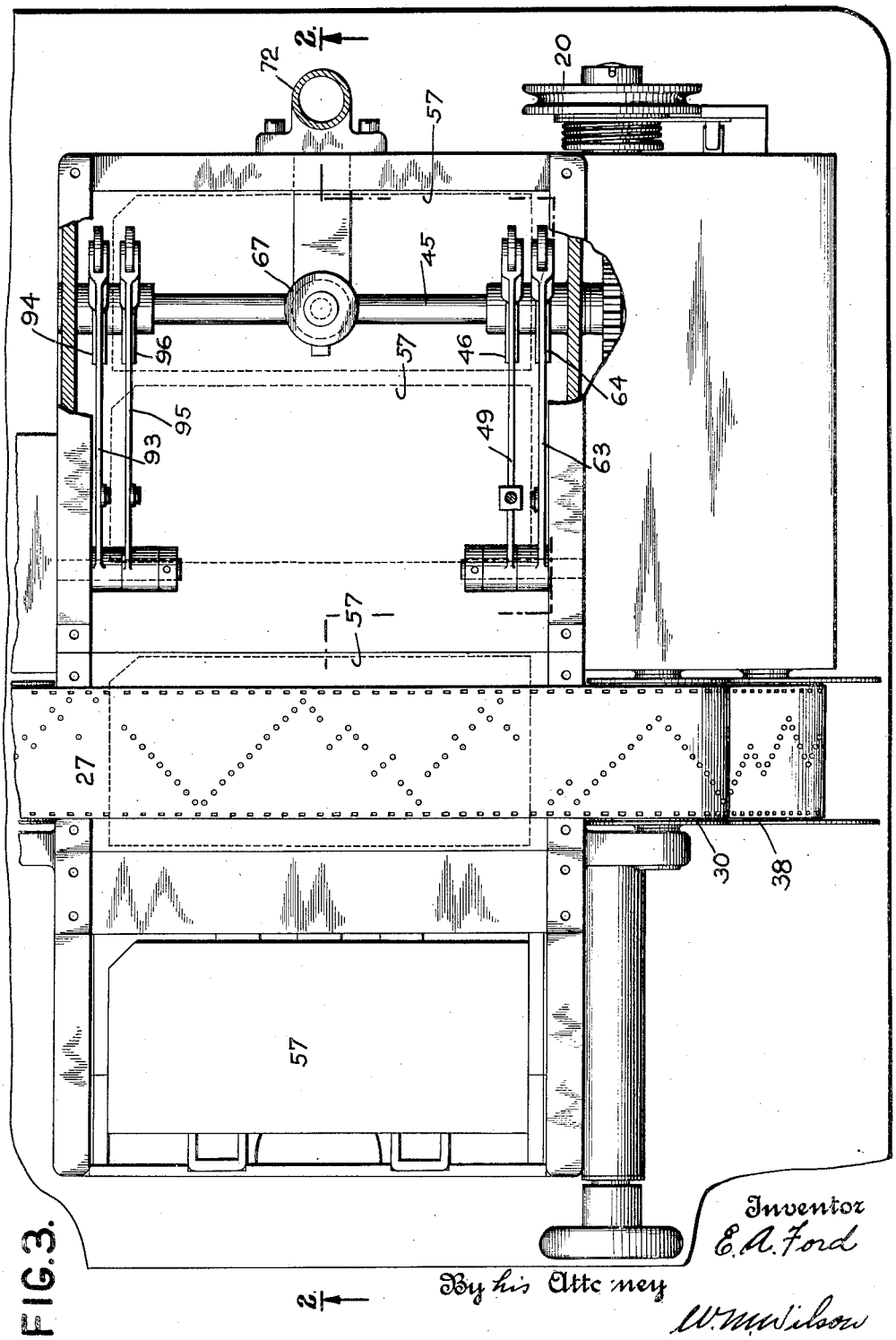


FIG. 3.

Inventor
E. A. Ford

By his Attorney
W. W. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 4

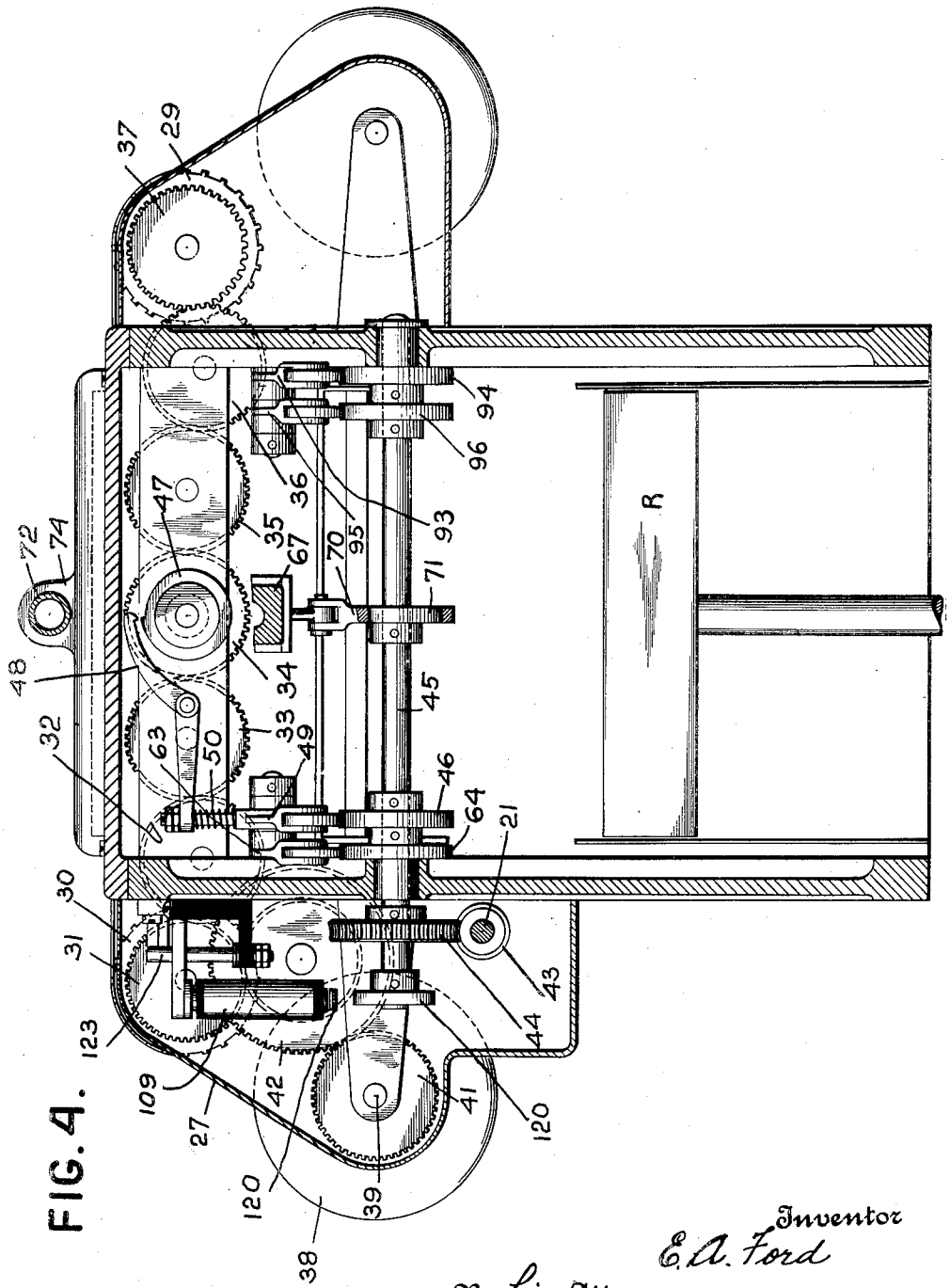


FIG. 4.

Inventor
E. A. Ford
By his Attorney
W. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 5

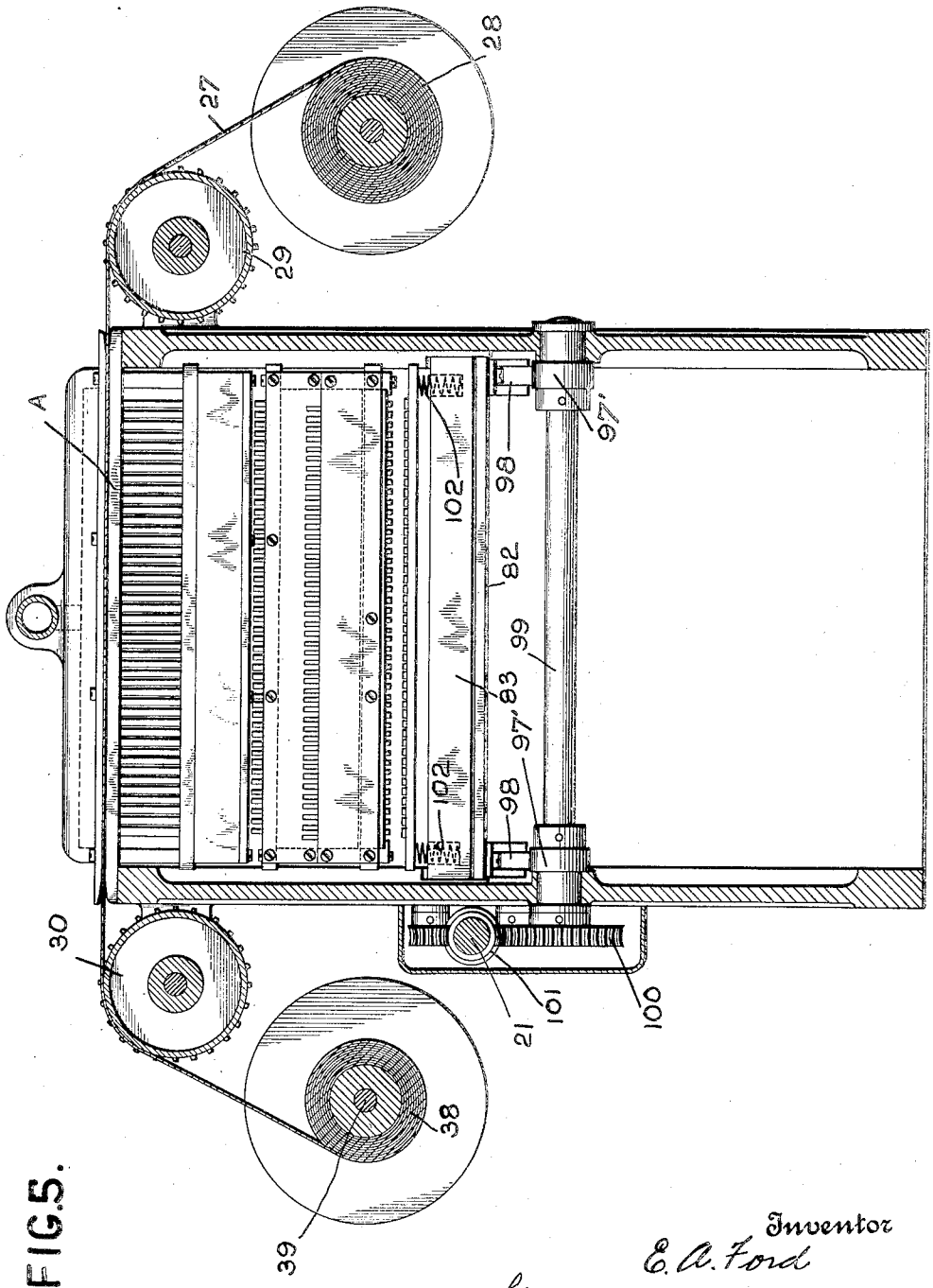


FIG.5.

Inventor
E. A. Ford
By his Attorney
W. M. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 6

FIG.8.

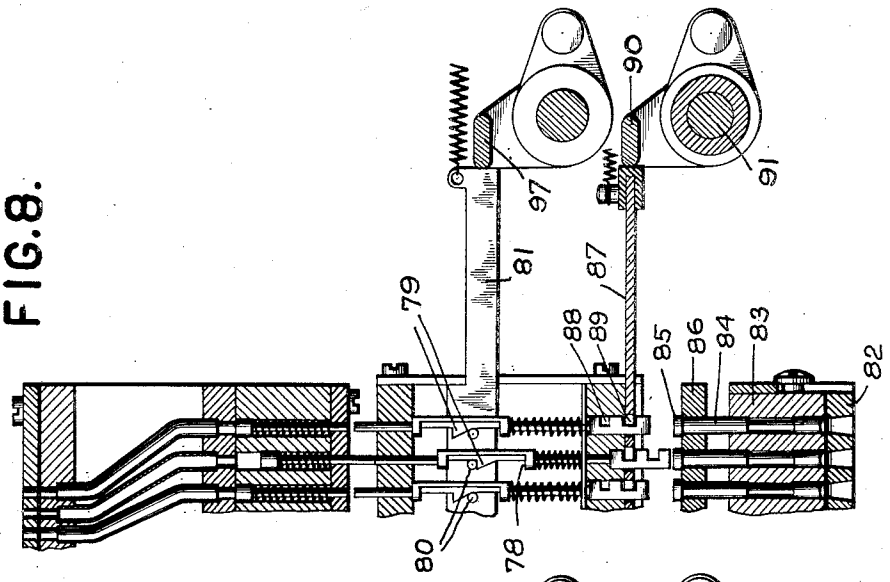


FIG.7.

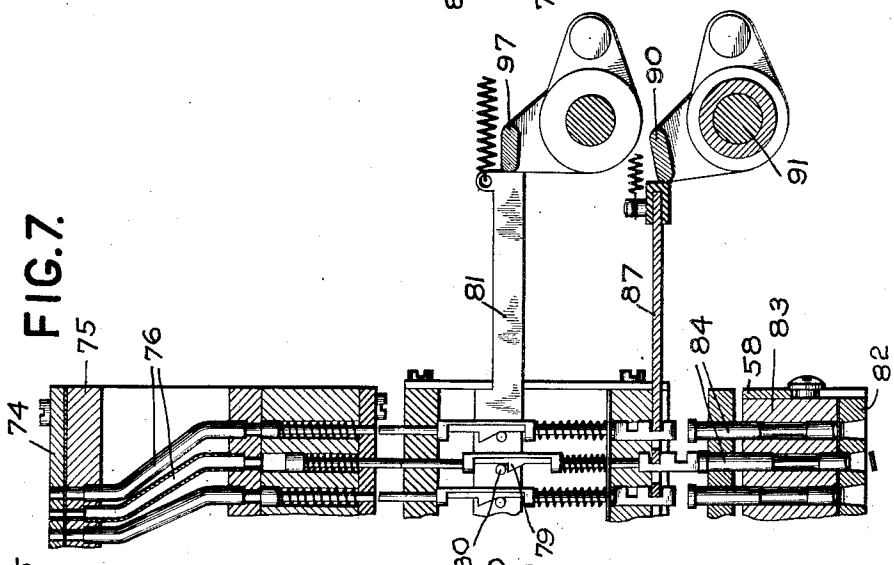
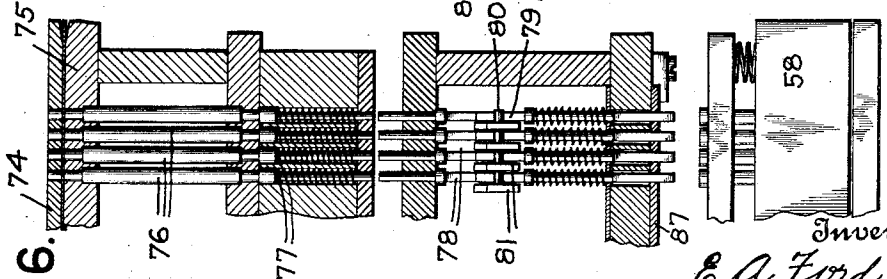


FIG.6.



Inventor
E. A. Ford
By his Attorney
W. M. Wilson

March 21, 1933. E. A. FORD 1,902,064

PERFORATING MACHINE

Filed Jan. 25, 1929 7 Sheets-Sheet 7

FIG. 9.

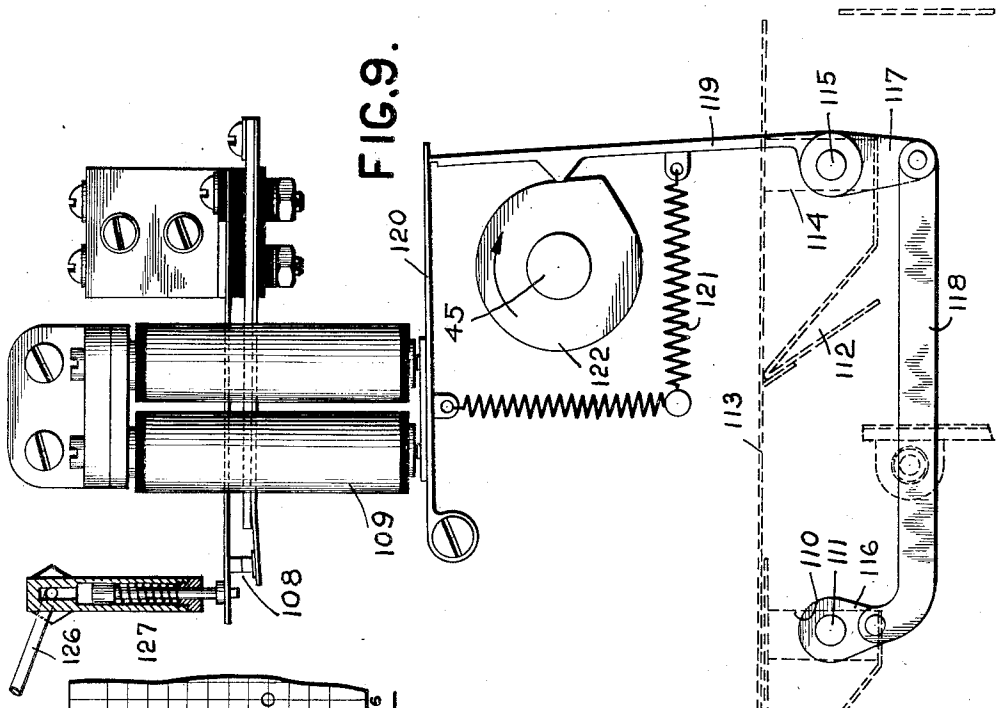


FIG. 10.

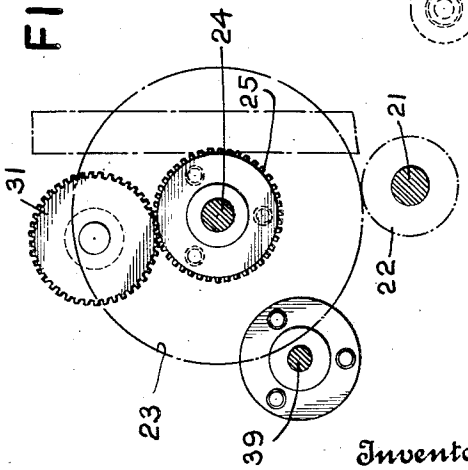
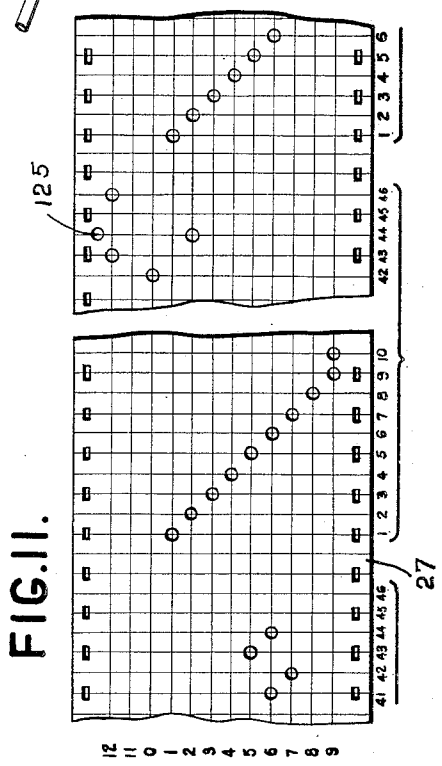


FIG. 11.



Inventor
E. A. Ford
By his Attorney
Wm. Wilson

Patented Mar. 21, 1933 1,902,064

UNITED STATES PATENT OFFICE

EUGENE A. FORD, OF SCARSDALE, NEW YORK, ASSIGNOR TO THE TABULATING MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY

PERFORATING MACHINE

Application filed January 25, 1929. Serial No. 334,882.

This invention relates to card perforating machines and more particularly to the type adapted to effect copies of perforated record sheets or cards.

It has been proposed, heretofore, to provide certain types of accounting machines such as cash registers with a perforating mechanism to perforate a record tape at the time of making a sale. The tape is perforated with characters representing different classification transactions and the amount of such sales. The perforated tape is then passed through the auditing machines to obtain the totals corresponding to the different classification transactions and the tape is passed through the machine once for each segregation desired.

However, it is not possible to obtain totals of sales related to certain ones of a group identified by the same classification characters and this lack of flexibility and other objectionable features militates against the extensive use of such systems. As is generally understood, where the entries are represented by perforated record cards considerable flexibility is possible, since it is a simple matter to sort cards according to any desired classification to subsequently control accounting machines. Aside from the flexibility derived, record cards may contain considerable more data than represented by a perforated tape and are of a form convenient to handle, file and operate with.

It is then the main object of the present invention to prepare in duplicate a record card for each section of a record tape representing a classified entry.

It is a further object of the invention to reject or segregate the cards which are prepared in duplicate from a section of the tape erroneously or improperly perforated, such segregation being controlled either automatically or manually.

Other objects of the present invention will be clearly apparent from the following specification, claims and drawings which disclose a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a view in side elevation of the illustrative machine, the casing having been removed to more clearly illustrate certain parts.

Fig. 2 is a central longitudinal sectional view of the machine taken on the line 2—2 of Fig. 3.

Fig. 3 is a plan view of the machine.

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is a central transverse sectional view taken on the line 5—5 of Fig. 2.

Fig. 6 is an enlarged sectional view showing details of construction of the punching mechanism.

Fig. 7 is another view of the parts shown in Fig. 6.

Fig. 8 is a view similar to Fig. 7 illustrating the parts in an operated position.

Fig. 9 is a view in side elevation showing details of the card rejecting mechanism.

Fig. 10 illustrates details of a part of the gearing associated with the operating mechanism.

Fig. 11 is a plan view of a section of the perforated record strip.

Power for driving the various mechanisms is provided by any suitable motor driving the belt pulley 20 (Fig. 1) rotatable with a drive shaft 21 secured to which is a pinion 22 meshing with a gear 23. The latter is secured to shaft 24 which drives a gear 25 through a pair of friction clutch elements 26, the element rotatable with gear 25 being loosely mounted on shaft 24. As best shown in Fig. 5 the perforated record strip 27 is drawn from a supply roll 28 and is unrolled therefrom by a feeding roller 29 having peripheral projections engaging the usual marginal perforations.

The strip as it leaves roller 29 is presented to an analyzing mechanism A and is subsequently fed by a supplemental roller 30 similar to roller 29. The roller 30 is driven by a gear 31 meshing with gear 25 (see Figs. 1 and 10) while the roller 29 is driven by gear 31 through a gear train (Fig. 4) comprising one to one ratio gears 32, 33, 34, 35, 36 and 37. After leaving roller 30 the strip is rolled about a storage roller 38, the supporting spindle 39 (Fig. 1) being driven by a drive pinion 41 through a pair of friction clutch elements

40, the pinion 41 being in mesh with a gear 42 secured to shaft 24.

Secured to shaft 21 is a worm 43 (Figs. 1 and 4) meshing with a worm wheel 44 secured to a cam shaft 45 which carries a paper feed controlling cam 46. Suitable means now to be described is provided to control the intermittent paper feeding operations. Rotatable with the gear 34 (Fig. 4) is a shouldered disk 47 the shoulder of which is in the plane of the hooked end of a bell crank member 48. The cam 46 (Fig. 2) cooperates with a follower of an arm 49 which imparts motion to the bell crank member 48 through a coil spring 50. In the position shown (Fig. 2) the low point of cam 46 has permitted a spring 51 to rock arm 49 downwardly to raise the hooked end of bell crank member 48 out of engagement with the shoulder of disk 47 to render the paper feeding mechanism operative.

Clutch elements 26 and 40 are now effective to feed the perforated strip and when a certain amount has been fed the high point of cam 46 will rock bell crank 48 reversely so that the hooked end reengages the shoulder of disk 47 to stop the paper feed. During paper feeding operations a record card is fed to the punching mechanism in order that the selected punches may perforate the card in accordance with the perforations in the strip. Any suitable picker mechanism may be provided to feed the cards singly from a hopper and may comprise that shown in the patent to C. D. Lake, No. 1,600,413 dated September 21, 1926.

The arm 52 (Fig. 2) which reciprocates a picker knife 53 to effect card feed may have any suitable driving connections to the operating mechanism. Each card 57 as fed is presented to pairs of feeding rollers 54 and 55 (Fig. 1). Both pairs are driven by a worm 56 secured to shaft 21. When a card 57 is fed to the desired position beneath the punches it is held against further feeding movement by a card gate comprising a card abutment plate 58 (Figs. 2, 6 and 7) suitably guided for vertical movement. A pair of levers 59 secured to a tube 61 and connected to the plate 58 by links 60 are adapted to be operated at the desired time to stop or release a card. Secured to the tube 61 is an arm having a link connection 62 to the arm 63 which carries at its end a follower in continuous engagement with the profile of a cam 64 (Fig. 4) secured to drive shaft 45.

Any suitable type of analyzing mechanism may be provided for sensing the record strip perforations to control the operation of the desired punches. The form employed may be of the pneumatic type herein shown. In detail, air pressure is supplied to an entrance pipe 65 (Fig. 2) which leads to the air entrance 66 of a valve 67 and which has an air communication to the exit 68 when a piston 69 is raised. The piston rod 69 is connected to a plate 70 apertured to receive an eccentrically mounted disk 71 secured to shaft 45. Elevation of the piston at the desired time permits compressed air to flow through perforations 661, through the cylinder and perforations 681 to the exit portion 68 to a connecting pipe 72 which communicates with a pocket 73 of a cap 74. The cap 74 at its lower face has several series of perforations in registration with a similar number of perforations in a plate 75 spaced apart from the cap to permit the perforated record strip to pass therebetween.

When the piston is lowered the cylinder is opened at its upper end to the atmosphere through a screen 682 relieving the air pressure on the record strip. When a perforation of the stationary strip is in registration with an aperture in cap 74 and plate 75 (Figs. 6 and 7) air pressure will flow through a duct 76 to actuate a related spring urged plunger 77. Each plunger when depressed actuates a spring pressed stop rod 78 having a shoulder 79 adapted to engage under a pin 80 of a latch plate 81 to thus lock the actuated stop in depressed position (see Fig. 7). The card when fed is interposed between a die plate 82 and a guide block 83 in which the punches 84 are slidably mounted. The die plate and guide block are spaced apart but move as a unit upwardly to effect punching and when both are in their normal lowered position (see Fig. 8) the heads 85 of the punches 84 rest upon a stationary guide plate 86 to avoid interference with the punches by a card in its transitory feeding movement. When a stop 78 is depressed the lower portion thereof contacts the head of the related punch 84 (see Fig. 8) so that when both the guide block and die are elevated the locked stop 78 will act to indirectly force the punch 84 through the card to perforate it, as clearly shown by a comparison of Figs. 8 and 7. To relieve pins 80 of any strain during the punching operation a slide 87 is positioned so that integral portions move into an interlocking relationship with one of two slots 88, 89 of the stops 78, depending whether a stop is depressed or not, thereby locking all the normally positioned or depressed stops. Movement of the locking plate 87 to accomplish the above is provided by a bail 90 loosely mounted on a stud shaft 91 and having a suitable connection (similar to arm 62; see Fig. 2) to an arm 93 (Fig. 3) actuated by its related operating cam 94. The latch plate is moved by a bail 97 (Fig. 8) which has a similar connection to its related operating arm 95 (Fig. 3) which, in turn, is actuated by its related cam 96. When the latch plate 81 is shifted it will release those stops 78 which have been locked in depressed position.

The preferred means for elevating the guide block and die plate comprises a pair of

cams 97' (Figs. 2 and 5) acting upon rollers 98 carried by the die plate 82. For the purpose of driving the cams 97', the cam shaft 99 carries a worm wheel 100 in mesh with a worm 101 secured to shaft 21. Guide block 83 and die plate 82 are restored by springs 102 (Fig. 5) previously compressed during the punching operation.

After the punching operation has been completed the card abutment 58 is elevated permitting sets of driven rollers 103 and 104 to feed the card between guide plates 105 (Fig. 2). The punched card in its feeding movement strikes a deflector plate 106 which guides it to the receiving hopper 107. The cycle of operation is thereafter repeated effecting a punched card which is a duplicate of the sections of the perforated strip.

It sometimes happens that the perforated strip is improperly perforated and since a card will nevertheless be prepared it is desirable to reject such cards in order to render it unnecessary for the operator to manually select such cards from the group of punched cards. The sections of the record strip which are improperly perforated may be marked "Void" or bear some similar identifying marking. When such as section appears the operator may depress a suitable button to close a set of contacts 108 (see Fig. 9) to energize a magnet 109. The deflector plate 106 is secured to a bar 110 which is pivoted by a rod 111 at its ends so that at the normal position of bar 110 (Fig. 2) the deflector will guide the card to the receiving hopper 107.

Associated with the reject station R is an angular deflector plate 112 and a guide plate 113 both carried by a fixed block 114. A link 118 at one end is connected to an arm 116 secured to rod 111 and at its other to an arm 117 loose on a rod 115. Extending upwardly and secured to the rod 115 is an arm 119 which is normally latched by the armature 120 of magnet 109 (see Fig. 1) and when this latching relationship exists deflector 106 (see Fig. 2) guides the cards to the hopper 107. Upon energization of the magnet 109 a spring 121 is effective to shift the deflector plate 106 to the position shown in Fig. 9 lowering it so that the card is fed by rollers 104 over a horizontal plate which is beneath the plate 113. A pair of feeding rollers 124 (Fig. 2) then convey the card until it strikes the deflector plate 112 which guides the cards to the reject station R. Arm 119 is shifted to be relatched by the armature 120 by a cam 122 secured to drive shaft 45.

While the control of the card rejecting mechanism may be manually effected it is pereferable to control it automatically and in the preferred embodiment the presence of a special card reject perforation 125 (Fig. 11) effects the rejection of the card. It will be observed that this perforation is outside of the field of data representing perforations to permit fluid pressure to flow in a tube 126 connected to a piston device 127 (Fig. 9) the piston rod of which is adapted to close the contacts 108 and automatically effect the rejection of the card in the manner just explained.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims:

I claim:

1. A machine for punching record cards in accordance with a perforated pattern record, a punching mechanism having punching pins and coordinated selectors shiftable to engage and hold said pins for a punching operation, pneumatic controlled means for shifting said selectors, said pneumatic controlled means being under the control of said perforated pattern record and means comprising a bar for locking said selectors preliminarily to a punching operation.

2. A machine for punching record cards in accordance with a perforated pattern record, a punching mechanism including punching pins coordinated with the index points of the card to be punched, selectors shiftable to coact and hold said punching pins against movement for a punching operation, means comprising individual elements, one for each selector to effect a coaction between said punching pins and said selectors, and a common bar to lock the shifted selectors, whereby said punching pins are held to punch the card in accordance with said pattern record.

3. In a machine for punching record cards in accordance with a perforated pattern record, a punching mechanism including punching pins, a pneumatically actuated controlling element for each pin, said element being under the control of said perforated pattern record, an interposer movable independently of the pin between each controlling element and punching pin to hold the pin for a punching operation, and a bar for locking the interposer in shifted position.

4. In a machine for punching record cards in accordance with a perforated pattern record, a punching mechanism including punching pins, a pneumatically actuated controlling element for each pin, said element being under the control of said perforated pattern record, an interposer between each controlling element and punching pin, a bar shiftable in a notch of the interposed to lock said interposer in its actuated position so that said pins are held to effect a punching operation,

and means to release said interposer by shifting said bar when punching of the record card has been effected.

5. A machine according to claim 4 wherein said controlling element comprises a resiliently returned plunger in combination with a plate having holes for guiding a plurality of controlling elements.

6. In a machine for punching record cards in accordance with a perforated pattern record, a punching device including punching pins, a pneumatically actuated controlling element for each pin, said element being under the control of said perforated pattern record, an interposer between each controlling element and punching pin set for direct engagement with said punching pin by the actuation of the related controlling element, means for simultaneously locking the set interposers in their active positions directly against the pins and the remaining interposers in an inactive position out of cooperation with the pins during a punching operation, and means to release said locking means after a punching operation.

7. In a machine of the character described, means for punching record cards in accordance with a section of a pattern strip, means to distribute the punched cards into different receptacles, and control devices whereby said distributing means is under the control of a predetermined index point position of said pattern strip alone.

8. In a machine of the character described, means for punching record cards in accordance with a section of a perforated pattern strip having a plurality of index point positions and a special designating perforation, means to guide a punched card into one of two receptacles, and pneumatic means under the control of said designating perforation alone and adapted to control said guiding means.

9. In a machine of the character described, means for punching record cards in accordance with a section of a perforated pattern strip having a predetermined designating perforation, a magnet controlled means adapted to distribute the punched record cards in one of two receptacles, contact means for said magnet, said contact means being under the control of a pneumatically actuated element controlled by said designating perforation of the pattern strip alone.

10. In a machine for transferring data from several successive and separate sections of a perforated record strip in web form, means to analyze at a single operation all the perforations in a separate section of the strip, a punching mechanism controlled by said analyzing mechanism and settable to effect the simultaneous punching upon a single record card of all the data upon the section of the strip analyzed to thereby designate like data, a roller carrying a supply of said record strip, means to feed the record strip from said roller a distance equivalent to a section of the strip after the completion of the punching of a record card, and means for limiting the extent of feed of the strip to the length of one section.

11. In a machine for transferring data from each of a series of successive and separate sections of a perforated record strip in web form, means to analyze at a single operation all the perforations in a section of the strip, a punching mechanism controlled by said analyzing mechanisms and settable to effect the simultaneous reproduction upon a single card all the perforations of the section of the strip analyzed to designate the same and like controlling data, a roller carrying a supply of said strip, automatic means for limiting the feeding of the strip from the roller an extent equivalent to a section of the strip after a punching operation, and automatic means effective after a punching operation to present a card to the punching mechanism.

12. A machine for punching records in accordance with sections of a continuous strip each section having a predetermined number of columns of perforations, an analyzing mechanism for analyzing at a single operation all the perforations in a section, means controlled by said analyzing mechanism for correspondingly setting punches to punch at a single operation a corresponding number of columns of a record card, a supply roller carrying the strip and means for cyclically and automatically limiting the feeding of said strip from the roller to an amount equivalent to the length of a section thereof for each record presented to the punching mechanism.

13. A machine for punching records in accordance with sections of a continuous strip each section having a predetermined number of columns of perforations, an analyzing mechanism for analyzing at a single operation all the perforations in a section, means controlled by said analyzing mechanism for correspondingly setting punches to punch at a single operation a corresponding number of columns of a record card, means to feed record cards singly to said punching mechanism, frictional feeding means operated in correspondence with the record card feeding means for intermittently and automatically feeding the strip, and means for limiting the amount of feed equivalent to the length of a section to bring a new section into controlling position after each punching operation.

14. In a machine for transferring data from successive sections of a strip each section comprising a plurality of adjacent columns, an analyzing mechanism for simultaneously analyzing the perforations of a section of the strip, a punching mechanism set-

table by a single analyzing operation and operative to effect a simultaneous punching of a record card in columns arranged exactly like the section of the strip, means for rendering the punching mechanism operative when a record is in punching position, a storage roller, a supply roller means to feed the record strip from the supply roller to the storage roller a distance equivalent to the length of a section to present a successive section to said analyzing means after each record punching operation, and means including a rotatable element for measuring the length of strip fed and limiting it to a section.

15. A machine for punching record cards in accordance with perforations in a plurality of adjacent columns of a section of a strip, a corresponding number of columns of punches, means for simultaneously analyzing a section of the strip at a single operation to effect a setting of the corresponding punches, means whereby the set punches effect at a single operation a punching of the record card, means for feeding records singly to said punching mechanism, a supply roller carrying the controlling record strip, a storage roller and frictional means for intermittently feeding said strip from the supply roller and simultaneously to the storage roller a distance equivalent to the length of a record section of said strip.

16. In a machine for punching record cards in accordance with a perforated pattern record, a punching device comprising a plurality of punching pins, a selecting element for holding each pin for a punching operation, plungers for actuating said selecting elements, air supply pressure means including ducts leading to the plungers in which ducts the passage of air is controlled by perforations in a record strip to determine which of said plungers and correlated selecting elements shall be simultaneously actuated, and a common bar for locking a plurality of actuated selecting elements prior to punching by the punching pins.

17. In a machine for punching records in accordance with a pattern sheet consisting of separate sections, a punching mechanism comprising rows of punches, rows of punch selectors actuated to hold said punches for a punching operation, valve means periodically operated to pneumatically analyze by air pressure a plurality of columns of the pattern sheet simultaneously whereby the corresponding punch selectors are actuated simultaneously, mechanical means for retaining the selectors in actuated position irrespective of cutting off the air pressure by the valve means and means for periodically operating the valve means for each analyzing operation.

18. The invention according to claim 17 wherein individual plungers actuate the selectors, and said valve means comprises a plunger reciprocally movable in a cylinder having openings to connect an air supply to selectively actuate the individual plungers in accordance with a plurality of columns of perforations of the sheet in one position of the valve plunger, and to cut off air pressure to the individual plungers in another position of the valve plunger.

19. In a punching apparatus, a punching mechanism settable and effective at a single operation to reproduce on a card the perforations in a section of a perforated strip, an analyzing device for simultaneously sensing the perforations of a complete section to correspondingly set the punches, a pair of rollers positioned adjacent each side of said analyzing device, means for driving both of said rollers to feed said strip after each punching operation and means movable with the driving means for limiting the feed of the strip to a section of predetermined length.

20. In a punching machine, a punching mechanism settable and effective to punch at a single operation a plurality of columns of an individual card, a pneumatic analyzing device for simultaneously sensing a plurality of columns of perforations of a section of a continuous strip, means for feeding to said analyzing device means for controlling the feeding means to effectively limit the length of feed to an extent equivalent to a section, and a storage roller driven by the feeding means for receiving the perforated record.

21. In a punching machine, a punching mechanism settable at a single operation for punching a plurality of columns of an individual card, an analyzing device for sensing the plurality of columns of a record strip while at rest, said strip having marginal perforations, rollers at each side of said analyzing device having projections engaging said marginal perforations, and devices for driving said rollers, and means correlated with the rollers to effectively limit the extent of the feed to a predetermined length of strip for each analyzing operation.

22. The invention according to claim 21 further characterized by the provision of a storage roller receiving said strip and driven by said driving devices.

23. In a punching machine, a punching mechanism settable only once for each section of a record strip to reproduce by a single operation perforations of a section of a strip upon an individual card, an analyzing device for analyzing at a single operation a plurality of columns of the strip comprising a section thereof, means for ejecting a punched card after each punching operation and introducing a new work card to the punching mechanism, means for feeding a subsequent section of the strip to the analyzing device whereby the new work card is per-

forated under control of the subsequent section of the strip and means for limiting the extent of feed of the strip for each machine operation to a predetermined length.

24. In a machine for punching record cards in accordance with a perforated pattern strip, a punching mechanism, means to control the punching mechanism by a section of the pattern strip, means for feeding record cards to and from said punching mechanism, a drive comprising a pair of frictionally engaged elements for feeding the pattern strip into controlling position, a control disk, and means comprising a pawl correlated with the control disk for limiting the feed of the pattern strip to the length of a controlling section.

25. A machine for punching record cards in accordance with a perforated pattern strip, a punching machine including punches, punch selectors, pneumatic means effective upon the analyzing of perforations in a section of a pattern strip for controlling the punch selectors, means for feeding a record card to the punching mechanism, means for feeding a section of the pattern strip to control the punch selectors, and means comprising a plate engageable with a plurality of selectors for locking said selectors during the punching of the card.

In testimony whereof I hereto affix my signature.

EUGENE A. FORD.