Jan. 31, 1956 W. T. GOLLWITZER 2,732,793

SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 1

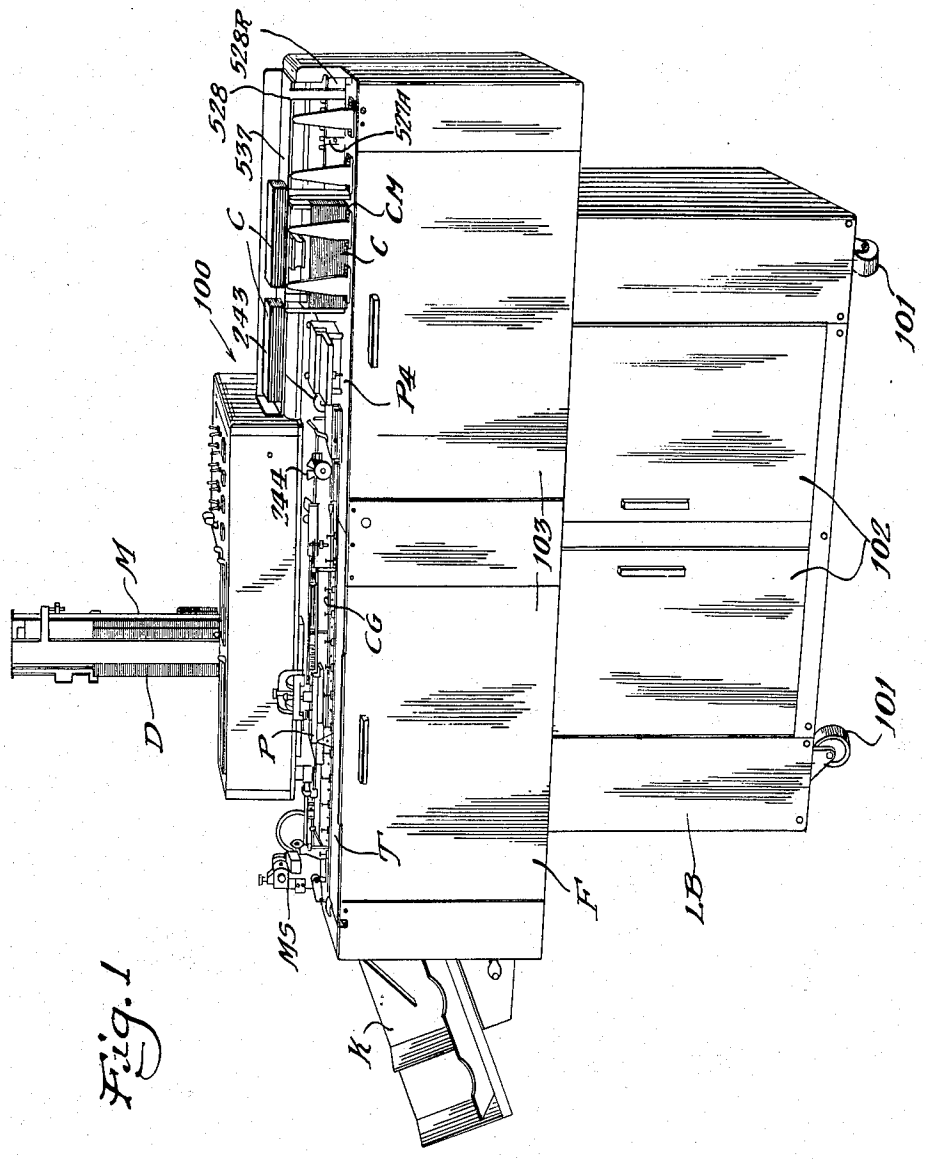


Fig. 1

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 2

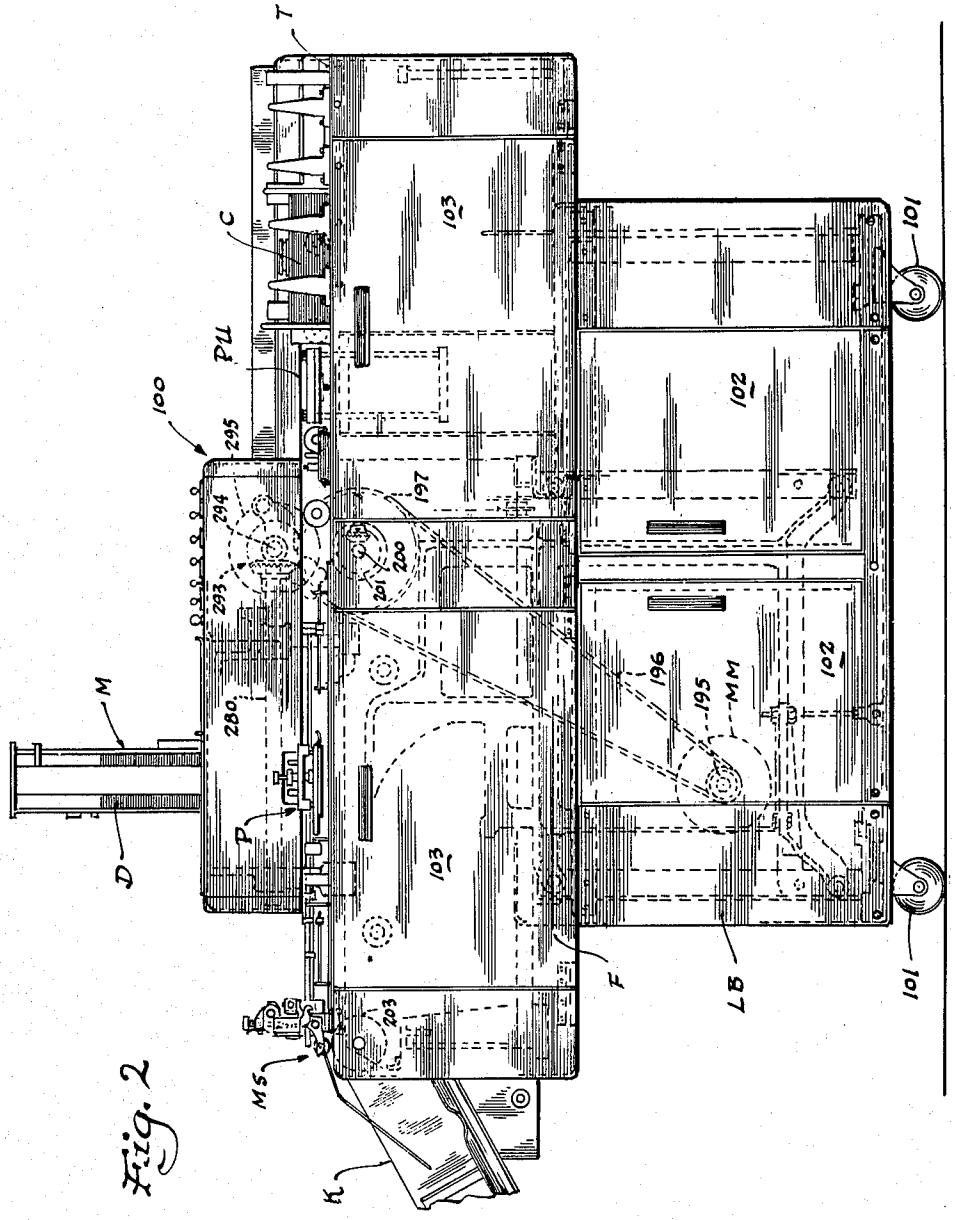


Fig. 2

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 3

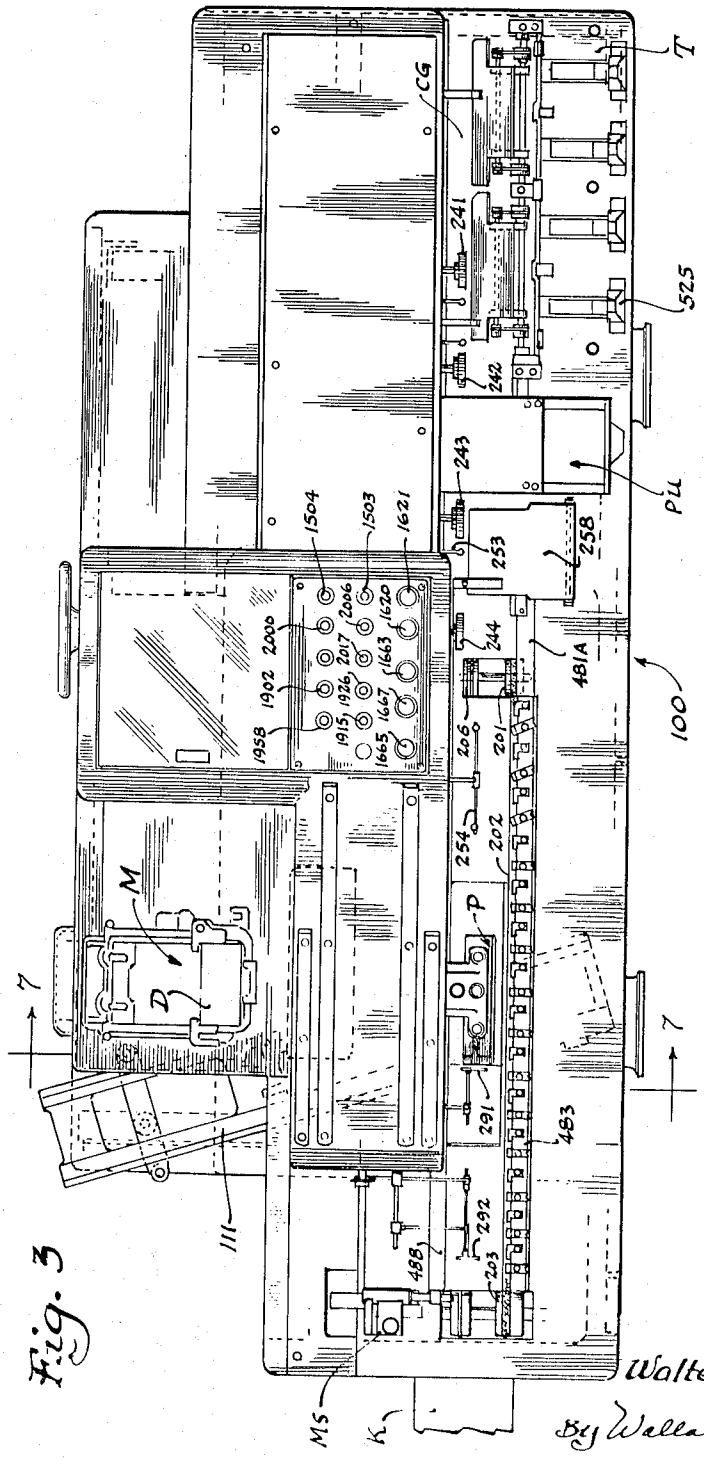


Fig. 3

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 4

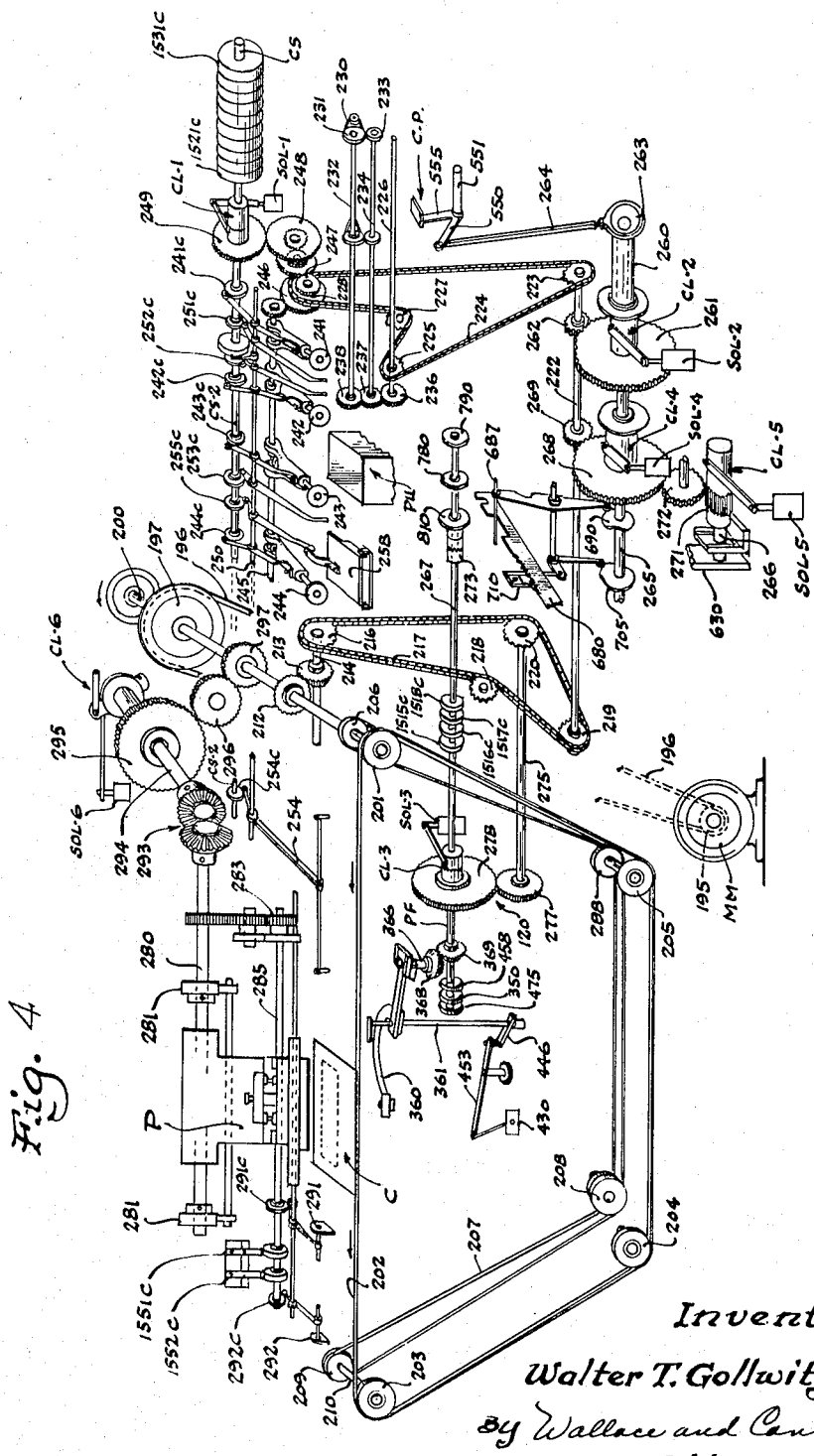


Fig. 4

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 5

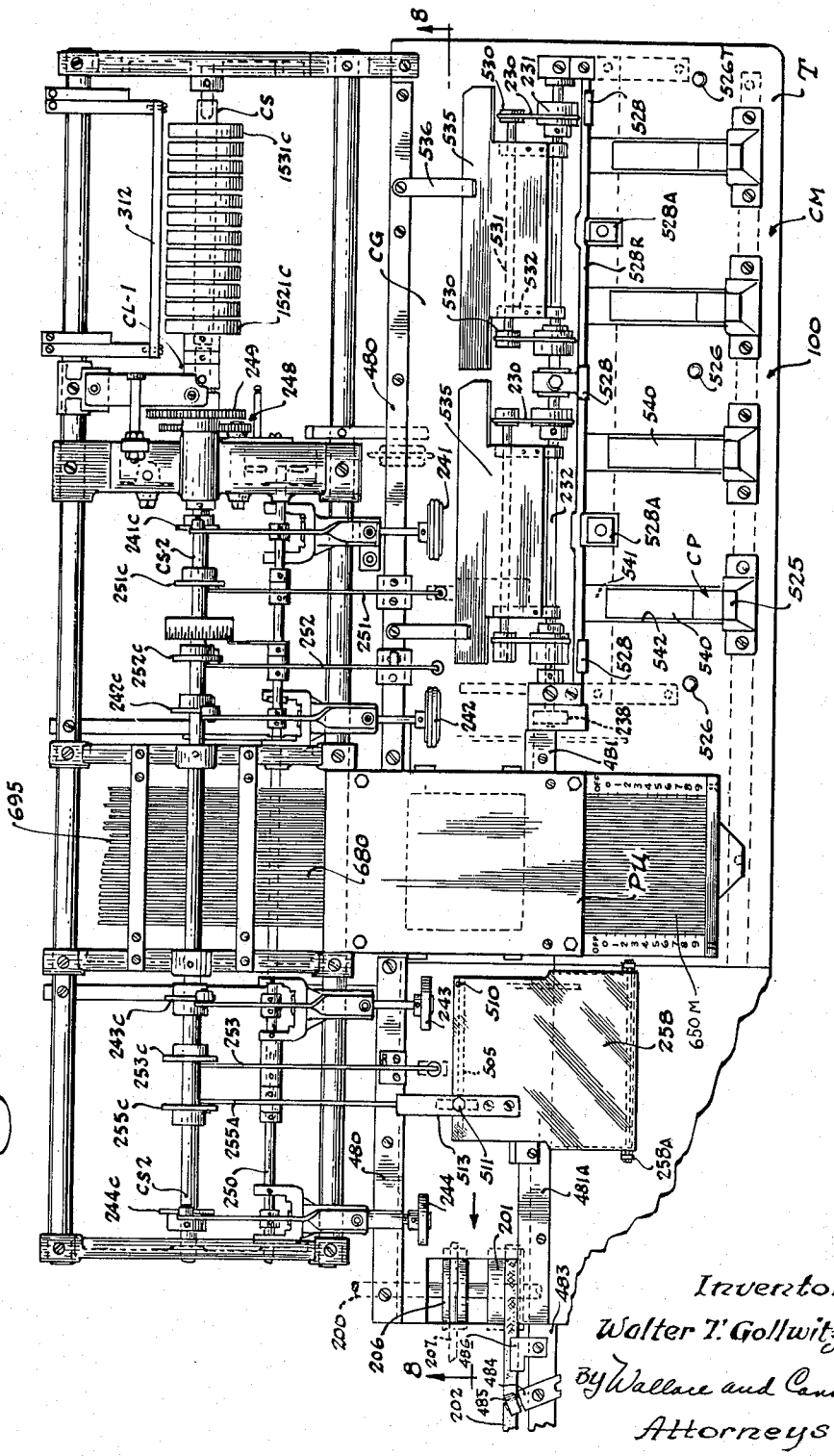


Fig. 5

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 6

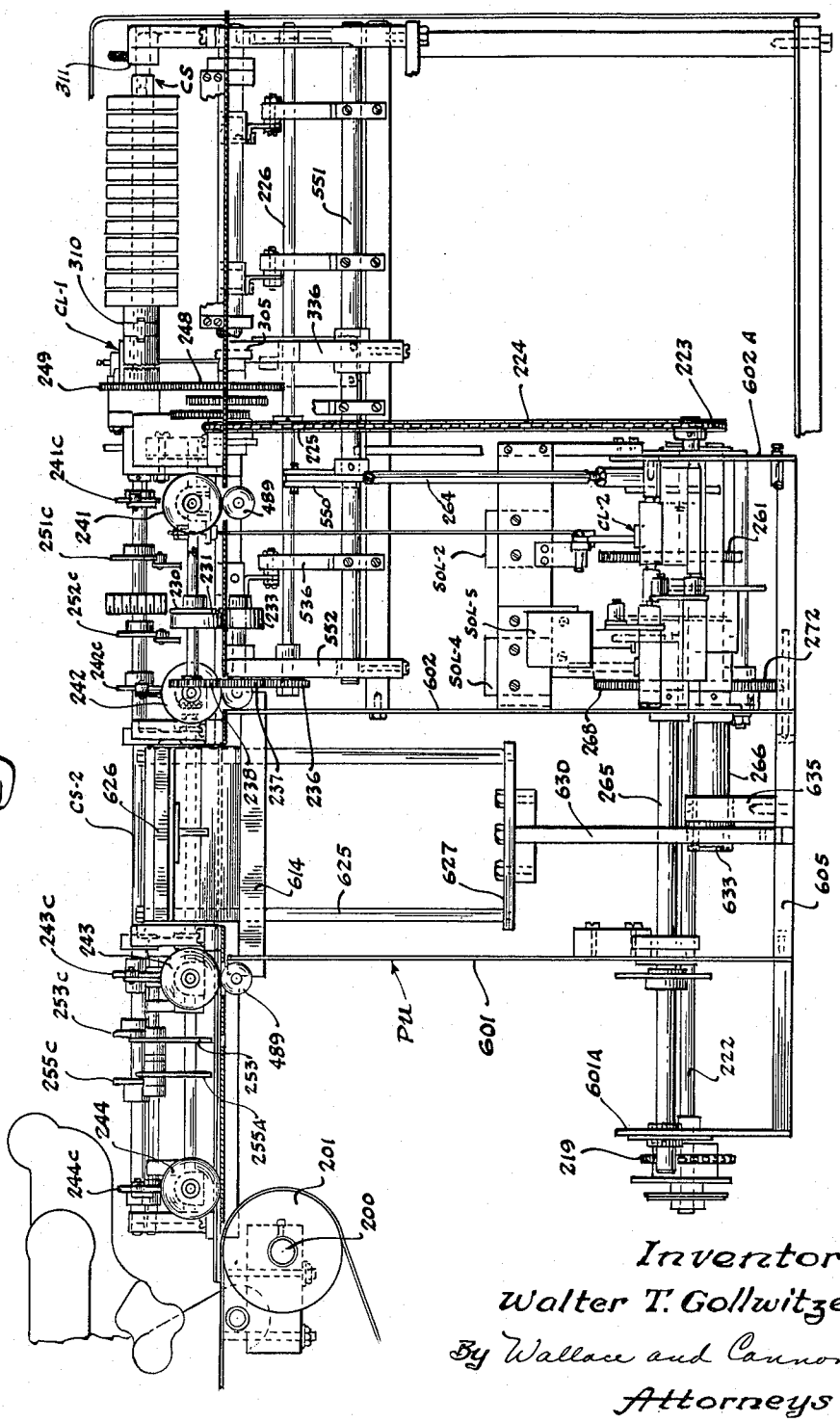


Fig. 6

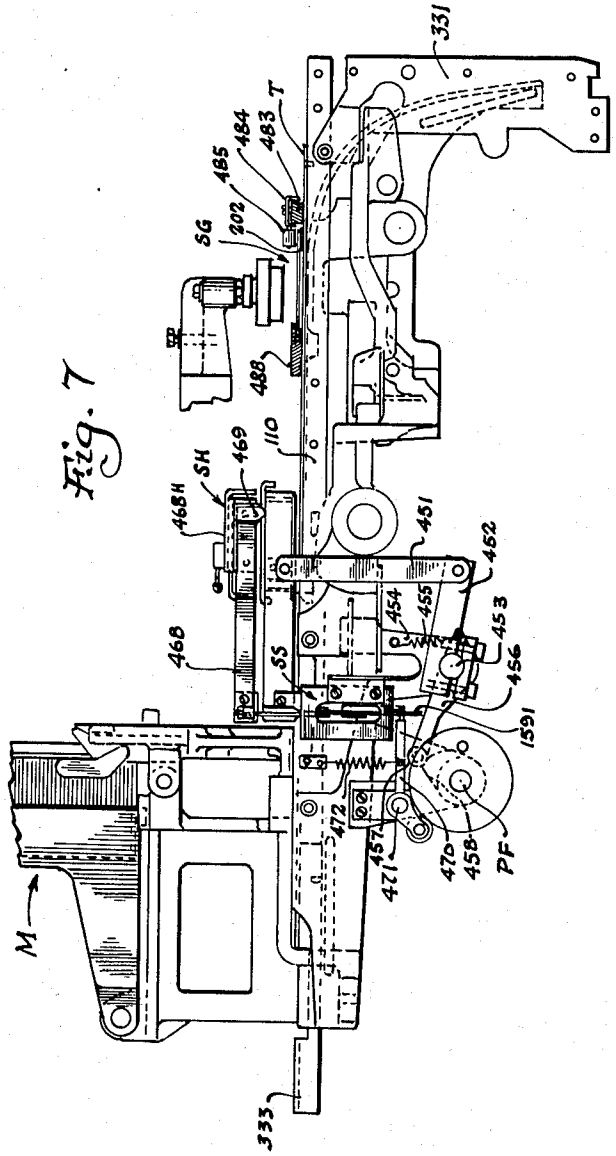
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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 7

Fig. 7



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Original Filed Dec. 16, 1950 10 Sheets-Sheet 8

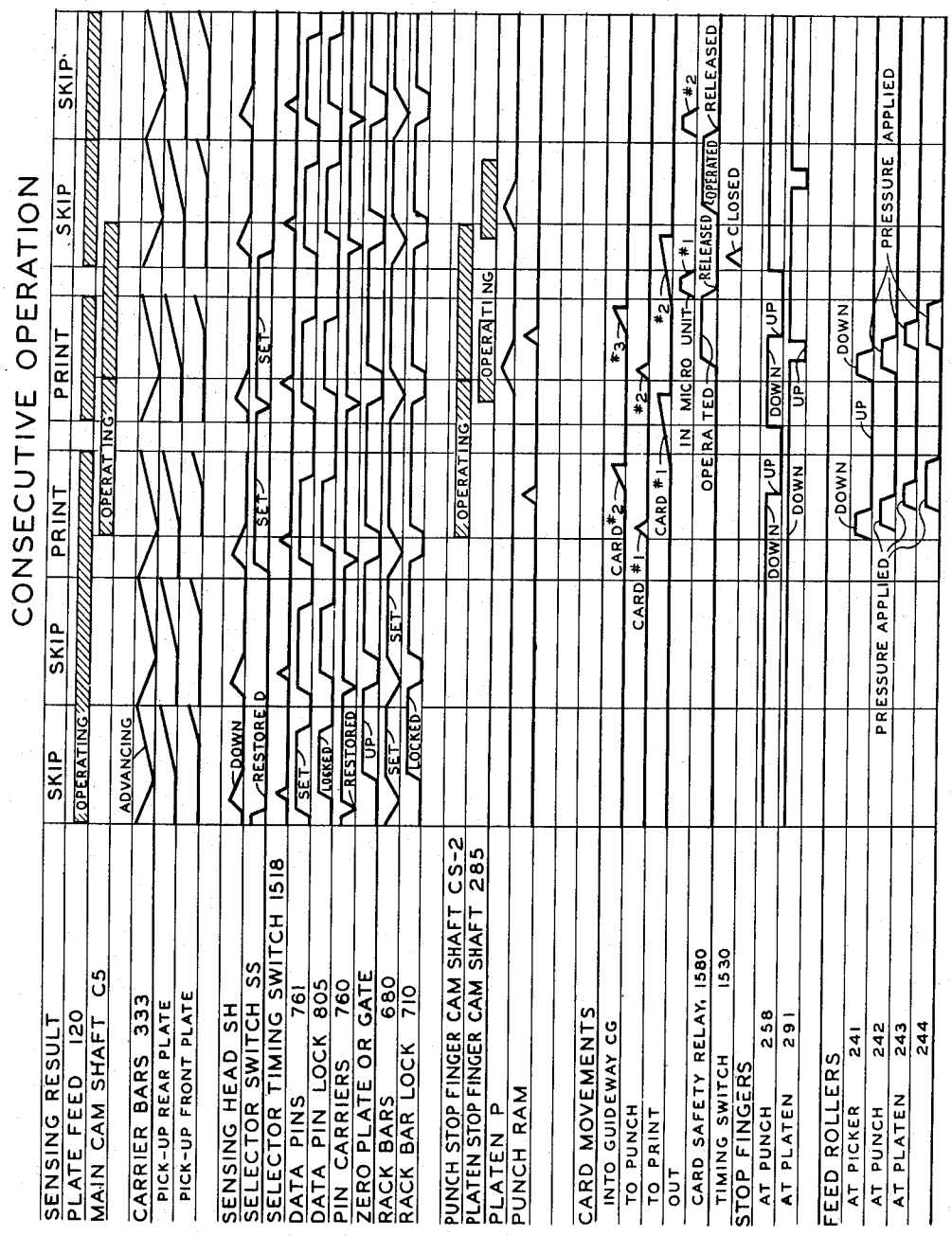


FIG. 8

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

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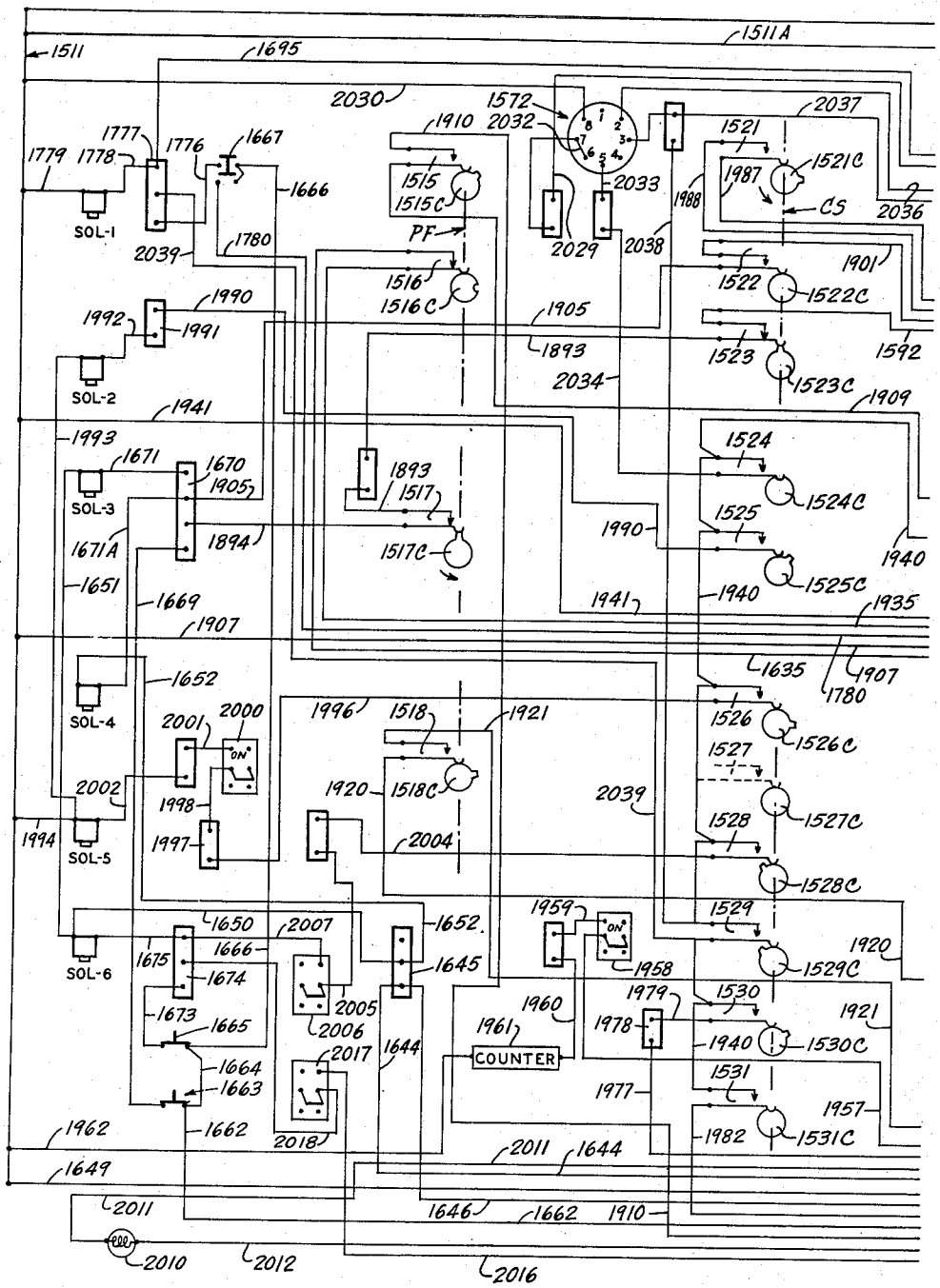


FIG. 9

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SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Original Filed Dec. 16, 1950 10 Sheets-Sheet 10

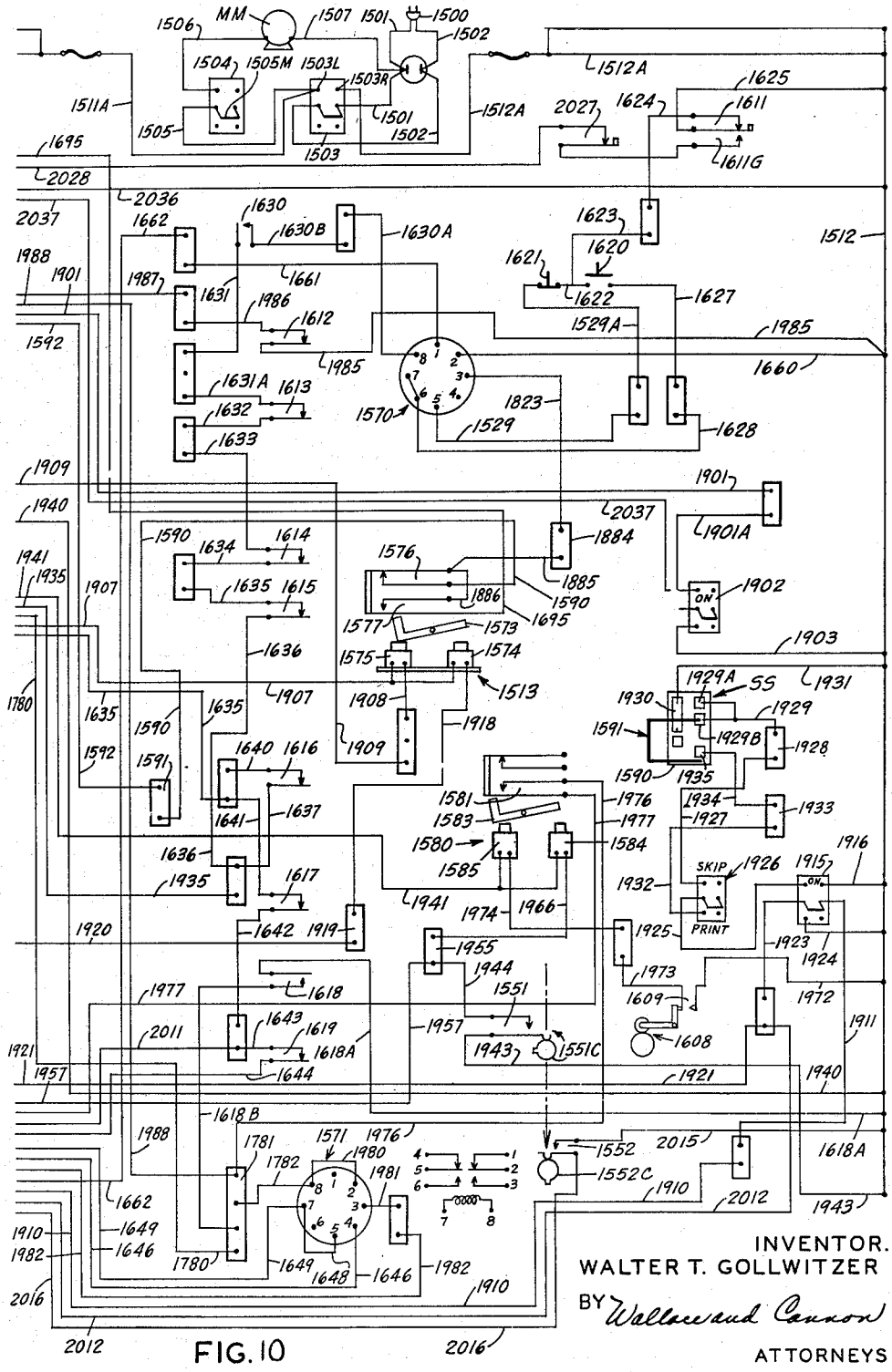


FIG. 10

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United States Patent Office 2,732,793 Patented Jan. 31, 1956

2,732,793

SEQUENTIALLY OPERATING ADDRESS PRINTING MEANS

Walter T. Gollwitzer, Euclid, Ohio, assignor to Addressograph-Multigraph Corporation, Wilmington, Del., a corporation of Delaware

Original application December 16, 1950, Serial No. 201,102. Divided and this application April 20, 1953, Serial No. 349,585

4 Claims. (Cl. 101—47)

This application is a division of my copending application Serial No. 201,102, filed December 16, 1950.

This invention relates to machines for producing business instruments such as checks, insurance premium notices, bills and the like.

In business establishments where bills, checks and the like are prepared in large numbers, it has been customary in many instances to prepare such business instruments through the use of individual printing and control devices such as the printing and control devices illustrated in my Patent No. 2,132,412, patented October 11, 1938. Such printing and control devices embody a carrier or frame having one or more printing plates fixed thereon and such printing plates are provided with embossed type which may be utilized for printing numerical amounts, and which may be used for printing the name and address and the other identifying data that may pertain to the person, company or the like, to which such printing devices may be assigned. In such printing and control devices as shown in my aforesaid patent, an upper area of the frame of the printing device is utilized for carrying physically represented information such as numerical data and such numerical data are represented as shown in such patent by perforations located in accordance with a predetermined positional code. Such printing and control devices also are arranged in most instances to carry identifying means such as tabs at one or more selected identifying positions along the upper edge thereof and these tabs may, of course, be formed and arranged in accordance with any of the systems known in the art which include full solid tabs, notched tabs and perforated tabs. The numerical data represented by the coded perforations in the printing and control devices may be sensed to control mechanisms in a machine so that such mechanisms may cooperate with the printing or other operative mechanism of such machine to produce a business instrument that includes not only printed impressions from the embossed type of the particular printing and control devices but other physical representations such as printed information or data representing perforations or the like made under control of the data representing perforations of the printing devices. Moreover, such printing and control devices may be selectively utilized in such printing machines through the use of selector mechanism that is responsive to the identifying means such as tabs that may be carried on the printing and control devices, and the control operation that is accomplished by the selector mechanism in such machines is effective primarily to govern the print-skip operation of such machines. In other words, under the control of the identifying tabs, the machine may be rendered effective to produce business instruments with respect to only a portion of the printing and control devices that may be passed through the machine.

In the production of business instruments of the aforesaid character on a large quantity basis in large establishments such as, banks, governmental agencies, utility billing departments and the like, it is of course desirable that a

sustained high production rate be established, and it is the primary object of the present invention to enable this to be accomplished in a novel manner.

In machines of the aforesaid character where sustained or continuous operation of the machine is to be accomplished, it is nevertheless necessary to afford manual controls for certain of the operative mechanisms of the machine so that power-operated cycles of these mechanisms may be individually initiated, as for example in testing, setting of the machine, or in starting a run of the machine. Such individual mechanisms, however, must during automatic operation of the machine operate in timed relation to all of the other elements of the machine, and therefore a further and more specific object of the invention is to assure that such proper timing will take place despite the provision of individual controls for such mechanisms.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a front perspective view of a machine embodying the features of the invention;

Fig. 2 is a front elevational view of the machine;

Fig. 3 is a plan view of the machine;

Fig. 4 is a schematic and partially perspective view illustrating the drive-transmitting means and the related control clutches of the machine;

Fig. 5 is an enlarged plan view of the right-hand portion of the machine, the cover plates being removed in some instances to show details of internal construction;

Fig. 6 is a front view taken partially in vertical section and showing the portion of the machine illustrated in Fig. 5;

Fig. 7 is a vertical sectional view taken substantially along the line 7—7 of Fig. 5;

Fig. 8 is a timing chart illustrating the timing of the elements of the machine in consecutive operation; and

Figs. 9 and 10, when taken together with Fig. 9 located to the left of Fig. 10, constitute a wiring diagram showing the electrical power and control connections utilized in the machine.

The machine in general

For the purpose of disclosure the invention is herein illustrated as embodied in a printing machine **100** that is adapted to produce business instruments such as bills, checks and the like in the form of tabulating cards containing printed data, as well as physically represented data afforded by means of perforations in the cards, and such documents in the form of cards C are produced from and under control of printing devices D that are passed through the machine. The machine **100** has a main enclosed frame F that is supported on top of a lower base LB which in the present instance is mounted on casters **101**. The lower base LB has access doors **102** afforded as parts of the usual enclosing cover plates, and the upper frame F is similarly provided with access doors **103** as well as other removable cover plates whereby access may be had to mechanism enclosed within the frame. The machine frame F also affords a table top T that is relatively elongated and which has an elongated card guideway CG extended along what may be termed the forward edge portion of the table top. The cards C

are supplied to a card magazine CM which in the present instance is adjustable as to its overall size so as to provide for handling cards C of different lengths, and these cards C are discharged edgewise or in a rearward direction one by one from the bottom of the card magazine CM and into the card guideway CG and are thereafter fed along the card guideway by means to be hereinafter described into cooperation, first, with a punching unit PU, which produces the desired coded perforations in the card C, and such card C is thereafter advanced in a left-hand direction, as viewed in Fig. 1, into a printing position beneath a platen P whereby a printed impression may be made from the printing means of a printing device D onto the card C, and the card is thereafter released from printing position and is discharged through a micrometer sensing or safety device MS into a collector hopper K that is afforded at the left-hand end of the machine as viewed in Fig. 1.

The printing devices D are stacked in a magazine M that is located at the rear edge of the machine in an upstanding relationship and in front to rear alignment with the printing position that is defined by the platen P.

The printing devices D are withdrawn one by one from the bottom of the magazine M and are advanced in step-by-step manner forwardly along a printing device guideway **110**, and in the first such movement, the printing device is advanced from magazine M into a sensing position that is defined by and located beneath a sensing head SH that is of the general character shown in my co-pending application, Serial No. 58,742, filed November 6, 1948, and while the printing device D is at rest in this sensing position, the sensing head SH is moved downwardly through a sensing stroke and physically represented data on the printing and control device D are sensed and this sensing is effective as will hereinafter be described to set up certain of the control elements of the punching unit PU so that such data may thereafter be represented by perforations formed in a card C by the punching unit PU. In the course of such sensing operation, other representing means or identifying means on the printing and control device D are sensed as described in my aforesaid copending application to determine whether or not a document is to be produced from and under control of such printing device, and this may be referred to as a sensing operation to determine the print-skip functioning of the machine as a whole. After the performance of the aforesaid sensing operation by the sensing head SH, the printing device is in the same machine cycle, advanced into the printing position wherein it is located over an anvil A that is afforded in the printing device guideway **110**, such anvil A being disposed beneath the platen P and cooperating in defining the aforesaid printing position. While the printing device D is in position at the printing station, and in the same machine cycle, a printing operation may be performed therefrom by operation of the platen P, and the printing device is thereafter, in the next machine cycle, advanced forwardly along the printing device guideway and is then directed downwardly into the forward end of a collecting tray **111** which has packer mechanism associated therewith and operated in timed relation to the printing device feed mechanism. This printing device or plate feed mechanism is designated in a general way as the plate feed unit **120**, Fig. 3.

The driving and control connections

Under and in accordance with the present invention the production rate of the machine is maintained at the maximum by so constructing and arranging the machine that the over-all cycle may be held at the minimum consistent with the performance of the required number of printing or other data representing operations.

In accomplishing this advantageous operation and control, the driving and control elements of the machine are arranged and related in the manner shown diagrammatically in Fig. 4 of the drawings. Thus, the main motor MM has a belt connection afforded by a motor pulley **195**, a belt **196**, and a main pulley **197** to a main drive shaft **200** that extends horizontally from front to rear of the machine just beneath the table top T and between the punch unit PU and the printing station, and this main shaft **200** is operated constantly and serves to drive certain constantly operating elements of the machine as well as to afford constantly operating drive source for the severally independently clutched elements or units of the machine.

Thus, the main shaft **200** has a pulley **201** fixed thereon for driving an endless card feed belt **202** that has its upper run extended along and in the card feed guideway CG from a point adjacent to the punch unit PU to the discharge end of the guideway, and at such discharge end of the guideway, the belt extends over a pulley **203** and thence downwardly and about two spaced guide pulleys **204** and **205**. The pulley **203** is also driven so as to maintain the belt **202** taut within the guideway and this is accomplished by a drive pulley **206** on the shaft **200**, and a belt **207** extended about guide pulleys **208** and a pulley **209** that is fixed to the same shaft **210** as the pulley **203**.

Rearwardly of the pulley **206**, the shaft **200** has a bevel gear **212** fixed thereon and meshing with a bevel gear **213** fixed on a horizontal and transversely related shaft **214**. On the other end of the shaft **214** a sprocket **216** is fixed and an endless chain **217** extends about this sprocket **216** beneath an idler sprocket **218** and about a pair of sprockets **219** and **220** that are disposed on fixed axes. The sprocket **219** is fixed on a horizontal shaft **222** which extends to the right past the punching unit PU and on its right hand end, the shaft has a sprocket **223** fixed. An endless chain **224** extends about the sprocket **223** and upwardly over and about a sprocket **225** that is fixed on a shaft **226**, and the chain then extends rearwardly beneath an idler sprocket **227** and then upwardly and over a sprocket **228** from which it extends downwardly to the sprocket **223**.

The shaft **226** serves as a drive for a plurality of transverse feed belts **230** that are over a part of the card guideway CG opposite the card magazine CM. The feed belts **230** are arranged in relatively deep annular slots or grooves in the upper feed rollers **231** that are fixed on a shaft **232**, and beneath the feed rollers **231**, the opposed feed rollers **233** are arranged and are fixed on a drive shaft **234**. The feed rollers **231** and **233** cooperate to continue the in-feeding movement of each card C after the card has been projected for a short distance from the magazine by the reciprocating card picker CP, and after discharge of the card from the bight of the rollers **231** and **233**, the feed belts **230** become effective to complete the in-feeding movement as will be described. Gears **236**, **237** and **238** meshed in series, are fixed respectively on the shafts **226**, **234** and **232** to transmit drive from the constantly operated shaft **226**.

The sprocket **208** also serves to drive a series of card feed wheels **241**, **242**, **243** and **244** that are disposed in spaced relation along and over the card guideway CG and are arranged to be lowered into engagement with the cards at certain times in the cycle as will be described. These card feed wheels are of similar form and each is mounted on the forward end of a shaft **240S** that is carried in a frame **240F** which is pivotally carried on a longitudinal drive shaft **245**. The wheel supporting shafts **240S** are geared to the shaft **245** so as to be driven thereby, and this shaft **245** has a pinion fixed thereon which is meshed with a gear **246** that is fixed to the sprocket **228** so that the shaft **245** and the associated feed wheels are constantly driven.

The sprocket **228** also has a pinion **247** fixed thereto which is associated by means including a replaceable change gear **248** with a gear **249** which is loosely mounted on one section CS–2 of a main cam shaft CS, sec-

tion CS–2 of which serves as a punch stop finger cam shaft and to operate or raise and lower the card feed wheels 241 to 244, while the section CS serves to carry a plurality of switch control cams 1521C to 1531C which exercise control on the machine operation as will be described hereinafter. A pivot shaft 250 is disposed forwardly of the shaft CS–2 and the cam shaft CS–2 has a cam 241C thereon which engages an arm 241A pivoted on the shaft 250 for raising and lowering the wheel 241; a cam 242C thereon which engages a similarly pivoted arm 242A for applying downward pressure to the wheel 242; a cam 243C thereon which engages a similarly pivoted arm 243A for applying downward pressure to the wheel 243; and a cam 244C thereon which engages a similarly pivoted arm 244A for applying downward pressure to the wheel 244. The cam shaft CS also has cams 251C, 252C, 253C and 254C thereon for operating the card sensing fingers 251, 252, 253 and 254, respectively, that are pivoted on the shaft 250 and disposed along the card guideway, and these sensing fingers are operated through card sensing operations in each rotation of the cam shaft CS. In addition, the cam shaft CS has a cam 255 thereon which operates a transmitting arm 255A which is pivoted on the shaft 250 and serves to raise and lower a stop finger rocker 258 that is disposed at the punching station for stopping the card C in the desired relation to the punch. This stop finger rocker is pivoted at its forward edge by a horizontal pivot 258A that extends through downwardly projecting ears on flanges 258F on the rocker. The pivot pin 258A is supported in a bracket 258B with the ears 258F disposed within or between the upstanding elements of the bracket. Accurate location of the rocker 258 is assured by affording the pivot 258A in the form of a bolt that may be tightened between the elements of the bracket, and by affording a spring 258S surrounding the pivot to the left of a collar 258C fixed on the pivot. The spring thus urges the rocker to the left and against the upstanding left element of the bracket.

The gear 249 serves as the driving element of a one revolution clutch CL–1 the driven element of which is fixed to the cam shaft CS, and the stop lever of this clutch may be released by operation of a clutch control solenoid SOL–1. This clutch, as well as the other one-revolution clutches to be described hereinafter, may be of the construction shown in my Patent No. 2,256,133, patented December 9, 1941.

The drive for the card picker CP includes an operating sleeve 260 mounted loosely on a shaft 265, and a gear 261 is loosely mounted on the shaft 265 adjacent the sleeve 260. This gear 261 is constantly driven by a pinion 262 fixed on the shaft 222. The gear 261 serves as the driving element of a one-revolution clutch CL–2, the driven element of which is rotatively fixed to the sleeve 260, and this clutch is governed by a solenoid SOL–2. The sleeve 260 has an eccentric 263 fixed thereon, and a connecting link 264 has a bearing surrounding such eccentric and is operatively connected to the card picker as will be described.

The punch unit PU includes three operating cam shafts that are afforded by the shaft 265 and additional shafts 266 and 267 as will be described hereinafter, the first cam shaft 265 being used primarily for restoring the set-up racks of the punch unit as will be described. This shaft 265 has a gear 268 loosely mounted thereon and constantly driven by a pinion 269 fixed on the shaft 222. The gear 268 constitutes the driving member of a one-revolution clutch CL–4, the driven member of which is fixed to the punch unit shaft 265, and a solenoid SOL–4 serves to control this clutch.

The shaft 266 serves to operate the punch ram, and has a toothed sleeve 271 loosely mounted thereon and connected to the gear 268 by an idler pinion 272. The toothed sleeve 271 constitutes the driving element of a one-revolution clutch CL–5, the driven element of which is connected to the punch ram operating shaft 266, and this clutch is controlled by a solenoid SOL–5.

The plate feed unit 120 includes a main operating shaft PF which is aligned with the shaft 267 of the punch unit PU and connected therewith by a universal joint 273 so that these shafts operate in unison. The shaft PF serves to drive the plate feed mechanism, the packer mechanism, the sensing head SH, and a plurality of switch operating cams 1515C to 1518C, as will be described hereinafter, and the shaft PF is driven from the sprocket 220. Thus, the sprocket 220 is loosely mounted on a shaft 275 and is connected thereto by an overload release 276. A pinion 277 fixed on the shaft 275 is meshed with a gear 278 loosely mounted on the shaft PF and this gear serves as the driving element of a one-revolution clutch CL–3, the driven element of which is fixed to the shaft PF. This plate feed clutch CL–3 is governed by a solenoid SOL–3.

The platen P is operated by a platen cam shaft 280 having cams 281 thereon for forcing the platen P through its printing stroke, as described in detail in my aforesaid patent application, and this shaft 280 serves through change gears 283 to drive a platen stopfinger cam shaft 285. A stop finger pivot shaft 286 is mounted forwardly of the cam shaft 286. The shaft 285 has cams 291C and 292C fixed thereon which serve to operate stop fingers 291 and 292 that are pivoted on the shaft 286 and act to stop the card C in first and second positions beneath the platen P, it being noted that in consecutive operation the shaft 285 is driven in a one-to-one relation to the shaft 280 and that the finger 292 is blocked so that only the stop finger 291 is effective, while in duplicate operation the shaft 285 is driven in a one-half-to-one relation, and that the stop fingers 291 and 292 are effective successively to stop the card in successive printing positions. The stop finger cam shaft 285 also has switch control cams 1551C and 1552C thereon as will be described hereinafter.

The platen cam shaft 280 has a bevel gear connection 293 at one end thereof with a rearwardly projecting shaft 294, and on this shaft 294 a gear 295 is loosely mounted. The gear 295 is connected by an idler gear 296 with a gear 297 fixed on the main drive shaft 200. The gear 294, which is thus constantly driven, serves as the driving element of a one-revolution plate feed clutch CL–6, the driven element of which is fixed on the shaft 294, and this clutch is controlled by a solenoid SOL–6.

The main cam shaft drive

As hereinbefore pointed out, the main cam shaft CS is arranged so that it may be driven at different speeds, and the details of this drive are shown in Figs. 4, 5 and 6 of the drawings. Thus, the gear 247 that is constantly driven by the sprocket 228 is mesh with the larger gear element 301A of a cluster gear which has a smaller gear element 301B. This smaller gear 301B has a gear 302 meshed therewith, and the gear 302 is mounted on a swingable arm 303 that is pivoted on the axis of the gears 301A and 301B. The gear 302 has a coupling element 302C rigid therewith, and this coupling element is adapted to be drivingly engaged with a coupling 248C that is formed on the change gear 248. This change gear 248 of course meshes with the gear 249, and when a gear 248 of a particular diameter is put in place, it is, of course, coupled with the gear 302 so as to be rotated thereby, and the gear 248 is moved into meshing relationship with the gear 249 by swinging movement of the arm 303. In this connection it should be observed that a knurled fastening element 305 is provided for fixing this change gear 248 in place, and this fastening element 305 is effective on the mounting stud to effect a clamping operation of such stud with respect to an arcuate slot 306 in which such stud is mounted so as to hold the arm 303 in such position that the change gear 248 is meshed with the gear 249. This arcuate slot 306 is centered on the axis of the gears 301A and 301B.

The cam shaft CB has a permanently mounted portion CS–2 upon which the driven element of the clutch CL–1 is fixed, and this section CS–2 serves as a mounting for the various cams that actuate the feed rolls and the sensing and stop finger mechanisms. To the right of the driven element of the clutch CL–1, the cam shaft CS is afforded as a removable or replaceable section that is joined to the driven element of the clutch CL–1 by a driving coupling 310 and at its other end is supported by a releaseable supporting element 311. In this connection it should be noted that the cam shaft CS is removed upwardly, and that the switches 1521 to 1531 are supported rearwardly of the cams on a support bar 312 so as to facilitate the mounting and removal of the cam shaft section. This removable section of the cam shaft constitutes the support for the cams 1521C to 1531C and by removal and replacement of the cam shaft section just described, the machine is adapted for consecutive or duplicate operation as required.

The sensing head SH and its drive

The sensing head SH, Fig. 7, is of the general character disclosed in my aforesaid co-pending application, Serial No. 58,742, and reference may be had to such co-pending application for details of construction and operation thereof. For present purposes it is sufficient to note that the sensing head SH is pivoted at its rear end on knife-edge pivots so that the forward end thereof may be brought downwardly into sensing cooperation with a printing device D that is located at sensing station. The pivoting movements are imparted to the sensing head SH by means driven by the plate feed cam shaft PF and for this purpose a pair of downwardly extending links 451 are pivoted at their upper ends on the sensing head adjacent to the forward end thereof and at their lower ends, links 451 are connected to arms 452 that are fixed on a horizontal rock shaft 453. This rock shaft is supported by bearings 454 that extend downwardly from the frame members 331 and 332, and springs 455 act on the arms 452 so as to urge the sensing head SH towards its upper or raised position. The rock shaft 453 has a rearwardly extending arm 456 fixed thereon and a cam roller 457 on the rear end of this arm rides on the upper edge of an operating cam 458 that is fixed on the plate feed cam shaft PF adjacent to the cam 350. The sensing head SH is operated through its sensing cycle during the retracting movements of the carrier bars 333, as shown in the timing chart of Fig. 8, and the sensing movements are completed relatively early in the cycle of operation of the plate feed unit 120.

The sensing head SH is effective, as described in my aforesaid parent application, to sense the printing devices D and to set up the punching unit PU in accordance with such sensing operation.

The sensing head SH also has a print-skip control arm 468 that is fixed to and extends rearwardly from an upper head 468H that is pivoted near its forward edge of the forward edge of the sensing head SH at 469, as shown in Fig. 7. The sensing head SH has one or more tab-sensing pins mounted therein beneath the rear edge of the upper head 468H so that this head 468H and the arm 468 are shifted or rocked in clockwise direction about such pivot 469, thus to raise the rear end of the arm 468, and this serves to impart an upward setting movement to the movable element of the sensing switch SS when an identifying tab 165 is sensed by the tab-sensing pin 468P mounted in the sensing head SH. The sensing switch SS is substantially like that shown in my aforesaid co-pending application, and after the setting of the switch SS has been utilized in the control of the print-skip operation of the machine as will hereinafter be described, the movable contact 1591 of the sensing switch is restored in a downward direction. This is accomplished by a restoring arm 470 that is fixed on a horizontal rock shaft 471. The spring 472 normally urges the arm 470 in an upward direction toward an ineffective position, shown in Fig. 7, and when the sensing switch SS is to be restored, the rock shaft 471 is rocked in a downward or restoring direction at the time indicated in Fig. 8 of the drawings. The rock shaft 471 is extended to the right and has an arm thereon which engages a selector switch restoring cam 475 that is fixed on the plate feed cam shaft PF adjacent to the cams 350 and 458.

The card guideway CG and related elements

The card guideway CG is defined along its rear edge by rear rails 480, Fig. 5, that are secured to the table top T. In that portion of the card guideway CG that is opposite the card pickers CP, the forward edge of the card guideway is defined by a strip 481 and the cards are advanced in a transverse direction by the feed rolls 231 and 233 over the strip 481 and then are dropped into the card guideway CG between the strips 480 and 481 as will be described. To the left of the card magazine CM, the forward edge of the card guideway is defined by a continuation of the strip 481 that extends to the punching unit PU, and by a similar strip 481A that extends from the left hand side of the punching unit PU beneath the stop finger rocker 258 and to a point just beyond the pulley 201. In the left hand portion of the card guideway CG, the forward edge of such card guideway CG is defined by a rail 481B that is fixed to the table top T, and on this rail 481B, a mounting bar 483 is secured. This mounting bar 483 has a plurality of angularly arranged support brackets 484 arranged thereon and these brackets have skid rollers 485 rotatably supported thereon so as to tend to displace the cards laterally in a forward direction and thereby maintain the same in engagement with the forward guide rail 481B, while at the same time holding such cards downwardly in engagement with the feed belt 202. A plurality of guide shoes 486 are also secured to the mounting rail 483 so as to maintain the cards C in engagement with the feed belt 202 in the spaces intermediate the skid rollers 485. The rear portion of the card guideway CG in the zone that is opposite the feed belt 202 is defined by a rear rail 488 that is secured to the table top T.

When the card C that is in its initial position in the card guideway CG opposite the card magazine CM is to be advanced in a left hand direction, as viewed in Fig. 5, the constantly driven card feed wheel 241, which has been in an elevated position, is moved downwardly into engagement with the card C by the action of its cam 241C and the card is thus advanced into position beneath the card feed wheel 242 which is at all times in its lowered position and which at this time has had downward pressure applied thereto by its cam 242C. The card is then advanced into the throat of the punching unit PU and its forward end moves on through this throat and under the card feed wheel 243 which at this time has downward pressure applied thereto. The card, however, comes to rest with its forward end beneath the stop finger rocker 258, there being a downwardly projecting stop finger element on the rocker 258, as will be described. The card C remains in this position and is held against the stop finger by the continued feeding action of the feed wheel 243, while the punching operation takes place, and the stop finger rocker 258 is raised just prior to completion of the withdrawal of the punching elements so that when such withdrawal releases the card, the card feed wheel 243 immediately starts the advancing movement of the card into position beneath the card feed wheel 244 which continues such movement of the card and causes the forward edge of the card to move into position over the feed belt 202 which continues such advancing movement. With particular reference to the card feed wheels 241 to 244, it should be observed that when a card is not in position beneath such wheels, these wheels en-

gage free running idler rollers 489 that are disposed in position beneath slots in the card guideway.

The sensing fingers 251, 252, 253 and 254 are arranged so that their forward ends are positioned over safety or control switches that are located beneath the card guideway. Thus, the sensing finger 252 is arranged over a switch 1611A so that this switch 1611A is opened when the sensing finger 252 passes downwardly through the bottom of the card guideway and into operative engagement with the switch 1611, and this downward movement takes place immediately after a card C has been fed laterally into the card guideway by the card picker CP and the transverse belts 230. The sensing finger 251 is operated at the same time as the sensing finger 252, and when a card is not in position in the guideway, the sensing finger 251 is operable to open a normally closed switch 2027 that is disposed beneath the card guideway. In ordinary machine operation, the stop finger 252 serves as a safety which operates when a card is not in a position in the guideway at the proper time to open the switch 1611 and stop the operation of the machine, as will hereinafter be described.

The sensing finger 253 is utilized to determine that a card C is in position at the punch, and this sensing finger 253 is lowered at the time when a card C should have been advanced to such punching position. The sensing finger 253 is arranged, when a card is not sensed in a punching position, to close a normally opened card safety switch 1618 that is disposed beneath the card guideway, and such closure of the switch 1618 causes stopping of the machine, as will hereinafter be described.

The sensing finger 254 is utilized to determine whether or not a card C that has been released by the stop finger 258 has passed onwardly through a relatively long intermediate space in the card guideway and into a printing position, and the operation of this sensing finger 254 takes place at a time when such card should have passed through such intermediate space. Thus, if improper feeding movements of the card have caused this card to be delayed so that it remains in this intermediate space when the safety sensing finger 254 is lowered, such sensing finger is ineffective to open a normally closed card safety switch 1612 that is located beneath the card guideway, and the continued closure of the safety switch 1612 at this time, cooperates with a related timing switch 1521, to cause the machine to stop, as will be described hereinafter.

As a final safety sensing feature, the discharge of each card from the printing device guideway CG is sensed by the micrometer stop switch 1608, as will hereinafter be described, the operation of this structure being such that unless the micrometer stop switch structure 1608 is actuated by discharge of a card from the printing device guideway, the next cycle of the machine will be stopped.

The electrical circuits and controls

(Figs. 9 and 10)

The electrical power is supplied from a connector plug 1500 through wires 1501 and 1502 to the input terminals of a main switch 1503 which has a double pole switch member 1503M whereby circuit may be extended from the wires 1501 and 1502 respectively to output terminals 1503R and 1503L. A main motor switch 1504 has one terminal connected by a wire 1505 to the terminal 1503L, and by a movable contact 1505M, circuit may be extended to the other terminal 1504L of the switch 1504, such other terminal 1504L being connected by a wire 1506 to one terminal of the main motor MM, the other terminal of which is connected by a wire 1507 to the wire 1501. The primary control circuits for the machine are afforded between wires 1511 and 1512 that are connected respectively to the switch terminals 1503L and 1503R by wires 1511A and 1512A.

The control of the machine operation is attained primarily through timed and selective actuation of the several clutch control solenoid SOL–1, the card feed clutch solenoid SOL–2, the plate feed clutch solenoid SOL–3, the punch unit clutch solenoid SOL–4, the punch ram clutch solenoid SOL–5, and the platen clutch solenoid SOL–6, and this timed and selective control is brought about in part by the inter-related action of cam actuated timing switch means operated respectively by the plate feed drive shaft PF, the main cam shaft and the platen stop finger cam shaft 285, as well as the selector switch SS, the selector relay 1513, and various safety switches and other relays, as will be described in detail hereinafter.

Thus the plate feed drive shaft PF has a cam 1515C thereon which acts on a normally open selector relay restoring switch 1515 to close this switch for a short period at about 10° in the rotative cycle of this shaft. Another cam 1516C on the shaft PF serves to hold a plate drop safety switch 1516 closed except for a short period at substantially 90° of the cycle. A third cam 1517C on the shaft PF serves to close a normally open timing switch 1517 while the shaft PF is in its zero position, while a fourth cam 1518C on the shaft PF serves to close a normally open selector timing switch 1518 at substantially 90° of the cycle of the plate feed unit.

The main cam shaft CS has cams 1521C to 1531C fixed thereon, and these cams are arranged respectively to control normally open switches 1521 to 1531, and as shown in Fig. 9, the cams are of the form and setting utilized in consecutive operation of the machine.

Switch 1521 constitutes a card safety timing switch and is closed at substantially 90°; switch 1522 constitutes a control switch for the plate feed and is closed at substantially 240°; switch 1523 constitutes a zero position switch and is closed at substantially zero; switch 1524 constitutes a group release switch and is closed except at zero; switch 1525 constitutes a card feed switch and is closed at substantially 40°; switch 1526 constitutes a punch ram control switch and is closed at substantially 85°; switch 1527 constitutes a punch ram control switch and is closed at substantially 200°; switch 1528 constitutes a platen control switch and is closed at substantially 315°; switch 1529 constitutes a group control switch and is closed only at about 355°; switch 1530 constitutes a card safety switch and is closed at substantially 45°; and switch 1531 constitutes an emergency relay release switch and is closed at all times except when the main cam shaft CS is at zero.

The stop finger cam shaft 285 has a cam 1551C thereon which serves to close a card safety timing switch 1551 at substantially 270° of the rotative cycle of this shaft. Another cam 1552C is also fixed to this shaft and is arranged to close a second impression platen control switch 1552, this switch 1552 being connected in circuit only when the machine is being used for duplicate printing as described in said present application.

A start relay 1570, and emergency relay 1571 and a group control relay 1572 are provided, and these relays are of similar construction in that movable contacts 2 and 5 are engaged with contacts 1 and 4 respectively when the relays are de-energized, and are shifted into engagement with contacts 3 and 6 respectively when the relays are energized; and in each instance, the operating coil is connected across terminals 7 and 8 and in the relays 1570 and 1572 the terminal 7 is connected to the terminal 6, while in the relay 1571 the terminals 5 and 7 are connected and the terminals 2 and 8 are connected.

The selector relay 1513 is of the mechanical lock-up type having a pivoted armature 1573 that may be shifted to an operated position by an operating coil 1574 or to a restored position by a restoring coil 1575. This relay has a normally closed switch 1576 that is opened by the armature 1573 in its operated position, and a normally open switch 1577 that is closed by the armature when it is in its operated position.

A similar card safety relay 1580 has a normally open

switch 1581 that is closed when its armature 1583 is shifted to its operated position by its operating coil 1584, and which switch is again allowed to open when the armature is shifted to its released position by its restoring coil 1585.

The selector switch SS is of the general construction shown in my copending application Serial No. 58,742 filed November 6, 1948, and comprises a stationary contact block 1590 and a shiftable contact member 1591 that is operated by the sensing head SH as described in such application.

The card collector safety unit MS has a micrometer card sensing mechanism 1608 which is arranged to close a related safety switch 1609 when a card passes from the sheet guideway into the card collector.

The machine also has a series of normally closed safety switches 1611 to 1619, which are included in certain safety circuits as will be described. Thus, the switch 1611 constitutes a card safety switch and is opened by the safety finger 252 when a card is not sensed at the initial card feed position; switch 1612 is a card safety switch that is opened by the safety sensing fingers 254; switch 1613 is a plate feed drive safety switch, that is associated with an overload mechanism in the plate feed drive; switch 1614 is a punch unit drive safety switch that is associated with an overload means in the punch drive; switch 1615 is a last plate stop switch that is associated with a last plate sensing means of the magazine M; switch 1616 is a plate drop safety switch that is associated with the plate drop member 400; switch 1617 is a front chute safety switch that is associated with the collector tray 111; switch 1618 is a card safety switch that is operated by the safety sensing finger 253; and switch 1619 is the V-notch safety switch that is operated by the locating pawl 340 at the sensing position.

The starting and stopping operations of the machine are governed by a normally open push button start switch 1620 and a normally closed push button stop switch 1621 and these switches are connected in series by a wire 1622. Wires 1623 and 1624 extend from the wire 1622 to one contact of the card safety switch 1611, the other contact of which is connected by a wire 1625 to one side of the power circuit as represented by the wire 1512. Upon closure of the start switch 1620, circuit is extended from the other terminal of the switch through wires 1627 and 1628 to terminal 6 of the start relay 1570, and thus to one end of the operating coil of this relay. The other end of the operating coil is connected through a multiple-switch safety circuit from terminal 8 as will be described. When the start relay 1570 is energized, the closure of contacts 5 and 6 thereof establishes a running circuit through the stop switch 1621, and this is accomplished through wires 1629 and 1629A extended in series from terminal 5 of this relay to the other contact of switch 1621.

Thus, wires 1630A and 1630B extend in series from such terminal 8 to one contact of a punch safety switch 1630; and wires 1631 and 1632 extend from the other contact of switch 1630 to one contact of the plate feed drive safety switch 1613; wires 1632 and 1633 extend from the other contact of switch 1613 to one contact of the punch unit safety switch 1614; wires 1634 and 1635 extend from the other contact of switch 1614 to one contact of the last plate stop switch 1615; wires 1634 and 1637 extend from the other contact of switch 1615 to one contact of the plate drop safety switch 1616, it being noted that this switch 1616 is open at certain times in the cycle and is bridged with a shunt circuit at such times through the plate drop safety timing switch 1616 as described in said parent application. The main safety circuit is extended from the other contact of the plate drop safety switch 1616 by wires 1640 and 1641 to one contact of the front chute safety switch 1617, the other contact of which is connected by wires 1642 and 1643 to one contact of the V-notch safety switch 1619. The other contact of the safety switch 1619 is connected by a wire 1644 to a terminal 1645 from which the safety circuit is extended to the line wire 1511 as will be described, through normally closed contacts 4 and 5 of the emergency relay 1571 so that the emergency relay constitutes an element of the safety circuit, and operation of the emergency relay will be effective to stop the machine. Thus the main safety circuit is extended from the terminal block 1645 by a wire 1646 to the terminal 4 of the emergency relay 1571, and when this relay is de-energized, circuit is extended between contacts 4 and 5, and by a wire 1648 to terminal 7 which is connected by a wire 1649 to the other side of the power source as represented by wire 1511.

The terminal 1645 constitutes one side of the power source for the plate feed solenoid SOL–3, the punch unit solenoid SOL–4, and the platen solenoid SOL–6, and is connected by a wire 1650 to one terminal of the platen solenoid SOL–6, and a wire 1651 is extended from the wire 1650 to one terminal of the plate feed solenoid SOL–3. Similarly a wire 1652 extends from terminal 1645 to one terminal of the punch unit solenoid SOL–4, thus rendering operation of solenoids SOL–3, SOL–4, and SOL–6 dependent upon the emergency relay 1571 being in its released condition. Thus when the emergency relay 1571 is operated, the platen solenoid, the punch unit solenoid, and the plate feed solenoid cannot be energized, and the main safety circuit is broken so as to stop the machine.

When the start relay 1570 is de-energized, it conditions certain single cycle controls for manual operation, and for this purpose a wire 1660 extends from the wire 1512 to terminal 2 of this relay. This circuit is extended by wires 1661 and 1662 from terminal 1 of this relay to one contact of a plate feed push button switch 1663. A wire 1664 extends from the wire 1662 to one contact of a single impression push button switch 1665. Thus, a wire 1666 extends from the wire 1664 to the common terminals of a double pole push button switch 1667 which serves to initiate a cycle of operation of the main cam shaft CS and also to cause a card C to be fed, as will be described. It should be noted that when the start relay 1570 is operated, the circuits to the manual switches just described are opened so that such switches are ineffective, and this constitutes an important safety feature in that it prevents damage to the machine that might otherwise result in the event of inadvertent closure of such manual switches during automatic machine operation.

Thus the switch 1663, when closed extends an energizing circuit to the plate feed clutch solenoid SOL–3, a wire 1669 being extended from the other terminal of the switch 1663 to a terminal block 1670 from which a wire 1671 extends to one terminal of the solenoid SOL–3. It will be observed that the other terminal of the solenoid SOL–3 is connected by the wires 1651 and 1650 back through the contacts of the emergency relay 1571 to the other side of the circuit as represented by the wire 1511. Similarly, a wire 171A is extended from the terminal block 1670 to the other terminal of the punch unit solenoid SOL–4.

The single impression switch 1665 has its other contact connected by wire 1673 to the terminal block 1674 which is connected by a wire 1675 to the other terminals of the platen clutch solenoid SOL–6 so that closure of the switch 1665 causes operation of the platen.

The switch 1667 has the other terminal for one of its contact bars connected by a wire 1776 to a terminal block 1777 which in turn is connected by a wire 1778 to one terminal of the main cam shaft solenoid SOL–1, the other terminal of this solenoid being connected by a wire 1779 to the wire 1511. The other contact for the other of the contact bars of the switch 1667 is connected by a wire 1780 to a terminal block 1781 and this contact block is connected by a wire 1782 to the No. 8 terminal of emergency relay 1571 and this serves to energize the emergency relay since the contact No. 7 of this relay is

connected to the wire 1511. Hence, when the card feed switch 1667 is closed, the emergency relay 1571 is operated as an incident to the starting of the main cam shaft CS, and this serves to disable the circuits to the platen solenoid, the punch unit solenoid and the plate feed solenoid which would normally be operated in a cycle of the main cam shaft.

When the start relay 1570 is in its energized or operated condition the contacts 5 and 7 thereof are engaged and this serves to afford a holding circuit for the start relay, it being recalled that terminals 6 and 7 thereof are connected. When the start relay is in its operated condition the contacts 2 and 3 thereof are also engaged, and terminal No. 2 of this relay is of course connected by the wire 1660 to the wire 1512. Contact No. 3 is connected by a wire 1883 to a terminal block 1884 from which a wire 1885 is extended to one contact of the switch 1576, of the selector relay 1513, a further extension 1886 also being provided to connect the wire 1885 to the stationary contact of the switch 1577. The switches 1576 and 1577 are parts of the selector relay 1513, and the switch 1576 is normally closed or in other words, is closed when the selector relay 1513 is in its restored relationship. When the switch 1576 is in this closed relation, circuit is extended from the other contact thereof by a wire 1590 to a terminal block 1591 from which a wire 1592 extends to one contact of the cam operated switch 1523. A wire 1893 extends from the other contact of this switch to one contact of the switch 1517, the other contact of this last switch being connected by a wire 1894 to the terminal block 1670. Hence so long as the selector relay remains in its restored condition and while the main cam shaft CS remains in its at rest or zero position, circuit will be extended through the switch 1517 each time the plate feed shaft reaches its zero position, and thus the plate feed clutch solenoid SOL–3 will be energized in each cycle of the plate feed shaft PF and the plate feed shaft will rotate continuously. If on the other hand, the main cam shaft CS is in the course of a rotative movement, the switch 1523 will be opened and the main cam shaft CS will be caused to stop until such time as the switch 1523 is again closed, or until such time as another circuit to the plate feed clutch solenoid SOL–3 is established.

When the selector relay 1513 is operated, the switch 1576 is opened and the switch 1577 is closed, and upon closure of the switch 1577, circuit is extended from its other or movable contact by a wire 1695 to the terminal block 1777, thus to complete an energizing circuit for the main cam shaft clutch solenoid SOL–1. As hereinabove pointed out this causes the switch 1576 to be opened and hence the plate feed shaft PF will come to rest at its zero position after completing its cycle. The next rotation of the plate feed shaft PF is then initiated at the proper time under control of the switch 1522, that is operated by the related cam on the main cam shaft, one contact of which switch 1522 is connected by wires 1901 and 1901A to the movable contact of a double throw group control switch 1902 which in its "off" position extends circuit to a wire 1903 that extends to the line wire 1512. The other contact of the switch 1522 is connected by a wire 1905 to the terminal block 1670 so that upon closure of the switch 1522 in the rotative movement of the main cam shaft CS, the plate feed clutch solenoid SOL–3 will be energized.

The operating and restoring coils 1574 and 1575 of the selector relay 1513 each have one terminal thereof connected to the line wire 1511 by a wire 1907, and in each rotation of the plate feed shaft PF, the restoring coil 1575 is energized so that the selector relay will be restored in the event that it has been operated in such machine cycle. Thus wires 1908 and 1909 are extended in series to one contact of the selector relay restoring switch 1515, the other contact of this switch being connected by a wire 1910 and a wire 1911 in series, to the other contact of a double throw, double pole selector switch 1915. This switch 1915 has an upper portion that constitutes the "on" position of the switch and when the center switch members is in this position, circuit is extended from the wire 1911 through a wire 1916 to the wire 1512, thus to complete the energizing circuit for the restoring coil 1575 each time the selector relay restoring switch 1515 is closed.

The operating coil 1574 of the selector relay 1513 is of course under the control of the main selector switch SS as will be described hereinafter, and a wire 1918 is extended from the other terminal thereof to a terminal block 1919 and a wire 1920 from this terminal block extends to one contact of the selector timing switch 1518. A wire 1921 from the other contact of the selector timing switch 1518 extends to a terminal block 1922 and a wire 1923 extends from this terminal block to the other center contact of the selector "off-on" switch 1915. When the movable member of this switch is in its "off" position circuit is extended from the wire 1923 through the switch and a wire 1924 to the wire 1512. In the other or "on" position of the selector "off-on" switch 1915, circuit is extended from the wire 1923 through a wire 1925 to a print-skip switch 1926 that is used as described in my aforesaid copending application to alter or revise the selecting action of the selector switch SS. Thus the wire 1925 connects to the center contact of the double throw print-skip switch 1926 and when the movable switch member is in its upper or skip position circuit is extended through a wire 1927 to what may be termed a skip terminal block 1928 from which a wire 1929 and a branch lead extend to a pair of contacts 1929 and 1929A on the stationary block 1590 of the selector switch SS. In certain positions of the movable member 1591 of this switch SS these stationary contact members may be connected with another stationary contact member 1930 which is in turn connected by a wire 1931 to the line wire 1512.

In its other position, the movable member of the print-skip switch 1926 extends circuit from the wire 1925 to a wire 1932 which is connected to what may be termed a print terminal 1933 and a wire 1934 extends from this terminal and is connected with a stationary contact 1935. As described in my aforesaid copending application, the closure of a circuit by the selector switch SS is accomplished in accordance with the sensed identifying means on the printing devices D that are passed through the machine, and whenever such a circuit is completed, the selector relay 1513 is operated due to closure of circuit through the operating coil 1574 thereof. As hereinbefore pointed out, this operation of the selector relay causes an operation of the main cam shaft CS to be initiated.

In the operation of the plate feed unit, the switch 1516 is opened in each cycle to serve as a timing means in the plate drop safety circuit, during the time when the plate drop safety switch 1616 is opened. Thus a wire 1935 extends from the wire 1637 to one contact of the switch 1516, and a wire 1936 from the other contact of this switch extends to the wire 1640. Thus at the time when the plate drop safety switch 1616 is to be normally closed by the action of the plate drop mechanism, the circuit through the switch 1516 will be opened so as to thereby render the switch 1616 effective to accomplish its desired function.

Of the other switches that are controlled by the main cam shaft, one contact of each switch is connected to the wire 1512 by a wire 1940, such wire extending from the line wire 1512 to one contact of each of the switches 1525, 1526, 1528, 1530 and 1531.

The card safety relay 1580 has one terminal of each of its coils 1584 and 1585 connected by a wire 1941 to the line wire 1511. The card safety relay 1580 is energized in each rotation of the stop finger cam shaft 285 by the closure of the switch 1551. Thus a wire 1943 is extended from the line wire 1512 to one con-

tact of the switch 1551, and a wire 1944 extends from the other contact of this switch to a terminal block 1955. A wire 1966 extends from this terminal block to the other terminal of the operating coil 1584 of the card safety relay 1580, and thus the card safety relay is operated each time the stop finger cam shaft 285 is rotated. A further circuit is extended from the terminal 1955 by a wire 1957 to a counter switch 1958 and from this switch wires 1959 and 1960 extend in series to one terminal of an electrically operated counter 1961, the other terminal of which is connected by a wire 1962 to the line wire 1512.

The card safety relay 1580 is restored in each properly completed machine cycle through the action of the card as it leaves the printing device guideway. Thus the card passes through or between the micrometer wheels of the safety device 1608 and this causes the related micrometer switch 1609 to be closed. One contact of this switch 1609 is connected by a wire 1972 to the line wire 1512 and the other contact of this switch 1609 is connected by wires 1973 and 1974 to the other terminal of the restoring coil 1585 of the card safety relay 1580.

When the card safety relay 1580 is in its operated condition, the switch 1581 thereof is maintained in its closed position, and this conditions, but does not complete, an operating circuit for the emergency relay 1571. Thus, it will be recalled, that terminal 7 of this relay is directly connected by the wires 1649 to the line wire 1511, and that the terminal 8 of this relay is connected to the terminal block 1781. A wire 1976 is extended from the terminal block 1781 to one contact of the switch 1581 and a wire 1977 is extended from the other contact of this switch to a terminal block 1978 which is connected by a wire 1979 to the other contact of the card safety switch 1530. Thus the operating circuit for the emergency relay 1571 is conditioned by operation of the card safety relay 1581, and if the card has not passed out of the guideway so as to close the micrometer switch 1609, and cause restoring of the card safety relay 1580, then the closure of the switch 1530 early in the next cycle of the main cam shaft CS completes a circuit so that the emergency relay is operated. When the emergency relay 1571 is thus operated a holding circuit for such relay is established. This holding circuit is afforded by a wire 1980 that connects terminals 2 and 8 of the emergency relay, and when this relay is operated contact 2 of this relay is engaged with contact 3 thereof. The holding circuit is extended from contact 3 by wire 1981 and 1982 in series, to the other contact of the cam operated switch 1531 which at this time will be in its closed relationship so that circuit will be extended through the wire 1940 back to the line wire 1512. The switch 1531 is arranged to open when the main cam shaft reaches its zero position and thus the emergency relay 1571 is released at this time after having caused the plate feed solenoid, the platen solenoid and the punch unit solenoid to be disabled and after having caused the start relay 1570 to be released so as to stop the machine.

The emergency relay may also be operated by the card safety switch 1618, one contact of which is connected by a wire 1618A to the line wire 1512, and the other contact of which is connected to the terminal block 1781 by a wire 1618B.

The card safety switch 1521 is arranged in a circuit with the related card safety switch 1612. Thus a wire 1985 is extended from the line wire 1512 to one contact of the switch 1612 and the wires 1986 and 1987 in series connected to the other contact of this switch to one contact of the timing switch 1521. The other contact of the switch 1521 is connected by a wire 1988 to the terminal block 1781. This circuit is utilized to energize the emergency relay 1571 and thus stop the machine in the event that the card has not passed at the proper time from the punch to the printing position. Thus if the card has remained in an intermediate zone between these two positions, the safety finger will strike such card and will not open the switch 1612, and hence upon closure of the timing switch 1521, the circuit will be completed to the emergency relay 1571 so as to stop the machine.

The card feed switch 1525 has one contact thereof connected to the line wire 1512 by the wire 1940 and a wire 1990 is extended from the other contact of this switch to a terminal block 1991 from which another wire 1992 is connected to the card feed clutch solenoid SOL–2, a wire 1993 extends from the other terminal of this solenoid SOL–2 to one terminal of the solenoid SOL–5, and a wire 1994 extends from this terminal to the line wire 1511. Thus upon closure of the cam controlled switch 1525, the card feed solenoid SOL–2 will be energized.

The cam controlled switch 1526 governs the operation of the punch ram, and one contact of this switch is connected to the line wire 1512 as hereinbefore described. The other contact of this switch is connected by a wire 1996 to a terminal block 1997 from which a wire 1998 extends to one contact of an "off-on" switch 2000 whereby the punch ram may be rendered inoperative. Wires 2001 and 2002 extend in series from the other contact of this switch to the other terminal of the punch ram solenoid SOL–5, thus to afford the desired energized circuit of the solenoid under the control of the switch 1526.

The platen is governed by the switch 1528 and the other contact of this switch is connected by wires 2004 and 2005 in series to one contact of a platen control switch 2006. The other contact of this switch is connected by a wire 2007 to the terminal block 1674 which it will be recalled is connected by a wire 1675 to one terminal of the solenoid SOL–6, thus the solenoid SOL–6 may be energized by closure of the cam controlled switch 1528.

The presence of a print plate at the printing station of the machine is indicated by a signal light 2010 that has a circuit which extends through the V-notch safety switch 1619 and through the contacts 4 and 5 of the emergency relay 1571. Thus, a wire 2011 extends from one terminal of the light 2010 to the wire 1643 at the switch 1619, the other contact of which is connected by the wire 1644 to the terminal block 1645, thus to be connected through contacts 4–5 of the emergency relay 1571 to the line wire 1511 when the emergency relay 1571 is de-energized. The other terminal of the light 2011 is connected by a wire 2012 to the wire 1923 to the selector circuits, and when the selector switch SS is set in a position which selects a printing device for a print operation, circuit for the light 2010 is extended through the switch SS and back to the line wire 1512.

The machine is of course adapted for consecutive operation or duplicate operation as well as for group printing, as described in my aforesaid parent application, but for present purposes it is necessary only to describe consecutive operation of the machine.

Consecutive operation

When the machine is to be operated for consecutive printing wherein but one impression is to be made from each selected printing device, the manual controls of the punch unit PU are set so as to provide for data perforations representative of the fixed data such as date, ledger number and the like. This is accomplished by setting of the manually settable interposers 650M and the manually settable control elements 650M–1 in the manner illustrated in Fig. 5 of the drawings.

The printing and control devices D that are to be used in a particular run of the machine will have the numerical data representing perforations formed therein in a uniform manner and in particular orders of the data representing field thereof, and this numerical data may of course be punched into the cards C in any selected columns of the card, this being accomplished by setting of the transfer elements 870 in the transfer frame 801. This

transfer frame 801 is therefore set up in accordance with the orders in which the numerical data appear on the printing and control devices D that are to be used and further in accordance with the particular columns of the card in which such data are to be perforated. Further, if fixed data are to be represented by perforations in any columns of the card wherein automatically operated interposers 650A are present the transfer frame 801 is set up with control wires 870M in those columns where the control members 680 must be released in each cycle of the punch. After the transfer frame 801 has thus been set up, it is placed in position in the machine so that it may effect transfer of the sensed data from the Bowden cables 465 to the set-up pins 761 of the punching unit.

The printing devices D are then loaded into the magazine M and the cards C are loaded into the card magazine CM.

Since the operation of the machine that is being described is to be normal consecutive operation, the group switch 1902 is turned to its lower or off position, and the duplicate control switch 2017 is also turned to its off position, thus to disable the switch 1552. As hereinabove pointed out the second stop finger 292 at printing position that is utilized only in duplicate operation of the machine may be blocked or held continuously in its upper or ineffective position and this must of course be done in this instance. It should be observed however, that in some instances the particular timing of the stop finger 292 may be such that it does not interfere with consecutive operation of the machine and in such instance, the stop finger need not be blocked as aforesaid.

Since the machine is to operate in consecutive printing, the stop finger cam shaft 285 is set through adjustment of its change gearing so as to operate in a one-to-one relationship with respect to the platen operating cam shaft 280. In addition, the cam shaft CS that is in place in the machine must be one which has the cams thereof set for consecutive printing, and the change gear 248 which drives the cam shaft CS must be such that the cam shaft CS operates at its highest speed which is the speed that is needed for consecutive printing operation of the machine.

The main motor MM is then started by the closure of the main motor switch 1504, and the main switch 1503 is closed so as to energize the main power lines 1511 and 1512 of the control circuits of the machine.

With the machine thus conditioned, it is necessary to advance the first one of the printing and control devices D into sensing position, and this is accomplished by momentary closure of the manual plate feed switch 1663. This causes operation of the plate feed unit 120, in the course of which the first printing and control device D is advanced into sensing position beneath the sensing head SH. With the machine timed in the manner disclosed in Fig. 7 of the drawings, it is necessary to have the first card C advanced from the card magazine CM so as to be in position opposite the card magagine and in the sheet guideway CG, and this is accomplished by momentary actuation of the manual card feed switch 1667. Such operation of the card feed involves an operation of the main cam shaft CS, in the normal course of which the platen P and the plate feed unit 120 would be operated, but as hereinabove pointed out the closure of the card feed switch 1667 also serves to energize the emergency relay 1571 which serves when thus energized to disable the means which would, in the normal rotation of the main cam shaft, cause operation of the plate feed unt 120 and the platen P. Thus the operation of the manual card feed switch 1667 results only in a feeding of a card C into the initial position in the card guide-way opposite the card magazine CM.

When the foregoing operations have been completed, the machine as ready to start on its normal course of automatic operation, and this is accomplished through momentary closure of the manual start switch 1620. This switch closure causes the start relay 1570 to be energized and a holding circuit for this relay is afforded through number 5 and 6 contacts of the relay and through the manual stop switch 1621 as weli as through the various safety switches and through the normally closed safety contacts 4 and 5 of the emergency relay 1571.

When the start relay 1570 is thus operated, closure of the contacts 2 and 3 thereof closes a circuit to the common contacts of the switches of the selector relay 1513, and at this time in the machine cycle the selector relay 1513 is in its restored position wherein the switch 1576 is closed and the switch 1577 is open. Circuit is thus extended by closed switch 1576 through the zero position switch 1523 of the main cam shaft unit and through the zero position switch 1517 of the plate feed unit 120 and this serves to complete circuit to the control solenoid SOL-3 so as to cause closure of the plate feed clutch CL-3. A cycle of operation of the plate feed unit 120 is thus initiated, and if the operation of the sensing head SH in this cycle indicates that the printing and control device D that is sensed is one from which an impression is not to be made, then the return of the zero position cams 1518C on the plate feed shaft PF to its zero position will cause another cycle of the plate feed unit 120 to be initiated immediately upon completion of the first cycle thereof. Such continuus operation of the plate feed unit will continue, of course, so long as the result of the sensing operation constitutes a skip indication.

In each cycle of operation of the plate feed unit 120 a large number of different functions take place at times indicated in the timing chart of Fig. 7. Thus the selector switch SS is restored early in the cycle and the previous sensing or data pattern that has been locked up on the pins 803 of the pattern lock unit 802 is unlocked and the pins 761 and 803 are restored to their normal down positions through the operation of the restoring bail 775. The pin housings or carriers 760 are also restored to their forward positions by operation of the restoring plate 785. The rack bars 680 are also restored as shown in the timing chart of Fig. 7 and the rack bar locking pawls 710 are released. During the restoring of the rack bars 680, the pins 761 and their housings are first restored, and are then re-set in accordance with the new sensing operation, and hence, at the end of the restoring action, those rack bars 680 with respect to which one or more pins 761 have been set, are free to move to the right through their new setting movements while those rack bars 680 with respect to which no pins 761 have been set, are held in their restored positions by the zero gate 692 which is at this time in its upper or effective position as shown in Fig. 7.

The printing device D that is located at sensing position is sensed by downward movement of the sensing head SH, and the sensing switch SS set in accordance with the tabs 165 that are sensed by the pins 468P. The spring pins 468 of the sensing head SH are also effective to sense the numerical data represented by coded perforations in the printing and control device D that is at sensing position, and the Bowden cables 465 are effective through the transmitting pins 855 and the transfer wires 870 to actuate and set the locking pins 803 and the corresponding set-up pins 761. After the setting movement of the pins 803 and 761 has been accomplished the locking plate 805 is shifted to its effective or locking position, and the rack bars 680, the pawls 695 of which have been released, move to their set positions and are locked in these set positions by the locking pawls 710. The sensing head SH is then withdrawn, and as will be evident in Fig. 7, this takes place relatively early in the cycle of operation of the plate feed unit. While the above described operations are in progress, the carrier bars 333 are moving through their rearward movement, and as soon as the printing device D at sens-

ing position has been freed by upward withdrawing movement of the sensing head SH, the rack bars start their forward or advancing movement and the printing device that is at sensing position is engaged almost immediately and the forward movement thereof is started as indicated in Fig. 7 so that this printing device comes to rest at printing position at substantially the end of the cycle of operation of the plate feed unit.

In the example that is being described, the sensing of the tabs 165 by the pins 468P will be assumed to have set the selector switch SS in its "skip" position, and hence the circuit to the selector relay will not be completed. Hence the selector relay 1513 will remain in its restored position in which it has been set at the very beginning of the plate feed cycle, and as hereinabove pointed out, the next cycle of the operation of the plate feed unit 120 will be immediately initiated, and there will be no printing operation in respect to the printing device D that has been fed into printing postion..

When an operation of the sensing head SH sets the selector switch SS in its "print" position, the operating circuit for the selector relay 1513 will be completed when the selector timing switch 1518 is closed, the time of such closure being indicated in Fig. 7. The operation of the selector relay 1513 serves to open the switch 1576, thus to break the circuit which would normally initiate the next cycle of operation of the plate feed unit 120, and as a result the plate feed unit 120 will come to a stop at the end of its cycle. The operation of the selector relay 1513 also closes the switch 1577, and this completes a circuit to the solenoid SLO–1 which causes the main cam shaft clutch CL–1 to be engaged so as to start rotation of the main cam shaft CS. It should be observed in this regard that the selector relay 1513 is actuated to its restored position due to closure of the switch 1515 and that this takes place in the first part of the cycle of the shaft PF. One of the first functions that results from this cam shaft operation is the initiation of a feeding movement of the card C from its initial position in the card guideway CG toward the punch unit PU. This is accomplished by lowering of the feed wheel 241 which is governed by the cam shaft section CS–2.

At the time when this advancing movement of the card C is initiated the stop finger 258 at the punching unit is in its lowered or effective position, and the card C therefore comes to rest in the throat of the punch and in a proper relationship to the punching elements. The main cam shaft CS then causes the switch 1526 to be closed so as to thereby energize the punch ram solenoid SOL–5. This causes the punch ram clutch CL–5 to be engaged so that the punch ram 626 moves downwardly through a punching cycle. In this punching cycle the data perforations will be punched in the card C in accordance with the setting of the interposers that has been made in the last cycle of the plate feed unit 120. As the punches 611 start on their upward or withdrawing movement, the stop finger 258 is raised so that as soon as the punches 611 have been withdrawn, the card C is free to be advanced to the printing position. Such advance is caused by the feed roller 243 which has downward pressure applied at this time, and the card is advanced to the feed roller 244 which feeds the card onto the feed belt 202 which completes the advancing movement to the stop finger 291 which is then in its lowered position at the printing station. The operation of the platen P is then initiated by closure of the switch 1528 which energizes the platen control solenoid SOL–6.

The operation of the plate B by the platen cam shaft 280 serves also to operate the stop finger cam shaft 285 so that upon completion of the printing operation the stop finger 291 is raised and the card C is released for discharge to the collecting hopper K. In the course of rotation of the stop finger cam shaft 285, the switch 1551 is closed so as to cause the card safety relay 1580 to be operated to its "set" position, and this card relay remains in its set position until discharge of the card C through the micrometer switch unit MS causes the relay 1580 to be operated to its restored position. In the event that the card C does not pass through the micrometer switch unit MS, the emergency relay 1571 is operated, so as to stop the operation of the machine. If however, the card is discharged properly through the micrometer switch unit MS, the card safety relay 1580 is restored in proper time so that on operation of the machine will not be interrupted.

It will be observed that in the operation of the machine as thus described, the printing and control device D has been sensed, the punching unit PU has been set up and operated and the punched card has been advanced to printing position and in impression has been made thereon, and all of this has been accomplished in a single cycle of operation of the machine so that upon completion of this cycle there are no partially processed cards in the machine.

In the course of the operation of the main cam shaft, the plate feed unit 120 remains idle for a length of time that is dependent upon the amount of time that is required for the card feeding, punching and printing operations that are to be performed, and at a time in the cycle of the main cam shaft which is determined by the aforesaid considerations, the switch 1522 is closed so as to initiate another cycle of operation of the plate feed unit 1520. The operation of the machine as a whole then proceeds with the operation of the plate feed unit 120 interrupted or suspended only in those cycles where printing operations are required, and even then, the idle periods of the plate feed unit are determined only by the time that is required for performance of the required card feeding, punching and printing operations.

In the operation of the machine as aforesaid, the safety sensing fingers 252, 253 and 254 are effective to check on the presence of a card at different positions along the card guideway. Thus, the presence of a card at the initial position in this guideway is checked by the sensing finger 252, and if no card is sensed, the switch 1611 is opened so as to release the start relay 1570 and stop operation of the machine.

At the time when a card should be in position at the punch, the sensing finger 253 is operated, and if a card is not sensed, the switch 1618 is closed so as to energize the emergency relay 1571 and thus stop the machine.

The card sensing finger 254 is operated at a time when the card should have passed from the punch and through the intermediate space into the printing station, and if the card is still in this intermediate space, the finger 254 will fail to open the switch 1612, and the emergency relay will be operated so as to stop the machine.

Conclusion

From the foregoing description it will be evident that the present invention affords novel sheet safety means whereby proper sheet feed is assured during high speed sustained operation of the machine.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In an automatic machine for producing business instruments or the like, a plurality of functioning units operatively related for cooperation in producing business instruments, said units each including at least one operative mechanism and independent one-revolution drive clutches therefor, control means in said machine including control cams operable during operation of said control means to cause engagement of the respective clutches of the units in predetermined sequence to produce auto-

matic operation of the machine, a governing unit having an operated and an unoperated condition and effective when operated to cause operation of said control means and thus cause continuous automatic machine operation, means under control of an operator to cause operation of said governing unit, manual control means for causing engagement of at least one of said clutches, and means operable by said governing unit when in its operated condition to disable said manual control means.

2. In an automatic machine for producing business instruments or the like, a plurality of functioning units operatively related for cooperation in producing business instruments, said units each including at least one operative mechanism and independent one-revolution drive clutches therefor, control means in said machine including control solenoids and sequentially operated control switches for causing engagement of the clutches of the respective units in predetermined sequence when said control means are operated to cause automatic operation of the machine, a governing unit effective when operated to cause operation of said control means to cause continuous automatic machine operation, means under control of an operator for operating said governing unit, a manual control switch associated with one of such solenoids for causing engagement of the related one of said clutches, and means operable by said governing unit when in its operated condition to disable said manual control switch.

3. In an automatic machine for producing business instruments or the like, a plurality of functioning units related for cooperation in producing business instruments or the like, said units each including at least one operative mechanism and independent one-revolution drive clutches therefor, secondary control solenoids allocated to the respective drive clutches, a main control cam shaft in said machine, control switches associated with the respective solenoids, cams on said cam shaft operable in rotation of said shaft to sequentially operate said switches for causing engagement of the clutches of the respective units in predetermined sequence in automatic operation of the machine, a main one-revolution clutch for controlling operation of said cam shaft, a main solenoid for controlling said main clutch, a governing unit in said machine effective when operated to render to said main solenoid effective to cause continuous automatic machine operation, means under control of an operator for causing operation of said governing unit, a manual control switch associated with one of said secondary solenoids for causing engagement of the related one of said clutches, and means operable by said governing unit when in its operated condition to disable said manual control switch.

4. In an automatic machine for producing business instruments or the like, a plurality of functioning units in said machine adapted for cooperation to produce business instruments or the like, each unit each including at least one operative mechanism and independent one-revolution drive clutches therefor, unit-control solenoids for causing engagement of the clutches of the respective units, a main cam shaft, means including a main one-revolution clutch for driving said cam shaft, a main solenoid for causing operation of said main clutch, switches allocated to the respective unit-control solenoids, cams on said shaft effective when said cam shaft is driven to close said switches in predetermined sequence to cause automatic operation of the machine, a main control for said machine having an operated and an unoperated condition and including a main relay effective when said main control is operated to energize said main solenoid to cause continuous automatic machine operation, means whereby an operator may cause operation of said main control, a manual control switch having a control circuit associated with one of said unit-control solenoids for causing engagement of the related one of said clutches, and a disabling switch in said circuit operable by said relay when in its operated condition to disable said manual control switch.

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