

Oct. 9, 1934.

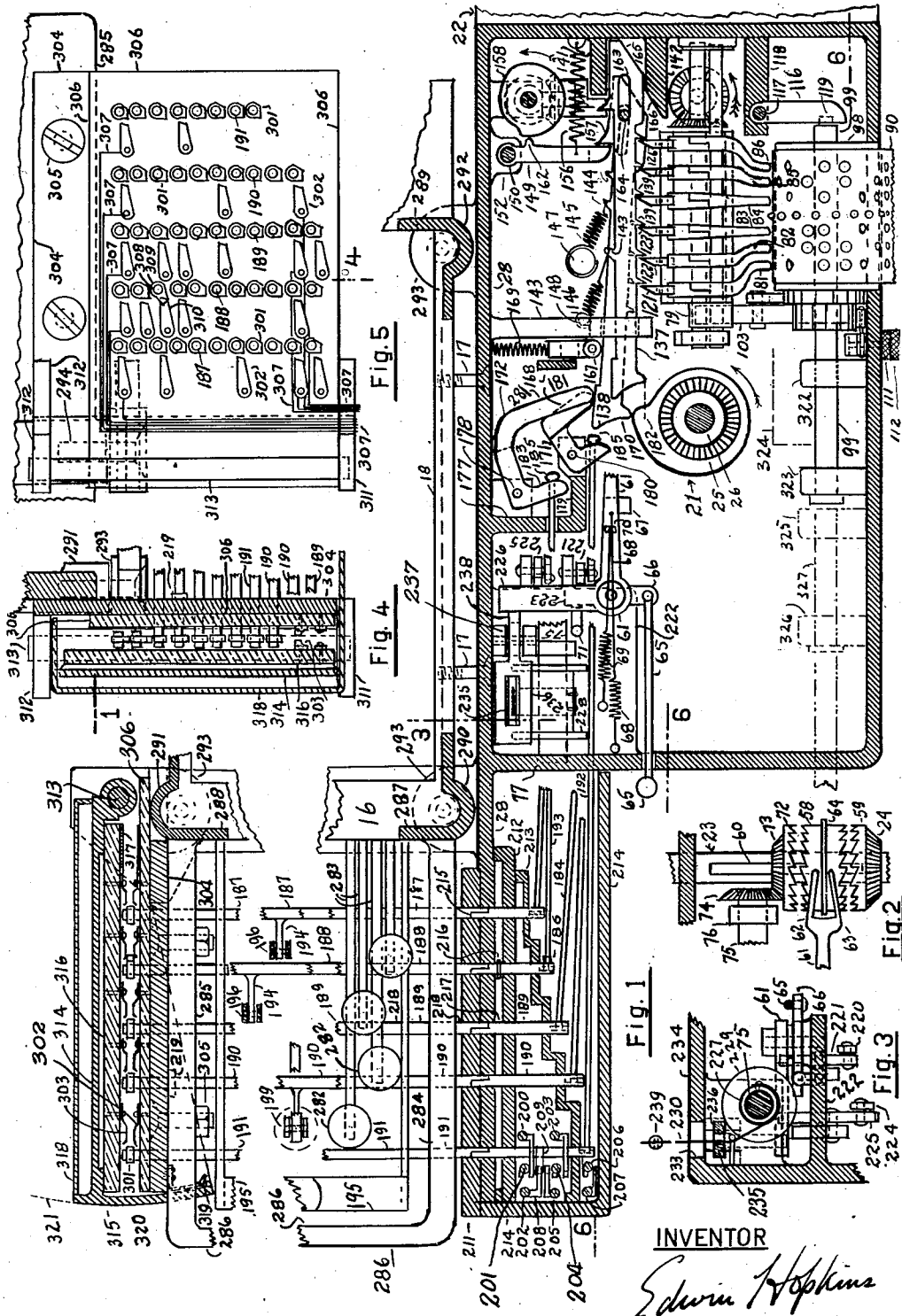
E. HOPKINS

1,975,791

TYPEWRITER ACTUATOR

Filed March 9, 1928

3 Sheets-Sheet 1



Oct. 9, 1934.

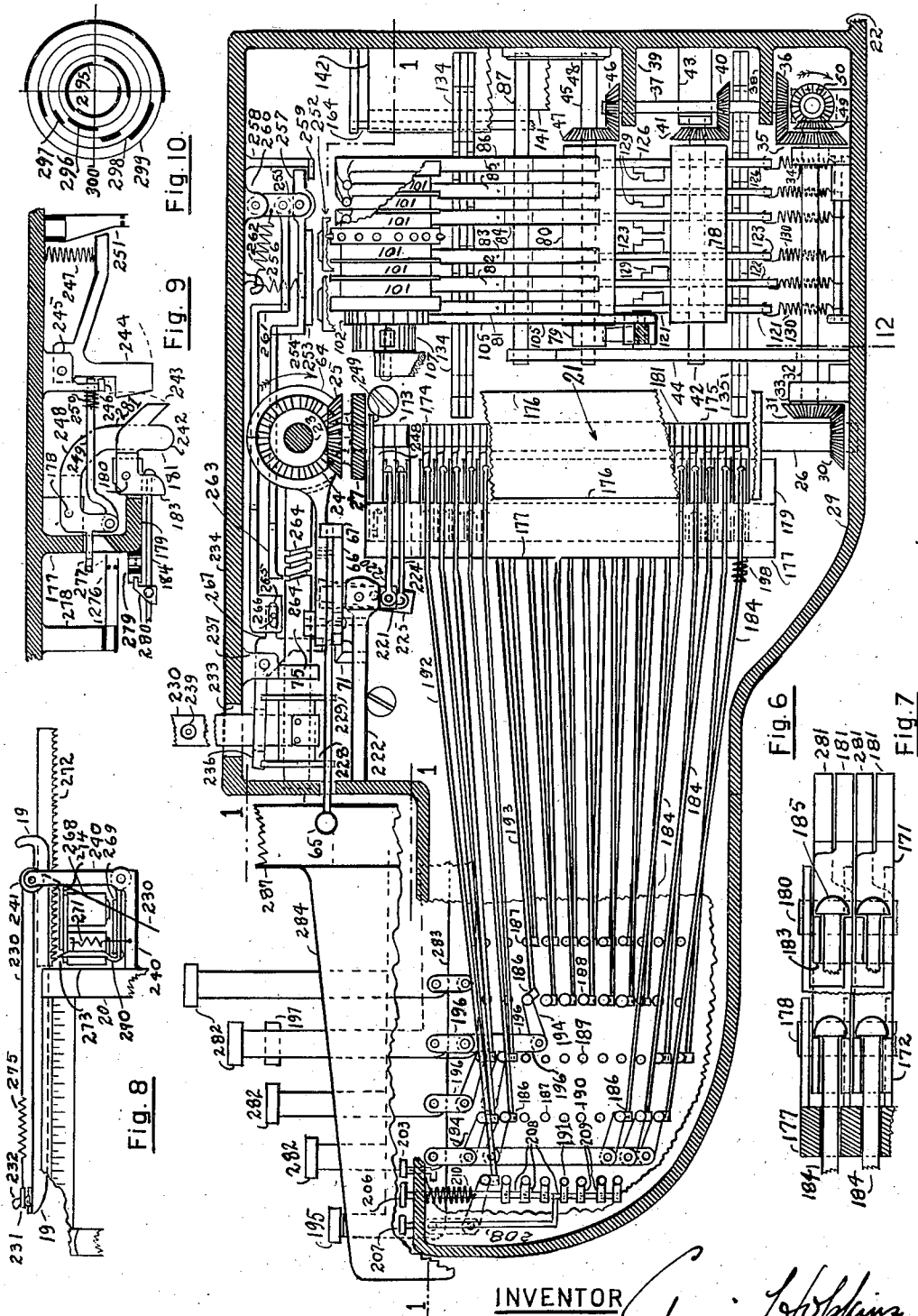
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3 Sheets-Sheet 2



Oct. 9, 1934.

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3 Sheets-Sheet 3

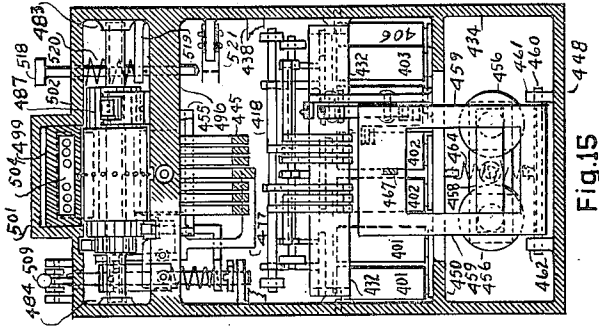


Fig. 15

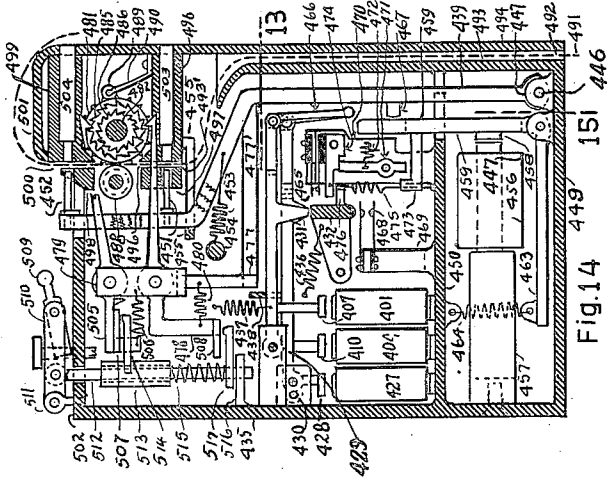


Fig. 14

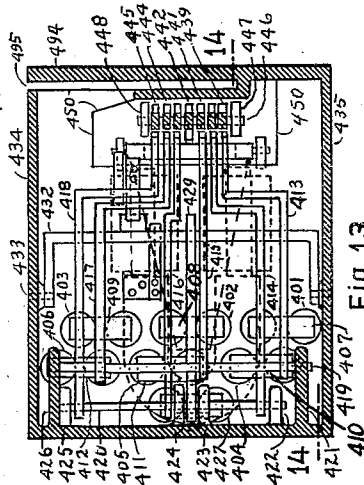


Fig. 13

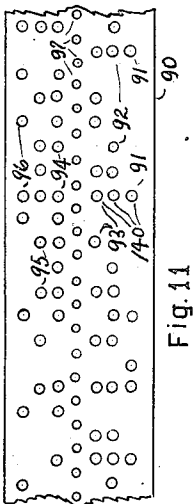


Fig. 11

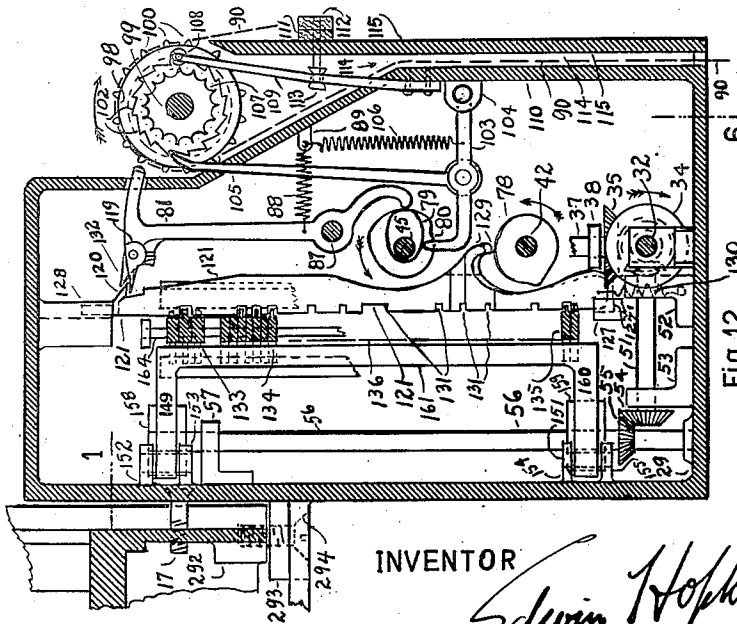


Fig. 12

INVENTOR

Edwin Hopkins

UNITED STATES PATENT OFFICE

1,975,791

TYPEWRITER ACTUATOR

Edwin Hopkins, New York, N. Y.

Application March 9, 1928, Serial No. 260,341

18 Claims. (Cl. 197—20)

My invention chiefly relates to an actuator or mechanism designed to operate a typewriter automatically in repeating the same typewritten matter a number of times.

I provide means connected with the typewriter for making, automatically, as the typewriter is operated manually, a strip record in the form of a six unit perforated code strip of the typewritten matter as it is first written, and means for causing the typewriter, later, to be actuated through the instrumentality of the six unit code strip, in reproducing, key by key, its original action and thus a duplicate of the original typewritten matter.

Means are also provided, which is an advantage of my invention, for effecting the duplication of the six unit code strip itself, automatically, during the automatic operation of the typewriter by the original six unit code strip.

Customarily in the use of my actuators letters will be addressed on the typewriter manually and the actuator then will be turned on to cause the typewriter to write the body of the letter. My apparatus enables a code strip to be made of the successive addresses separately from the body of the letter. Thus after a number of letters are written there will be a code strip suitable for addressing the envelopes automatically.

Further features of my invention will be set forth hereinafter.

In carrying out my invention I find it desirable to employ the herein described apparatus, machines and manufactures, but it is to be understood that in carrying out the objects of my invention, less than all of the different means, mechanisms and manufactures herein described may be employed for some uses, or parts only may be employed for some uses, or parts only may be employed, or other mechanisms and manufactures similar may be substituted, and while the preferred forms embodying my invention are shown, it is to be understood that many structural details may be varied and many changes in details and steps resorted to, without departing from the scope and spirit of my invention, nor do I limit myself to the specific devices, machines and manufactures shown, although I believe them especially suited to the ends to be attained by my invention.

The accompanying drawings are largely diagrammatical and are not to be considered as working drawings, but merely as illustrations of the principles of the invention. Many parts are omitted from particular figures, and in particular figures different planes are taken and planes are bent without this being more than approximately indicated, for the purpose of clearness of illustration of the principles of the invention without the multiplication of drawings.

In the accompanying figures of the drawings,

illustrating a form of my invention, and forming a part hereof, and in which the same reference numerals indicate the same or corresponding parts:

Fig. 1 is a sectional plan in planes indicated by lines 1 in Figs. 4, 6 and 12.

Fig. 2 is a plan of a portion of the mechanism for starting and stopping the apparatus, and the carriage return of the typewriter.

Fig. 3 is a sectional end elevation of another portion of the same, taken on line 3 of Fig. 1.

Fig. 4 is a transverse section of a portion of the electrical mechanism for making the code strip, taken on line 4 of Fig. 5.

Fig. 5 is a side elevation of the same.

Fig. 6 is a longitudinal vertical section of the actuator taken on lines 6 of Figs. 1 and 12.

Fig. 7 is an enlarged detail of a portion of the actuator shown in Fig. 6.

Fig. 8 is a front elevation of a portion of the actuator showing method of attachment to typewriter and connection with typewriter carriage.

Fig. 9 is a sectional plan of a typical portion of the actuator.

Fig. 10 is a diagram of cam successions and phases.

Fig. 11 is a portion of the six unit code strip.

Fig. 12 is a transverse section of the actuator taken on line 12 of Fig. 6.

Fig. 13 is a sectional plan of the mechanism for punching the six unit code strip, taken on line 13 of Fig. 14.

Fig. 14 is a sectional side elevation of the same taken on line 14 of Fig. 13.

Fig. 15 is a sectional end elevation of the same, taken on line 15 of Fig. 14.

The mechanism functions by means of the six unit code strip being advanced step by step from one transverse row of differentially placed apertures to the next. At each step a bank of selector peckers is presented to the strip which admits the ones for which holes are provided at that location. The particular selector peckers so accepted determine the movement of an equal number of corresponding differentially slotted permutation bars. When thereby aligned the permutation bars permit the passage of a single one of a bank of interposer cross bars having differentially placed projections functionally related to the slots of the permutation bars. The end of the activated interposer cross bar comes into the path of a universal cam which presses it against one of a bank of U-crank levers which communicates the motion of the cam to the typewriter key corresponding to the U-crank. Meanwhile, the code strip is being advanced for a new selection of peckers, there being an overlap in the functions of the mechanism.

A typewriter of any usual make is indicated in plan at 16 attached to my invention by any

convenient means, as screws 17 through side bar 18 of the typewriter as seen in Fig. 1. In Fig. 8 a front elevation of a typewriter carriage is shown, with carriage 19 and post 20 to which portions of my apparatus are attached.

Referring to Fig. 1, universal driving cam 21 vertically placed is driven by any convenient source of power applied to shaft 23. Such source of power may be an electric motor not shown placed on ledge 22, shown broken off, and in communication with shaft 23 through a belt or otherwise. Shaft 23 is connected through bevel gears 24—25 to shaft 26 carrying cam 21. Shaft 26 is journaled in lug 27 extending from the rear side 28 of the frame-cover and in bottom plate 29 of such frame-cover. Through bevel gears 30—31 it drives horizontally placed shaft 32, journaled in lugs 33—34.

Shaft 32 through bevel gears 35—36 drives vertical shaft 37, journaled in lugs 38—39, which in turn, through bevel gears 40—41 drives horizontally placed shaft 42, journaled in lug 43 and upright 44, and also horizontally placed shaft 45 through bevel gears 46—47, shaft 45 being journaled in lug 48 and upright 44.

Shaft 32 through bevel gears 49—50 drives horizontally placed shaft 51, journaled in lugs 52—53. Shaft 51 through bevel gears 54—55 drives vertically placed shaft 56, journaled in bottom plate 29 and lug 57.

Power shaft 23 carries a slidably mounted clutch 58 adapted to mesh with clutch portion 59 of bevel gear 24, which bevel gear rotates loosely on shaft 23. Clutch 58 is rotated with shaft 23 by slidable spline connection with channel 60 of shaft 23.

Clutch 58 is operated by bell crank lever 61 having arms 62—63 which engage annular projection 64 of clutch 58. When clutch 58 is in the neutral position as seen in Fig. 2 and out of connection with 24—59 the whole mechanism comes to rest. This may be effected manually by handle 65 operating T-crank lever 66, which has an upwardly extending projection 67 which carries lever 61 along with it. Levers 61 and 66 are pivoted on the same shaft and 61 is on top. They are fitted with springs 68 for lever 61 and 69 for 66, the latter connecting with lever 66 through a slot 70 in lever 61. These springs are arranged to function critically. When lever 61 passes a certain angle spring 68 carries it further automatically, and vice versa on the return motion, while spring 69 is similarly critical for lever 66. Lever 66 is stopped by stop 71. These levers are also operated automatically as will be hereinafter described.

Clutch member 72 is rotatably mounted on shaft 23, and through bevel gear portion 73 and gear 74 drives shaft 75 journaled in lug 76 and frame 77. When clutch 58 passes the neutral point as seen in Fig. 2 it engages clutch member 72 and drives shaft 75. This shaft functions to return the typewriter carriage to the beginning-of-the-line position, while the rest of the actuator is idle.

As illustrated in Fig. 12, shaft 42 carries universal cam 78 rotating counter-clockwise and shaft 45 carries individual cam 79 and universal cam 80 rotating counterclockwise. Cam 80 operates the selector peckers 81, 82, 83, 84, 85 and 86 mounted on shaft 87 and drawn towards the code strip feed roller by springs 88, one for each pecker, from lugs 89 when permitted to do so by the universal cam in contact with the lower end of the pecker levers.

Six unit code strip 90 has six rows of holes in six files, 91 to 96, the holes in the ranks abreast being differentially placed, varying in combinations from one to six, and in addition a middle row of feed holes 97. Code strip 90 is carried on feed roller 98, mounted to rotate on shaft 99. It has peripheral projections as 100 to engage the center file of holes 97 of code strip 90. Six peripheral channels 101 in feed roller 98 enable the peckers to pass through the holes in the code strip when they find them.

Code feed roller 98 has ratchet teeth 102. Cam follower 103, controlled by individual cam 79 is hinged at lug 104 and carries driving pawl 105, which is drawn upwardly by spring 106. When permitted by cam 79 spring 106 drives pawl 105 which rotates feed roller 98 one ratchet tooth step. After the spring does this work the pawl is retracted by cam 79. Feed roller 98 carries brake ratchet 107, into which holder brake wheel 108 fits. Wheel 108 is journaled on the end of leaf spring 109, which is attached to wall 110 and adjusted by thumb screws 111—112 and holder 113. In the attitude shown in Fig. 12 the roller 98 is approaching the midway point of a feed stroke. On going a little further the wheel 108 will descend into a notch in 107 and hold roller 98 in a braked attitude while 105 begins to retract.

Code strip 90 runs upward in channel 114 between wall 110 and wall 115 and over the roller 98 and down on the outside. In operation code strip 90 is usually arranged as an endless belt so that the same subject matter may be repeated over and over again every time the belt returns. To put the code strip belt in position door 116 is opened. It swings on spindle 117 in lugs of frame 118 and at 119 serves as an additional support for shaft 99.

Immediately upon roller 98 coming to a stop, cam 80 permits peckers 81 to 86 inclusive to be drawn against the code strip by springs 88. Some of the peckers will find holes and enter while others will find no holes and be unable to enter. The other ends of peckers 81—86 are fitted with ratchets 119, which lift upwards upon the rising of points 120 of permutation bars 121, 122, 123, 124, 125, 126 which work up and down in guides 127 and 128, guides 127 having stops 127'. Ratchets 119 support the permutation bars and prevent them from being drawn down in the cases of such peckers as do not find holes in the code strip. When the peckers move against the code strip all those that find holes are drawn by springs 88 far enough to the right to escape points 120 of the permutation bars when the latter descend.

Permutation bars 121 to 126 inclusive each carry a cam follower as 129, resting on universal cam 78. Springs 130, one to each permutation bar, tend to draw the permutation bars down at all times. The permutation bars that cannot escape the ends of pecker ratchets 119 remain resting against these ratchets drawn by springs 130. The others descend the proper distance meeting a stop at 127'.

The permutation bars have slots differentially placed, as 131. The lowering of one or more permutation bars serves to align certain slots functionally with the interposed cross bars and their barbs, so that a single interposed cross bar is allowed to function, the others being retained in their original positions. In the drawings the second permutation bar, 122, is indicated as the only one down, while the peckers have retracted and one interposer cross bar is in working position.

tion. The peckers are idle and the permutation bars are idle while the roller 98 is moving the code strip to the ensuing position or stage.

Ratchet 132 of pecker 82 is indicated as having been forced upward since on its retraction it does not strike under point 120 of its permutation bar. When the permutation bar retracts upwards the ratchet 119 will be still further forced upward until the point 120 passes it and the ratchet snaps back into normal position. These pecker ratchets enable a considerable overlap in functions to take place between the roller 98 action and the striking of the typewriter key. A portion of bar 122 is omitted at the upper end in the drawing for the sake of clearness.

Functioning in relation to the permutation bars is a bank of interposer cross bars, one for each letter and other function of the typewriter. For the sake of clearness, only representative examples are shown, several at the top as 133 and 134 and at the bottom as 135, although the whole space as indicated by the dashed line 136 is filled with interposer cross bars. They are indicated as being in contact with each other, but if desired, individual guides may be inserted between them like the teeth of a comb.

In Fig. 1 typical interposers are seen in plan, 137 and 138. Interposer 137 indicates the idle position corresponding to bars 121 to 126 not including 122 while interposer 138 indicates the working position to correspond to bar 122.

The interposer cross bars carry barbs or prongs as 139, differentially selected in such relation to the permutation bar slots that any particular alignment of the permutation bars will allow only one interposer to function. However, when there are six holes abreast on the code strip no interposer can pass. This is to provide for corrections on the code strip, as if a wrong combination of holes is punched, others may be added to make up six and the actuator will then idle as the six signal passes the peckers. Such a rank is indicated at 140 Fig. 11.

The interposers work in guides 141 and 142, common to all, at their rear ends and at 143 near their work ends. Each interposer has a prong as 143 or 144, the prongs being placed on alternate interposers in the two positions, to allow room for two banks of springs, 145 and 146 attached to posts 147 and 148. The springs are arranged in the two banks to afford greater clearance. Springs 145, 146 always tend to draw their interposers into the working position. When idle this is prevented by barrier or retractor arm 149, which is hinged at 150—151 in lugs 152—153 and 154—155. Universal retractor arm 149 is normally drawn to the right by two strong springs 156, which are strong enough to overcome all the springs in banks 145 and 146. Retractor arm 149 is shown in Fig. 1 in working position bearing against prong 157 of interposer 138. The other interposers are kept from advancing to the working position by their prongs 139 resting against one or more of the permutation bars 121—126 on shoulders between slots.

Cams 158 and 159 of similar contour are fixed to shaft 56 Fig. 12 journaled in lugs 57 and base 29. Retractor arm 149 and retractor arm 160 are connected by universal cross bar 161, all acting as a unit. Cross bar 161 bears against all prongs 157 when in the idle position and holds them all idle. When cams 158 and 159 rotate they move arms 149 and 160 by projections 162 in opposition to springs 156. Were the interposers not restrained by the permutation bars all would

then move into the working position, but as only one interposer can get through at a time, its spring 145 or 146 will draw it into working position on the relief of the cross bar 161 by cams 158—159 and arms 149—160. After the work is performed are drawn to the right by springs 156 and cross bar 161 draws the interposer back from its working position, which enables the permutation bars to have a clear retraction pathway.

Interposers have common slots 163 in their rear ends through which upright stop rod 164, universal to all, extends, preventing them from moving too far in either direction. On the retract stroke bevel ends 165 of interposers strike bevel 166 of guide 142, thus being guided into the idle position between guides 141 and 142. Universal roller bar 167 working between guides 168 and 143 and kept pushed against the interposers by springs 169 holds end 170 of interposer against cam 21 and when the cam peak is passed pushes interposer back into normal line, to be returned to initial position by 149—160—161. When this has occurred, cam 78 lifts the permutation bars into their idle position, which could not be done before as their alignment had to be preserved to enable the interposer to retract.

Main working stroke cam 21 has a valley of almost 180 degrees. Before the work peak is passed the roller 98 has begun to feed. After the work peak is passed the interposer is retracted, the permutation bars then retract, the feed pawl for 98 stops, the peckers make a fresh selection, the permutation bars fall and a new interposer advances.

Each typewriter key and other typewriter function is represented by a U-shaped crank lever Fig. 1. These levers are arranged in two banks or stacks. One being further away is made larger to provide equal amplitude of movement with the other. The smaller cranks 171 are pivoted nearer the cam 21 and the larger cranks 172 are pivoted further away, but their power receiving ends interlard alternately in the same vertical line. Somewhat heavier U-cranks are indicated at 173 Fig. 6 at the top for certain functions requiring greater power than the key strokes. The normal cranks are indicated at 174 at the top and 175 at the bottom, being broken away in the drawing to enable the illustration of cam 21 at 176. For the sake of clearness only representative members are indicated in this portion of the drawings.

In Fig. 9 the idle position of the U-crank levers is shown. In Fig. 1 both the smaller and larger U-cranks are shown in the work position for purposes of comparative illustration. In operation only one at a time would be in the operative position.

The U-cranks are mounted in lug 177, the larger cranks being pivoted on rod 178. Lug 177 has arm 179 and the smaller U-cranks are carried by it pivoted on rod 180. The free ends 181 and 281 of the cranks are thinner than the main body of the cranks and sandwich between each other so that there is alternately a free end of the larger crank and a free end of the smaller crank, all aligned in a bank. As indicated in Fig. 7 the free end of the larger crank is seen at 281 and the free end of the smaller at 181. This arrangement effects economy of space and enables the other portions of the cranks to be double the thickness of the free ends.

When an interposer comes into working position as 137, it moves on a dotted line 182, in which

position it remains until the cam 21 presses it into the position shown by 138 in Fig. 1. As this takes place its pressure on the corresponding U-crank drives the U-crank back. U-crank arm 183 is bifurcated to receive type bar rods 184, held in place by curved-outline knobs 185 on ends of rods 184. Rods 184 being drawn to the right, pull arms 186 affixed to spindles as 187, thus rotating the spindle through a portion of a revolution. The connection of 184 with arms 186 is such that spindles 187 may partly rotate when the typewriter is manually operated without forcing rods 184 to the right.

The peak of cam 21 passes slightly before the typewriter key hits the paper as it acquires a certain momentum and does not need to be driven all the way to the end by the cam. The spindles are arranged in five vertical rows, 187, 188, 189, 190 and 191, one above the other to the number of typewriter keys in the corresponding rank. The ranks of spindles are of different lengths, rank for rank, the ones nearest the U-cranks being the shortest to enable rods 184 to pass to all spindle arms without interference. Thus rods 184 have inclinations in and out and up and down as the case may be. They are slightly bent where they pass to the U-cranks in order to be in line with the U-cranks.

Rods 192 and 193 are of the common type 184. Rod 192 operates the top spindle in row 191 which causes the space bar 195 of the typewriter to function. Arms 194 are attached to the spindles at suitable points under the respective keys to which they are connected by links 196, holes being bored in the lower parts of the key levers to enable this to be done. The links are of varying lengths corresponding to the distances between the key levers and the corresponding spindles. The connection of link to key bar is indicated at 199 Fig. 1. All links 196 and arms 194 are positively connected so that the manual operation of the typewriter causes spindles 187 to 191 to be partly rotated. One side of the link may be a leaf spring to enable detachment and attachment to be readily made.

Rod 193 is shown in operative position causing functioning of arm 186, spindle as 188, arm 194, link 196 and typewriter key 197.

Springs at 198 act in opposition to the pull of the U-cranks and restore rods 184 to normal after the work stroke.

The lower eight spindles of row 191 are each operated by a special manual key, three, 200, 201 and 202 being nearest the typewriter key board, 203, 204 and 205 next them and 206 and 207 on the outside. These are keys for functions not represented on the typewriter key board, and are for the purpose of making the code strip, as hereinafter described.

These special keys are mounted on rods as 208, which connect positively with arms as 209 and are retracted as by springs 210, rods 208 being so bent as to clear each other.

Side plate 28 of the frame-cover has apertures for journalling the spindles 187—191. Plate 211 also serves the same purpose, as do plates 212 and 213, while plate 214 serves as a cover and for journalling the eight special keys.

The spindles 187—191 are divided at 215 by a running joint into short ends 217 and longer ends 218, for convenience in mounting. Collars at 216 hold the short ends in position and collars as 219, Fig. 4 hold the longer ends in position.

The apparatus for automatically stopping the

actuator, for automatic carriage return and for capitalization and decapitalization is indicated in Figs. 1, 2, 3, 6, 8 and 9.

The functions originate in suitable code signals in the code strip. Stopping is effected by such a code signal eventuating in the operation of U-crank 173 having a special rod, 220, connecting with lever 221 pivoted in lug 222 of the front plate and operating to push end 223 of T-crank lever 66, previously described. This throws over lever 61 and clutch 64—58 out of engagement with 59. Just as the clutches are about to be disengaged spring 69 is carried across the critical line and then carries lever 66 further until it meets stop 71. This critical spring action frees the clutches which would otherwise fall in and out of engagement and chatter.

Critical spring 68 of lever 61, however, has not been carried across the critical line and tends to oppose spring 69 but is overbalanced by 69. The actuator may also be stopped manually by lever 65, or by cutting off the power driving master shaft 23, either before or after the function of 66.

Carriage return is effected by a code signal which eventuates in the action of U-crank connecting rod 224 which pulls lever 225 journaled in frame 222. This throws over arm 226 of lever 61 to the left as seen in Fig. 1 far enough to cause critical spring 68 to pass its critical line and disengage clutches 58—59 and throw into engagement clutches 58 and 72, which starts the rotation of shaft 75 and allows the rest of the mechanism to stop, leaving lever 66 unaffected.

Shaft 75 Fig. 3 carries drum 227 with side plates 228—229 and tape or ribbon 230. Normally, drum 227 turns loosely and tape 230, which is attached to the carriage line spacing and carriage return lever at 231 Fig. 8 is unwound as the line is typed. When shaft 75 is rotated to return the carriage it effects a line spacing and the carriage return through ordinary typewriter lever 232 customarily provided for that double purpose.

Tape 230 passes through an aperture 233 in top of frame plate 234, and through a slot 235 in bell crank lever 236 pivoted to lugs 237, its lower arm 238 bearing against arm 226 of lever 61. Tape 230 carries a stop, 239, so placed that when the typewriter carriage has been fully returned stop 239 strikes bell crank lever 236 which in turn throws lever 61 to the right as seen in Fig. 1, until the critical point of spring 68 is reached, clutch 72—58 disengaged and clutch members 58—59 re-engaged, which completes the carriage return function and restarts the remainder of the apparatus.

Angle arm 240 Fig. 8 attached to the typewriter at 20 journals roller 241 which carries tape 230. Roller 241 is placed at such a distance from the typewriter that there is room enough to allow the typewriter carriage to be retracted to its initial position.

Capitalization and decapitalization are effected in a special manner, as illustrated in Fig. 9. A customary code signal is used for capitalization which eventuates in the action of a special U-crank as 242, which carries ratchet pawl 243, and a customary rod 184. Upon the capitalization function of shifting the typewriter carriage from lower case to upper case letters occurring, pawl 243 engages ratchet 244 pivoted in lugs 245 held normally against stop 246 by spring 247. The electrical contacts shown are not involved in this

function but are for another purpose hereinafter described.

When U-crank 243 is thus held by ratchet 244 the typewriter carriage is held in the upper case or capitalizing position indefinitely for one or more capitals. When decapitalization is desired a new code signal to that effect eventuates in the functioning of special U-crank 248, which does not connect with the typewriter, but has a rod 249 with spring 250 holding 248 normally at rest. When 248 functions it drives ratchet 244 back and releases U-crank 243, allowing the typewriter of itself to return to the lower case position. In Fig. 6 U-crank 248 is indicated as the upper one of the three heavy cranks at 173. However, U-crank 248 may be placed wherever convenient, being reachable by suitable bends in rod 249.

To effect line spacing it is first necessary to block the carriage, wherever it may be, and then set the carriage return mechanism into action. The carriage block prevents any return of the carriage forcing the action to effect the spacing, after which the carriage block may be released.

A set of two U-cranks and ratchets similar to 242—244—248 are used but without any rods as 184 leading to the typewriter. Spring leaf electrical contact 251 is added. A code signal causes U-crank 242 to function. It is locked up by ratchet 244, which at the same time makes and holds electrical contact 251. Current from any suitable source is thus supplied to magnet 252, of Fig. 6. Magnet 252 has armature 253 attached to lever 254 pivoted in swinging holder 255, lifted away from magnet 252 by spring 256. Lever 254 has short arm 257 which stops against a stop consisting of standard 258 with which arm 257 does not contact, but which carries platform 259 with which 257 contacts and along which it may slide. Swinging holder 255 is pivoted to lugs 260 and carries lever 261. Spring 262 tends to draw swinging holder 255 and levers 254 and 261 to the left as seen in Fig. 6.

Lever 254 carries at its left hand end worm follower projection 263, which is adapted to mesh with worm 264 in shaft 75. Lever 261 has on its left end a slot 265 which engages with a pin 266 in a projection 267 of bell crank 236. When it is desired to stop or block the typewriter carriage suitable code signal effects an electrical contact at 251. Magnet 252 is thus energized and pulls lever 254 down, whereupon worm follower 263 enters worm 264 in shaft 75 which is at this moment idle. Simultaneously electrical contact 251 effects through parallel connection the locking of the typewriter carriage. It energizes magnet 268 Fig. 8 on lug 274, having armature 269 affixed to bell crank lever 270. The pull of the magnet is opposed by spring 271. Attached to the carriage of the typewriter also, is a new member, of my invention, ratchet rack 272, with a tooth for each letter space. When magnet 268 is energized tooth 273 of bell crank lever 270 enters a tooth of ratchet rack 272 and locks the carriage in whatever position it may then be in.

The next code signal is one which will cause the regular carriage return to function through tape 230. But as the carriage is now locked only the line spacing function will occur. Meanwhile shaft 75 is turning and driving lever 254 to the right. This causes lever 261 to move to the right following swinging holder 255. This presently pulls bell crank lever 236 to the right, effecting the function usually performed by stop 239 of tape 230. This disengages shaft 75 which comes to rest while the remainder of the actuator

begins to operate again, the carriage, however, still being locked by magnet 268. The next code signal operates U-crank 248 which unlocks ratchet 244 and breaks electrical contacts at 251. This simultaneously releases magnet 268 and leaves the carriage free to move and releases magnet 252 which permits worm follower 263 to be lifted out of worm 264 and permits spring 262 to draw swinging arm holder 255 to the left, positioning levers 254 and 261 for a new operation. Spring 275 in tape 230 and an excess of worm track in shaft 75 with suitable play in slot 265 of lever 261 provide clearance for these various functions.

Electrical leaf springs-contact 276 is mounted on standard 278. Electrical contact is made when prong 277 of U-crank 248 strikes it upon operation of the U-crank. Similarly electric contact 279 is made when U-crank 242 functions through ratchet contactor 280. The end 281 of U-crank 248 is in the same position as 242 but just below it. The purpose of electrical contacts 276 and 279 is to make code signals in the duplicate code strip automatically during automatic operation of the actuator as described later.

Fig. 7 shows the construction of the U-cranks and their assembly as seen at 174 in Fig. 6.

Figs. 1, 4, 5, 6 and 8 and Fig. 12 show portions of an ordinary typewriter to which my invention is attached.

Keys 282, key levers 283, key board frame side bars 284 and 285, front bar 286, uprights 287, 288 and 289, side bar 18, cross bar 16, screws 17, and feet 290, 291 and 292 are indicated. My invention supplies lugs 293 upon which the typewriter feet rest and to which they are affixed by screws 294 whereupon the lugs may function as feet for the whole apparatus.

Fig. 10 is a diagram of cam phases, sequences and attitudes. The heavy lines indicate movements of cam followers and the thin lines idle phases. A heavy line on the outside of the thin line position indicates a work stroke and a heavy line inside the thin line position is the retract stroke.

The diagram represents the code strip feed by inner circle 295. The next circle 296 represents the peckers, the middle circle 297 the permutation bars, the next 298 the interposers and the outer circle 299 the universal work stroke cam 21. Considering the start to be on the horizontal line 300 at the right side and proceeding counter-clockwise, the functions are as follows: The code strip feed 295 begins about the middle of the work stroke of 299 of cam 21. The interposer 298, retract begins about 90 degrees later at the end of the work stroke or peak of 299. At the end of the interposer retract the permutation bar 297 retract begins. It ends coincidentally with the end of the code strip feed work stroke. Then the pecker 296 work stroke begins simultaneously with the beginning of the code feed strip retract. At the conclusion of the pecker work stroke the permutation bar 297 work stroke begins. This is succeeded by interposer 298 work stroke. At its conclusion comes the pecker retract and the beginning of the main work stroke of cam 21 shortly after followed by the idle portion of the code feed, while the pecker retract continues for about 90 degrees. It is obvious that there is considerable overlap. During the stroke of the typewriter keys most of the pecker retract and code strip feed take place.

If desired the code strip may be mechanically

fed at a regular rate of speed, allowing a loop of code strip between the regular feed and the intermittent feed of roller 98.

In Fig. 1 lugs 322 and 323 serve as holders for axle 99 on which feed roller 98 turns.

Dotted lines 324, 325, 326 and 327 indicate the position of a possible additional roller. This would be for the purpose of carrying an additional code strip with code signals for a list of addresses or other matter to be interpolated between portions of the matter of the main code strip. At the conclusion of or during the operation of the main code strip a code signal on it would stop it and cause the functioning of apparatus to push the new code strip and roller into the position in front of the peckers. The machine would then write the address or interpolated matter and supply a code signal to throw it out of operation and into its initial position, returning the main code strip roller and strip to the working position automatically, the whole of both hanging code strips thus being moved back and forth. This would require additional U-cranks for two new shifting functions with switching apparatus similar to that shown for line spacing 252—266 of Fig. 6, or this shifting could be done manually.

Or a new set of peckers could be supplied to be presented to the supplementary code strip from time to time for supplementary matter, automatically being switched in and out.

Cam 21 could be arranged to work like cam 158 and levers 149—160, operating on the U-cranks as 149 does on 156, if desired, to avoid friction on points at ends of 138 and 170 of interposers where they rub against the main cam 21.

The mechanism for making the original and duplicate code strips is indicated in the main in Figs. 13, 14 and 15 while portions are shown in Figs. 1, 4 and 5.

The upper part of Fig. 1 is a sectional plan on line 1 of Fig. 4. Figs. 4 and 5 are other views of the portion of the apparatus for effecting electrical contacts for the punching of the code strip by the punching apparatus shown in Figs. 13, 14 and 15, while special keys 200, 201, 202, 203, 204, 205, 206 and 207 effect the electrical contacts for the typewriter and other operative functions of the puncher not represented by typewriter keys.

Spindles 187 to 191 inclusive, Figs. 5 and 6, 51 in number, are partly rotated by the typewriter and special keys when operated manually. This occurs through links 196, arms 194, rods 208 and arms 209 in the several instances. As seen in Fig. 5 this partial rotation of the spindles is clockwise. The spindles are fitted with contact blocks as 301. Contact switch arms 302 and 303 provide electrical contacts upon the partial rotation of the spindles and blocks 301. Plate 304 affixed to side 285 of typewriter frame by bolts 305 has apertures to journal the spindles. Insulation plate 306 is affixed to 304 and carries the banks of contact switch arms 302, of which only representative examples are illustrated.

Wires 307 lead away from all these switch arms. At spindle 308 block 309 is shown in contact with switch arm 310. These are specially illustrated items typical of 187—191 inclusive, 301 and 302. Plate 304 has base lug 311 and crown lug 312, and carries axle 313 on which is mounted hinge plate 314, having guard plate 315. Attached to hinge plate 314 is insulating plate 316 corresponding to and carried opposite to plate 306. It carries switch arms 303 opposite switch arms 302, with wire connections at 317 similar to 307. Cover plate 318 has a spring catch at 319 to hold it shut.

When this door, 320, composed of 316, 317, 318 and hinged at 313 is closed as in the illustration in Figs. 1 and 4, blocks 301 makes contacts between 302 and 303 upon operation of the typewriter and special keys. When the door is opened, however, along line 321, no electrical contacts will be made. This is desirable to avoid unnecessary wear on the contact blocks and switch during automatic operation.

This contacting apparatus supplies an electrical contact for each typewriter key and special key for other functions and completes circuits for the control of the punching apparatus for punching the code strip.

Figs. 13, 14 and 15 illustrate a form of the code strip puncher. In general a blank code strip is advanced step by step. There are six magnets energized either singly or in permutative combinations by current from the key contacts. A key contact as 301, 302, 303 may be wired to any one, two, three, four, five or six of the magnets in parallel. Sixty-two combinations are possible, although only fifty-one are needed in my apparatus as illustrated. Additional ones may be used when the typewriter has tabulation keys.

When the magnets are energized they set interposing bars, which, when the punching hammer functions cause corresponding punches to operate, omitting those for which no interposers are set.

Permutation magnets 401, 402, 403, 404, 405 and 406 are placed in two rows, having armatures 407 to 412 inclusive, attached to interposer levers 413 to 418 inclusive, which are hinged on spindles 419 and 420 held in lugs 421 to 426 inclusive. An additional spacing magnet 427 has armature 428 attached to lever 429, carried on spindle 430 in lugs 423—424. The levers 413, 415 and 417 are on a higher level than 414, 416, 418 and 429, in order to make the apparatus more compact. Each has a projection as 431 resting on a universal contact bar 432 hinged at 433 in bosses at frame sides, 434, 435. Bar 432 is drawn upward by spring 436. Magnet levers are drawn upwards by springs 437 against universal stop bar 438.

Punch levers 439 to 445 inclusive are pivoted to spindle 446 in lugs 447—448 of base plate 449. These levers pass upward through an aperture in the intermediate base plate 450, on which the permutation magnets are mounted. One of the levers, 442, the middle one, carries punch 451 for the feed holes in the middle row of the code strip, and the other levers carry punches as 452, six in number, one for each of the files of code strip holes. These levers are retracted by springs 453 attached to universal bar 454 and stopped by universal stop bar 455.

Magnet windings 456 have for cores a permanent magnet 457, with armature 458 attached to universal bell crank lever hammer 459 hinged to spindle 460 in lugs 461—462 and having bell crank arm 463 drawn up by spring 464, which is a strong spring.

Current in windings 456 normally flows continuously in such a direction as to oppose partly or almost overbalance the pull of the permanent magnet 457. The balancing circuit passes through contact 465. Spring 464 does the work of punching. The attraction of the permanent magnet minus the opposition of the balancing current in windings 456 is only a trifle more than the tension of spring 464. A very slight additional critical work circuit current in the windings 456 will reduce the pull of magnet 457

and allow the spring to do the work of punching. Then all the current in the windings is turned off which enables the permanent magnet to retract the hammer. This provides a quick, strong action.

Interposer pendants 466 hang on the ends of levers 413 to 418 inclusive. On the action of the permutation magnets one or more are lowered between the upper part of the hammer 459 and the corresponding punch levers 439, 440, 441 and 443, 444, 445. Hammer 459 driven by spring 464, when released, causes them to punch the code strip. The ends of the punches may be slightly staggered where they enter the paper to obviate the necessity of forcing all the punches through simultaneously.

Feed hole punch lever 442 does not operate by an interposer being interposed but has projection 467 which is struck by the hammer on every stroke even though no other punch lever functions. This insures an uninterrupted series of feed holes. The feed holes are midway between the ranks of the signal holes to utilize the strength of the paper to better advantage.

When one or more of the permutation magnets are energized corresponding interposer pendants are lowered and universal contact bar 432 is driven down and causes spring leaf electrical contact 468 mounted on standard 469 to make a contact. This occurs also when the spacer magnet 427 is energized. This contact supplies to windings 456 the additional critical work circuit current necessary to cause the functioning of the hammer, enabling spring 464 to do the work of punching.

Standard 470 rising from plate 450 carries trip pawl 471 retracted by spring 472. Hammer 459 carries hook 473, which, upon the completion of the punching stroke strikes the lower end of trip pawl 471. The upper end of the trip pawl supports contact lever arm 474, retracted by spring 475, carrying one spring of a leaf spring contact 465 normally closed and carrying the balancing current for windings 456. Contact 465 also affords a path for the additional critical current supplied by the contact 468. When pawl 471 is tripped contact lever 474 is drawn down by spring 475 and breaks contact 465. This reduces to nil all current in windings 456 and allows the full force of the permanent magnet to retract the hammer.

When contact lever 474 is drawn down it strikes stop 476 on universal bar 432 where it is temporarily held. When the permutation magnets are de-energized by the completion of the manually operated key stroke of the typewriter, universal bar 432 is permitted to rise. This breaks contact 468 and restores contact 465, allowing pawl 471 to be retracted to its normal position. This restores the strong balancing current to the windings 456 ready for another cycle of operations.

Feed hole punching lever 442 has arm 477 which carries pawl lever 478, pivoted in fork 479 of arm 477 and retracted by spring 480. Feed roller 481 on shaft 482 journaled at 483—484 in frame sides 434, 435 carries two ratchet wheels, 485 and 486 and a brake ratchet 487.

Clockwise or advancing rotation of feed roller 481 is effected by means of pawl lever 478 and outer ratchet 485, the feed roller being held stationary between strokes by brake roller 489 journaled on end of spring arm 490, meshing with brake ratchet 487.

Code strip 491 is drawn up through channel 492 between wall 493 and frame wall 494, an aperture or slot 495 in the side 434 permitting this to

take place. Code strip 491 passes from channel 492 to channel 493 where it passes between guide and punch blocks 496—497 meeting the feed punch 451. A few preliminary punch holes made manually in the initial end of the strip will facilitate this. It then passes between feed roller 481 and idle pressure roller 488 which holds it in contact with feed roller. The code strip next passes between guide and punch blocks 498—499 meeting punches 452 and passing out at 500 in view of the operator just after the punching is accomplished. This enables mistakes to be detected at once. It then passes over crown 501 of top frame plate 502.

Punch blocks 496 and 499 have enlarged apertures 503 and 504 for the freer disposition of punchings.

Reversal of the feed roller and feeding of the code strip back is accomplished as follows:

Lever 477 carries pawl lever 505 normally thrown out of engagement, by the spring 506, with the smaller ratchet wheel 486, the teeth of which are reversely faced as compared with 485. Pawl lever 505 has a table 507 on its rear arm and pawl lever 478 has a table 508 on its rear arm. Stop 509, manually operated, functions when lever 510, pivoted in bearing 511 and carrying rod 512 is lifted. Rod 512 has loose sleeve 513 having arm 514 which bears, only when drawn up, on the underside of table 507. A spring 515 supports this loose sleeve normally. The bottom of the rod 512 is journaled in lug 516 and carries arm 517 which bears on the underside of table 508 when drawn up. When rod 512 is drawn up, pawl 478 is thrown out of engagement with the ratchet wheel 485. As it moves back and forth, table 508 is supported by arm 517. Table 507 at the same time is lifted up by arm 514, spring 515 being strong enough to overcome spring 506. This forces pawl lever 505 into contact with ratchet wheel 486 and arm 514 on sleeve 513 holds pawl 505 in proper working position, spring 515 permitting the pawl lever to retract properly over the ratchet wheel 486 as arm 477 carries it back and forth. This causes the code strip to run backwards as long as stop 509 stands in the vertical position. When lowered, arm 514 and arm 517 escape the tables and there is no wear from friction as pawl lever 478 advances the roller 481 regularly. Key 518, journaled in top 502 and lug 519 Fig. 15 and held up by spring 520, is adapted to close electrical contact at 521 when pressed down and to hold contact when held down, manually. This contact supplies current to spacing magnet 427, so that punch lever 442 is caused to function once every time the spacing key is struck. Thus the code strip may be stepped back and forth as desired without punching anything except feed holes. Once the permutation or spacing magnets are energized the punching takes place, then the feeding and the retracting of the hammer ready for a new stroke without it being necessary to de-energize the permutation or punching magnets. They may be held energized indefinitely. Once de-energized by the completion of the manually operated key stroke then levers retract in position for functioning for the next manual key stroke.

To make a new code strip automatically during the automatic operation of an existing one, door 320 is first closed, and electric current supplied to the punching apparatus in the customary manner for manual operation. Special electrical contacts are provided to take the place of

the special function keys 200, 207, although these may also be operated by U-cranks and rods as 184 after the manner of the operation of the other spindles. The electrical contacts, however, enable the whole mechanism to be kept more compact.

The special function keys and special function contacts are as follows: When in Fig. 9 parts are referred to it is to be understood that typical parts are intended, since the parts shown are typically similar and need no special illustration.

Key 200 effects spacing of the code strip, similarly to key 518, being in parallel therewith electrically. Being a spacing key it does not call for automatic operation.

Key 203 is used to punch all six holes for the correction of errors and does not call for automatic operation.

Key 201 is one of the three necessary for line spacing. It makes the code signal that operates the small U-crank as 242, which is locked up by the ratchet as 244, which completes electrical contact 251, energizing in parallel magnets 252 for the worm carriage return releaser system 252—267 and magnet 268 for the carriage lock. The electrical contact for making the new code strip is as 279. 279—280 is any ratchet form of electrical contact that does not stay locked up and does not contact on its retract which follows immediately after the contact.

Key 202 is for carriage return, whether used in the line spacing system or alone for regular carriage return. Contact for the new code is effected by large U-crank as 248 which pulls lever 225 and has prong 277. Large U-crank as 172 Fig. 1 which pulls a typical rod 184 may also be fitted in this way with prong 277. Prong 277 makes contact 276 for punching the new code strip.

Key 204 is not used but is held in reserve, as for optional uses as with system 324—327 inclusive.

Key 205 is for making the code signal to unlock the line spacing system after the carriage release has functioned. It operates a large U-crank as 248 with ratchet release as 249 which releases contact as 251 and deenergizes magnets 252 and 268. Electrical contact is made as at 276 for the new code. The line spacing thus requires three code signals; locking as key 201, carriage return as key 202 and unlocking as key 205.

Key 206 is for the full stop of apparatus, effected by a small U-crank as 242 pulling lever 221. The electrical contact for the new code is made as at 279.

Key 207 is for decapitalizing. Capitalizing having been effected through a small U-crank as 242, without electrical contact as 279, and the typewriter carriage being locked in the upper case shift position through ratchet 244 holding 242, the decapitalizing is effected by a large U-crank as 248 with rod 249 unlocking ratchet 244. The electrical contact for the new code strip is made as at 276.

The automatic punching of a new code strip during automatic operation of the actuator and typewriter is useful in an additional way. After a portion of the new strip has been made, automatic operation may be turned off and the typewriter operated manually to insert new matter in addition to that in the standard form of letter on the original code strip. The new code strip, however, can be made to contain this new matter. The automatic operation is then resumed and the new code strip finished in that way. It will then

contain all the matter on the original code strip with the newly interpolated matter.

By using a cable with multiple conductors the punching apparatus may be placed at a distance from the typewriter being automatically operated.

One punching apparatus may thus serve several actuator-typewriter units.

What I claim is:

1. A mechanism of the class described, comprising a key-controlled machine to be operated, a permutative-combination signal code in the form of a strip, a source of power, translating means driven by the source of power and controlled by the code strip adapted to cause the key-controlled machine to be operated automatically; and means for automatically duplicating the code strip during automatic operation.

2. The means for automatically duplicating the code strip during automatic operation set forth in claim 1, when comprising a set of electrical circuits with contacts adapted to be closed by the operation of the key-controlled machine, and automatic electrically functioning means adapted to be caused to function by such circuits, whereby to make such duplicate of such signal code strip during automatic operation.

3. The matter of claim 1 when the key-controlled machine to be actuated is a typewriter.

4. A mechanism of the class described, comprising a typewriter to be operated, a permutative-combination signal code in the form of a strip, a source of power, translating means driven by the source of power and controlled by the code strip, adapted to cause the typewriter to be operated automatically in consonance with the signals of the code strip, and means for automatically duplicating the code strip during automatic operation, comprising a set of electrical circuits, with contacts adapted to be closed by the operation of the typewriter, and automatically electrically functioning means adapted to be caused to function by such circuits, whereby to make such duplicate of such signal code strip during automatic operation.

5. In a mechanism of the class described for automatically operating a key-controlled machine by means of a permutative-combination signal code strip, means for making a duplicate of such code strip during automatic operation of the key-controlled machine, comprising a set of electric circuits, means connected with the keys of the key-controlled machine for closing such circuits, and means for making such duplicate code strip, adapted to be caused to function by the operation of such circuits.

6. The matter of claim 5 when the key-controlled machine is a typewriter.

7. An apparatus of the class described, comprising a typewriter to be operated automatically, a permutative-combination signal code strip having signals in the form of apertures; and automatic translating means adapted to be controlled by said code strip, and adapted to operate said typewriter, whereby said typewriter may be operated in consonance with the permutative-combination signal holes of the code strip, and means for making by manual operation of the typewriter said code strip, comprising a set of electrical circuits for the keys of the typewriter and non-key functions of the typewriter, with means adapted to close said circuits in selected order upon manual operation of said typewriter, and means controlled by said circuits, functioning in the succession desired and as determined by the manual

operation, adapted to punch the signal holes of said code strip.

8. The matter of claim 7, and means for automatically making by automatic operation of the typewriter by such code strip, a duplicate of such code strip.

9. The matter of claim 7, and means for automatically making by automatic operation of the typewriter by such code strip, a duplicate of such code strip, comprising a set of electrical circuits for the keys of the typewriter and non-key functions of the typewriter, with means for closing such circuits automatically in consonance with the signals of the code strip, and means controlled by such circuits, electrically functioning, for punching the signal holes of such duplicated code strip.

10. An apparatus of the class described, comprising a typewriter to be operated automatically, a permutative-combination signal code strip, automatic translating means adapted to be controlled by said code strip and adapted to effect the operation of the typewriter in consonance with the signals of said code strip, and means for making, automatically a duplicate of said code strip during automatic operation of said typewriter, said code strips to be of an interchangeable character.

11. The matter of claim 10 when the means for making automatically said code strip comprises a set of electrical circuits with contacts adapted to be closed by the automatic operation of the typewriter keys, and supplementary electrical circuits corresponding to the non-key functions of the typewriter, adapted to be closed by the automatic action of supplementary electrical contacts, a set of supplementary electrical contacts corresponding to the non-key functions of the typewriter and adapted to be caused to function in consonance with signal holes of the code strip supplied for said purpose; said closing of said principal and supplementary electric circuits adapted to control means of making said duplicate code strip, and means adapted to be controlled by said circuits for making said duplicate signal code strip automatically during automatic operation of a prior made code strip.

12. A typewriter actuator of the class described comprising a typewriter to be automatically operated; a permutative-combination signal code strip of an interchangeable character containing code signals of matter to be duplicated, adapted to control mechanical translating means, and mechanical translating means adapted to be controlled by said code strip and adapted to effect the automatic operation of the typewriter in consonance with the characteristics of and the order of said code strip signals, in combination with means for automatically duplicating said code strip during automatic operation, and supplementary electrical means for automatic duplication of the signals in the code strip adapted to effect the operation of non-key functions of the typewriter.

13. A typewriter actuator of the class described comprising a typewriter to be automatically operated; a permutative-combination signal code strip of an interchangeable character containing code signals of matter to be duplicated, adapted to control translating means, and mechanical translating means adapted to be controlled thereby and adapted to effect the automatic operation of the typewriter in consonance with the characteristics of and in the order of said code

strip signals, and automatic means for making a duplicate of said code strip during automatic operation of the typewriter by said prior made code strip.

14. The matter of claim 13 when the automatic means for making said duplicate code strip during automatic operation comprises a set of electrical circuits corresponding to the key controlled functions of the typewriter and a set of electrical circuits corresponding to the non-key functions of the typewriter; electrical contacts for said circuits adapted to be closed automatically during automatic operation, and a code strip-making apparatus adapted to be controlled by said electrical circuits, whereby to make said duplicate code strip.

15. A typewriter actuator of the class described comprising a permutative-combination signal code strip having permutative-combination signals corresponding to typewritten matter, a typewriter to be operated automatically, means for feeding said strip intermittently; mechanical permutative translating means controlled by said code signals and adapted to determine the functioning of particular interposers corresponding to particular signals of the strip; a set of interposers adapted to be so caused to function; a set of transmitter members adapted to effect the operation of the typewriter keys and supplementary non-key functions of the typewriter; a set of members for the non-key functions adapted to be so operated; a universal driving member; said universal driving member, transmitter members and interposers so arranged as to effect the functioning of the transmitter members upon the interposition of interposers between them and the universal driving member sequentially, whereby to effect the operation of said typewriter automatically in consonance with the signals of the code strip.

16. A typewriter actuator comprising a typewriter to be actuated automatically, a permutative-combination signal code strip; means for causing said strip to be fed intermittently; a universal driver; a set of transmitter members adapted to cause the typewriter keys to function, a supplementary set of transmitter members adapted to effect the non-key functions of the typewriter; a set of interposers adapted to be caused to be interposed between said transmitter members and said universal driver, one interposer for each transmitter member, said driver, interposers and transmitters being so arranged that power is transmitted from the driver to the transmitter on the interposition of the interposer; and translating means of a mechanical nature adapted to control and determine the functioning of particular interposers in consonance with the characteristics of certain particular signals corresponding thereto, whereby to effect the automatic operation of the typewriter automatically in consonance with the characteristics of the code strip signals and in their order.

17. The matter of claim 16 when having in addition means for making said code strip by manual operation.

18. The matter of claim 16 when having in addition means for making a duplicate of said code strip automatically during automatic operation of the typewriter by a prior-made code strip.

EDWIN HOPKINS.