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F. E. BEST

LOCK FILLING MACHINE

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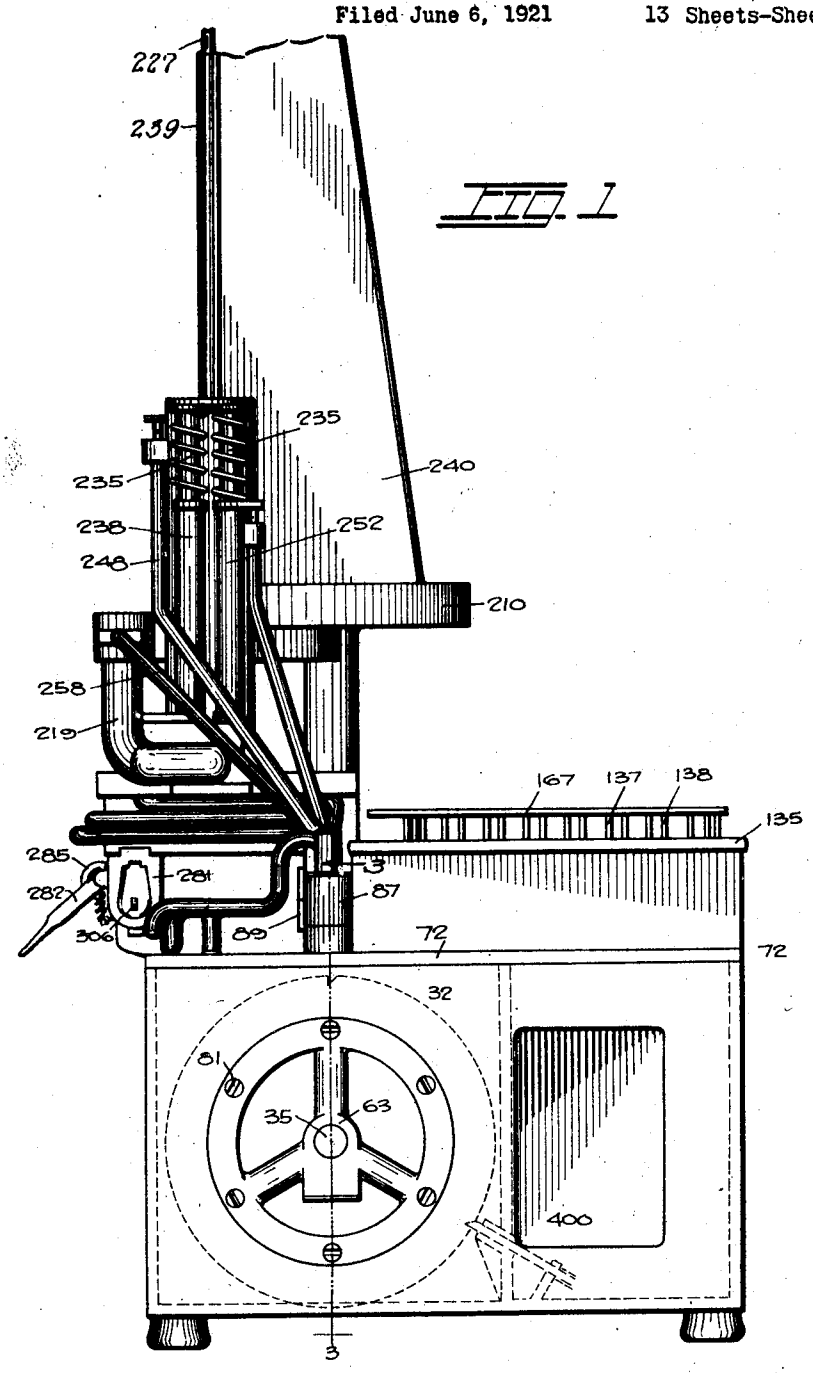


FIG. 1

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INVENTOR

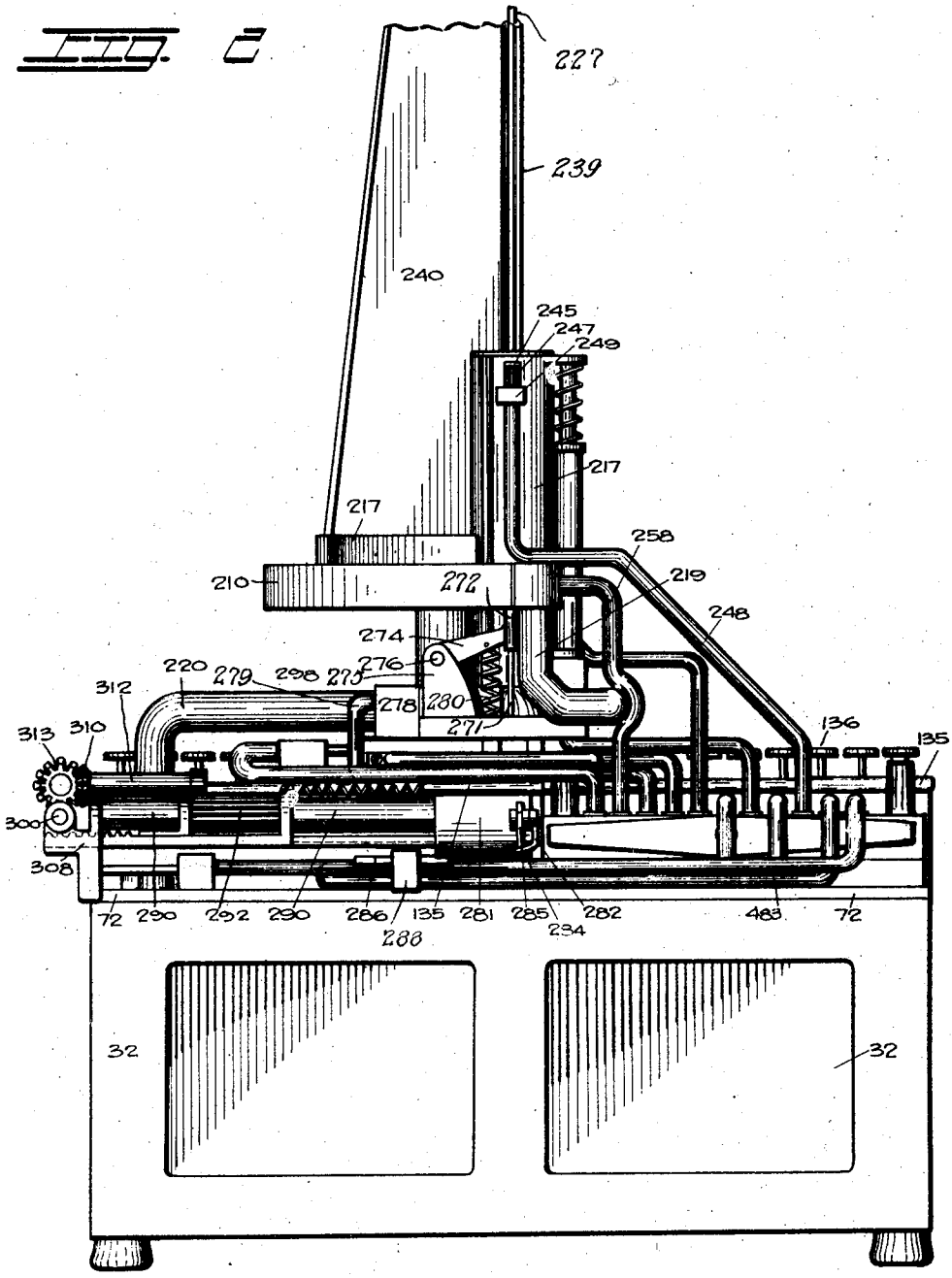
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FIG. 2



Frank Ellis Best.

INVENTOR

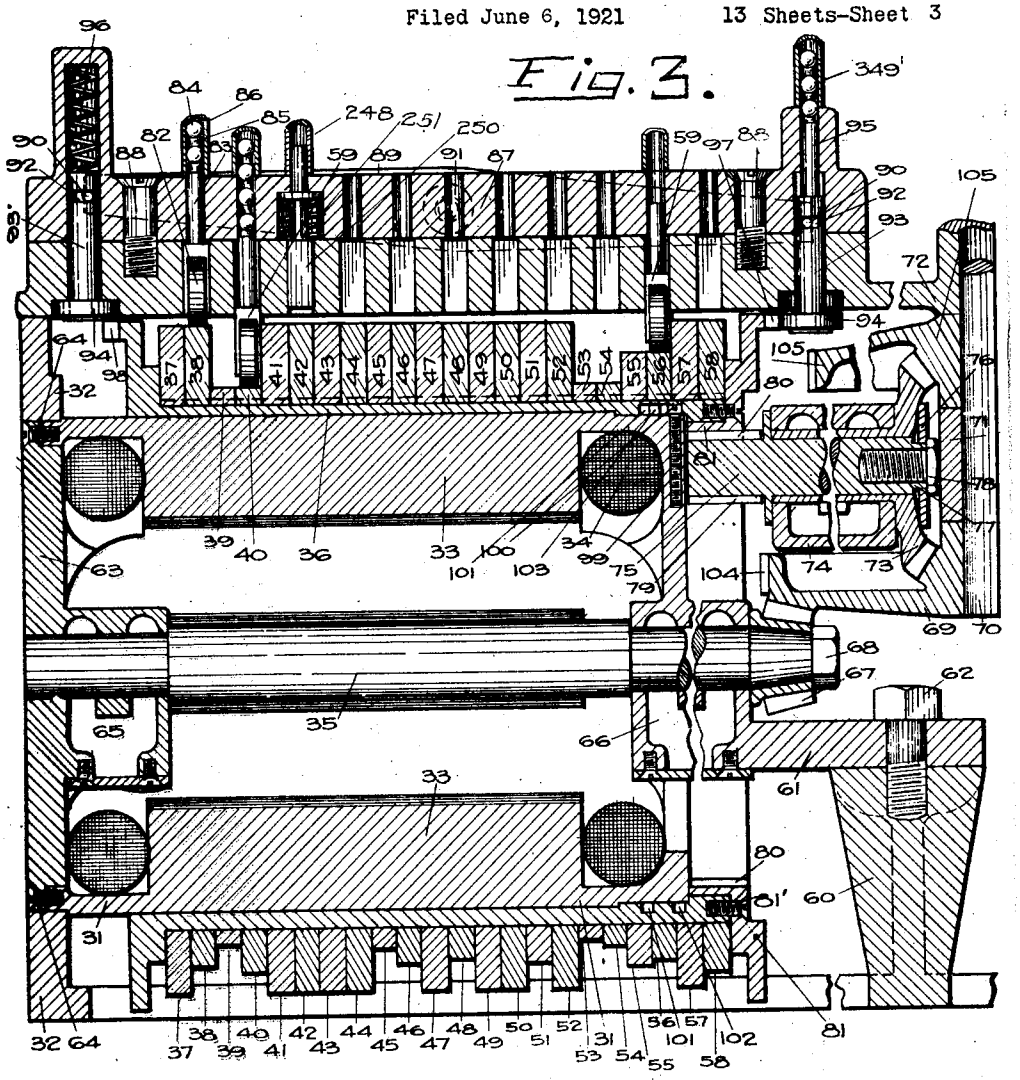
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Fig. 3.



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FIG 4

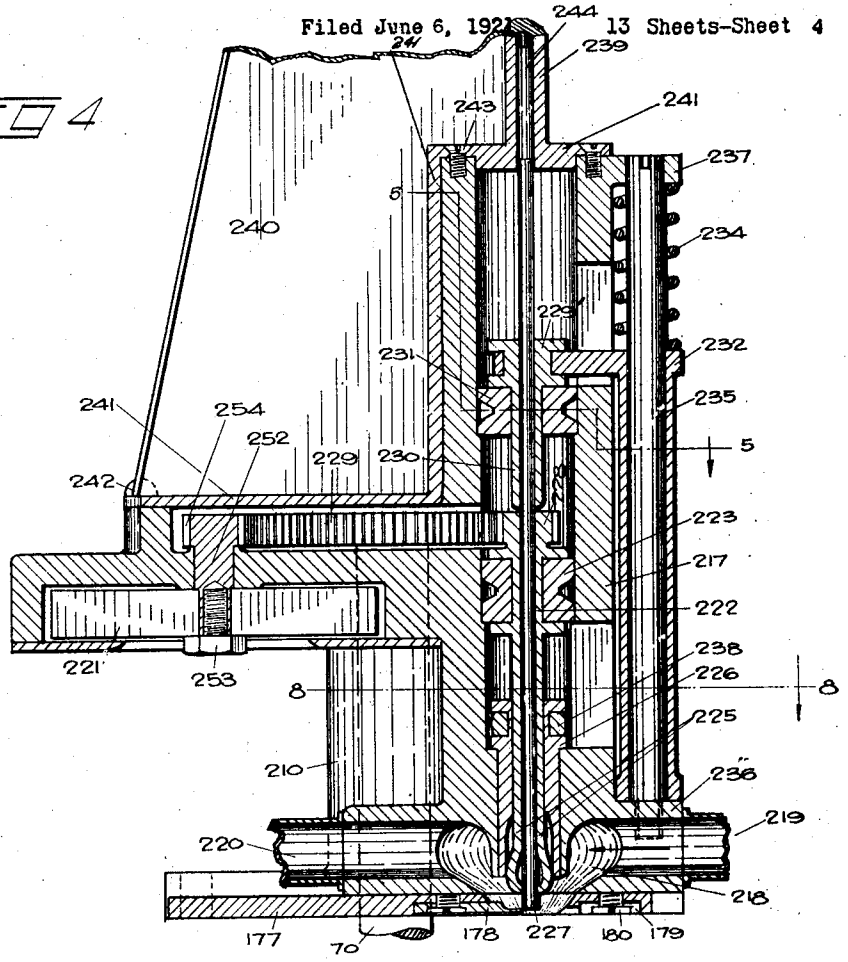


FIG 5

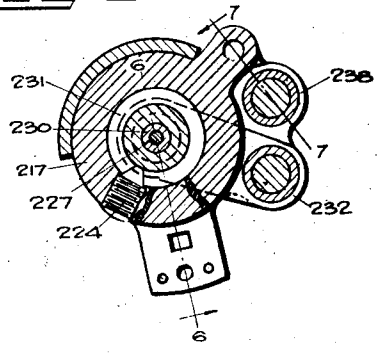
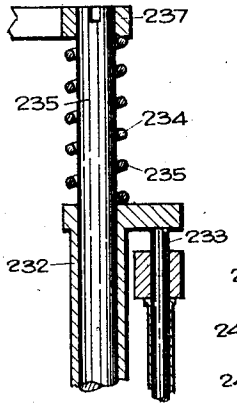


FIG 6



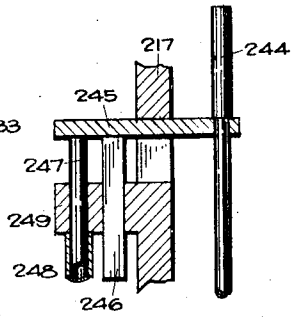


FIG 7

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FIG. 8

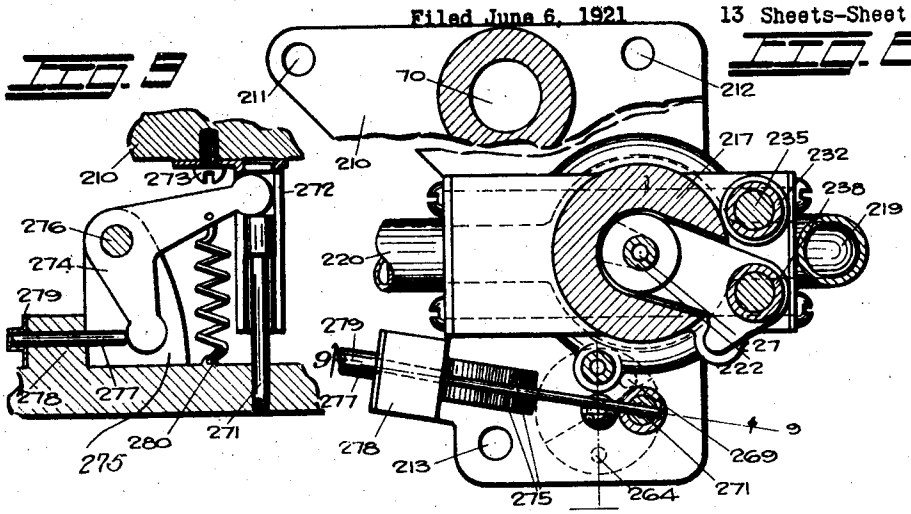


FIG. 10

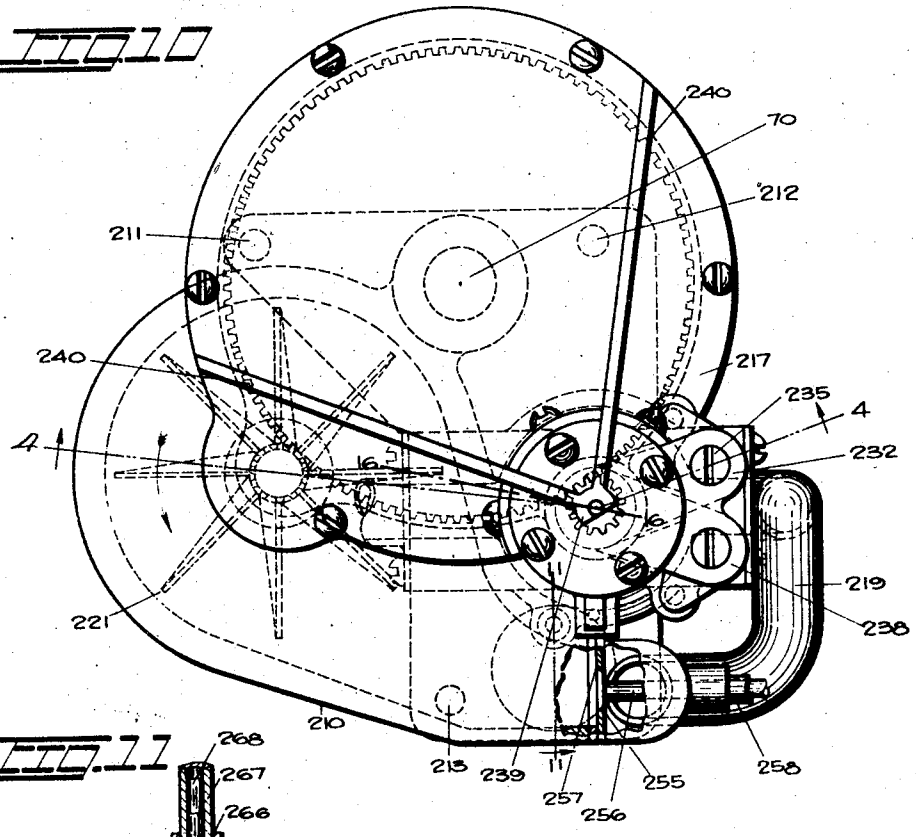
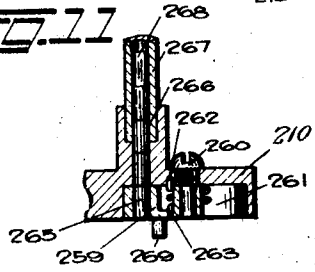


FIG. 11



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FIG 12

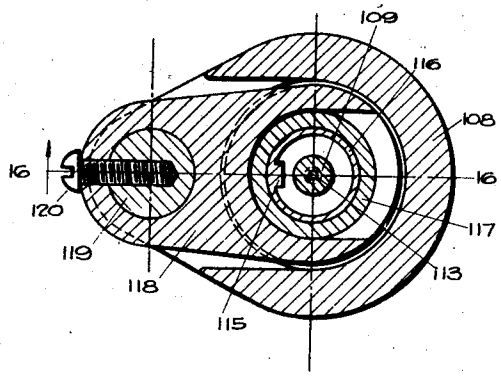


FIG 13

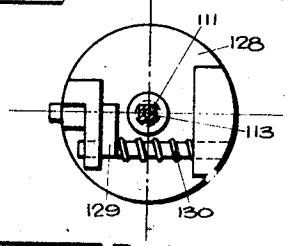


FIG 14

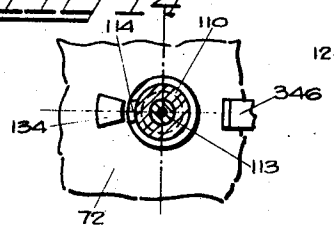


FIG 15

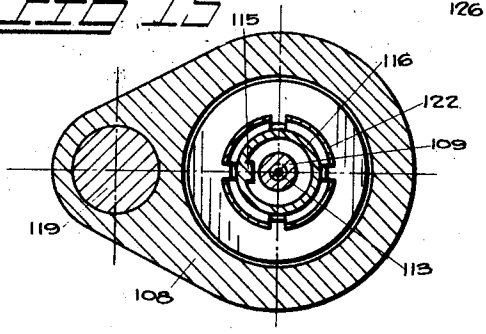
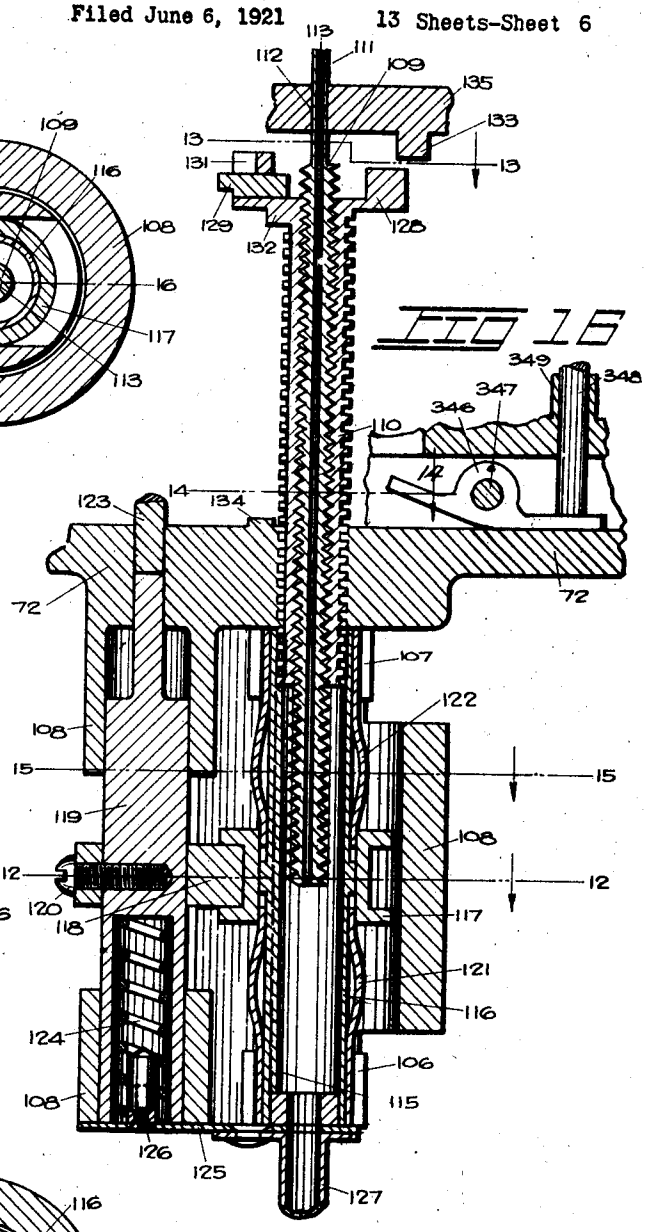


FIG 16



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FIG 17

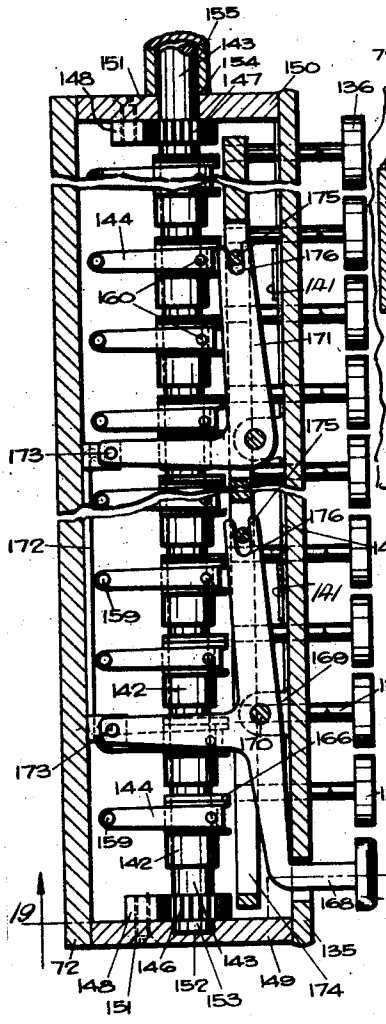


FIG 18

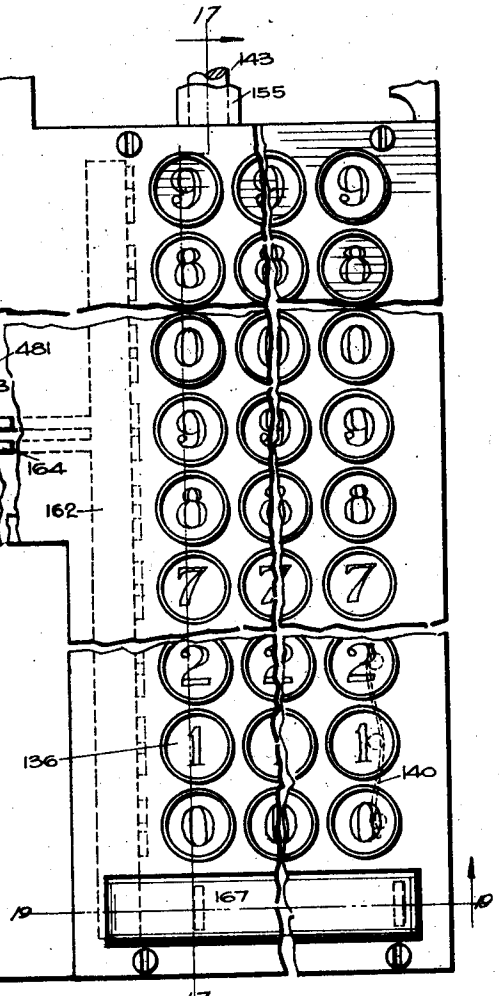


FIG 19

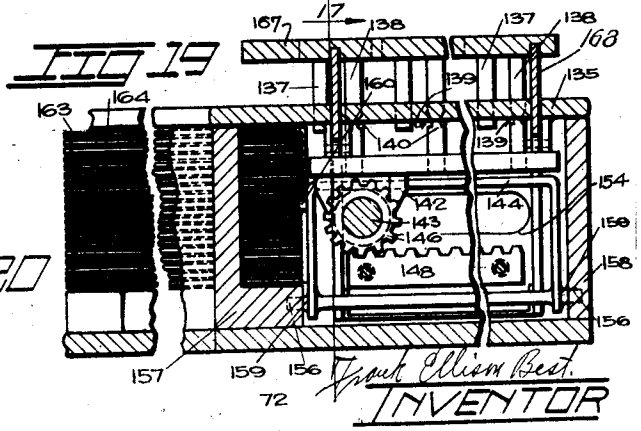
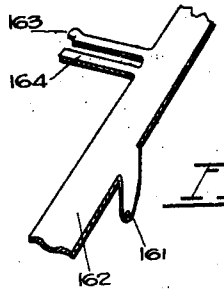


FIG 20



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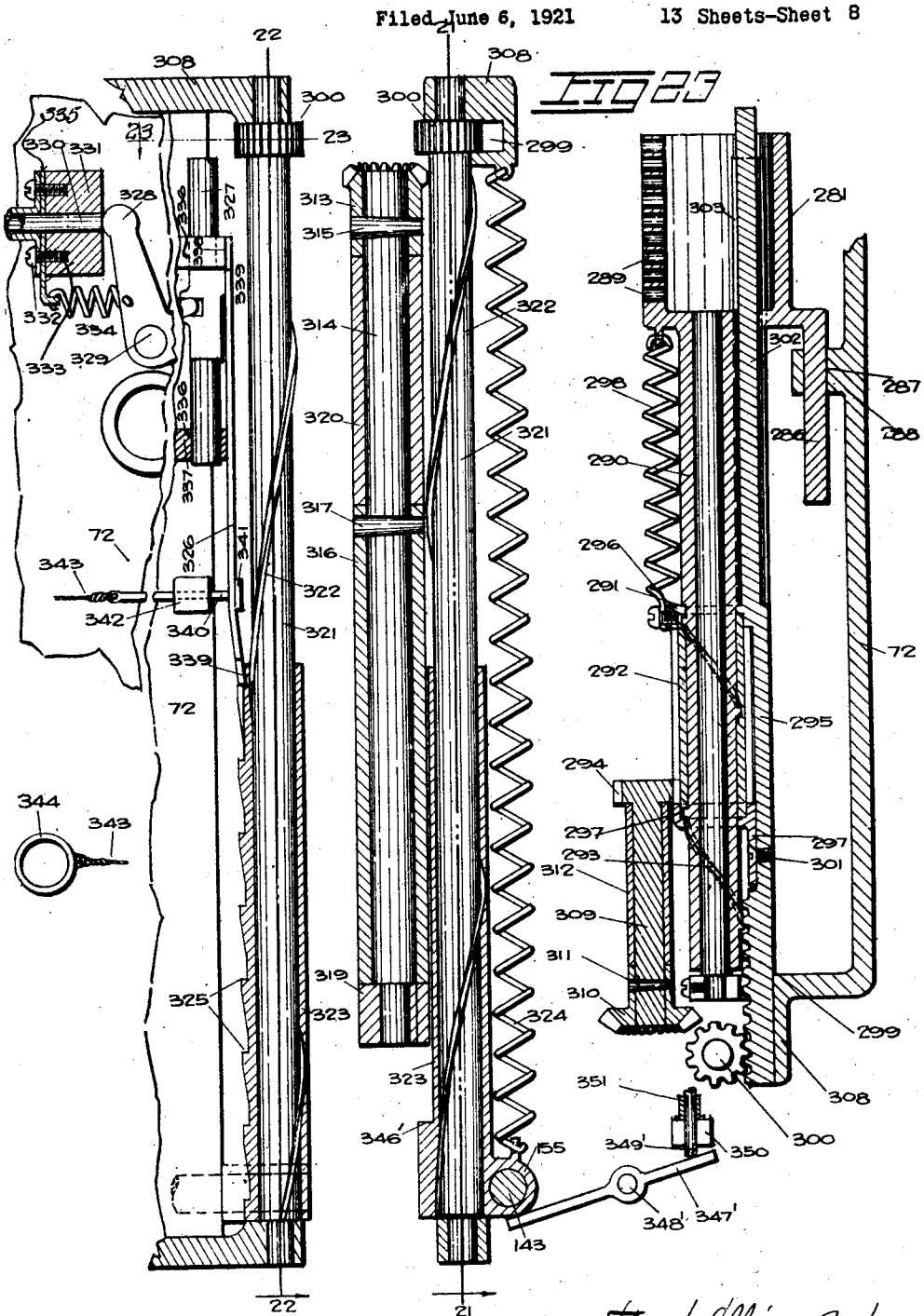


FIG 21 FIG 22 FIG 23

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FIG 24

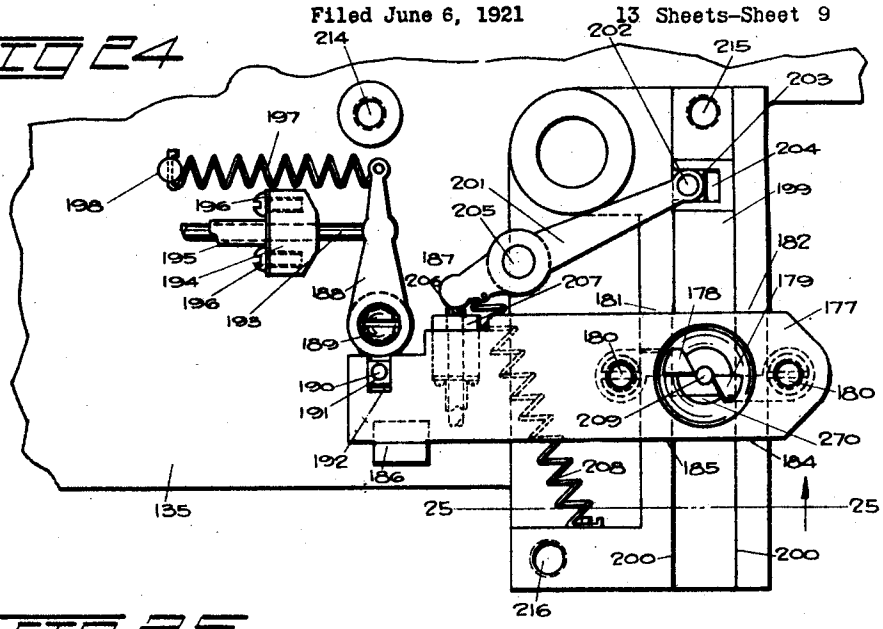


FIG 25

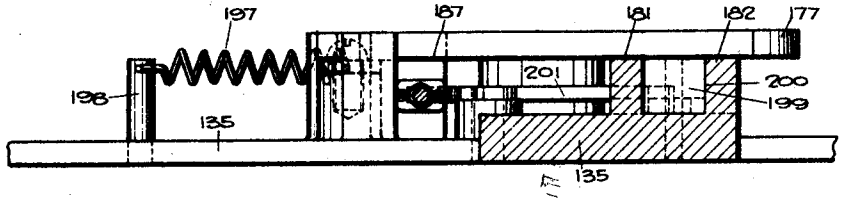
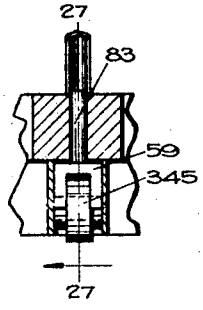
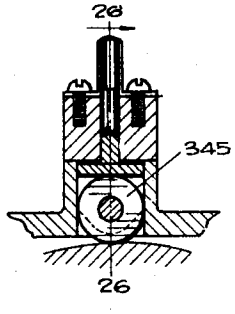
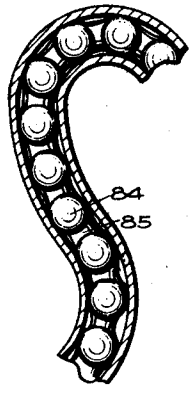


FIG 26 FIG 27 FIG 28







Frank Allison Best.

INVENTOR

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FIG 29

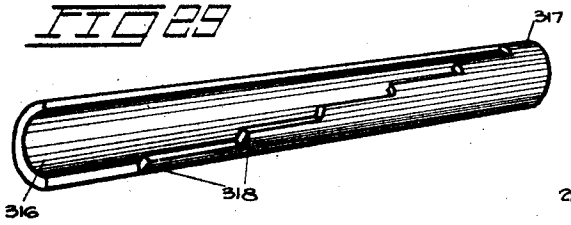


FIG 30

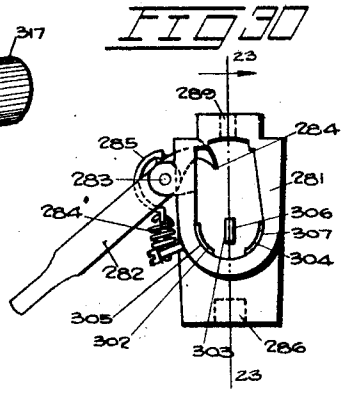
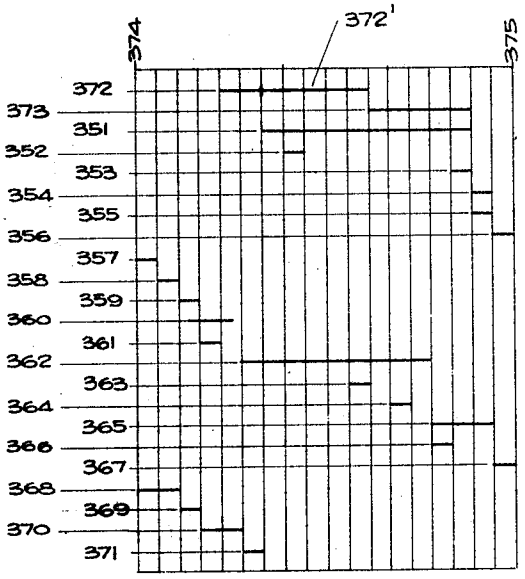


FIG 31



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INVENTOR

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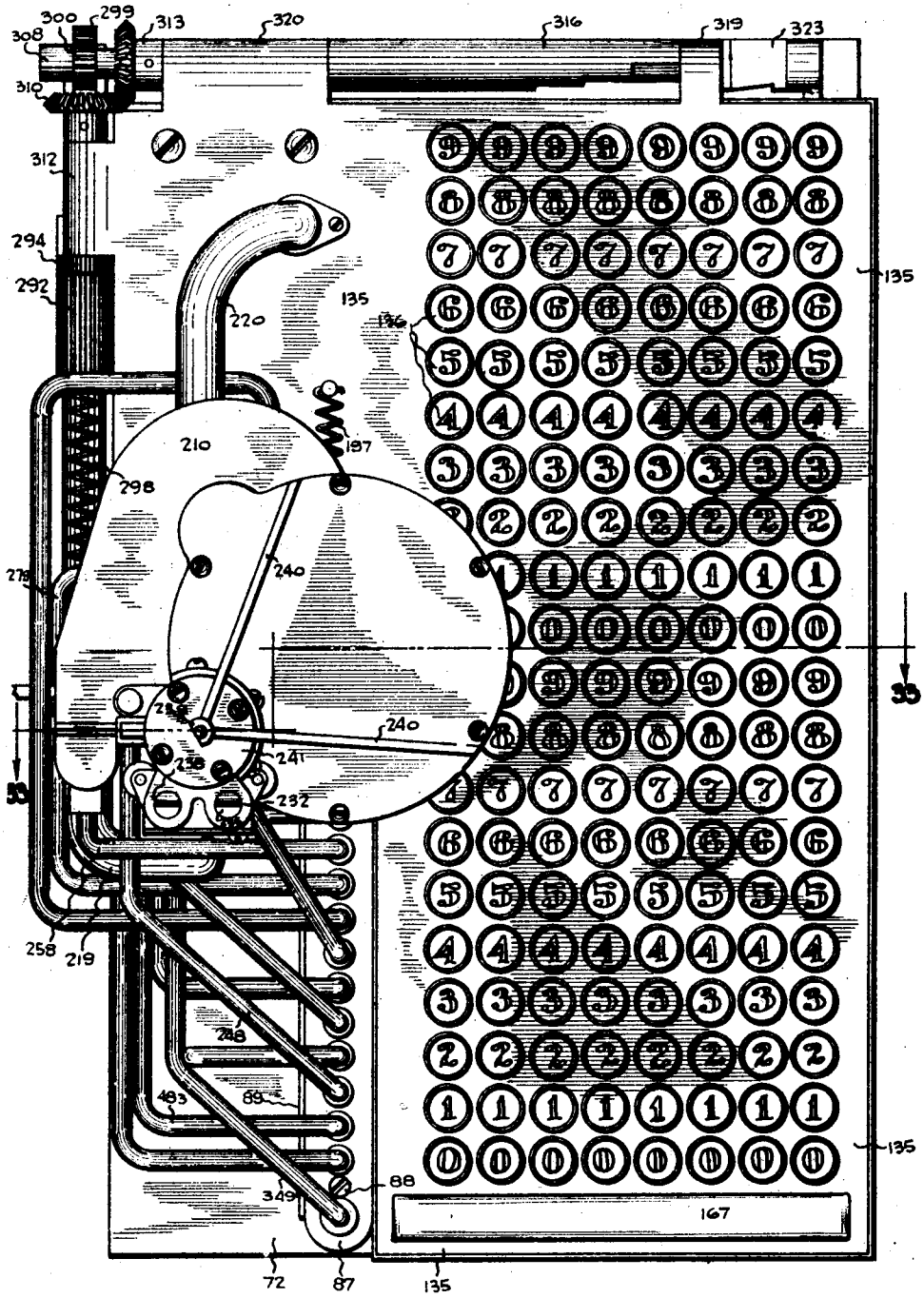


Fig. 32

Frank Ellis Best.
INVENTOR

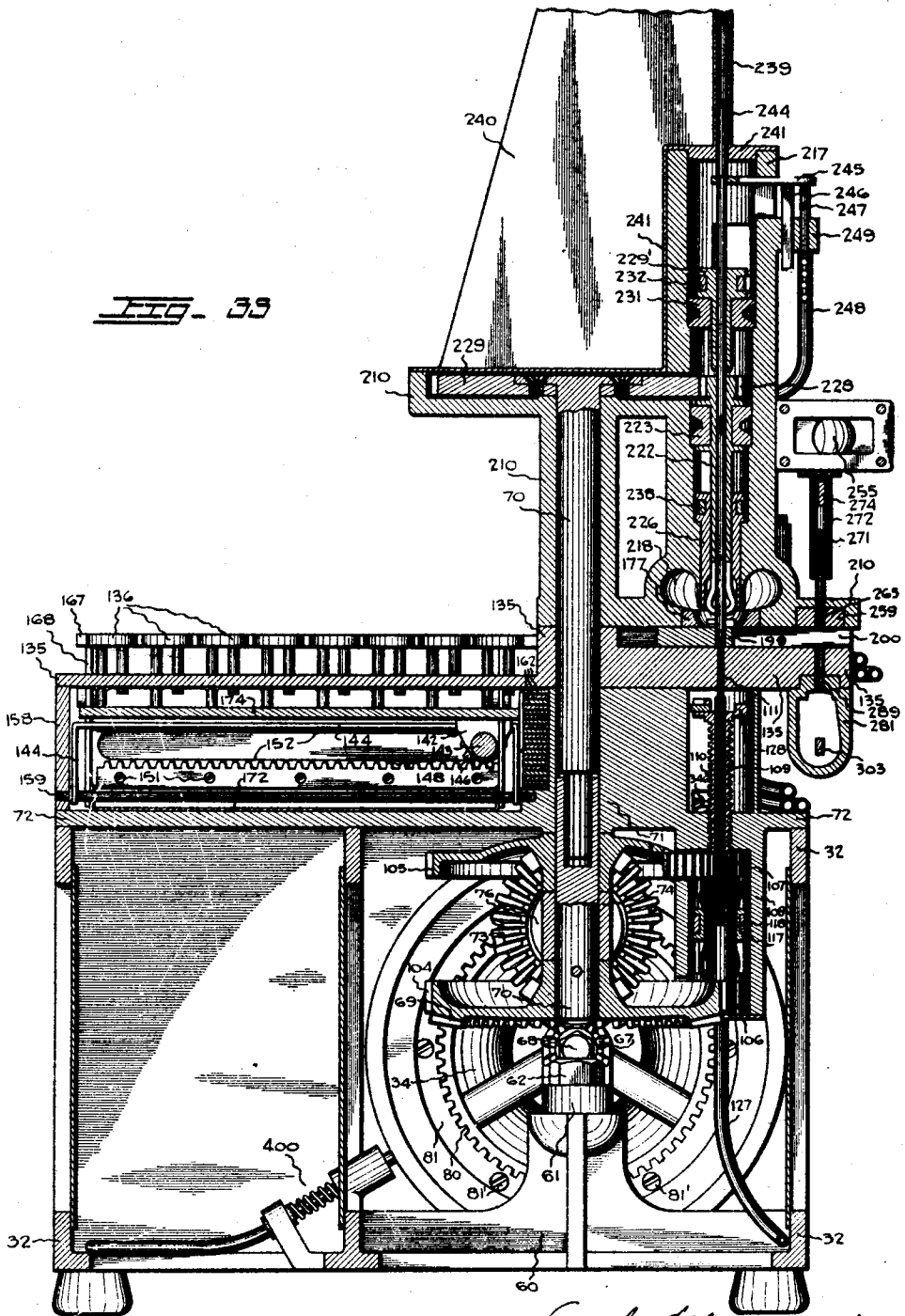
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Fig. 39



Frank Ellison Best.
INVENTOR

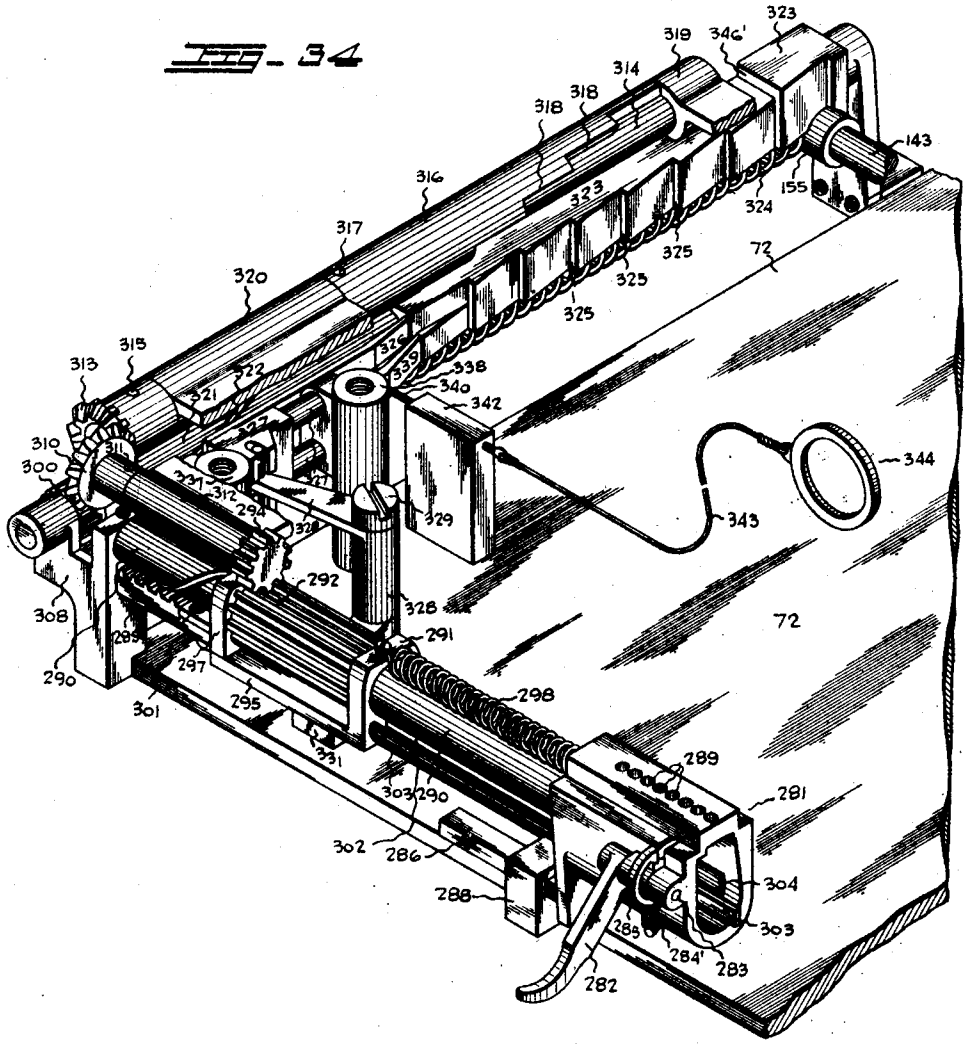
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LOCK FILLING MACHINE

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Fig. 34



Frank Ellison Best.

INVENTOR

Patented Aug. 7, 1928. 1,679,759

UNITED STATES PATENT OFFICE.

FRANK ELLISON BEST, OF SEATTLE, WASHINGTON, ASSIGNOR TO FRANK E. BEST, INC., OF SEATTLE, WASHINGTON, A CORPORATION OF WASHINGTON.

LOCK-FILLING MACHINE.

Application filed June 6, 1921. Serial No. 475,405.

This device is to be used in making and inserting pin tumblers of various lengths into locks; and the principal object of my device is to provide easily operated and automatic means for making pin tumblers of various sizes and inserting said pin tumblers together with springs therefor into locks to produce therein predetermined locking combinations.

Another object of the invention is to provide a lock filling machine having manually operable permutation devices arranged to be set in advance of the filling of a pin tumbler lock to determine the lengths to which the various pins that make up the several stacks of pin tumblers may be cut.

In a general way this lock filling machine embodies means for receiving and holding a pin tumbler lock core into which a set of pin tumblers forming a locking combination are to be inserted; rotatable collet means for holding and rotating a bar of material from which tumblers are to be cut; pin measuring means for engaging with the end of the bar of material from which the pins are cut to determine the length of the pins; permutation devices for determinign in advance of the filling of a lock, the setting of the pin measuring means and in this way determining the combination to which the lock is to be set up; devices for receiving the stacks of properly cut pins and for loading said stacks of pins together with springs into the locks; suitable motor and cam means for driving the machine and for producing the proper sequence of operations of the various parts and such automatic stop and safety devices as are necessary.

Other and more specific objects will be apparent from the following description taken in connection with the accompanying drawings.

For convenience, I am resolving the adaptation herein shown, into six principal units namely; (1) motor and cam unit, (2) pin measuring unit ,(3) key board unit, (4) pin cutting and delivery unit, (5) collect arrangement, and (6) communicating unit.

In referring to the accompanying views: Fig. 1 is a front elevation of the device. Fig. 2 is an elevation of the left side. Fig. 3 is an enlarged vertical section of the motor and cam unit taken on line 3—3, Fig. 1. Fig. 4 is an enlarged vertical section of the pin cutting and delivering unit taken on lines 4—4, Fig. 10. Fig. 5 is a horizontal section taken on lines 5—5, Fig. 4. Fig. 6 is a vertical section taken on line 6—6, Fig. 5. Fig. 7 is a vertical section taken on line 7—7, Fig. 5. Fig. 8 is a horizontal section taken on line 8—8, Fig. 4. Fig. 9 is a vertical section taken on line 9—9, Fig. 8. Fig. 10 is a top view of the pin cutting and delivering unit. Fig. 11 is a vertical section taken on line 11—11, Fig. 10. Figs. 12, 13, 14, and 15 are horizontal cross sections of the pin measuring unit taken on lines 12—12, 13—13, 14—14, and 15—15 respectively of Fig. 16. Fig. 16 is a vertical section of the pin measuring unit taken on line 16—16 Figs. 10 and 12. Fig. 17 is a vertical section of the key board unit taken on line 17—17, Fig. 18. Fig. 18 is a fragmentary top view of the key board unit. Fig. 19 is a vertical section through the key board unit taken in line 19—19, Figs. 17 and 18. Fig. 20 is a perspective view of a communicating plate. Fig. 21 shows a horizontal section taken in line 21—21, Fig. 22 of the communicating unit which is at the rear of the key board unit. This figure also shows a fragmentary top view of the main plate which supports said key board unit. Fig. 22 is a vertical section of the communicating unit taken in line 22—22, Fig. 21. Fig. 23 is a vertical section of said communicating unit taken in line 23—23, Fig. 21. Fig. 24 is top view of the pin cutting and delivering unit showing a fragmentary view of the top plate which is integral with the key board unit. Fig. 25 is a vertical section taken on line 25—25, Fig. 24. Fig. 26 is a vertical section taken on line 26—26, Fig. 27. Fig. 27 is a vertical section taken on line 27—27, Fig. 26. Fig. 28 is a sectional view of a bent guide to be used with balls and spacers for communicating movements from a cam follower to a lever to be operated thereby. Fig. 29 is a perspective view of a stepped sleeve used in the communicating unit. Fig. 30 is a front elevation of the lock housing which is a part of the pin cutting and delivering unit. Fig. 31 is a diagrammatic view showing cam actions. Fig. 32 is a complete plan view of this lock filling machine. Fig. 33 is a view in vertical section substantially on broken line 33—33 of Fig. 32. Fig. 34 is a detached isometric view showing the core holding device and communicating unit.

Similar figures refer to the same or similar parts throughout the several views.

The motor and cam unit functions to provide power and a variety of movements to the various parts of the machine.

It is provided with a stator 31 housed in the main frame element 32 (see Fig. 3), and possesses the usual fields 33, windings 34, rotor (not shown) and rotor shaft 35. Frame element 32 has a cross strut 60 to which extension 61 of stator 31 is secured by cap screw 62. To the forward extremity of the stator is secured a face 63 secured thereto by screws 64. Face 63 is provided with oil well 65 corresponding with oil well 66 in stator 31 supplying lubrication for rotor shaft 35 journalled in the respective parts. Rotor shaft 35 Figs. 3 and 33 carries on its rear extremity a bevel gear 67 keyed thereon and secured by nut 68. Gear 67 drives gear 69 carried on vertical drive shaft 70. Shaft 70 is journaled in bridge 71 and main plate 72 and drives bevel gear 73 which is journaled in bridge frame 74 and which drives gear shaft 75 through friction plate 76 fitting over a square end 77 of shaft 75 and secured thereto by cap screw 78. Shaft 75 has gear teeth 79 which mesh with and drive drum 81 by means of internal gear teeth 80. Said drum is secured to cam drum 36 by screws 81′ and forms the rear retainer for cam drum 36. Cam drum 36 carries cams 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, and 58, which actuate followers 59 only three of which are shown in Fig. 3. Followers 59 are provided with rollers 82 and stems 83, balls 84 and spacers 85 operating in flexible tubing 86 thereby providing flexible tappets which transmit desirable impulses from the corresponding cams. Stems 83 are guided by plate 87 secured to top plate 72 by screws 88. Pivoted on plate 87 by screw 91 (shown dotted) is lever 89 having extremities 90 which register in holes 92 in roller stems 93 and 93′ provided with rollers 94. Stem 93 is actuated by impulses transmitted by tappet rod 95 whose action is balanced by a spring 96 over the head of stem 93′. The function of stems 93 and 93′ is to shift axially cam drum 36 together with the cams by means of end cams 97 and 98 so that either the even or odd numbered cams register with the cam followers as desired. Screw 99 has a head 100 which extends above stator 31 and operates in grooves 101 and 102 (see bottom Fig. 3) in cam drum 36, and functions to retain said cam drum in either of its shifted positions. Grooves 101 and 102 are joined by opening 103 at a position suitably positioned with respect to end cams 97 and 98 to permit shifting of cam drum 36. Spur gear 105 is driven by bevel gear 73 (right hand side Fig. 3) and is adjusted to a running fit on shaft 70.

Gears 104 and 105 rotating in opposite directions mesh with gears 106 and 107 respectively of the pin measuring unit Fig. 16, which is drawn to a large scale. The position of this unit relative to the motor and cam unit just described is shown in Fig. 33 by line 16—16, Fig. 10 in which the front of the machine is at the right side, while in Fig. 3 the front of the machine is at the left side. The location of shaft 70 in the two views will also aid in establishing this relation. It will be noted that in Fig. 33 the line of cross section is offset at this point.

The pin measuring unit is housed in an extension 108 of main plate 72 Figs. 33 and 16. It consists of a central stem 109 screwed into a sleeve 110 which in turn is screwed through main plate 72 as shown. Central stem 109 is provided with a square extension 111 fitting through a square hole 112 in top plate 135, which permits longitudinal but not rotary movement. An air hole 113 is provided in central stem 111. Sleeve 110 is also provided with a longitudinal groove 114 see Fig. 14, which meshes with a feather 115 of sleeve 116. Gears 106 and 107 are adjusted on sleeve 116 to a running fit. A collar 117, operated by a finger 118 secured on plunger 119 by screw 120, is provided to ride upon and thereby lock by the spring friction thereof, springs 121 and 122 of gears 106 and 107 in its downward and upward movement imparted to plunger 119 by cam tappet 123 and spring 124 respectively. Through this means sleeve 116 and thereby sleeve 110 is rotated alternately so as to travel up and down imparting a vertical movement to central stem 111 equal to the difference between the pitches of the inside and outside thread of sleeve 110. A plate 125 is secured to the end of extensions 108 by screws 126 to secure sleeve 116 and gear 106 in position and to form a support for air tube 127 which is connected to the fan for furnishing currents of air, as will be described later. Sleeve 110 is provided with a head 128, Fig. 13, having a latch 129 held in position by a spring 130 adjusted to engage points 476 of plates 162 of key board unit Figs. 18, 19, and 20. Head 128 is provided with stops 131 and 132 adapted to engage stops 133 and 134 of top plate 135 and main plate 72 respectively to limit its movements. A plunger 477, Fig. 18, operating in a stud 478 integral with main plate 72 and screwed into tappet 479 as shown, is adapted to retract prongs 163 when desirable by catch 480 acting on spur 481. It is also adapted to push latch 129 back so that said latch will no longer engage with points 476 of prong 163 to provide escapement for said latch 129 at desirable intervals. A spring 482 and cam follower 59 operating on cams 39 and 40 together with the tappet train consisting of balls 84 and spacers 85 in tube 483 cooperate

to give proper movements to said plunger 477.

The key board unit consists of mechanism illustrated in Figs. 32, 33, 17, 18, 19, and 20, extending between main plate 72 and top plate 135. (See also Figs. 1 and 2.)

Stems 137 and 138 of finger keys 136 extend downward through top plate 135. Stems 138 are provided with grooves 139 which engage with spring wires 140 (shown dotted, Fig. 18) to prevent their removal upward and to friction bind them in extreme positions up and down. These spring wires 140 are held up tightly against the top plate by any convenient method such as strips 141, Fig. 17, secured to top plate 135. The lower extremity of stems 138 are adapted to engage riders 142, carried jointly by rider rod 143 and cross rods 144 on both of which rods they are adjusted to sliding fits, when said keys are pushed down.

Rider rod 143 is provided with spur gears 146 and 147 keyed thereto which operate on racks 148, Figs. 17 and 33, secured to the front end plate 149 and rear end plate 150 respectively by screws 151.

Front plate 149 has a longitudinal guide groove 152 into which end 153 of rider rod 143 fits to prevent disengagement of gears 146 from rack 148 in its transverse movements. The gears 146 and 147 and racks 148 provide alignment for rider shaft in its transverse movements. Rider rod 143 protrudes through a guide slot 154 of rear plate 150 to engage with sleeve 155 of the communicating unit to be described later.

Cross rods 144 are provided with studs 159 journalled in holes 156 of the side plates 157 and 158, and are also provided with studs 160 which engage in slots 161 of communicating plates 162. There is one cross rod 144 and rider 142 and communicating plate 162 for every transverse row of finger keys 136. The top communicating plate as seen Fig. 19 engages with studs 160 of the lowest cross rod 144 as seen in Fig. 17, while the next communicating plate engages the stud of the next cross rod and so on through the whole series.

Each communicating plate 162 has an engaging prong 163 adapted to engage with catch 129 of the pin measuring unit and further has a spring 164 for engaging with frame member 165, Fig. 18.

The function of said spring prong 164 is to move and retain the communicating plate 162 in a rearward direction so as to keep prong 163 free from engagement with latch 129 of the pin measuring unit.

Whenever a finger key 136 is pushed down, and rider rod 143 is moved in alignment therewith, a wedge shaped projection 166 of rider 142 strikes against and is wedged between finger key stem 138 and cross rod 144 thereby moving said cross rod 144 and its corresponding communicating plate 162, which is pivoted thereto by stud 160 fitting into groove 161, forward, compressing spring prong 164 and bringing prong 163 into a position engageable by latch 129 of the pin measuring unit.

A release bar 167 is secured to levers 168 and pivoted to hangers 169 of top plate 135 by pivots 170. Said levers 168 are coupled by plate 172, having bearing 173, to levers 171. A plate 174 is provided having pivots 175 engaging in slots 176 of levers 168 and 171. By pressing down on release bar 167 plate 174 is thereby lifted carrying all depressed finger keys up with it by means of stems 137 engageable therewith. The weight of plate 174 is sufficient to return said plate to its lower position when the pressure is removed from the release bar.

The pin cutting and delivering unit is mounted on the top plate 135. The lowest element of which, Figs. 24 and 25 consists of cutter bar 177 provided with cutters 178 and 179 secured thereto by screws 180. Cutter bar 177 is adjusted to a sliding fit in frame projections 181, 182, 183, 184, 185, 186, and 187 most of which are flush therewith at the top surface. Said cutter bar is actuated by lever 188 pivoted by screw 189 and having a stud 190 closely fitting a square collar thereon 191 which in turn closely fits into a groove 192. Said lever 188 is actuated by cam tappet 193 fitted in block 194 to which tappet tube 195 is secured by screws 196. A spring 197, secured to a projection 198 of top plate 135 and lever 188, serves to retract said lever when pressure is relieved on said cam tappet.

The pin delivering shuttle 199 operates in a groove 200 and is actuated by lever 201 through stud 202 and square collar 203 operating in a groove 204. Lever 201 is pivoted by screw 205 and actuated by cam tappet 206 adjusted in a stud 207 and retracted by a spring 208. Shuttle 199 is provided with a pin tumbler hole 209.

Placed above the pin cutting and delivering unit is the collet arrangement, Figs. 4, 8, 10, 32 and 33. (See also Figs. 1 and 2.) This consists of a frame 210, Figs. 4 and 8 adapted to be secured to top plate 135, Fig. 24 by cap screws inserted through holes 211, 212, 213, Fig. 8 (dotted Fig. 10) of frame 210 and screwed into tappet holes 214, 215, and 216 respectively, of top plate 135.

Frame 210 has a hollow vertical cylinder 217, provided, at its lower extremity, with an air chamber 218 opening into an air pipe 219 at the front and another air pipe 220 at the rear air tube 127 of the pin measuring unit being joined to air pipe 219. The direction of air flow from air fan 221, (shown dotted Fig. 10) is indicated by arrows therein. The air blast is to carry away

the chips made in cutting pins. Cylinder 217 is also provided with a collet member 222 guided by a collar 223 which is secured in position by set screw, not shown, similar to set screw 224, Fig. 5. This collet member has a number of spring prongs 225 which when compressed by sliding collet 226, as shown, grips a rod 227 out of which the pin tumblers are made. Collet member 222 carries at its upper extremity a spur gear 228 driven by spur gear 229 carried on main shaft 70. When pin rod 227 is gripped by prongs 225 it is rotated thereby.

Another collet 229′ having spring prongs 230 and guided in collar 231 secured by set screw 224 (Fig. 5) frictionally grips rod 227 and functions to lift rod 227 up and down when the same is not securely gripped by prongs 225 of collet member 222. Collet 229′ is actuated by collet lift 232 mounted on stud 235 (see Fig. 7) which is lifted by tappet 233 and retracted by spring 234. Stud 235 is screwed into projection 236 of frame 210 and guided at its upper end by projection 237 of cylinder 217.

Collet 226 is also actuated up and down by a collet lift 238 similar to 232 (see Fig. 5).

The rod 227 is guided above cylinder 217 by rod guide 239 having staying ribs 240 (also see Fig. 10). Rod guide 239 and ribs 240 are integral with a base plate 241 secured to frame 210 and cylinder 217 by screws 242 and 243 respectively.

Rod 227 is provided with a head 244 which serves, when the rod is nearly used up, to pull down finger 245 having a guide 246 operating in projection 249 of cylinder 217, as said rod is pulled down by collet 229. The downward movement of finger 245 carries therewith tappet 247, operating in tube 248 secured at its upper extremity to projection 249 and at its lower extremity to plate 87 (see Figs. 1 and 3), and thereby causes catch 250 to engage with cam 41. This action can never take place when the drum is shifted to position shown in Fig. 3 in which catch 250 is over cam 42. Catch 250, balls 84 and spacers 85, contained in tube 248 (see Figs. 1 and 28) and through them finger 245 are retracted by spring 251 (Fig. 3) when the stub of the used rod 227 is removed for the insertion of a new one.

Fan 221, Fig. 4, is keyed to shaft 252 and further secured by screw 253. Shaft 252 carries a spur gear 254 which is driven from gear 229.

Air tube 219 is secured at both extremities to frame 210. It carries on its upper extremity, Fig. 10, a tappet valve 255 having a stem 256, housed in tube 258, and a seat 257. Said valve is opened by cams 43 and 44, Fig. 3 through a cam follower 59, balls 84 and spacers 85 operating in tube 258, (see Fig. 1). The pressure of the air from fan 221 is sufficient to seat said valve.

Figure 11 shows a cross section through the spring shuttle 259 and related parts. Shuttle 259 is pivoted on screw 260 secured to frame 210. It is provided with a spring 261 one end of which is secured in a hole 262 of frame 210 and the other end of which extends into a hole 263 in shuttle 259, said spring functioning to keep shuttle 259 against a stop 264 of plate 210 (shown dotted in lower part of Fig. 8), in which position hole 265 of said shuttle will be aligned with hole 266 of spring tube 267 as shown Fig. 11, so that spring pins 268 will be automatically fed into said shuttle. The spring pins 268 each preferably consist of a compression spring contained within two relatively telescopic tubes that normally expand to the length shown in Fig. 11 but are capable of being compressed. It will be noted that the vertical dimension of shuttle 259 is equal to the length of spring pins 268 so that the insertion of said pin into said shuttle will not lock the shuttle from rotary movement about pivot 260. A stud 269 (shown dotted Fig. 8) integral with shuttle 259 is engaged by the end 270 of pin delivery shuttle 199, Fig. 24, causing said spring shuttle 259 to rotate, as shuttle 199 is actuated by cam tappet 206 through lever 201, bringing pin hole 209 of shuttle 199 and hole 265 of shuttle 259 in alignment for delivery of their contents into a barrel of a lock being set up.

This delivery is accomplished by a plunger 271, Figs. 33, 8 and 9, operating in a guide 272 secured to frame 210 pivoted between projections 275 of frame 210 by screws 273, and arranged to be moved by lever 274, on pivot 276. This lever 274 is, in turn, actuated by cam tappet 277 guided in bracket 278 to which is secured tappet tube 279 containing the usual balls 84 and spacers 85 and leading to a cam follower 59 (not shown) acting on cams 53 and 54. It is retracted by spring 280 joining lever 274 with frame 210.

Extending across the rear and left side of the key board unit, see Figs. 1, 32 and 34, is the communicating unit.

A lock housing 281 (Figs. 1, 34 and 30), adapted to hold a lock core while being filled, is provided with a lever 282 pivoted to said housing by pivot 283, lever 282 serves to secure said lock core in said housing by means of a point 284 fitting into an aperture in said lock core. This lever 282 is held in its extreme positions by means of a hook 285 operating in a notch of lever 282 and spring 284′ hooked thereto secured to housing 281. Housing 281 has a tongue 286 (shown dotted Fig. 30). See also Fig. 2 and Fig. 23, operating in a close fitting hole 287 of stud 288 rising out of main plate 72. Housing 281 is also guided at the top by top plate 135 which conforms to its outline as shown in Fig. 2. This housing is pro-

vided with holes 289 through which pin tumblers are delivered to the lock core housed therein. An extension 290 is provided on housing 281, Figs. 23 and 34, having a shoulder 291 which acts as a stop for a rider 292 adjusted therein to long helical grooves or threads 293. The external surface of rider 292 is a long spur gear which meshes with gear 294. Rider 292 is housed in rings 296 and 297 of rack member 295 and is held axially thereby while permitted to rotate freely therein. Ring 297 is secured to rack member 295 by screws 301. Rack member 295 is linked to housing 281 by spring 298 as shown.

Rack member 295 is provided with rack 299 which meshes with gear 300. Rack member 295 is provided with prongs 302, 303, and 304 (Fig. 30) which are adjusted to sliding fits in holes 305, 306, and 307 respectively of housing 281. Rack member 295 is guided by projection 308 of main plate 72 at its rear end. Gear 294 is integral with shaft 309 that has a bevel gear 310 secured to the rear extremity by pin 311, and is journaled in an extension 312 of top plate 135.

Extending across the rear end of the key board unit, Figs. 32 and 34, at right angles to the parts just described are the remaining parts of the communicating unit. Gear 310 meshes with gear 313, Fig. 22, which is keyed to shaft 314 by pin 315. This shaft carries a stepped collar 316 (see Fig. 29) secured thereto by pin 317 and provided with steps 318. This shaft is journaled in projections 319 and 320 of top plate 135. Gear 300, Figs. 34, 21, 22, and 23, is secured to shaft 321 which is provided with long helical threads 322 upon which sleeve 323 is adjusted. Sleeve 323 is provided with an extension 155 into which rider shaft 143 of the key board unit Fig. 17, is journaled. A spring 324 secured to extension 155 and guide 308 tends to draw said parts together. Sleeve 323 is provided with notches 325 by means of which step by step motion is imparted to said sleeve, by spring plunger 326 carried by guide block 327 which is actuated by lever 328 pivoted on main plate 72 by pivot 329. Lever 328 is actuated by cam tappet 330 guided through a block 331 integral with main plate 72. To block 331 is secured tappet tube 332 by screws 333. The other end of said tappet communicates with a cam follower which operates on cams 37 and 38 through the regular ball 84 and spacer 85 tappets. Lever 328 is retracted by spring 334 connecting lever 328 with strip 335 included in the securing process between tube 332 and block 331. Guide block 327 operates in guide holes 336 in studs 337 and 338 integral with top plate 72. Secured to stud 338 is a holding spring pawl 339 which acts to retain the step by step movement acquired by spring plunger 326. Spring plunger 326 hides the view of spring pawl 339 except at its extremities in Fig. 21, but these parts are more clearly shown in Fig. 34.

A hand release 340 is provided to release both spring plungers 326 and spring pawl 339, at the same time to permit the return of sleeve 323 under the action of spring 324. This hand release has a head 341 engaging said parts and is guided in a stud 342 integral with main plate 72. To hand release 340 is attached a wire 343 extending to a loop 344 at the front of the machine.

In the operation of the communicating unit when a lock core, not shown, is to be inserted, the housing 281 is drawn outwardly against the tension of spring 298, the lock core is inserted and locked within the housing 281 by raising lever 282, and the spring 298 is permitted to draw prongs 302, and 304 against the end of the lock core. The movement of housing 281 together with the extension 290 of said housing rotates gear sleeve 292 which acts through gear 294, shaft 309, gear 310, gear 313 and shaft 314 to rotate stepped sleeve 316 to bring the proper step 318 of said sleeve into alignment with stop 346′, the length of the lock core and number of barrels therein determining which step of collar 316 shall be aligned with stop 346′. The spring plunger 326 and pawl 339 are then released, permitting spring 324 to move sleeve 323 to the right until stop 346′ strikes against the step 318 that has been positioned in alignment therewith. Movement of sleeve 323 rotates gear wheel 300 by means of spiral 322 thereby moving rack 299 and positioning housing 281 so that the rearmost barrel of the lock core in said housing is in a correct position for loading. As the loading of each successive barrel of the lock core is completed the spring plunger 326 moves sleeve 323 one notch to the left thereby each time moving the lock core into the correct position for loading the next succeeding tumbler receiving barrel. In Fig. 34 rider rod 143 is shown in the inoperative position where it will be after the filling of one core and before the insertion of another core, while in Fig. 33 the rider rod 143 is shown in the position it will occupy in the filling of the first barrel of a lock core. If an eight barrel lock core is inserted in the core housing 281 the sleeve 316 will be positioned so that stop 346′, when released, will strike the last shoulder to the left on sleeve 316, but, if a shorter lock core of less than eight barrels is inserted in housing 281 then sleeve 316 will be turned so that an intermediate step 318 depending on the length of the lock core will be stopped in the path of stop 346′. As sleeve 323 is moved to the left rider rod 143 will be carried therewith and will move past the previously depressed keys

136 without permanently affecting the adjustment of any parts and will stop on the line of the last longitudinal row of keys in which any key is depressed thus positioning any plate 162 whose connected rider block strikes a depressed key so that said plate will be engaged by the pin measuring devices and thereby determine the length of a tumbler pin.

It will be noted that the keyboard is double, the numbers, reading longitudinally of the rows reading from zero to nine and then repeating thereby constituting, in effect, two different key boards for setting up a lock to operate on two different shear lines.

The cam followers and tappets employed in this device consist of cam followers 59 having wheels 345 and stems 83 above which are balls 84 and spacers 85 operating in tubes of various designations. See Figs. 26, 27, and 28.

Frame 72, Fig. 16, supports lever 346 pivoted at 347 and provided with a tappet 348 operating in tube 349. The other end of tube 349 is shown Fig. 3 (upper right hand corner) with the balls and spacers connecting plunger 95 to tappet 348. In filling a lock core after the filling of each barrel is completed head 128 of pin measuring unit is moved downwardly until it strikes the end of lever 346 and, by depressing such lever, operates through the connecting balls, spacers and tappets to lower roller 94, at right, and raise roller 94, at left, Fig. 3, thus causing the shifting of cam drum endwise to operate on a different cycle. When pin measuring unit again begins to move upwardly lever 346 is released and spring 96 reverses the position of rollers 94 and causes the cam drum to be shifted to the right, Fig. 3.

Fig. 22 reveals at the left an automatic stop lever for the machine. It consists of lever 347′ pivoted to main frame 32 by stud 348. Said lever is actuated through engagement with projection 155 of sleeve 323 when reaching its extreme left hand position in response to the step by step movements imparted by spring plunger 326. Said lever moves tappet 349 guided in stud 350 to which is secured tappet tube 351 having the usual balls and spacers and communicating with device 400, shown dotted Fig. 1, similar to catch 250 and spring 251 Fig. 3 and positioned 120° therefrom about the cam drum, and which operates upon cams 41 and 42 to stop the rotation of said drum. This stoppage of said drum causes a slippage of disc 76 on gear 73 but does not stop the motor. Lever 347 and its train is retracted by the spring which corresponds with spring 251.

The operation of the machine is as follows:

Set up any desirable combination numbers on the key board by depressing finger keys. Insert a lock core of any length in housing 281. Lift lever 282 thereby securing said core in housing. Spring 298 Fig. 23, draws prongs 302 and 304 into engagement with lock core and at the same time rotates sleeve 292 on screw threads 293 rotating gear 294 and thereby gears 310, 313, and shaft 314 with stepped sleeve 316. The length of the lock core (depending on the number of barrels) determines which of the steps 318 is brought into alignment with a stop 346′ on sleeve 323.

Start motor.

Next pull hand release 344 which releases spring plunger 326 and spring pawl 339 and allows spring 324 to draw stop 346′ into engagement with the step 318 which corresponds to the number of lock barrels in the particular lock core. This longitudinal movement causes shaft 321 having helical threads 322 to rotate correspondingly operating gear 300 and thereby rack 299 which results in the positioning of the lock core so that the rearmost barrel of the core is in proper alignment for loading.

At the same time rider rod 143 Figs. 17—18 and 19 has been moved over to the finger key row corresponding to the rearmost barrel of the lock core.

This has caused riders 142 of the finger keys depressed in the row corresponding to the tumbler barrels, to become wedged between the corresponding cross rod 144 and finger key stem 138 thereby moving the cross rod and corresponding communicating plate 162 so that prongs 163 are engageable with catch 129 of the pin measuring unit.

Attending the movement of sleeve 323, Fig. 22, in response to the action of spring 324 when plunger 326 and pawl 339 are released, lever 347′, and its train are retracted by a spring, in device 400, (similar to spring 251 shown Fig. 3) allowing cam drum 36 to rotate by friction through friction plate 76, Fig. 3 from gear 73 operated by the revolving rotor 35 of the motor.

The rotation of cam drum 36 brings the various cams into play upon their respective cam followers and their trains performing the functions shown diagrammatically by Fig. 31.

Fig. 31 is a graphic representation of the time and duration of the various cam actions indicated by heavy lines, in each cycle of the cam drum represented by the distance between vertical lines 374 and 375 which is divided into 18 equal parts as shown. The cycle begins at line 374 and ends at 375, and represents one revolution of the cam drum.

For convenience we will refer to the whole group of even and odd numbered cams by the cycles in which they operate the respective followers and designate them as cycle A and cycle B respectively. For example, the cams are operating in cycle A, Fig. 3.

At the time the cam drum is manually released as described for making pins and setting up a lock, the cams are 6 units advanced in cycle A.

During the last 2 units of which cam 38 started to impart the step by step motion to communicating unit as represented in Fig. 31 by line 372.

Upon releasing the cam drum, cam 38 continues to impart said step by stem motion for 5 more units as shown by line 372'. Cam 38 then retracts through 5 units as shown by line 373.

Immediately upon release of cam drum, cam 58 operates cutter 178 to round the lower end of pin 227 as indicated by line 351, and cam 56 opens fan valve 255 as indicated by line 352, and closes same as indicated by line 353. Cam 48 reverses the direction of rotation of catch 129 so as to bring it up to its topmost position as indicated by line 354. Cam 58 returns cutter 178 to normal as shown by line 355.

Next end cam 98 engages wheel 94 and shifts cams into B cycle as shown by line 356. Cam 45 lifts collet clutch 226 releasing clutch 225 as per line 357. Cam 49 lowers spring collet 229' carrying pin rod down against central stem 111 which does the measuring of the pin lengths (see line 358). Cam 45 lowers thereby locking collet 225 line 359. Cam 57 operates cutter 179 to score pin rod 227. This is in order to remove the metal so that no burr can be left by the severing tool, line 360. Cam 55 opens fan valve furnishing a gust of air to remove chips etc. line 361. Cam 57 operates cutter 178 to sever pin rod 227 thereby cutting tumblers of desired lengths, line 363. Cam 55 closes fan valve, line 364. Cam 57 returns to normal, line 365, cam 39 moves out and returns releasing pin measuring catch 129, line 366.

This cycle B repeats until all the tumbler pins necessary to fill a barrel of the lock are made and placed in the hole 209 of shuttle bar 199. Then end cam 97 engages wheel 94 and shifts cams to cycle A.

Next cam 52 operates pin shuttle, delivering pins to the locks, line 368. Pin delivering cam 54 inserts pins and springs into lock and returns to normal, line 369.

Cam 52 brings shuttle back for new set of line 370. Cam 48 reverses the direction of rotation of catch 129 permitting same to return to top line 371.

The complete grand cycle comprising the foregoing repeats itself until the last barrel of the lock is set up at which time lever 347 of communicating unit operates stopping the machine.

Having thus described an adaptation of my device, what I claim as new and desire to secure by Letters Patent of the United States of America, is:

1. A lock filling machine embodying permutation devices and means governed by said permutation devices for forming pin tumblers of predetermined lengths.

2. A lock filling machine embodying permutation devices, means governed by said permutation devices for forming pin tumblers in accordance with predetermined combinations and means for loading said pin tumblers into a lock.

3. A lock filling machine embodying permutation devices, tumbler pin measuring means governed by said permutation devices and means for cutting off tumbler pins.

4. A lock filling machine embodying permutation devices, means governed by said permutation devices for determining the length to which tumbler pins are to be cut, pin cut off means, and means for loading cut off tumbler pins into locks.

5. A lock filling machine embodying permutation devices, automatic means governed by said permutation devices for forming tumbler pins in accordance with predetermined combinations, spring supply means and automatic means for loading said tumbler pins and said springs into locks.

6. A lock filling machine embodying means for supplying material from which tumbler pins may be cut, manually controlled permutation devices, tumbler pin measuring devices governed by said permutation devices, pin cut off means, and means for loading cut off tumbler pins into a lock.

7. In a lock filling machine, permutation devices embodying manually operated keys, pin measuring devices controlled by the positions of said keys for predetermining the lengths of tumbler pins that are to be cut off, tumbler pin cut off means, and means for loading cut off tumbler pins into locks.

8. In a lock filling machine, pin measuring and cut off devices embodying means for holding a bar of pin stock, devices for cutting off pins from the end of a bar of pin stock and measuring means embodying differential screws for determining the position of a bar of pin stock in said holding means.

9. In a lock filling machine, pin measuring and cut off devices embodying a collet for holding and rotating a bar of pin stock, a cutter adjacent the end of said collet for cutting off pins from the end of a bar of pin stock that protrudes from said collet, pin measuring devices embodying a differential screw arranged to engage the end of a bar of pin stock to determine the position of the same in said collet and manually operated permutation means for predetermining the position of said differential screw.

10. A lock filling machine, embodying automatic pin cut off devices, automatic pin measuring devices, a keyboard having keys arranged to be operated manually to pre-

determine a lock combination and means actuated by keys on said keyboard for determining the position of said pin measuring devices.

11. A lock filling machine embodying devices for holding and rotating a bar of pin stock, pin measuring means for determining the position of said bar of pin stock in said holding devices, permutation devices governing the operation of said pin measuring means, means for cutting off tumbler pins from the end of said bar of pin stock, shuttle means for receiving said tumbler pins in the order in which they are cut off, lock holding means, means for moving said shuttle into a delivery position with respect to said lock holding means and means for discharging the pins from said shuttle.

12. A lock filling machine embodying a collet for holding and rotating a bar of pin stock, manually operated permutation devices, pin measuring means governed by said permutation devices for determining the position of a bar of pin stock in said collet, pin tumbler cut off means, a pin shuttle having a receptacle for cut off tumbler pins, a lock holding device wherein a lock core having tumbler pin receiving holes may be inserted, a spring delivery shuttle, means for simultaneously aligning said spring delivery shuttle and said pin shuttle in a delivery position with respect to said lock core and means for loading the spring and pins from said shuttles into a tumbler pin receiving hole in said lock core.

13. In a lock filling machine, the combination with means for measuring and cutting off tumbler pins and loading said tumbler pins into locks, of a plurality of cams and flexible tappet means interconnecting said cams with said pin measuring, cut off, and loading means.

14. In a lock filling machine, means for supporting a bar of stock, means for severing tumbler pin segments from the end of said bar, permutation devices for predetermining the lengths of the respective segments and means for loading said pin segments into a lock.

15. In a lock filling machine means for supporting a bar of tumbler pin stock, means for cutting off tumbler pin segments from the end of said bar and permutation devices for governing the endwise movement of said bar to determine the length of the segments that will be cut off.

16. A lock combinator for loading pin tumbler locks embodying means for supplying tumbler pin segments to the loading mechanism and permutation devices for governing the operation of said pin tumbler segment supply means.

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