B. M. SHANKLIN.

STRIP PUNCHING APPARATUS.

APPLICATION FILED OCT. 8, 1917.

1,320,178.

Patented Oct. 28, 1919.

5 SHEETS—SHEET 1.

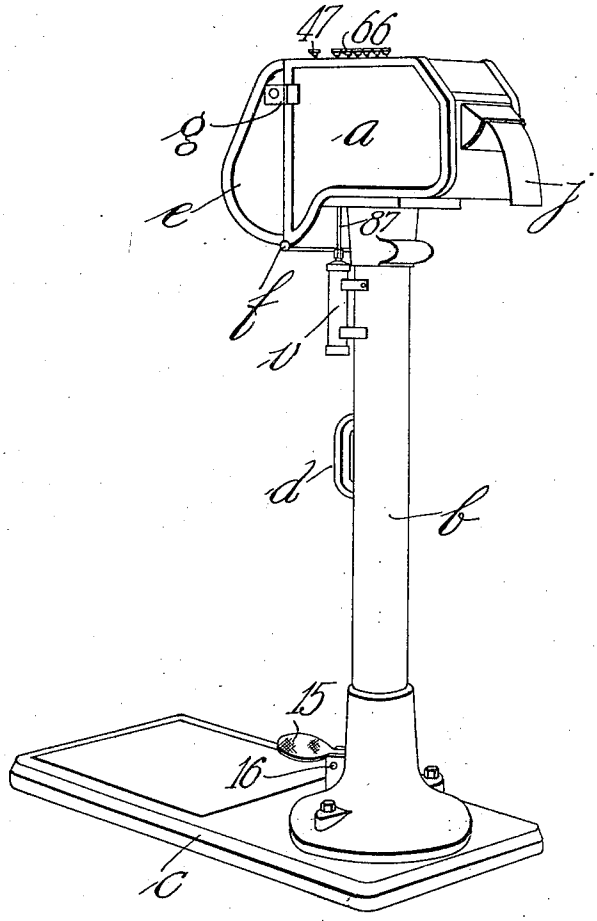


Fig. 1.

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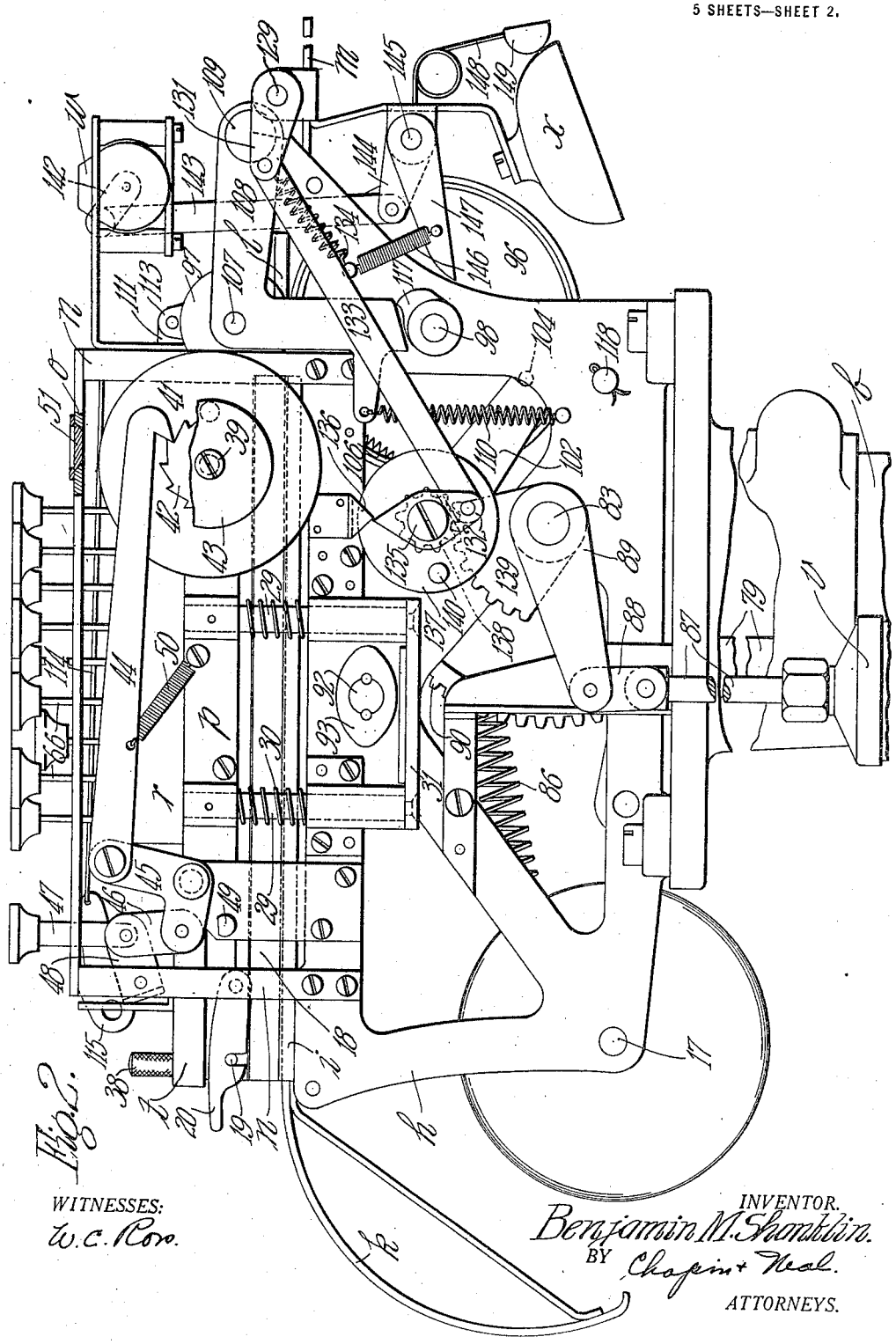


Fig. 2.

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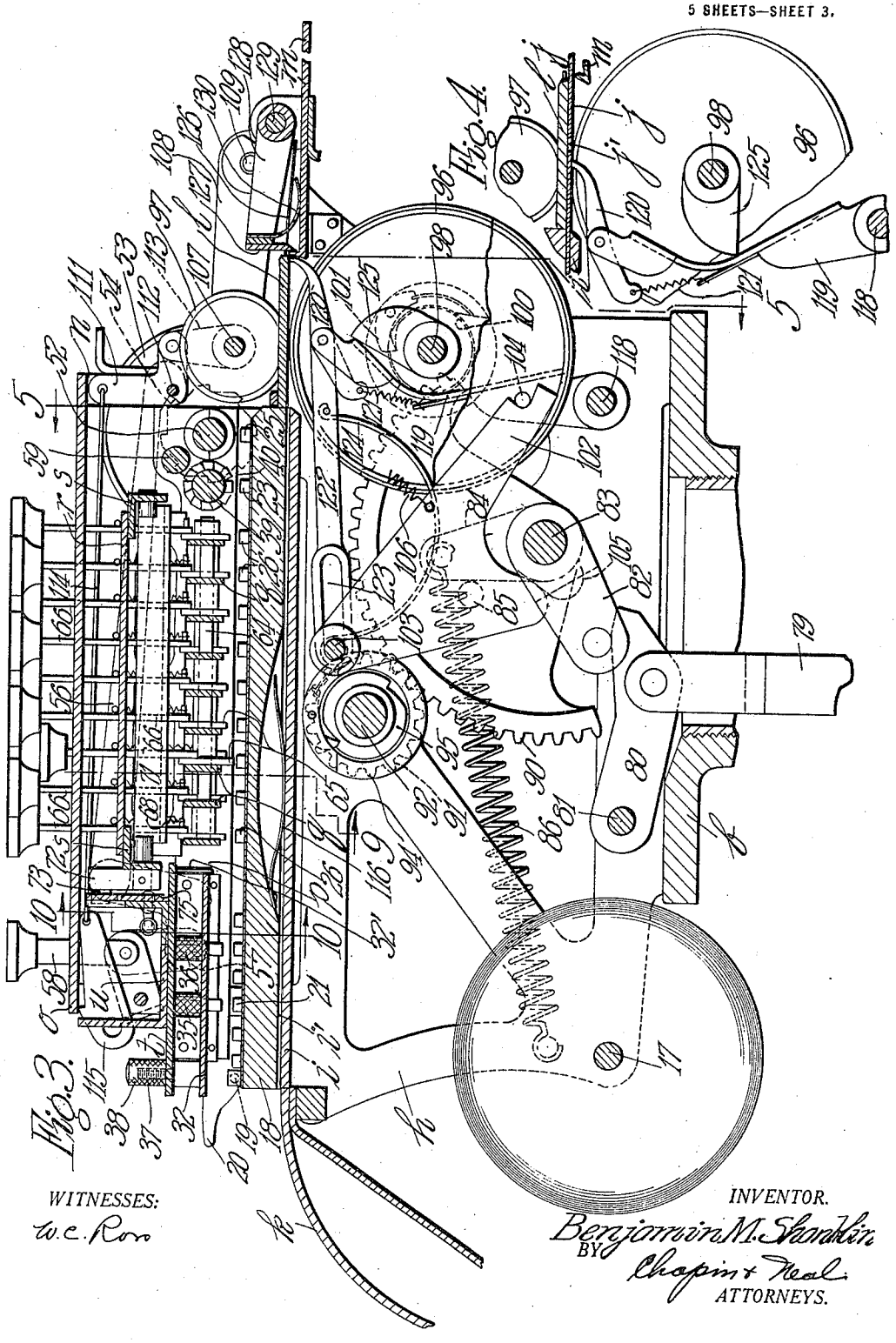


Fig. 3.

Fig. 4.

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Fig. 5.

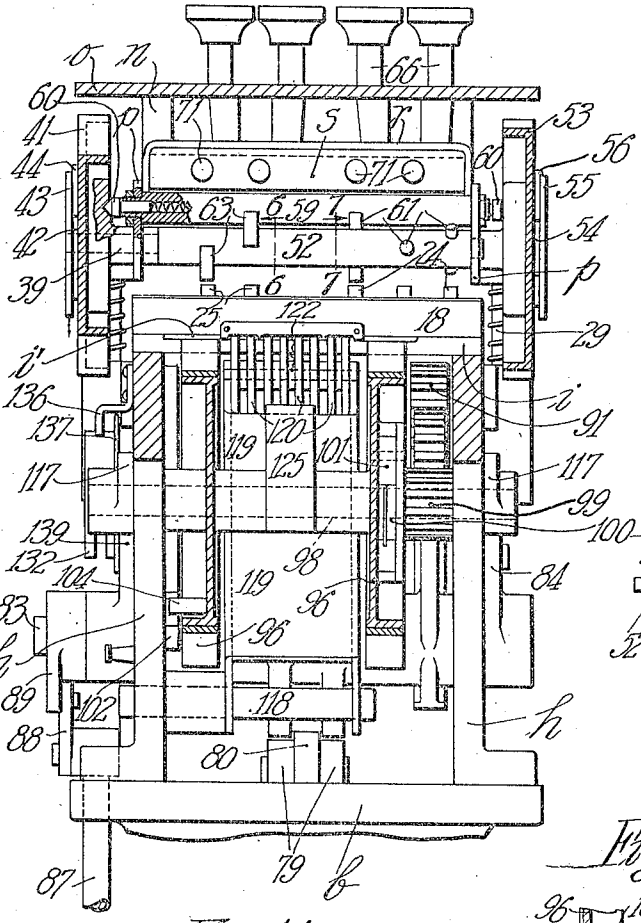


Fig. 6.

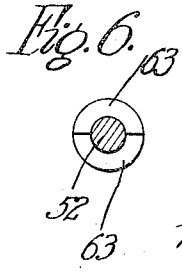


Fig. 7.

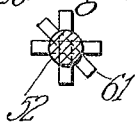


Fig. 15.

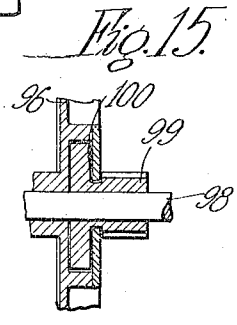
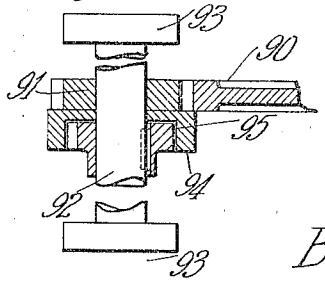


Fig. 14.



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Fig. 8.

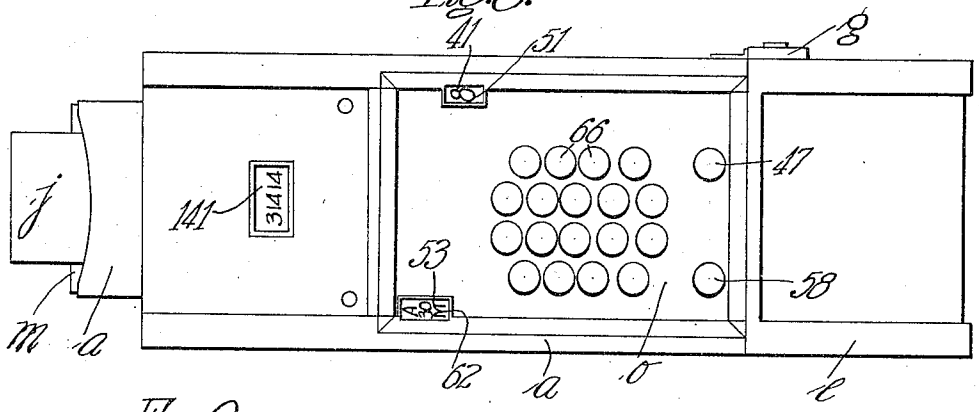


Fig. 9.

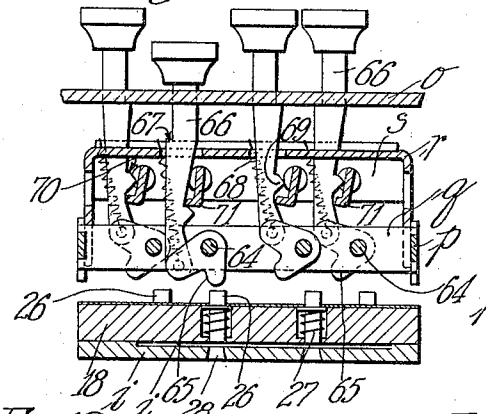


Fig. 10.

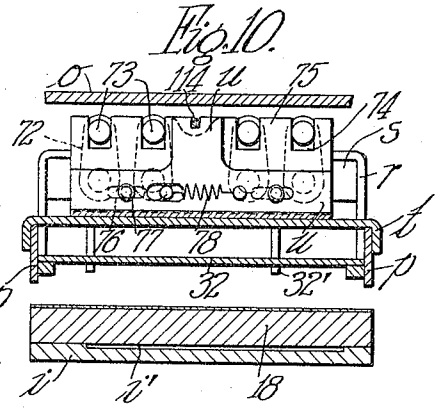


Fig. 13.

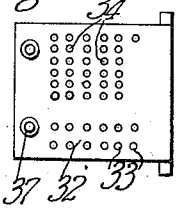


Fig. 11.

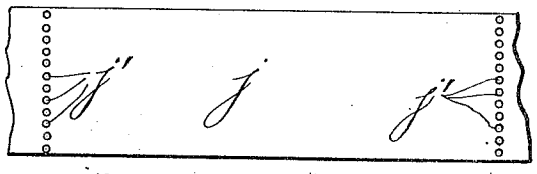
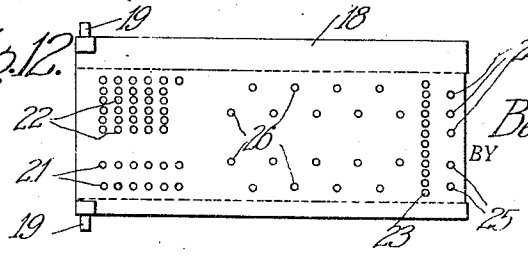


Fig. 12.



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STRIP-PUNCHING APPARATUS.

1,320,178. Specification of Letters Patent. Patented Oct. 28, 1919.

Application filed October 8, 1917. Serial No. 195,311.

To all whom it may concern:

Be it known that I, BENJAMIN M. SHANKLIN, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Strip-Punching Apparatus, of which the following is a specification.

This invention relates to improvements in strip punching apparatus and more particularly to an apparatus in which transfers, tickets, or the like in continuous strip form may be automatically punched, ejected, and severed from the strip. The invention also relates to improvements in apparatus of the class disclosed in my copending application Serial No. 142,434, filed January 15, 1917.

The problem of automatically feeding a strip of transfers or the like into such relation with the punching mechanism that the punches of the latter accurately aline with the respective printed designations on the strip, which they are adapted to punch, is complicated by the fact that paper, and particularly the poorer qualities of paper customarily used for transfers, is hygroscopic to a considerable degree. The apparatus, particularly when used in street cars, is exposed to varying weather conditions, changes in humidity, and so forth, with the result that the unit sections of the strip do not remain of constant length. Consequently, the usual forms of strip feeding mechanism, which operate to feed a measured length of strip, are not satisfactory in that the length of the strip does not remain constant. The variations in length in any one section of the strip may be small and so small as to cause no difficulty with relation to proper registration of the punches and printed designations on the strip during the issuing of several transfers. The difficulty is entirely due to the fact that the errors, due to the difference between the measured length of strip fed and the variable length of the unit sections of the strip, are cumulative and in time mount up to such an extent that the printed designations on the strip may aline with other than their proper punches, thus rendering the apparatus useless until adjusted. This invention is concerned among other things with the elimination of the difficulty set forth.

An object of the invention is to provide in an apparatus of the class described and in combination with a feeding mechanism operable to feed a measured length of strip, a supplementary feeding mechanism to cooperate with the first-named mechanism and carry the unit sections of the strip always to a predetermined position, whereby errors due to the first-named mechanism are corrected on each feeding movement of the strip.

Another object of the invention is to provide in apparatus of the class described, punching mechanism involving a plurality of groups of punches, a member movable toward the mechanism, and a plurality of groups of selector devices, one for each punch in its group, carried by said member, and means whereby any one and one only of the selector devices of each group may be positioned to engage and actuate its punch on movement of said member.

Another object of the invention is to provide specifically improved selector devices for use in an apparatus of the type mentioned and to provide various means to set the selector devices of the various groups, the setting means being characterized in that they are varied to provide for the greatest convenience in operation of the various groups in consideration of the relative frequency with which the various groups require to be operated.

A further object of the invention is to provide a punching mechanism, a mechanism to feed a strip to the latter, and a manually operable means to actuate the punching mechanism characterized in that by its operation other devices are set to automatically operate the feeding mechanism on release of the manually operable means.

Another object is to provide in a strip punching apparatus and in combination with punching and feeding mechanism, a device to sever the punched portion from the remainder of the strip, manually operable means to actuate the punching mechanism, means to automatically operate the feeding mechanism on release of the manually operable means, and means whereby the severing device is set and locked during the operation of the punching mechanism and held locked until the end of the feeding movement of the strip when it is automatically tripped to engage and sever the strip.

A further object is to provide in a strip

punching apparatus generally simplified and improved mechanical structure.

Other objects and advantages will appear in the following description and will be particularly pointed out in the appended claims.

The invention, in an embodiment at present preferred, is shown for illustrative purposes in the accompanying drawings, in which—

Figure 1 is a perspective view showing the exterior of the apparatus;

Fig. 2 is an enlarged side elevational view of the apparatus with parts broken away and with its inclosing casing removed;

Fig. 3 is a sectional elevation of the apparatus;

Fig. 4 is a fragmentary sectional view of a part of Fig. 3 showing a different relative positioning of certain parts;

Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 3;

Figs. 6 and 7 are detail sectional views taken on the lines 6—6 and 7—7, respectively, of Fig. 5;

Fig. 8 is a plan view of the apparatus;

Figs. 9 and 10 are fragmentary cross sectional views taken on the lines 9 and 10—10 respectively of Fig. 3;

Fig. 11 is a plan view of a fragment of a strip for use with the apparatus;

Fig. 12 is a plan view of the punching mechanism shown as removed from the apparatus;

Fig. 13 is a plan view of a selector device for a part of the punching mechanism;

Fig. 14 is a fragmentary sectional plan view illustrating the operating connections for the punching mechanism; and

Fig. 15 is a fragmentary sectional plan view illustrating a detail of the operating connections for the feeding mechanism.

Referring to these drawings, the apparatus comprises in general a suitable casing adapted to contain the transfers, tickets, or the like in continuous strip form; punching mechanism beneath which the strip may pass; mechanism comprising main and supplementary feeding devices to successively move unit sections of the strip into correct alinement with the punching mechanism and at the same time successively eject previously punched unit sections of the strip; devices to sever the punched units from the strip; and operating mechanism to actuate the feeding and punching mechanism and cutting devices in properly timed relation. The punching mechanism may be subdivided into a plurality of groups of punches, as for the month, day, hour, minute, and so forth, there being a punch for each unit of each group; and improved selector devices for each group which may be positioned to operate any desired punch of its group; and means to actuate the several selectors in unison to simultaneously operate the several selected punches.

The casing and general frame structure will first be described. Referring to Fig. 1, reference letter *a* indicates a casing within which substantially all the mechanism illustrated in the other figures of the drawings is housed. Casing *a* is supported by a hollow pedestal *b* which is supported on a base plate *c*. Upon the latter, the conductor or other operator may stand and operate the apparatus by depressing a foot lever 15 which is pivoted intermediate its ends at 16 and extends within the pedestal *b* to operate the apparatus in a manner to be described. The entire apparatus is arranged for convenient portability and a handle *d* is preferably provided on pedestal *b* so that the conductor may readily carry the apparatus from end to end of the car. The casing *a* includes a section *e* pivoted at *f* and normally held to casing *a* by suitable means, preferably a lock, such as is indicated conventionally at *g* (see also Fig. 8).

Referring to Figs. 2 and 3, within casing *a* and also supported from pedestal *b* are a pair of spaced side frames *h* which support a plate *i* having a channel *i'* (Figs. 9 and 10) adapted to receive the strip to be punched. The transfers, tickets, or the like are provided in a continuous strip *j*, successive unit sections of the latter being separated by rows of perforations *j'* previously made at desired intervals of length transversely of the strip. (Fig. 11). A supply of strip *j* in roll form is supported loosely on an arbor 17 removably mounted in and extending between the side frames *h*. The described cover *e*, when opened, allows access to the left-hand end of the machine and permits the supply of strip *j* on arbor 17 to be conveniently replaced. The strip *j* is led from the supply roll over a curved paper guide *k* (Fig. 2), into and through the channel *i'*, under a relatively narrow paper guide *l* (Figs. 3 and 5) and thence to a delivery table *m*. The members *k* and *m* are secured as indicated in Fig. 3 to frames *h* and member *l* is supported from the right hand pair of posts *n*. Supported adjacent each of its four corners on posts *n*, secured as shown in Fig. 2, to the frames *h*, is a plate *o* which, as shown in Fig. 8, is visible through a suitable opening in the top of casing *a* and forms the top wall of the apparatus.

The punching mechanism will now be described and the arrangement of the punches will be treated first. The punches are all contained in a member 18 which is coextensive in length and width with the described plate *i* and rests upon the latter, as shown in Figs. 3 and 9. Member 18 fits between and is positioned laterally by the posts *n*

and is mounted for convenient removal from the left hand end of the machine when cover *e* is opened. Thus, member 18 has adjacent its left hand end (Fig. 12) two pins 19, which protrude outwardly from lugs on its top face, and levers 20 pivoted to the left hand pair of posts *n*, as best shown in Fig. 2, have suitable slots to engage pins 19. The engagement of the latter and levers 20 position the member 18 longitudinally on plate *i* and, when levers 20 are lifted free of pins 19 by their handle portions, which are conveniently accessible when cover *e* is opened, the member 18 may be readily withdrawn by using the pins 19 as handles.

Referring to Fig. 12, a plurality of groups of punches are mounted in member 18. Thus, there is a group of punches 21 comprising a punch for each month in the year; a group of punches 22 comprising a punch for each day in the month; a group of punches 23 comprising a punch for each of the twelve hours; a relatively small group 24 comprising a punch for each of the quarter hours; a group consisting of two punches 25, one of which is adapted to punch the A. M. and the other the P. M. printed designations on the transfer strip *j*; and lastly a group of punches 26 for the several destination points printed on the transfer strip. The transfer strip *j* is suitably printed with appropriate designations, each of which, when the strip is properly positioned beneath member 18, underlies a corresponding punch in the latter. All the punches of all the groups are similarly constructed and mounted and the construction and mounting of each will be clearly obvious from Fig. 9 in connection with the punches 26. The latter are held with their upper ends protruding above member 18 and their lower ends substantially flush with the bottom face of member 18 by suitable springs 27. The plate *i* has an opening to underlie each of the punches, as the openings 28 in Fig. 9.

Referring to Figs. 2, 3, and 9, above member 18 and between it and top plate *o* is a depressible frame which consists of spaced longitudinal side bars *p* interconnected by a plurality of spaced laterally arranged bars *q*, which as shown in Fig. 9 are mortised into bars *p*. Bars *p* are furthermore connected laterally by an inverted U-shaped bridge *r* (Fig. 9) which, as shown in Fig. 3, overlies all of the bars *q*, and on each end of the bridge are laterally arranged angle irons *s* (Fig. 3). The bridge *r* connects merely the central portions of bars *p* and, adjacent their left hand ends, the bars are also connected by another plate *t* of inverted U-shape as best shown in Fig. 10. Secured to each bar *p* are a pair of spaced vertically arranged rods 29 which, as shown in Fig. 2, are slidable in brackets secured to frames *h* and are held in raised position by springs 30 in an obvious manner. The lower ends of each pair of rods 29 are connected by a plate 31, and the engagement of the plate with the lower faces of the described brackets limits the upward movement of rods 29 and thus bars *p*.

The depressible frame, comprising bars *p*, *q*, *r*, *s*, and *t*, carries selector devices, whereby the depression of the frame may simultaneously actuate one punch of each of the described groups. The selector devices for each group vary in construction and operation according to the group with which they are employed. Thus, the month punches 21 obviously need be but infrequently changed, and the same is true to a less degree with the day punches 22. Accordingly, the selector devices for the groups 21 and 22 may and preferably are arranged to be inaccessible from without the casing with the idea that the selection may be made only by a limited class of individuals, as while the cars, on which the apparatus may be used, are put up for the night in the car houses.

Referring to Figs. 3 and 10, a plate 32 rests by gravity upon suitable guides projecting inwardly from bars *p* and in this plate are a plurality of holes 33 and 34 (Fig. 13) to overlie corresponding punches 21 and 22, respectively, in member 18. When plate 32 is removed, a pin 35 may be inserted in the desired one of the holes 33 and a similar pin 36 in the desired one of the holes 34. These pins extend below plate 32 and, when the depressible frame is lowered, engage and actuate the selected punches 21 and 22. The knurled heads of pins 35 and 36 are arranged to engage the under face of the described plate *t* which prevents movement of the pins and plate 32 relatively to the depressible frame. Secured in spaced relation to the left-hand end of plate 32 are flanged upstanding studs 37, the flanges of which engage the lower face of plate *t* (Fig. 3). The latter has suitable slots to receive studs 37 and knurled nuts 38 on the latter are adapted to clamp the plate *t* against the flange on the stud, whereby plate 32 may be held against displacement relatively to plate *t*. The insertion of studs 37 in the slots in plate *t* positions plate 32 laterally, and the abutment of the latter with a pair of spaced pins 32′ depending from the rear of plate *t* positions the plate 32 longitudinally so that holes 33 and 34 properly aline with their respective punches 21 and 22. The plate 32 may be conveniently removed when cover *e* is opened, by loosening nuts 38 and thereafter drawing out the plate, the nuts and studs serving as convenient handles.

The selector device for the group of punches 23 must needs be arranged for more

convenient actuation and for more rapid selection of the desired punch than the selectors just described, inasmuch as they control the hour time. Referring to Fig. 3, a shaft 39 mounted in and extending between the side bars *p* of the depressible frame has a plurality of pins 40 extending radially outwardly from its periphery. Pins 40 are spaced axially on shaft 39 to correspond with the lateral spacing of the described punches 23. Starting from one end of shaft 39, successive pins are progressively spaced angularly of the shaft, as by thirty degree increments, for example. Thus, only one pin 40 can directly overlie a punch 23 at a time, and each pin can only actuate one of the punches 23. By turning shaft 39 step by step, as by thirty degree increments, it will be seen that each punch 23 may be successively selected and that on the lowering of the depressible frame a pin 40 will engage and actuate the selected punch 23.

The means for moving shaft 39 by increments will best be understood from Figs. 2 and 5. A disk 41 is fixed to one end of shaft 39 and on the disk is a ratchet 42 (Fig. 2) having the same number of teeth as there are pins 40 and punches 23. Fixed to the ratchet is a disk 43 and the latter coöperates with disk 41 to form a guide to receive and prevent lateral displacement of a pawl 44, which engages the ratchet. Pawl 44 is pivotally connected to one end of a bell crank lever 45 pivoted to a bracket upstanding from one of frames *h*, as clearly shown in Fig. 2. The other end of lever 45 is connected by a link 46 with the lower end of a vertically depressible bar 47 slidably mounted in plate *o* and having on its upper end a suitable head or button for convenient actuation. In order to supplement the relatively small guiding surface for bar 47, which is presented by plate *o*, a radius arm 48 is pivoted at one end to a post *n* and at the other to the pivotal connection between bar 47 and link 46, which arrangement constrains member 47 to move in a substantially vertical path. A stop pin 49 on the supporting bracket for bell crank 45 lies in the path of the latter and limits its movement to an amount just sufficient to move ratchet 42 through the desired angular increment. A spring 50 connects the pawl 44 to bar *p* and holds the former in engagement with the ratchet and bar 47 in elevated position, wherein a small lug on the latter abuts the under face of plate *o*, as clearly shown in Fig. 2. It will thus be seen that, as bar 47 is successively depressed, each pin 40 is caused to overlie one of the punches 23 and, to permit the operator to know which of the punches 23 has been selected, the disk 41 has on its periphery appropriate designations, as the Figs. 1 to 12, which successively become visible on step by step movement of the disk under a window 51 in plate *o* (Fig. 2 and 8).

The groups of punches 24 and 25 are controlled in a manner similar to that just described in connection with the group 23 by a single similarly mounted shaft 52 (Figs. 3 and 5), which is rotatable step by step in a similar manner. A disk 53 having designations on its periphery is fixed to shaft 52 and bears a ratchet 54 and a small disk 55. A pawl arm 56 is connected to a pivoted ball crank 57 (Fig. 3) which in turn is actuated by a depressible bar 58 in a manner similar to that already described. A bar 59, mounted in and extending between the side bars *p* of the depressible frame, has in each end a spring pressed pin 60 (Fig. 5), and the bar is located equidistantly from the centers of the described disks 41 and 53 so that one pin 60 may engage in any one of a plurality of notches in disks 41 and the other in any one of a plurality of notches in disk 53. The pins 60 serve to frictionally hold the disks in the various angular positions which they may assume.

Referring to Figs. 5, 6, and 7, the shaft 52 has adjacent one end three pins 61, which extend diametrically therethrough and project equidistantly from opposite sides of the shaft. The pins 61 are located axially on the latter in the vertical planes of their respective punches 24, as clearly shown in Fig. 5. As best shown in Fig. 7, the pins 61 are angularly spaced from one another on shaft 52 by angles of forty-five degrees, and the ratchet 54, as shown in Fig. 3, has eight teeth. It will thus be seen that in two positions of disk 54, no pin 61 will overlie any of punches 24, but in all other positions of the disk some one pin will overlie some one of the punches. The latter punch the "minute time" printed designations on the transfer strip, as 15, 30, and 45 indicating the quarter hours, and when the transfer is issued exactly on the hour no one of punches 24 are actuated, the shaft 52 being positioned so that no pin 61 overlies the punches. It will also be noticed that each pin 61 can operate its punch in either of two positions of shaft 52, and this arrangement makes it possible to control the punches 25, which punch the "A. M." and "P. M." printed designations on the transfer, from the same selector shaft. Thus, for example, the disk 53 may be marked on its periphery with two groups of figures 0, 15, 30, and 45 and the figures of one group, may be qualified by an A. M. (see Fig. 8) and of the other by a P. M., the figures being visible through a window 62 in top plate *o*, as shown in Fig. 8.

Positioned axially on shaft 52 in the vertical planes of punches 25 are two oppositely disposed segments 63, each substantially one hundred and eighty degrees in extent

(Fig. 6) so that one or the other of the punches 25 will always be actuated on the lowering of the depressible frame. The peripheral extent of each segment 63 thus includes in angular extent one end of each of the three pins 61 and a blank space, whereby the minute time and A. M., P. M., groups of punches may be selected for operation by a single device, thus necessitating less labor on the part of the operator.

The remaining group of punches 26, the "destination point" punches, are selected in an entirely different manner and in a manner calculated to permit very rapid and convenient selection of the punches, for the destinations called for vary with the desire of the passenger. Referring to Fig. 9, a shaft 64 is mounted in the described plates q above each longitudinal row of punches 26 and loosely mounted on each shaft, in an axially spaced relation corresponding to the longitudinal spacing of punches 26, are a plurality of bell crank levers 65, one for each punch 26 in the longitudinal row of punches therebelow. One arm of each bell crank 65 is pivotally connected to the lower end of a depressible bar 66 and on the other end of the latter is a suitable button, appropriately marked to indicate the destination punch 26, which is capable of being selected by depression of bar 66 in a manner to appear. Bars 66 have shoulders 67 thereon which are normally held against the under face of plate o by springs 68. When any one bar 66 is depressed, the free arm of its bell crank lever 65 lies directly above a punch 26, so that on depression of the frame, which includes bars p and q, the punch 26 is engaged and actuated.

In order to hold the bell cranks 65 in position to actuate the punches 26 and in order to obtain other desirable results to be described, the following means are provided. Each bar 66 is provided with a wedge-like projection 69, a portion of which also affords a small shoulder 70. Adjacent each longitudinal row of bars 66 is a plate 71 of right angular cross sectional shape. As shown in Fig. 3, each plate 71 is of sufficient length to cover all the bars 66 of a longitudinal row of punches. The plates 71 are pivotally supported by suitable end trunnions, as indicated in Figs. 3 and 9, from the described angle irons r, which constitute a part of the depressible frame. On the left hand trunnion of each plate 71 is a crank 72 (Figs. 3 and 10), the crank pins 73 of which lie within spaced slots 74 formed in a plate 75. The latter is provided near its base with two elongated slots 76 through which extend studs 77 riveted to a bracket u secured to the upper face of the described plate t, all as clearly indicated in Fig. 10. Thus, plate 75 is supported for lateral sliding movements and when laterally moved will move each crank 72 and thus each plate 71. A spring 78 connects the plate 75 to bracket u and normally retains the parts in the relative positions illustrated.

Referring now to Fig. 9, it will be seen that as any one bar 66 is depressed the projection 69 thereon will engage the adjacent plate 71 and swing it to the right, thereby moving plate 75 against the tension of spring 78 and thus all the other plates 71. It should be noted that Figs. 9 and 10 are taken in opposite directions, as indicated on Fig. 3, so that the described movement of plate 71 to the right, considering Fig. 9, causes a movement of plate 75 to the left, considering Fig. 10. On further depression of the bar 66, the plate 71 is moved toward the latter by spring 78 so that the tip end of the plate lodges against the shoulder 70 on bar 66 and prevents the latter from moving upwardly under the influence of its spring 68. Thus, a bell crank 65, once moved into a position effective to actuate its punch 26, is retained in such position until another bar 66 is depressed. On the depression of another bar 66, all the plates 71 are rocked outwardly away from their adjacent bars 66, as has been described, and thus the shoulder 70, hitherto engaged by a bar 71, is released, allowing the previously depressed bar to be moved back to normal position by its spring 68.

It will, therefore, be seen that the destination punches may be selected for subsequent actuation expeditiously and with comparative ease and convenience, since the operator does not have to manually hold the bar 66 depressed. The self-restoring feature, whereby an actuation of one bar 66 releases that bar previously actuated, is important in an apparatus of this character as making for rapid and efficient operation. In event one bar 66 is actuated incorrectly, it is only necessary to depress the correct bar before the depressible frame is lowered. I am aware that the automatic restoration of depressible bars has been accomplished heretofore, but as distinguished from the prior art, the actuation of a bar does not irrevocably set parts in position and an inadvertent selection of the wrong punch can be remedied by simply depressing the right one before the depressible frame is lowered by means to be described.

The main operating mechanism will now be described with reference to Figs. 2, 3, and 5. Within the described pedestal b is a plunger 79 (Fig. 2) which may be forced upwardly by depressing the described foot lever 15. A lever 80, fixed on a shaft 81 mounted in frames h, is pivotally connected to the upper end of plunger 79 and has a part adapted to engage a pin on a forked lever 82 fixed on a shaft 83 mounted in frames h. Also fixed on shaft 83 is a lever 84

which is normally held against a stop pin 85 by a spring 86. Shaft 83 is the main operating shaft of the apparatus and is adapted for oscillation in one direction by the foot lever 15 and in the other direction by spring 86. In order to prevent too rapid oscillation of shaft 83 by spring 86 and in order to control the speed of such oscillations, an air check cylinder *v* (Figs. 1 and 2) is provided and the piston rod 87 of the latter is connected by a link 88 (Fig. 2) to a lever 89 which is fixed to the outer end of shaft 83. Cylinder *v* is supported from pedestal *b*, as best shown in Fig. 1, and may be of any suitable form and further description of the air check is thought unnecessary to an understanding of the invention, inasmuch as such devices are well known in the art. Shaft 83 actuates three principal mechanisms, viz., the punching mechanism, the feeding mechanism, and the cutting mechanism,—and a secondary mechanism which consists in a release for the feeding mechanism.

The punching mechanism is operated from shaft 83 in the following manner. A segmental gear 90 fixed to shaft 83 (Figs. 3 and 4) drives a pinion 91 (Figs. 3 and 14) loose on a shaft 92 which is rotatably mounted in frames *h* and extends beyond the latter at each end between the previously described rods 29 and above plate 31 (Fig. 2). A cam 93 is fixed on each end of shaft 92 and is adapted to engage plate 31 and lower the described depressible frame to actuate the selected punches. The pinion 91 is fixed to a hollow pawl carrying disk 94 (Figs. 3 and 14) and within the disk and keyed to shaft 92 is a ratchet 95 having but two teeth, which as shown in Fig. 3 are oppositely disposed. As shaft 83 is turned in a clockwise direction by depression of foot lever 15, disk 94 is turned in a counterclockwise direction, and its pawl turns ratchet 95 and thus shaft 92. The gear connections between shaft 83 and disk 94 are such that shaft 92 is turned one-half of a revolution, thus lowering plate 31 and allowing the latter to be restored by springs 30 to a position similar to that illustrated in Fig. 2. As shaft 83 is turned in a reverse direction by the spring 86, disk 94 turns a half revolution in a clockwise direction bringing its pawl into the other notch in ratchet 95 ready to move the latter on a subsequent depression of foot lever 15. Thus, the several selectors 35, 36, 40, 61, 63, and 65 are lowered in unison to simultaneously force one punch of each of the groups of punches 21, 22, 23, 24, 25, and 26 through the strip *j* in the channel *i'*.

The means for feeding the strip through channel *i'* will next be described, including in the order named the main and supplementary feeding mechanisms. The main feeding mechanism comprises a pair of axially spaced rolls 96, preferably covered with rubber or the like, and a similar pair of smaller rolls 97 above rolls 96 to coact with the latter. Rolls 96 are fixed to a shaft 98 mounted in frames *h* which shaft is driven from main shaft 83 in the following manner. A pinion 99 (Figs. 5 and 15) loose on shaft 98 meshes with the described segmental gear 90 and has fixed thereto a wheel 100, having as shown in Fig. 3, a single notch. A pawl 101 pivoted to a side face of one feed roll 96 (Fig. 5) is adapted to engage in the notch in wheel 100. As shaft 83 is moved by foot treadle 15, wheel 100 is free to turn without moving pawl 101 or the feed rolls but, when the shaft moves in the reverse direction, wheel 100 carries with it the pawl 101 and thus turns the feed rolls. The gear 90 and pinion 99 are so proportioned that wheel 100 makes one complete revolution on each oscillation of shaft 83.

In order to prevent the feed rolls 96 from creeping or slightly turning in a clockwise direction out of the illustrated position, means are provided to hold the feed rolls from movement until the gear 90 has completed a substantial part of its clockwise oscillation. Such means comprise a lever 102, pivoted on a shaft 103 mounted in frame *h*, and a pin 104 fixed in the side face of one of the feed rolls 96 (Figs. 3 and 5). Lever 102 is normally and yieldingly held in the illustrated position, wherein pin 104 abuts a suitable shoulder on the lever, by a spring 106 which tends to swing the lever in a counterclockwise direction. Thus, any tendency of the feed rolls 96 to creep in a clockwise direction out of the illustrated position is frustrated by the abutment of the pin 104 with lever 102. The feed rolls 96 are released for clockwise rotation as the gear 90 approaches the end of its clockwise oscillation. Thus, the lever 102 has a part which is disposed in the path of a cam 105 which is fixed on shaft 83 and is thus movable with gear 90. As cam 105 is swung in a clockwise direction, it engages lever 102 and moves it in a counterclockwise direction, thus withdrawing the lever from pin 104 against the tension of spring 106. The contacting portions of lever 102 and cam 105 always lie to the left (as viewed in Fig. 3) of an imaginary straight line connecting the centers of shafts 83 and 103, so that, inasmuch as lever 102 cannot move in a counterclockwise direction beyond the illustrated position by reason of the abutment of its left hand portion with cam 105, the lever must of necessity be displaced in a clockwise direction. The release of pin 104 occurs just prior to the completion of the clockwise oscillation of gear 90, and it will

be obvious that the lever cannot drop back into the illustrated position until an interval has elapsed after gear 90, and thus cam 105, has started on its counterclockwise oscillation. This interval is so gaged as to permit rolls 96 to move slightly in a clockwise direction, whereby the pin 104 is moved sufficiently to prevent its being again engaged by the lever 102 as the latter drops back into the illustrated position. The lever 102 is engaged by pin 104 after the rolls 96 have completed exactly one revolution.

Referring to Fig. 2, the upper rolls 97 are mounted on a shaft 107 which is supported at both ends by levers 108 pivoted at 109 to frames *h*. Levers 108 are also connected to the latter by springs 110 which yieldingly hold rolls 97 against rolls 96. The tangent point of the coacting rolls is located in the plane of the strip passage *i'* and the strip *j* is gripped between the rolls and fed forward in the passage *i'* in an obvious manner.

In order to permit the strip *j* to be initially fed through the machine, as by pushing the strip from the left hand end of the machine through passage *i'*, means are provided whereby rolls 97 may be conveniently lifted from engagement with rolls 96. Referring to Fig. 3, a bell crank lever 111, fixed centrally on a shaft 112 mounted in and extending between the right hand pair of posts *n*, has one arm connected by a link 113 to the roll shaft 107. To the other arm of bell crank 111, a rod 114 is connected and rod 114 extends toward the left hand end of the machine where it is supported and guided in a slot in the described bracket *u* (see Fig. 10). To the free end of rod 114 is attached a finger piece 115, whereby rod 114 may be conveniently pulled to the left, when cover *e* is opened, to lift rolls 97, and member 115 has a shoulder which may be lifted to engage the left hand end of top plate *o* and thus hold rod 114 in its moved position and rolls 97 lifted until the strip *j* has been threaded through passage *i* and between rolls 96 and 97. Preferably, the described punch plate 18 is recessed as shown in Fig. 3 to receive a flat spring 116, which bears against the strip in passage *i'* and creates a slight frictional resistance to movement of the strip by rolls 96 and 97.

The rolls 96 and 97 are not relied upon to move the strip *j* accurately into position beneath the punching mechanism and supplementary feeding means are provided to insure that the transfer strip is positioned so that the printed designations thereon accurately aline with their respective punches in member 18. This supplementary feeding mechanism makes necessary the automatic raising of rolls 97 at the proper time to permit it to operate. The automatic release is best shown in Fig. 2 and will now be described. On each end of shaft 98 (see also Fig. 5) a cam 117 is secured, and the cams are arranged to engage depending parts of levers 109 (Fig. 2). The cams turn with the feed rolls 96 and near the end of the revolution of rolls 96 lift levers 108 and thus rolls 97. The latter are held raised for a period sufficient to allow the supplementary feeding mechanism to act and are then allowed to drop back on the strip ready to feed the latter on a subsequent actuation of the apparatus.

The supplementary feeding mechanism will next be described with reference to Figs. 3 and 5. Loosely mounted on a shaft 118 and arranged centrally between the feed rolls 96 is a curved upwardly extending lever 119. Pivotally mounted on the upper end of the latter in axially spaced relation (Fig. 5) are a plurality of pawls 120. The pawls are connected intermediate their ends to lever 119 and their left hand ends are connected by springs 121 to the latter, whereby their other ends are forced yieldingly against the under face of the described paper guide *l*. The upper end of lever 119 is also pivotally connected to one end of a link 122, and the other end of the latter has an elongated slot 123 to ride on shaft 103. A bow spring 124 acts between the latter and a pin on link 122 to force the link 122 and thus pawls 120 to the right, the extent of movement being limited by the engagement of the slotted end of link 122 with shaft 103. The pawls 120 are movable to the left by a cam 125, which is fixed centrally on shaft 98 and is adapted to engage and move the lever 119. Lever 119 is not moved by the cam until the feed rolls have turned substantially half a revolution and is then moved to left into the position shown in Fig. 4, while feed rolls 96 continue to draw the strip *j*. On further rotation of shaft 98 from the position shown in Fig. 4, cam 125 will allow the lever 119 to move to the right and substantially at this time cams 117 begin to lift the rolls 97 as described. The lever 119 moves slowly as it leaves the position shown in Fig. 4 and until the pawls 120 drop into the perforations *j'* in the transfer strip and then, as the cam 125 continues to turn, the pawls are carried at increasing speed and shoot the portion of the strip previously punched under a plurality of wires 126, fixed to and extending forwardly from the right hand end of paper guide *l* and upon table *m*. The movement of the strip is limited by the movement of pawls 120 to the right, and it will readily be seen that each unit section of the strip is positively carried into a predetermined position by the supplementary feeding

mechanism, which result could not be insured by the feed rolls alone. Thus, the ejection of a punched transfer causes a succeeding transfer to become accurately positioned beneath the punching mechanism.

The means for severing the punched sections of the strip from the unpunched portions will now be described. Referring to Fig. 3, a knife 127 is fixed on the ends of a pair of levers 128, which in turn are fixed in spaced relation on a shaft 129 carried by the table *m*. Knife 127 coöperates with an upturned portion of the table *m* to sever the strip *j*, and has a spring plate 130 secured thereto which bears upon and yieldingly holds the severed transfers to the table *m* until they are removed by the passenger. Referring now to Fig. 2, on one end of shaft 129 is a lever 131, which is connected to a lever 132 by a link 133, and a spring 134 normally holds lever 131 in the illustrated position. The lever 132 is loosely mounted intermediate its ends on a stud 135 and one end of the lever is adapted to abut a stop 136 fixed to frame *h*, whereby the edge of knife 127 may be prevented from engaging table *m*. Also loosely mounted on stud 135 is a disk 137 and secured to the latter is a pinion 138 which meshes with a segmental gear 139 fixed on the main operating shaft 83 between the lever 89 and one frame *h*. Fixed to disk 137 and projecting outwardly therefrom is a pin 140, which when shaft 83 is turned by foot lever 15, will eventually engage the lower end of lever 132 and swing it in a counterclockwise direction until the pivotal connection between lever 132 and link 133 lies above an imaginary straight line connecting the centers of stud 135 and the pivotal connection of link 133 with lever 131. Thus the knife 127 is lifted during the depression of foot lever 15 and during this interval the feed rolls 96 are stationary as has been described. The knife 127 is furthermore held lifted due to the "crossing of centers" above described by a toggle action. As rolls 96 begin to feed the paper, pin 140 moves in a clockwise direction away from the previously engaged end of lever 132 toward the other end thereof and at the end of its movement, pin 140 engages the last-named end of lever 132 and moves it sufficiently to break the "toggle" which has hitherto held knife 127 in lifted position. The result is that the knife 127 is sharply drawn back into the illustrated position by spring 134 and the paper is severed at the exact end of its feeding movement.

It is desirable to provide means for counting the transfers which are issued by the apparatus and accordingly a cumulative register *w*, of any suitable type, is mounted on a bracket secured to posts *n*, as shown in Fig. 2. As shown in Fig. 8, the readings of the register *w* are visible through a window 141 in casing *a*. The register has an operating crank 142 (Fig. 2) which when rocked back and forth operates the register in the usual manner. Crank 142 is connected by a link 143 with a lever 144 fixed on a shaft 145 which is rotatably supported in a bracket depending from table *m*. Fixed on one end of shaft 145 and normally held against one of frames *h* as a stop by a spring 146 is a lever 147, which has a part to lie in the path of the described pin 104 on feed roll 96. Thus, as the latter nears the end of its revolution pin 104 moves lever 147 and rocks the register crank 142 in an obvious manner. An audible signal, as a gong *x*, is also preferably provided. Gong *x* is supported on the bracket supporting shaft 145 and, carried by the latter through the intermediary of a resilient wire 148, is a hammer 149 which will engage the gong *x* on each operation of the feed roll 96 in an obvious manner.

The operation of the apparatus will now be briefly summarized. Assuming that an unpunched unit of strip *j* has been properly positioned beneath the member 18 and that the selector pins 35 and 36 have been previously adjusted, the operator depresses either member 58 or 47 or both as required to select the proper punch or punches to indicate the desired time. These members 47 and 48 obviously may not need to be changed except once each trip. The operator thus can set all the selectors, except the destination selectors, at the start of the trip, and thereafter need depress merely the desired member 66 which selects the proper destination punch. Having selected the latter, he then depresses lever 15 and the operation is thereafter automatic and extremely rapid. The depression of the lever 15 causes the selected punches to be actuated, the feed rolls to be released from lever 102, the knife 127 to be raised, and the spring 86 to be extended. As soon as lever 15 is released, spring 86 returns the shaft 83 to normal position, and the speed of the return movement is controlled by the air check described. The return movement of shaft 83 operates first the feed rolls 96, then the pawls 120 are carried to the left, and thereafter the rolls 97 are lifted free from rolls 96 while the pawls 120 move the strip into a predetermined position, in which the printed designations on strip *j* accurately aline with their respective punches. This movement of strip *j* causes the previously punched portion of strip *j* to be ejected from the machine and finally the knife 127 descends and severs the punched portion of strip *j* from the remaining unpunched portion, and the punched portion is held on table *m* by the spring plate 130.

An important feature of the invention consists in the arrangement whereby the

pawls 120 are caused to come into play at the proper time and complete the feeding movement of the strip. The pawls, since they engage the perforations j', insure that the leading end of each strip unit is carried accurately into a predetermined position, wherein the printed designations on the strip properly aline with their respective punches, so that differences in length of the strip are compensated for and errors due to variations in length of the strip or slip in the main feeding mechanism are prevented from accumulating.

The arrangement whereby the entire selector mechanism is carried by the depressible plate is also important as is also the particular arrangement whereby a selector is provided for each punch as distinguished from a single selector or a limited number of selectors for each group, in which case the selector must be shifted from punch to punch. The present arrangement permits rapid and efficient selection of the desired punch in each group by making the selectors conveniently operable by the conductor and operable with a minimum of labor.

The severing mechanism is considered advantageous in its particular operating arrangement, whereby it is raised against the tension of its spring and held raised by a toggle action through the mechanism which operates the depressible frame and whereby it is permitted to act sharply at the end of the feeding movement of the strip by releasing or breaking the toggle holding means through the action of the mechanism which feeds the strip.

The feature of the invention, whereby the manual actuation of the punching mechanism accomplishes the setting of other parts for subsequent and automatic operation on the release of the manually operable means, is also considered advantageous. The entire apparatus is designed so that the operator has a minimum of work to perform. Thus, for the major part of the time all that he has to do is to depress one button to set the selector controlling the desired destination punch and thereafter depress the pedal 15. If several transfers for the same point are required, the conductor, having set the selector for one, merely depresses the pedal repeatedly and the several transfers are successively ejected and stacked one upon another in convenient reach of the passenger.

Thus, new and useful improvements in strip punching apparatus have been provided, which are particularly advantageous for the rapid and efficient punching and issuing of transfers, tickets, or the like in continuous strip form. It is recognized that various modifications may be made in the one embodiment of the invention herein set forth for illustrative purposes without departing from the scope of the invention which is defined by the appended claims rather than by the foregoing description.

What I claim is—

1. A strip punching apparatus, comprising, a casing having means to receive a plurality of transfers or the like in continuous strip form, means affording a passage through which the transfers may be fed, punching mechanism adjacent said passage, feeding mechanism to successively advance transfers into aproximate position with relation to the punching mechanism, and means to successively engage the transfers after the operation of said mechanism and advance them into proper relation with the punching mechanism.

2. A strip punching apparatus, comprising, a casing to receive a plurality of transfers or the like in continuous strip form, means affording a passage through which the strip may pass, punching mechanism adjacent the passage, mechanism to feed a measured length of the strip through said passage, and other mechanism operable to carry the transfers a further distance into a predetermined position irrespective of variations in the length of the transfer.

3. A strip punching apparatus, comprising, a casing to receive the strip, means affording a passage through which the strip may pass, mechanism adjacent the passage to operate on said strip, a feed roll to move the strip through the passage, and reciprocable mechanism to positively grip the strip and carry it a further distance into proper relation with the first-named mechanism, all constructed and arranged to prevent accumulation of errors in the feeding of the strip by said roll.

4. A strip punchinug apparatus, comprising, a casing to receive the strip, means affording a passage through which the strip may be fed, punching mechanism adjacent said passage, feeding mechanism to move the strip into approximate position with relation to the punching mechanism, and a reciprocable pawl operable to engage a perforation in the strip fed by the first-named mechanism and carry it accurately into a predetermined position.

5. A strip punching apparatus, comprising, a casing to receive the strip, means affording a passage through which the strip may be fed, punching mechanism adjacent the passage, a feed roll to move the strip through the passage, a reciprocable feeding mechanism adapted to grip the strip, and means movable with the feed roll to reciprocate the last-named mechanism in timed relation with the feed roll, so that the strip fed by the latter may be gripped and carried accurately into a predetermined position.

6. A strip punching apparatus, comprising, a casing to receive the strip, means affording a passage through which the strip may be fed, punching mechanism adjacent the passage, a feed roll to move the strip through the passage, a roll coacting with the feed roll to grip the strip, a supplementary feeding mechanism to move the strip into a predetermined position, and means to separate said rolls during the feeding movement of the supplementary mechanism.

7. A strip punching apparatus, comprising, a casing to receive the strip, means affording a passage through which the strip may be fed, punching mechanism adjacent the passage, a feed roll to move the strip through the passage, a reciprocable feeding mechanism adapted to grip the strip and carry it into a predetermined position with relation to the punching mechanism, a roll coacting with said feed roll, and devices movable with the latter to reciprocate said feeding mechanism in properly timed relation with the feed roll and to separate said rolls during the operation of the feeding mechanism.

8. The combination with a feeding means operable to carry a strip into a predetermined position and means to operate on the strip while in such position, of a strip severing device capable of being moved into and releasably held in one position, means automatically operable when said device is released to sharply move the latter into a second position to sever the strip, mechanism to move said device into its first-named position and to subsequently release it for automatic movement to strip severing position at the end of the operation of said feeding means, and latching means to hold said device in its first named position after being so moved by said mechanism and until subsequently released by the latter.

9. In an apparatus of the class described, means to feed a strip into a predetermined position, means to operate on the strip while in such position, mechanism operable to actuate first one and then the other of said means, a device to sever the strip, mechanism operable during the actuation of the second means to move said device from one position into a second position, said last-named mechanism including means whereby said device is releasably held in its second position after the operation of the last-named mechanism, and means automatically operable when the last-named means are released to move said device from its second to its first position to sever the strip, the last-named mechanism arranged to release the last-named means at the end of the operation of said feeding means.

10. A strip punching apparatus, comprising, punching mechanism, mechanism to feed the strip to the latter, a common operating means for both including a lever adapted for manual operation in one direction and a spring to operate it in the other direction, all constructed and arranged so that the punching mechanism is operated by the actuation of said lever and the feeding mechanism by the contraction of said spring, and a dashpot to control the speed of the feeding mechanism.

11. A strip punching apparatus, comprising, punching mechanism, mechanism to feed the strip to the latter, mechanism to sever the punched portion from the strip, and means manually operable to actuate said punching mechanism and to set the feeding and severing mechanism for automatic operation on release of said manually operable means.

12. A strip punching apparatus, comprising, punching mechanism, mechanism to feed the strip to the latter, means movable in one direction to operate the punching mechanism and operable on its return movement to actuate the feeding mechanism, a spring operated knife to sever the punched portion of the strip arranged to be lifted by said means during the operation of the punching mechanism, and a toggle arrangement to hold said knife lifted, said means arranged to break the toggle at the end of its return movement and allow the knife to sever said strip.

13. A strip punching apparatus, comprising, punching mechanism, mechanism to feed the strip to the latter, rotary means including a clutch to operate the punching mechanism when turned in one direction, rotary means including a clutch to operate the feeding mechanism when turned in an opposite direction, and a common oscillatory means for both said rotary means arranged to simultaneously turn both in the same direction and first in one and then in the other direction, whereby the punching mechanism is operated on one stroke of the oscillatory means and the feeding mechanism on the other stroke.

14. A strip punching apparatus, comprising, punching mechanism, mechanism to feed the strip to the latter, oscillatory means to operate first one and then the other of said mechanisms, whereby the strip may be punched and then advanced to feed an unpunched portion to the first mechanism and eject the punched portion, a spring operated knife to sever the latter portion, an operating crank for the knife, a link connecting the latter and crank, and means associated with said oscillatory means operable on one stroke of the latter to turn the crank and move the knife against its spring, said crank and link arranged when thus moved to hold the knife in its moved position by a toggle action, said crank having a part to be engaged by the last-named

means at the end of its other stroke to break the toggle and allow said knife to be sharply actuated at the end of the feeding movement of the strip.

15. In a strip punching device, a casing having means to receive the strip and a passage through which the latter may be passed, a member adjacent said passage, a plurality of groups of punches mounted in said member, a depressible member, a plurality of groups of selector devices on the latter, one for each punch of each group, means whereby any one selector device of each group may be set to actuate its punch on depression of the last-named member, and means to depress the last-named member to simultaneously actuate the selected punches.

16. In a strip punching apparatus, means affording a passage through which the strip may pass, a row of punches including two groups, each punch adapted to be moved through said passage to punch the strip, a member movable toward the passage, a rotatable device carried by said member and having its axis alined with the row, a pair of diametrically opposed projections on said device for each punch of one group, each pair of projections being axially and angularly spaced from the adjacent pair, oppositely disposed and axially spaced segmental parts on said device for the punches of the other group, manually operable means to turn said device step by step, whereby one projection may be moved into and all others out of position to engage with its and their respective punches, all constructed and arranged so that each punch of one group is selected for operation twice on each revolution of said device and so that one punch of the second group is selected for operation by the selection of each of the first group during one-half of each revolution of said device and the other punch of the second group is selected by the selection of each of the first group during the other half of each revolution of said device, and means to move said member to actuate the selected punch of each group.

17. In a strip punching apparatus, a casing having means to receive the strip, means affording a passage through which the strip may pass, groups of punches, each arranged to punch the strip while in said passage, a member movable toward said passage, a plurality of devices one for each punch of each of a plurality of groups, means outside the casing to set any one device of each of said plurality of groups into position operative to actuate its punch on movement of said member, means within the casing movable into position to actuate any one punch of other groups on movement of said member, a movable portion provided on said casing to permit access to the last-named means, and means to move said member to actuate the several selected punches.

18. In a strip punching apparatus, a casing having means to receive the strip, means affording a passage through which the strip may pass, a plurality of groups of punches, each arranged to punch the strip while in said passage, a member movable toward said passage, a plurality of devices one for each punch of certain of said groups, means outside the casing to set any one device of each of the last-named groups into position operative to actuate its punch on movement of said member, a removable plate within said casing having a plurality of holes to correspond with the punches of the other groups, and removable members adapted to be positioned in said holes to select and operatively engage a punch of each group, a movable portion provided in said casing to permit access to said plate, and means to move said member to simultaneously actuate the several selected punches.

19. In a strip punching apparatus, a casing to contain the strip, means affording a passage through which the strip may pass, a depressible member adjacent the passage, a punch carrying member mounted on said means, a plurality of punches in the punch carrying member, means on the depressible member movable into position to engage and actuate certain of said punches on depression of said members, means to depress the latter, and a cover on said casing to permit access to one end of the punch carrying member, the latter being mounted to slide on the first-named means, whereby it may be withdrawn from the casing when the cover is open, and means to normally hold the punch carrying member in operative relation with the first-named means.

20. In an apparatus of the class described, feeding mechanism to advance a strip into a predetermined position, mechanism to operate on the strip when in such position, means movable in one direction to actuate the second mechanism and operable on its return movement to actuate the first mechanism, a spring operated knife to sever the strip after the operation of the feeding mechanism and arranged to be lifted by said means during the operation of the second mechanism, and releasable means to hold said knife in lifted position until the end of the operation of the feeding mechanism, the first named means arranged to then release the knife to sever the strip.

21. In an apparatus for issuing transfers or the like, a casing to contain the transfers in strip form, means affording a passage for the strip, punching mechanism adjacent said passage, means to feed the strip through said passage to bring unpunched unit sections into proper position relatively to the mechanism and eject previously punched

unit sections of the strip, a pivoted spring operated knife to sever the last-named sections, an oscillatory operating member for the knife, and toggle connections between the knife and member constructed so that the knife is moved on one oscillation of said member, and held lifted by a toggle action, and so that said member on its return oscillation breaks the toggle and allows the knife to return to normal position and sever said strip.

22. In a strip punching apparatus, punching mechanism, feeding mechanism to move the strip into proper position with relation to the punching mechanism, mechanism to sever the punched portion of the strip, and a single operating means operable to actuate each mechanism through one complete cycle and to coördinate the movements of each so that the strip is punched, an unpunched portion of the strip fed to the punching mechanism and the punched portion of the strip severed after the feeding movement, and means to yieldingly hold the severed portions of the strip until a succeeding feeding movement of the latter.

23. In an apparatus for punching and issuing transfers and the like, a casing to contain the transfers in continuous strip form, punching mechanism, feeding mechanism to successively position transfers in proper relation with the punching mechanism and eject previously punched transfers, a delivery table offset from the plane of the punching mechanism, means to sever the punched transfers from the strip as they are ejected upon said table, and means operable to yieldingly hold transfers on said table during the operation of the punching mechanism, all constructed and arranged so that a plurality of punched transfers may be stacked one upon another when desired.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."