Jan. 16, 1945. J. T. KANE 2,367,505

ARTICLE HANDLING APPARATUS

Filed July 8, 1942 5 Sheets-Sheet 1

FIG. 1

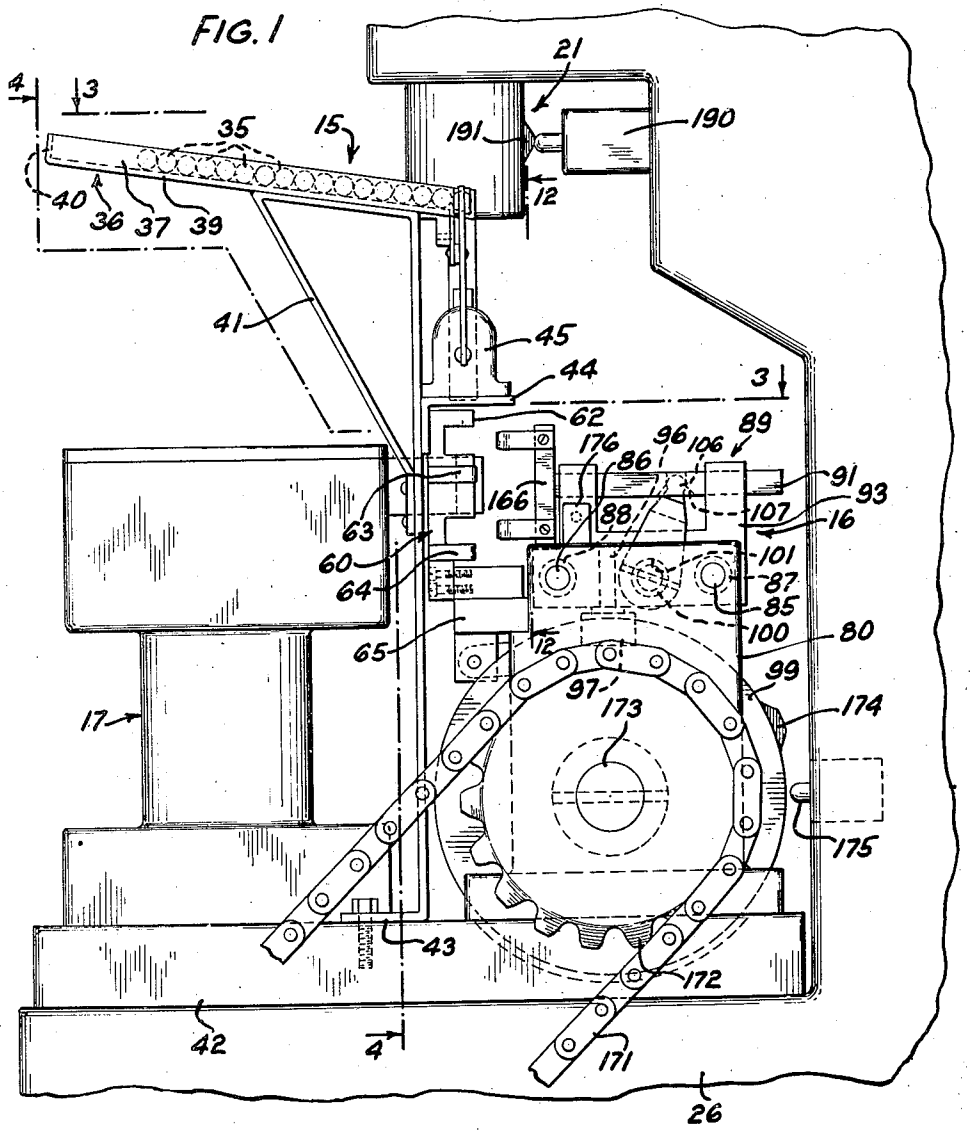
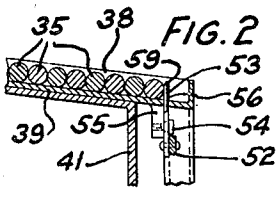


FIG. 2



INVENTOR
J. T. KANE
BY Harry R. Ousley
ATTORNEY

Jan. 16, 1945. J. T. KANE 2,367,505

ARTICLE HANDLING APPARATUS

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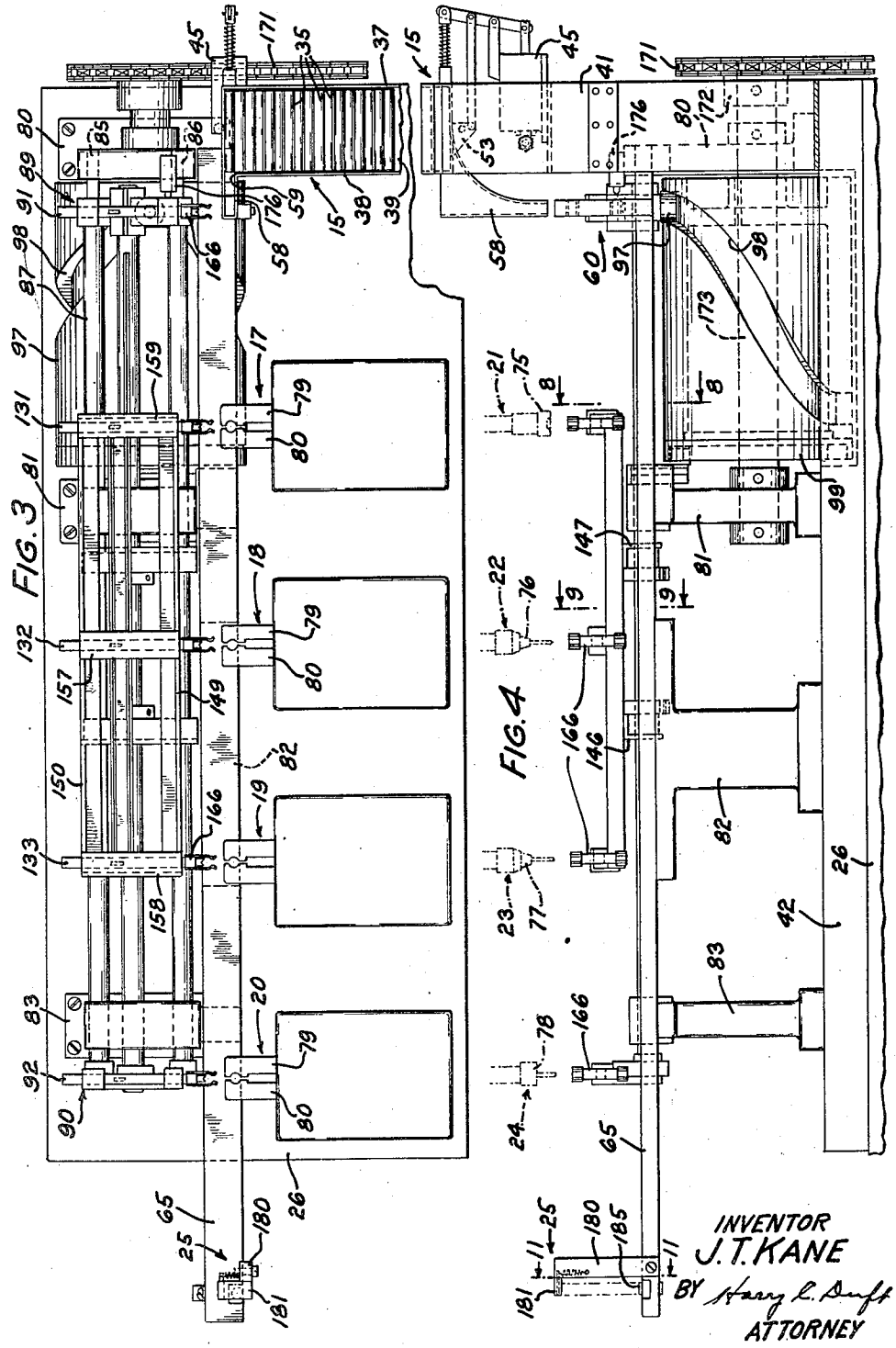

FIG. 3

FIG. 4

INVENTOR
J. T. KANE
BY Harry L. Duft
ATTORNEY

Jan. 16, 1945. J. T. KANE 2,367,505

ARTICLE HANDLING APPARATUS

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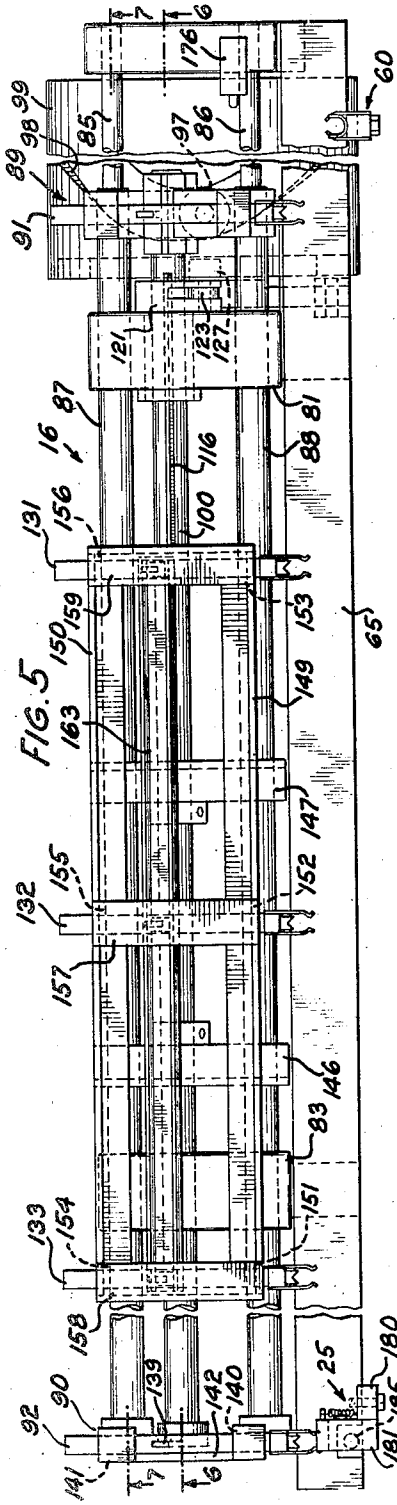

FIG. 5

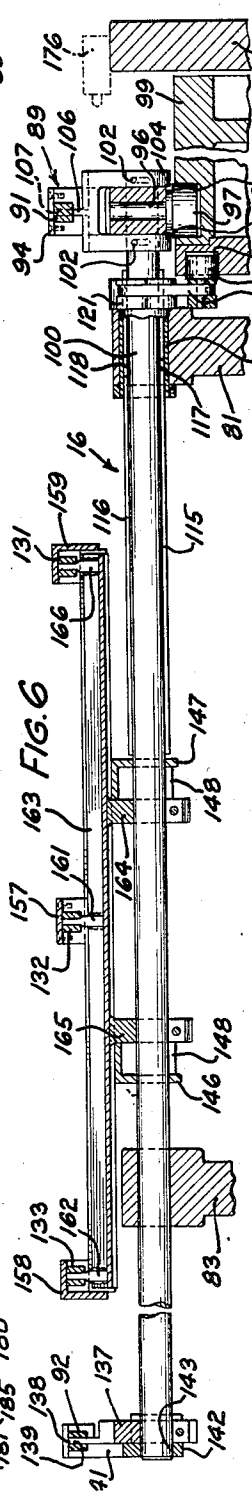

FIG. 6

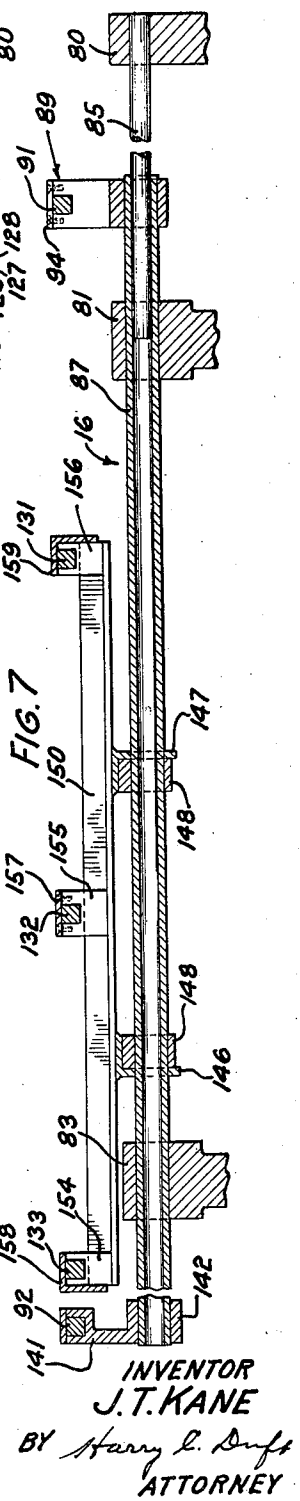

FIG. 7

INVENTOR
J. T. KANE
BY Harry E. Duft
ATTORNEY

Jan. 16, 1945. J. T. KANE 2,367,505

ARTICLE HANDLING APPARATUS

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FIG. 8

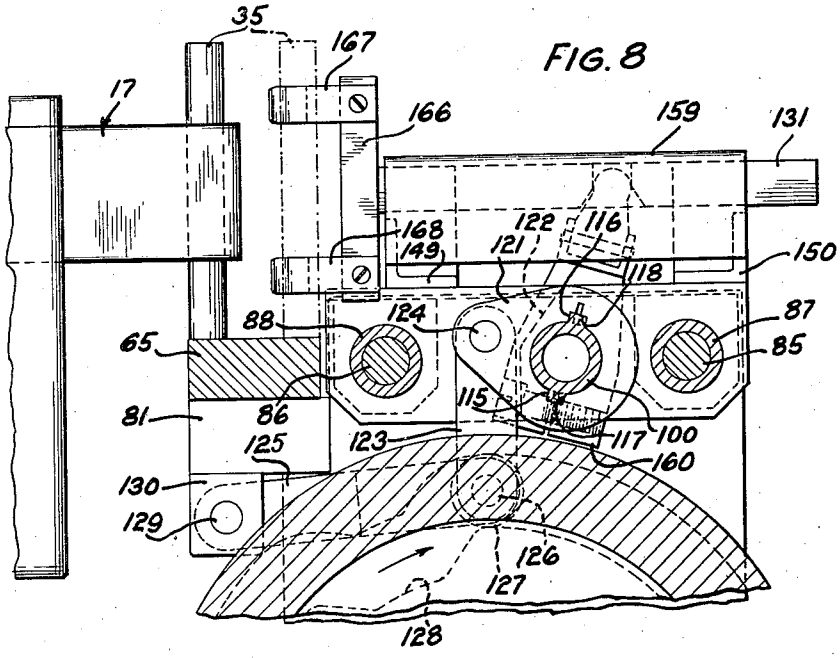
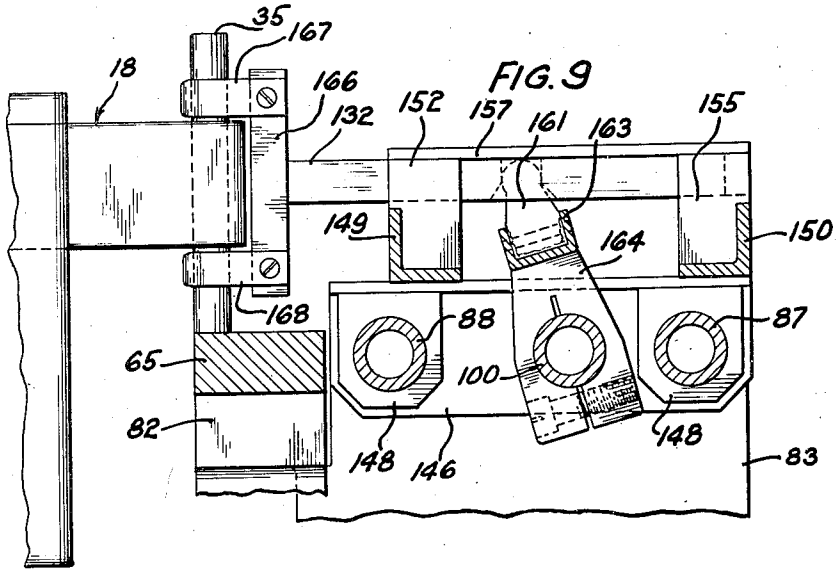


FIG. 9



INVENTOR
J. T. KANE
BY Harry L. Arnold
ATTORNEY

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ARTICLE HANDLING APPARATUS

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FIG. 10

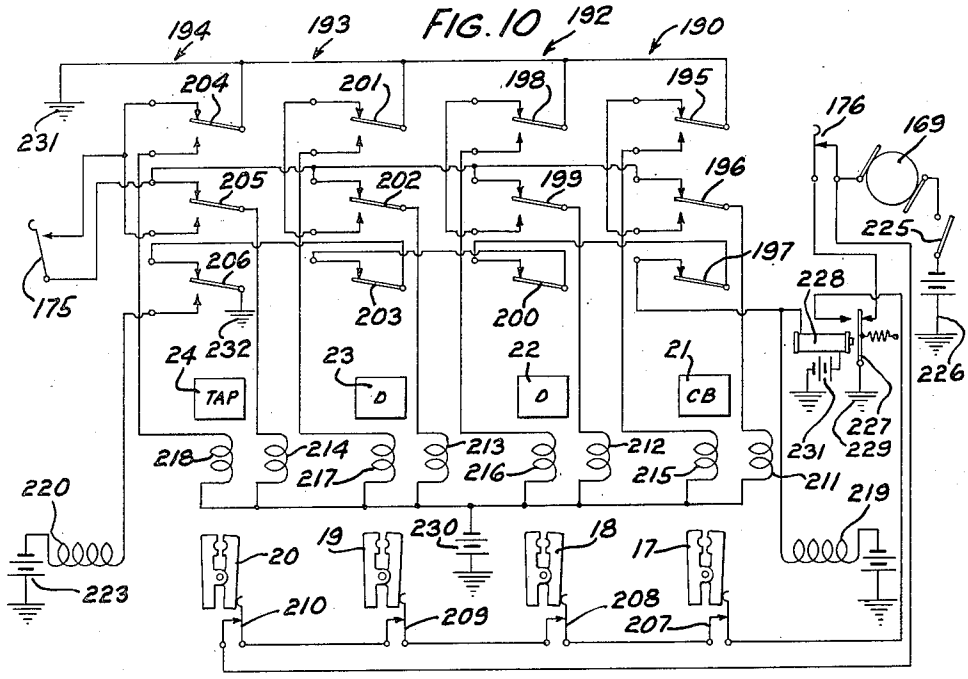


FIG. 11

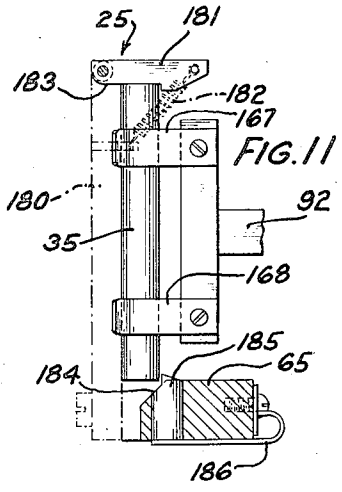
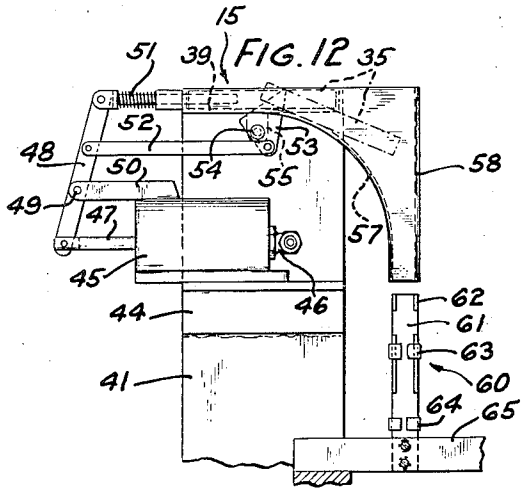


FIG. 12



INVENTOR
J. T. KANE
BY Harry L. Duft
ATTORNEY

Patented Jan. 16, 1945

2,367,505

UNITED STATES PATENT OFFICE

2,367,505

ARTICLE HANDLING APPARATUS

John T. Kane, River Forest, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application July 8, 1942, Serial No. 450,225

4 Claims. (Cl. 29—60)

This invention relates to article handling apparatus, and more particularly to an apparatus for handling parts during their transference from one to another of a group of machine tools and to circuit devices for controlling the time of operation of the various machine tools and the transfer apparatus.

An object of the invention is the provision of a simple automatic apparatus for handling blanks expeditiously while operations are performed upon them.

In accordance with one embodiment of the invention, a blank, which is in the form of a cylindrical rod, the end of which is to be drilled, chamfered and tapped, is transferred to various instrumentalities located in a straight line wherein these operations are performed in automatic succession. Upon initiation of the operation of the machine, no further manual intervention is required, except to keep a magazine, provided in the apparatus, supplied with blanks. The magazine comprises a sloping plate, down which the blanks will progress by gravity to a feeding plunger operable to remove one blank at a time from the magazine, means being provided for holding the remaining blanks in the magazine away from the blank to be ejected therefrom. The ejected blank drops down into the path of a pair of spring clips, which are suitably supported on a carrier and are moved toward the blank to engage with it. The carrier is mounted for reciprocation in a horizontal plane in two directions at 90° one to another and in reciprocating, the carrier will be moved toward the front of the apparatus and then back to its original position and then will be reciprocated transversely of the apparatus to carry parts across the face of the apparatus and then forward. The machining apparatus is comprised of motor driven machine tools, each tool having a vise in cooperation therewith and the carrier in transferring a blank from the feeding mechanism to the first machining station's vise, will have both transverse and rearward motions imparted to it. The carrier is provided with a series of pairs of spring clips effective to pick a blank from either the magazine station or any one of the machining stations and transfer it to the next adjoining machining station or the ejecting station which strips the blank from the carrier. A series of fluid operated and electrically controlled fluid pressure devices are provided for controlling the operation of the various tools and vises in timed relation to the operation of the carrier.

A better understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a side elevational view of the apparatus embodying the invention, parts being broken away which are not essential to an understanding of the invention;

Fig. 2 is a fragmentary detail view in section of a portion of the magazine showing the means for holding blanks away from a blank being ejected from the magazine;

Fig. 3 is a horizontal sectional view taken substantially along the line 3—3 of Fig. 1 in the direction of the arrows;

Fig. 4 is a vertical sectional view taken substantially along the line 4—4 of Fig. 1 in the direction of the arrows;

Fig. 5 is a plan view of a portion of the transfer mechanism shown in Fig. 3 on a large scale, parts being broken away to conserve space;

Figs. 6 and 7 are vertical sectional views, respectively, taken substantially along the lines 6—6 and 7—7 of Fig. 5 in the direction of the arrows;

Figs. 8 and 9 are enlarged fragmentary vertical sectional views taken along the lines 8—8 and 9—9 of Fig. 4 in the direction of the arrows;

Fig. 10 is a wiring diagram of the control circuits for the apparatus;

Fig. 11 is a vertical sectional view taken along the line 11—11 of Fig. 4 in the direction of the arrows, showing a portion of the apparatus for removing a completed part from the transfer mechanism; and

Fig. 12 is a fragmentary detail sectional view taken substantially along the line 12—12 of Fig. 1 in the direction of the arrows showing the portion of the apparatus where the blanks are removed from the magazine and picked up by the transfer mechanism.

Referring to the drawings, wherein like reference characters designate the same parts throughout the several views, particular reference being had to Figs. 1, 3 and 4, the apparatus includes a magazine section designated generally by the numeral 15, a carrier assembly 16, blank holding vises 17, 18, 19 and 20 and their associated tool assemblies 21, 22, 23 and 24, respectively, and a carrier unloading mechanism 25. All of these mechanisms are mounted on a common base or pedestal 26, which supports the various vises and their respective actuating members in a line across the face of the apparatus and which

has extending upwardly from it a support framework 27 (Fig. 1) which supports the tools 21 to 24, inclusive, in vertical alignment with the gripping jaws of the blank holding vises.

The articles to be operated upon in the embodiment of the invention chosen for illustration are relay core pieces 35, hereinafter called blanks. These core pieces or blanks are loaded into the machine by placing a plurality of them in the magazine section of the machine and then upon starting the machine, the core pieces will be in automatic succession, chamfered while held in the vise 17, successively drilled axially while held in the vises 18 and 19, and then tapped while held in the vise 20. After these operations have been performed on the part, it is transferred to the ejecting station where the part is stripped from the carrier and dropped into a suitable container provided therefor. The magazine 15 comprises a tilted tray 36 having side walls 37 and 38, a bottom 39 and an end wall 40. The tray 36 is supported on a triangularly shaped bracket 41 extending upwardly from a main base member 42, which is mounted upon the pedestal 26. The bracket 41 is formed of a single piece of metal bent to support the tray 36 and to provide a foot portion 43, which rests upon the main base member 42.

In addition to supporting the tray 36 in which the blanks 35 may be placed, the bracket 41 has an angle member 44 (Figs. 1 and 12) fixed to it intermediate its ends for supporting an air cylinder 45. This cylinder may be supplied with air under pressure through an entrance port 46 and has a piston (not shown) reciprocable within it for imparting reciprocation to a piston rod 47. The piston rod 47 has pivotally attached to it an actuator lever 48, to which oscillation may be imparted by the piston rod 47 to rock the lever about a pivot pin 49, which is, in turn, mounted in the free end of a pivot support 50 fixed to the cylinder 45. At its upper end, the lever 48 has pivoted on it a push rod 51 and between the push rod 51 and the pivot pin 49 there is pivoted on the lever 48 a link 52, which serves to actuate a spacing knife 53, which is pivoted for oscillation on a pin 54. The pin 54 is fixed in a bracket 55 secured to the underside of the bottom 39 of the tray 36. The bottom of the tray 36 is slotted at 56 (Fig. 2), through which slot the spacing knife 53 may be passed to engage the next to the lowest blank 35 on the tray 36 to push it and the blanks above it out of engagement with the lowest blank on the tray. At its rear end, that is, the end toward the carrier assembly 16, the bottom plate 39 of the tray 36 is cut away as shown most clearly in Fig. 12, and while the plate 39 provides a support for the blank 35, which happens to be positioned on it, the blank may be pushed to the right (Fig. 12) by the push rod 51 and when pushed a short distance to the right will fall onto a curved plate 57 forming a part of a guide tube 58. The side wall 38 of the tray 36 is cut away, as shown at 59, to permit a blank 35 to be pushed out of the tray and into the guide tube 58, which will direct it downwardly to a vertical position where it may be picked up by a carrier.

After passing out of the guide tube 58, the blank 35 will drop down into a holder 60 (Figs. 1 and 12) comprised of an upright post 61 having spring clips, 62, 63 and 64 attached to it, into which the blank 35 will drop from the guide tube 58. These clips 62, 63 and 64 are made of spring material, which is of a very light gage, so that the parts may be easily withdrawn from the holder 60 at a later portion of the operation of the apparatus. When a blank drops down through the guide tube 58 and into the holder 60, its bottom will engage on a supporting table 65, which will support the blank during its travel through the machine. The method of supporting the blank 65 will be described more in detail in connection with the description of the carrier.

The vises 17 to 20, inclusive, and the tool assemblies 21 to 24, inclusive, may be of any suitable type, operable under electrically controlled, pneumatically actuated devices and since the details of construction of these mechanisms do not constitute an essential part of the present invention, no detailed description of these particular mechanisms will be included herein, it being understood that the tool assembly 21 is provided with a rotating head 75, which is designed to form a chamfer and center drill on the end of the blank 35 when the head 75 is moved downwardly to engage the blank positioned beneath it. The tool assemblies 22 and 23 are equipped with drill heads 76 and 77, which perform successive drilling operations axially of the blank and the tool assembly 24 is provided with a reversible tapping head 78 for cutting threads in the side walls of the hole drilled by the drill heads 76 and 77. Similarly, the vises may be of any suitable construction wherein jaws 79 and 80 are adapted for actuation by fluid under pressure.

Extending upwardly from the main base member 42 are a series of four standards or pedestals 80, 81, 82 and 83 which support the table 65, comprising a hardened steel supporting plate, in position beneath the tool assemblies 21 to 24, respectively. The pedestal 82 acts simply as a support for the table 65, whereas the pedestals 80, 81 and 83 also extend toward the rear of the apparatus to support portions of the carrier assembly 16. The pedestal 80 has fixed in it a pair of rods 85 and 86 which extend over and partially through the pedestal 81 (Figs. 5, 7 and 8). However, the rods 85 and 86 do not engage directly with the pedestal 81, the rods riding in a pair of sleeves 87 and 88, the right ends of which encircle the rods 85 and 86, and these sleeves 87 and 88 are slidable in suitable apertures provided in the pedestals 81 and 83. Mounted upon the ends of the sleeves 87 and 88 are a pair of guide assemblies 89 and 90 (Figs. 3, 5, 6 and 7) for guiding a pair of slides 91 and 92. As may be seen most clearly in Figs. 1, 5, 6 and 7, the guide assembly 89 comprises, as viewed in Fig. 1, a U-shaped block 93, the upwardly extending end portions of which are slotted to receive the slide 91, retainer plates 94 being provided for holding the slide 91 in the slot formed in the upwardly extending portions of the U-shaped member 93. The base of the member 93 has suitable apertures formed in it, into which the sleeves 87 and 88 extend, and the sleeves are fixed to the U-shaped member 93 so that the slide 91, which is freely slidable with respect to the U-shaped member 93, is bodily movable transversely of its length upon movement of the member 93 with the sleeves 87 and 88. Adjacent the center of the U-shaped member 93 is a cam roller supporting pin 96 fixed in it, on which is carried a freely rotatable cam roller 97. The cam roller 97 rides in a cam groove 98 formed in a drum type cam 99 and upon rotation of the cam 99, the cam roller will serve to drive the sleeves 87 and 88 lengthwise of the apparatus. In addition to the sleeves 86 and 87, the U-shaped member 93 is apertured to receive a hollow shaft 100, which is freely rotatable in its aperture 101. The hollow shaft 100 has fixed to it, by means of pins 102, a

slide actuating member 103, which is bifurcated to provide a pair of legs 104 and 105 (Fig. 6) extending down on opposite sides of the U-shaped member 93. The slide actuating member 103 is provided with a slide actuating extension 106, which extends up into a slot 107 formed in the slide 91.

The hollow shaft 100 has keys 115 and 116 set into it for cooperation with key slots 117 and 118, respectively, formed in a sleeve 119. The sleeve 119 is suitably fixed against longitudinal movement with respect to the standard 81, but is freely rotatable therein and has fixed to it a lever 121 (Fig. 8), which is slotted as shown at 122 to receive a link 123. The link 123 is pivotally connected to the lever 121 by a pin 124 and is also pivotally connected to a lever 125 by means of a pin 126. The pin 126 supports a cam roller 127, which rides in a cam groove 128 formed in the left face (Fig. 6) of the drum type cam 99. Lever 125 is pivoted on a pin 129 (Fig. 8) fixed in a bracket 130 extending downwardly from the underside of the pedestal 81 so that the lever 125 will hold the cam roller 127 in the cam groove 128 and when the cam 99 is rotated, the link 123 will impart oscillation to the lever 121, thereby to advance and retract the slide 91 and group of similar slides 92, 131, 132 and 133 through instrumentalities to be described hereinafter. Since the hollow shaft 100 is slidable with respect to the pedestals 81 and 83 and is connected to the oscillatable sleeve 119, the drum type cam 99 will impart reciprocation to the hollow shaft 100 and will also impart oscillatory movement to it.

At its left end (Figs. 5 and 6), the hollow shaft 100 has clamped on it a slide actuator 137, which has an extension 138 extending up into a slot 139 formed in the slide 92 for reciprocating the slide 92 longitudinally. The slide 92 is supported in upwardly extending arms 140 and 141 of a guide block 142 fixed on the left ends of the sleeves 87 and 88. The guide block 142 is provided with an aperture 143 (Fig. 6), in which the hollow shaft 100 is freely rotatable and the block 142 will be moved by the sleeves 87 and 88 to which it is fixed when these sleeves move longitudinally, whereas the slide 92 will be reciprocated with respect to the guide block 42 upon oscillation of the hollow shaft 100.

Adjacent the center of the shaft 100 and the sleeves 87 and 88, there is provided an auxiliary framework which supports the slides 131, 132 and 133, a pair of transversely extending angle members 146 and 147 being fixed to the sleeves 87 and 88 by means of collars 148 so that the angle members 146 and 147 will travel with the sleeves 87 and 88. The angle members 146 and 147 are provided with suitable apertures which rotatably receive the hollow shaft 100. Fixed to the horizontal flanges of the angle members 146 and 147 are a pair of longitudinally extending angle members 149 and 150. The angle member 149 has extending upwardly from its horizontal flange three guide plates 151, 152 and 153, which correspond with three guide plates 154, 155 and 156 extending upwardly from the horizontal flange of the angle member 150. These guide plates 151 to 156, inclusive, have notches formed in them for slidably supporting slides 131, 132 and 133 and the guide plates 152 and 155 have fixed to the tops of them a retainer plate 157 which holds the slide 132 in the guide plates. The guide plates 151 and 154 have an angle member 158 attached to them which also serves to hold the slide 133 in position and similarly the guide plates 153 and 156 have an angle member 159 fixed to them for retaining the slide 131 in the plates. Each of the slides 131, 132 and 133 is provided with a slot similar to the slot 139 provided in the slide 92, into which extend slide actuating levers 160, 161 and 162, respectively. These slide actuating members, as seen most clearly in Figs. 6 and 9, are fixed in a channel member 163, which is, in turn, mounted on a pair of levers 164 and 165, suitably fixed to the hollow shaft 100 and thus the slides 91, 92, 131, 132 and 133 will all be actuated at the same time and will be moved equal distances to advance and retract the slides for carrying blanks 35 between the various clamping devices of the machine tools. Each of the slides 91, 92, 131, 132 and 133 are of the same construction and each of them carries at its end a vertically extending bar 166, which is provided with spring clips 167 and 168 adjacent its upper and lower ends, as seen most clearly in Fig. 9. These spring clips are adapted to engage a blank 35 and transfer it from the magazine to the various vises 17, 18, 19 and 20 and to the carrier unloading mechanism 25.

Power for driving the various parts described hereinbefore is supplied from a motor 169 (Fig. 10) which drives a chain 171 (Figs. 1, 3 and 4). The chain 171 encircles and drives a sprocket 172 attached to drive shaft 173. The drive shaft 173 is journalled in the pedestals 80 and 81 and carries the cam drum 99 which, in addition to imparting oscillation to the shaft 100 to reciprocate the slides 91, 92 and 131, 132 and 133 and to impart reciprocation to the shaft 100 also is provided with a cam 174, which controls an electrical switch 175. There is also provided in the apparatus a switch 176 which is mounted on the pedestal 80 to be opened momentarily by the guide assembly 89 at the right end (Figs. 3, 4 and 5) of its travel along the rods 85 and 86. At the left end of the table 65, there is mounted a post 180, which supports the carrier unloading mechanism 25 on the edge of the table 65. The post 180 is provided, at its upper end, with a latch 181 pivoted on it and urged downwardly by a coil spring 182. The post 180 is cut out, as indicated at 183, to prevent the latch 181 from tilting beyond the position shown in Fig. 11. Adjacent the lower end of the post 180, the table 65 is cut away, as indicated at 184, and has slidable in it a latch plunger 185 fixed on the end of a leaf spring 186, which is, in turn, fastened to the table 65. Thus, when a blank 35, which has been completed in the apparatus, is moved to the last position, it will be carried to the left (Fig. 11) to cam the latching plunger 185 and latch 181 downwardly and upwardly, respectively, until the blank 35 moves to the position shown in Fig. 11. When the slide 92 is retracted to the right (Fig. 11), the latch 181 and latching plunger 185 will strip the blank out of the clips 167 and 168 and the blank will be discharged from the apparatus into a suitable container (not shown).

Each of the tool assemblies 21, 22, 23 and 24 has associated with it a switching mechanism, adapted to be actuated when the tool assembly reaches its upper and lowermost positions. In Fig. 1, illustrating the apparatus structurally, there is shown a switching device 190, adapted to be actuated by a cam projection 191 on the tool assembly. It will be understood that each of the tool assemblies is provided with a similar switching device, and, as shown in Fig. 10, the tool as-

semblies 22, 23 and 24 have switching devices 192, 193 and 194 associated with them. The switching device 190 comprises two break-make contacts 195 and 196 and a break contact 197. Switching device 192 includes make-break contacts 198 and 199 and break contact 200. Switching device 193 includes make-break contacts 201 and 202 and break contact 203. Switching device 194 includes break-make contacts 204, 205 and 206.

It will be understood that these switches are all shown in Fig. 10 in the position they occupy when the tool assemblies are in their upper position and that the switches' positions will be reversed only when the tools with which they are associated are moved downwardly. In addition to the switching mechanisms described hereinbefore, each of the vises 17, 18, 19 and 20 are provided with switches 207, 208, 209 and 210, respectively, which are normally closed and which are opened when the vises are operated to grip parts in them.

As pointed out hereinbefore, the tool assemblies 21 to 24 and the blank holding vises 17 to 20 are adapted to be actuated under pneumatic pressure and under electrical control. Accordingly, in Fig. 10, the tool assemblies 21 to 24 are shown as having two solenoids associated with each of them which control suitable valves for supplying fluid to drive the tool assemblies downwardly and upwardly. The solenoids for the tool assemblies 21 to 24 which upon actuation cause fluid to be supplied to drive the tools downwardly are designated 211, 212, 213 and 214, respectively, whereas the solenoids which upon actuation cause fluid to be supplied to drive the tools upwardly are designated 215, 216, 217 and 218, respectively. In addition to these controlling devices, the vises are all connected to a single pneumatic line, the valve to which may be controlled by a vise exhaust solenoid 219 and a vise input solenoid 220. Further details of the circuit will be described in connection with the description of the operation of the apparatus.

If it be assumed that a supply of blanks 35 have been placed in the tray 36, that the carrier assembly 16 is in its left hand position (Figs. 3, 4, 5, 6 and 7) and that the slides 91, 92, 131, 132 and 133 are in their left hand positions, as viewed in Figs. 1, 8 and 9, a switch 225 may be closed to supply power to the driving motor 169 over a circuit from grounded battery at 226, through switch 225, motor 169, normally closed switch 176, break contact and armature 227 of a relay 228 to ground at 229. While the apparatus may be started in a number of positions, this position has been chosen because at this time all of the circuit connections are normal and the motor will start immediately. Shortly after the motor 169 starts from the above described position, the switch 175 will be closed by cam 174 to initiate downward movement of the tool assemblies 21 to 24. When switch 175 closes its contacts momentarily, a circuit will be completed from grounded battery at 230, through solenoids 211, 212, 213 and 214, their contacts 196, 199, 202 and 205, respectively, in the positions shown in Fig. 10, through switch 175 and switch 204 to ground at 231. This circuit will energize the solenoids 211, 212, 213 and 214 and the tool assemblies 21 to 24, inclusive, will start to move down. As soon as the tool assemblies 21 to 24 start to move downwardly, contacts 196, 199, 202 and 205 will shift into engagement with their make contacts to hold the solenoids 211, 212, 213 and 214 energized over a circuit from grounded battery 230, through the solenoids, make contacts 196, 199, 202 and 205 and break contacts 195, 198, 201 and 204 to ground at 231. Contacts 195, 198, 201 and 204 will remain closed, as shown, until the tool assemblies 21 to 24 reach their lowermost position, when they will shift to the opposite position from that shown and complete a circuit from grounded battery at 230 through solenoids 215, 216, 217 and 218, contacts 195, 198, 201 and 204, which shift from the position shown into engagement with their make contacts at the bottom of the movement of the assemblies 21 to 24, to ground at 231.

Contacts 197, 200, 203 and 206 shift from the position shown as soon as the tool assemblies 21 to 24, inclusive, leave their uppermost position. Thereafter, contact 206 will complete a circuit from ground at 232 through its make contact and solenoid 220 to ground at battery at 233. This will energize the solenoid 220 and cause all of the vises to be closed since the solenoid 220 controls a valve (not shown) for supplying fluid under pressure to close the vises 17, 18, 19 and 20. In this manner, any blank which is in alignment with a vise will be gripped by the vise and held during the downward and upward strokes of the tool assemblies associated therewith. When the tool assemblies reach their uppermost position, the contacts 197, 200, 203 and 206 will be restored to the position shown and then ground will be connected serially through these contacts from ground at 232 to the solenoid 219 and the relay 228. Thus, relay 228 will be energized and ground at 229 will be connected to contact 227 and switches 207, 208, 209 and 210 at the various vise jaws 17, 18, 19 and 20 through the motor 169 to grounded battery at 226 again energizing the motor 169 to initiate a second operation of the apparatus. In spite of the fact that the circuit to the motor 169 is broken at this time at switch 176, the motor 169 will drive its associated apparatus through a complete cycle of operation until all of the tool assemblies have completed their work on the blanks and the switch 176 will be opened when the carrier assembly 16 reaches its right hand position to await the completion of operations on the blanks and the closure of the circuit through the contact 227 of relay 228 and the switches 207, 208, 209 and 210 at the vises to initiate a second operation of the apparatus.

Each time the motor 169 is started in operation, it will through the cams 99 cooperating with cam roller 97, move the carrier assembly 16 to the left and back to the right, that is, from the position shown in Figs. 3 and 4 to the position shown in Figs. 5, 6 and 7 and at each end of the travel of the carrier assembly 16 to the left and right, the slides 91, 131, 132, 133 and 92 will be advanced and retracted toward the vises and/or the magazine section 15 and carrier unloading mechanism 25. The air cylinder 45 is connected in series with the fluid supply to the vises 17, 18, 19 and 20 and each time the vises close, fluid under pressure will be admitted to the cylinder 45 to actuate the push rod 51, thereby to eject a part from the end of the magazine to the curved plate 57 from whence it will drop down into the holder 60. At the time that the push rod 51 operates, the spacing knife 53 will also be operated to push the blanks 35 which normally bear against the first blank in the magazine away from the first blank in the magazine to permit it to drop into the holder 60. The spring clips 167 and 168 on each of the slides 91, 92, 131, 132 and 133 will engage a blank associated with them prior to the release of the blank by its associated vises and will withdraw the blanks from

the vises that they are engaged by or from the holder **60** and move them to the rear of the apparatus, thence to the left and over into engagement with the next adjacent vise or the carrier unloading mechanism **25**. Thus, blanks upon which all operations have been completed will be pushed into the carrier unloading mechanism, causing the latch **181** and latch plunger **185** to be moved apart and then will permit them to snap to the position shown in Fig. 11. Then when the slide **92** is retracted toward the rear of the machine, the blank in the carrier unloading mechanism will be disengaged from the spring clips **167** and **168** and permitted to drop out of the apparatus. Similarly, at each of the vises **17, 18, 19** and **20**, the vises will clamp blanks prior to the retraction of the slides **91, 131, 132** and **133** and will hold the blanks in position to be operated upon by their respective tool assemblies.

In the operation of the apparatus, it will be understood that normally the motor **169** is stopped with the carrier assembly **16** at its right hand position and with the slides **91, 131, 132** and **133** and **92** advanced toward the front of the machine and engaging the blanks in the holder **60** and vises **17, 18, 19** and **20** while the tool assemblies **21, 22, 23** and **24** perform their operations on the blanks. As soon as all operations have been completed on the blanks and the tool assemblies have all returned to their normal position, which is their uppermost position, the operation of the motor **169** will be reinitiated by the closure of the circuit through contacts **206, 203, 200** and **197** in series, causing the energization of relay **228** and the opening of the vises **17, 18, 19** and **20**.

What is claimed is:

1. In an article handling apparatus for transferring blanks to tools in automatic succession, a longitudinally slidable framework, means for slidably supporting said framework intermediate its ends, means for reciprocating said framework, an auxiliary framework mounted in fixed relation on said longitudinally slidable framework with portions thereof in position to pass the supporting means for the slidable framework upon reciprocation of the slidable framework, blank supporting members slidable transversely on said auxiliary framework and on said longitudinally slidable framework, an actuator associated with each blank supporting member, and a rock shaft connected to all the actuators and operable to move the slidable blank supporting members transversely of the slideable framework and auxiliary framework.

2. In an article handling apparatus for transferring blanks to tools in automatic succession, a longitudinally slidable framework, means for slidably supporting said framework intermediate its ends, means for reciprocating said framework, an auxiliary framework mounted in fixed relation on said longitudinally slidable framework with portions thereof in position to pass the supporting means for the slidable framework upon reciprocation of the slidable framework, blank supporting members slidable transversely on said auxiliary framework and on said longitudinally slidable framework, an actuator associated with each blank supporting member, a rock shaft connected to all the actuators and operable to move the slidable blank supporting members transversely of the slidable framework and auxiliary framework, and means operable in timed relation to the means for reciprocating the slidable framework for imparting movement to the rock shaft.

3. In an article handling apparatus for transferring blanks from one tool to another, a cam element operable in timed relation to the operation of the tools, a pair of camming slots formed in said cam element, a longitudinally slidable framework, a cam roller on said framework for cooperating with one of said slots to impart reciprocation to said framework, a plurality of blank carrying slides slidable transversely of said framework, a cam lever having a cam roller on it for cooperation with the other camming slot on the cam element, a splined shaft slidably keyed to the cam lever to be rocked thereby, and slide actuators fixed to said shaft and engaging said slides to actuate them.

4. In an article handling apparatus for transferring blanks from one tool to another, a cam element operable in timed relation to the operation of the tools, a pair of camming slots formed in said cam element, a longitudinally slidable framework, a cam roller on said framework for cooperating with one of said slots to impart reciprocation to said framework, a plurality of blank carrying slides slidable transversely of said framework, a cam lever having a cam roller on it for cooperation with the other camming slot on the cam element, a splined shaft slidably keyed to said cam lever to be rocked thereby and rotatably supported by said framework for reciprocation therewith, and slide actuators fixed to said splined shaft and engaging the slides on the framework to actuate them.

JOHN T. KANE.