Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 1

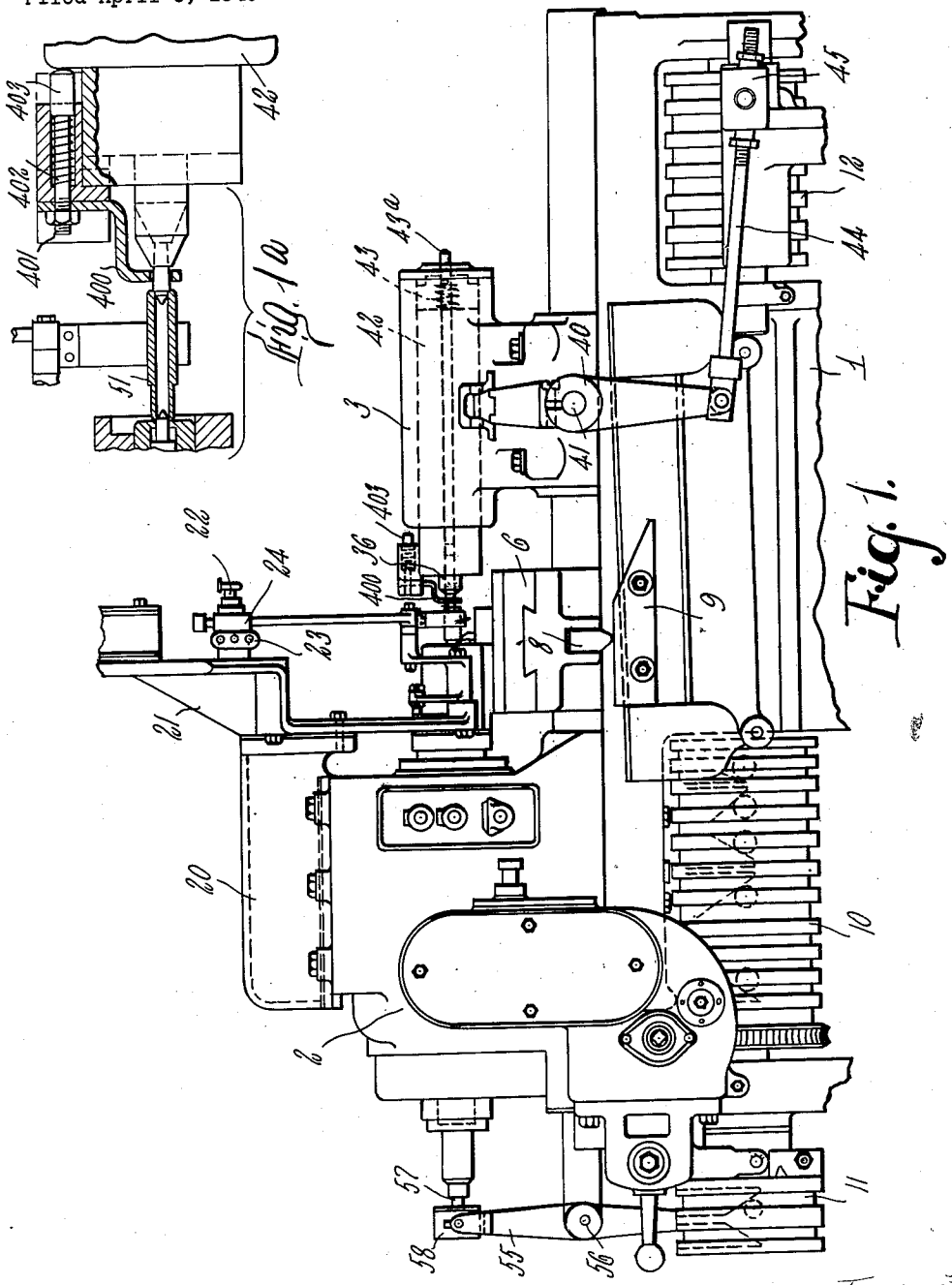


Fig. 1.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & Clay
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 2

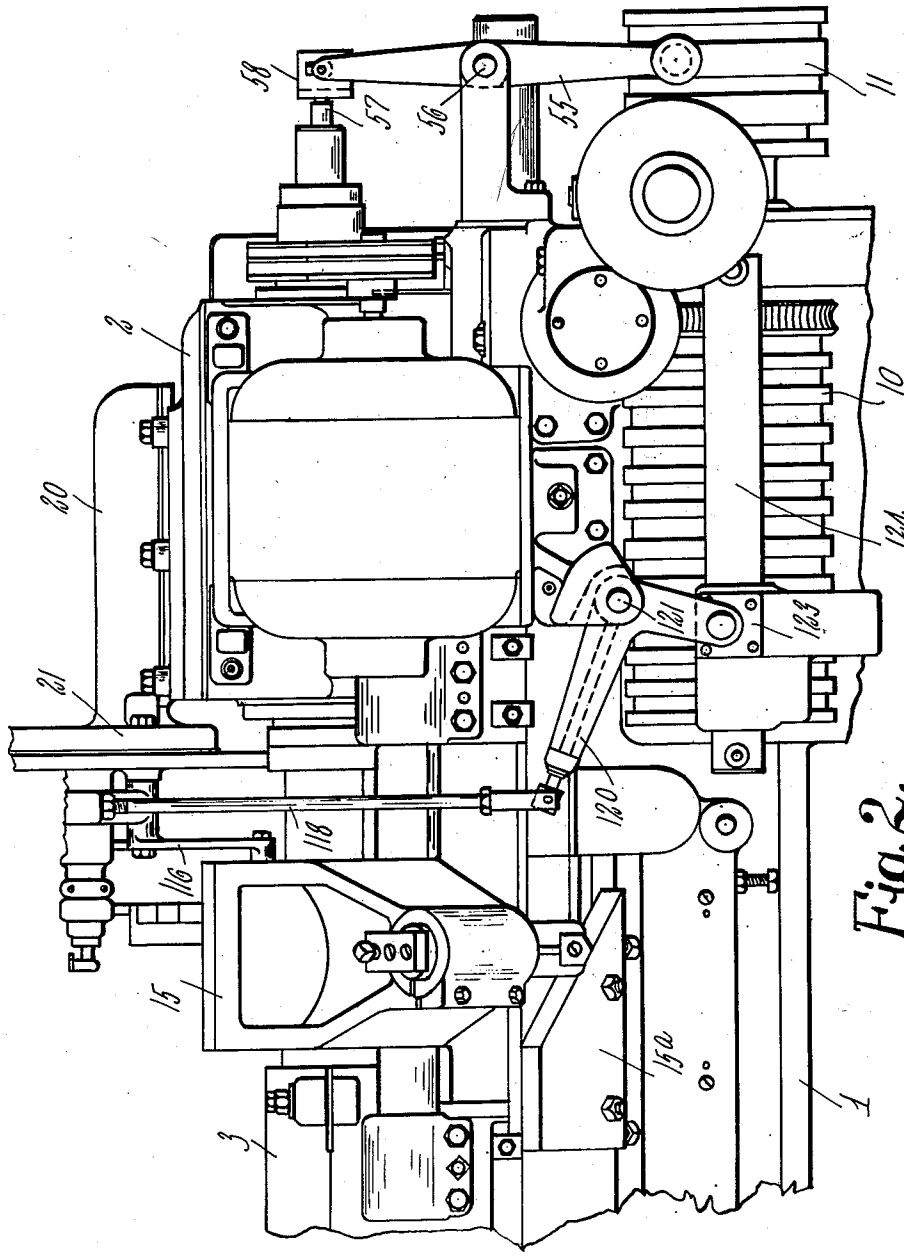


Fig. 2.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & May,
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 3

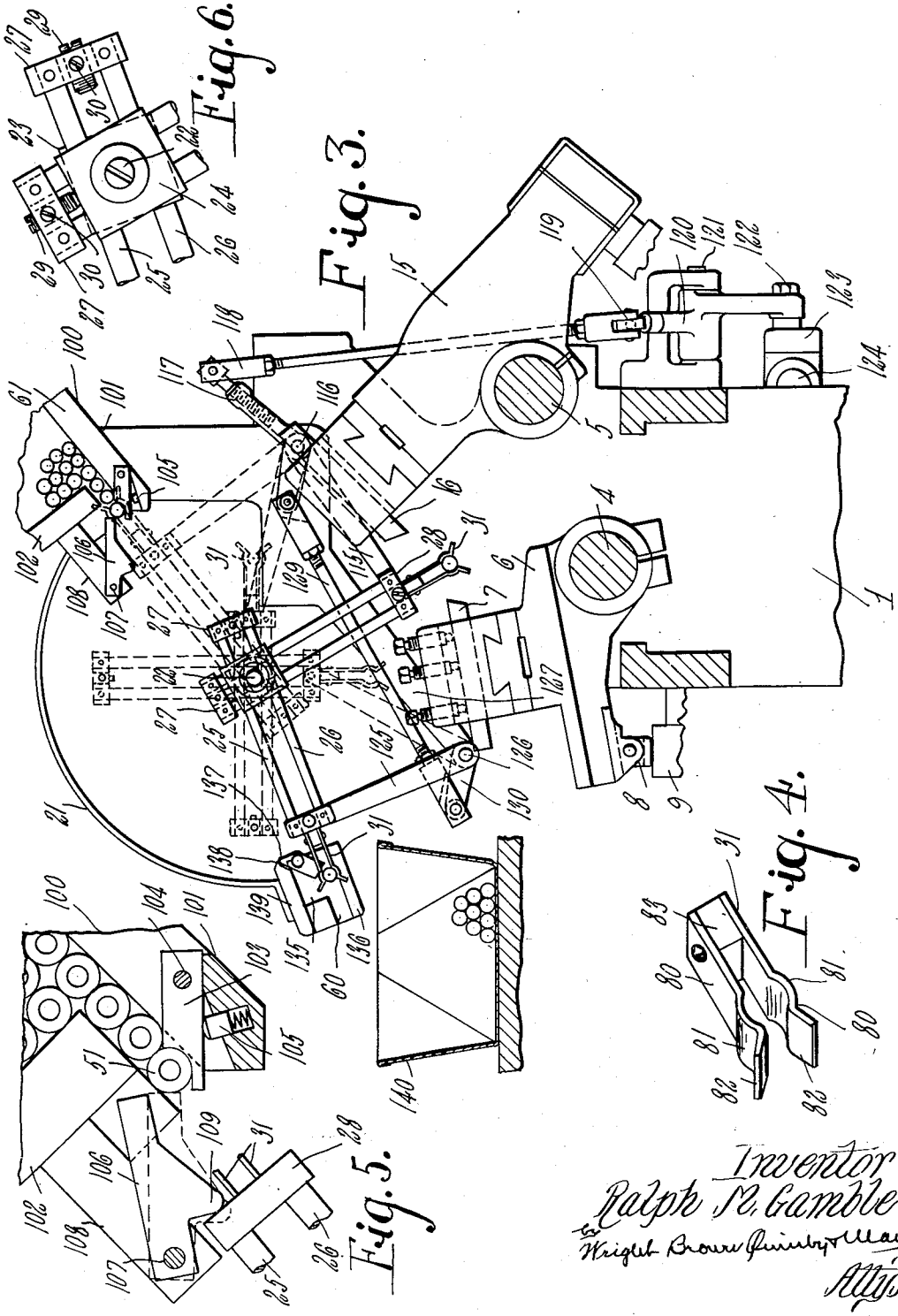


Fig. 6.

Fig. 3.

Fig. 4.

Fig. 5.

Inventor
Ralph M. Gamble
By Wright Brown Quinby & May
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 4

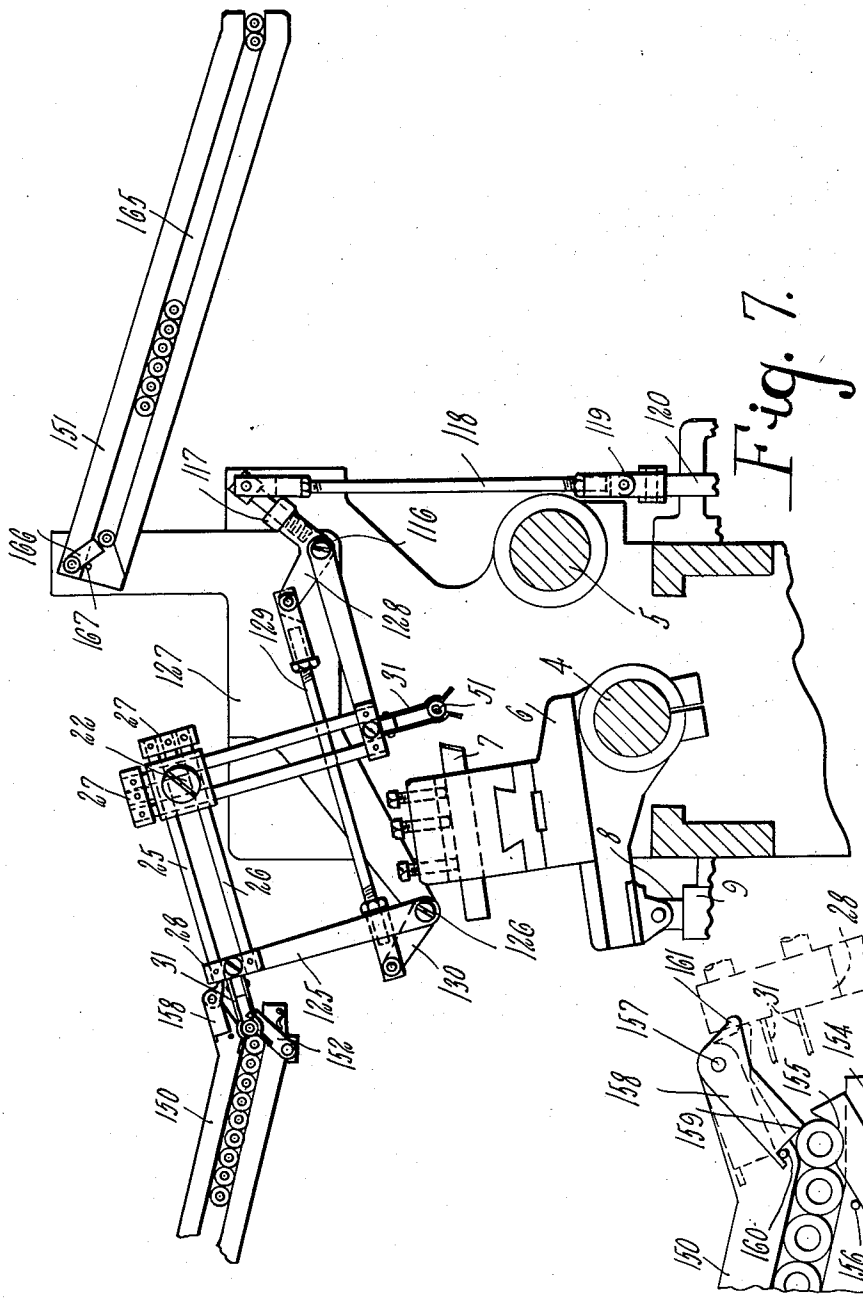


Fig. 7.

Fig. 8.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & Clay
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 5

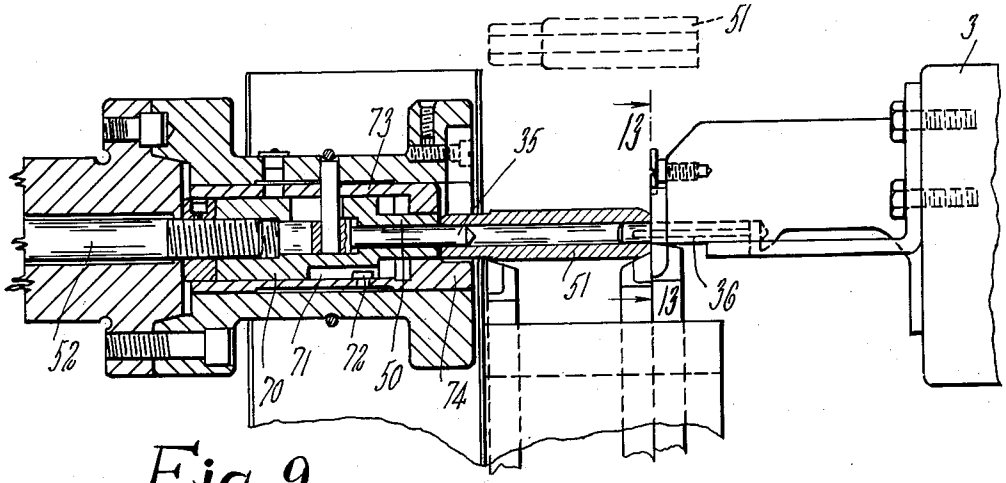


Fig. 9.

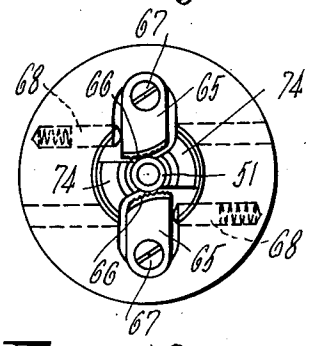


Fig. 10.

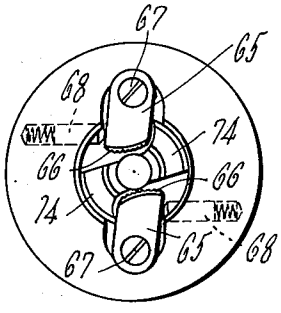


Fig. 11.

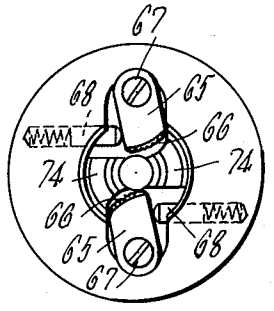


Fig. 12.

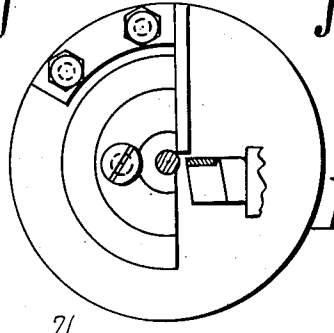


Fig. 13.

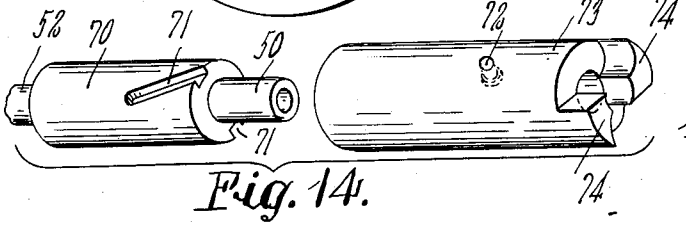


Fig. 14.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & May
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 6

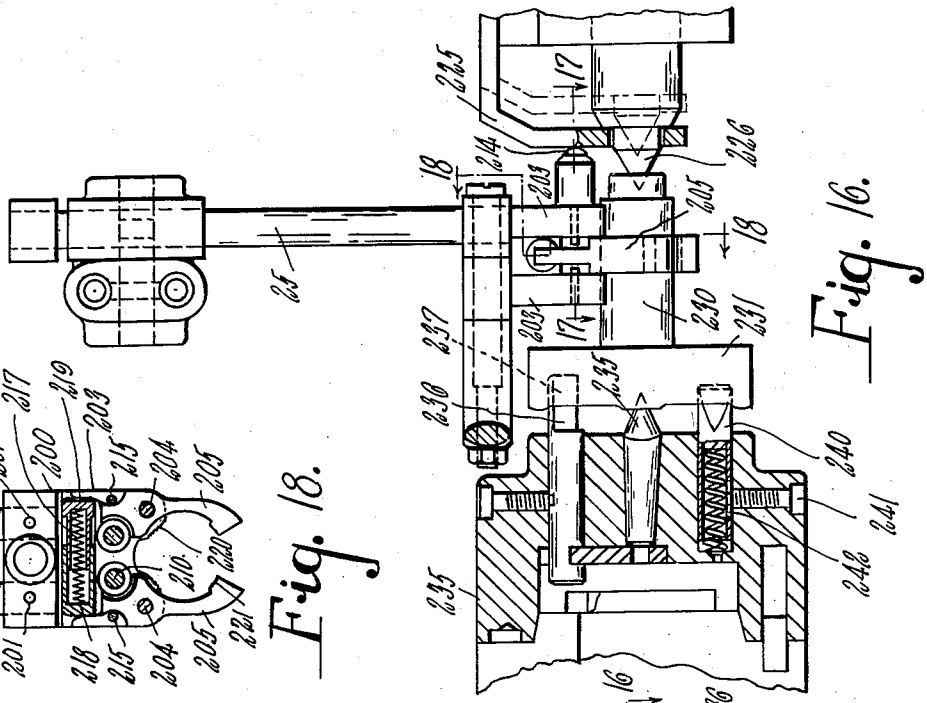


Fig. 16.

Fig. 18.

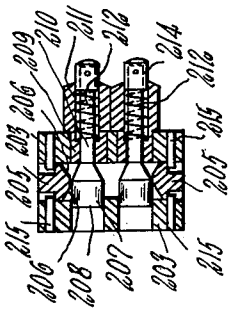


Fig. 17.

Fig. 15.

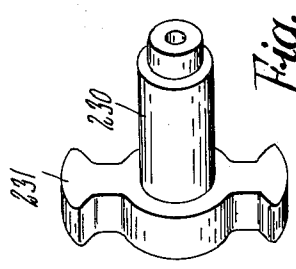


Fig. 19.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & Clay
Attys.

Oct. 9, 1951 R. M. GAMBLE 2,570,660

TRANSFER MECHANISM

Filed April 6, 1945 7 Sheets-Sheet 7

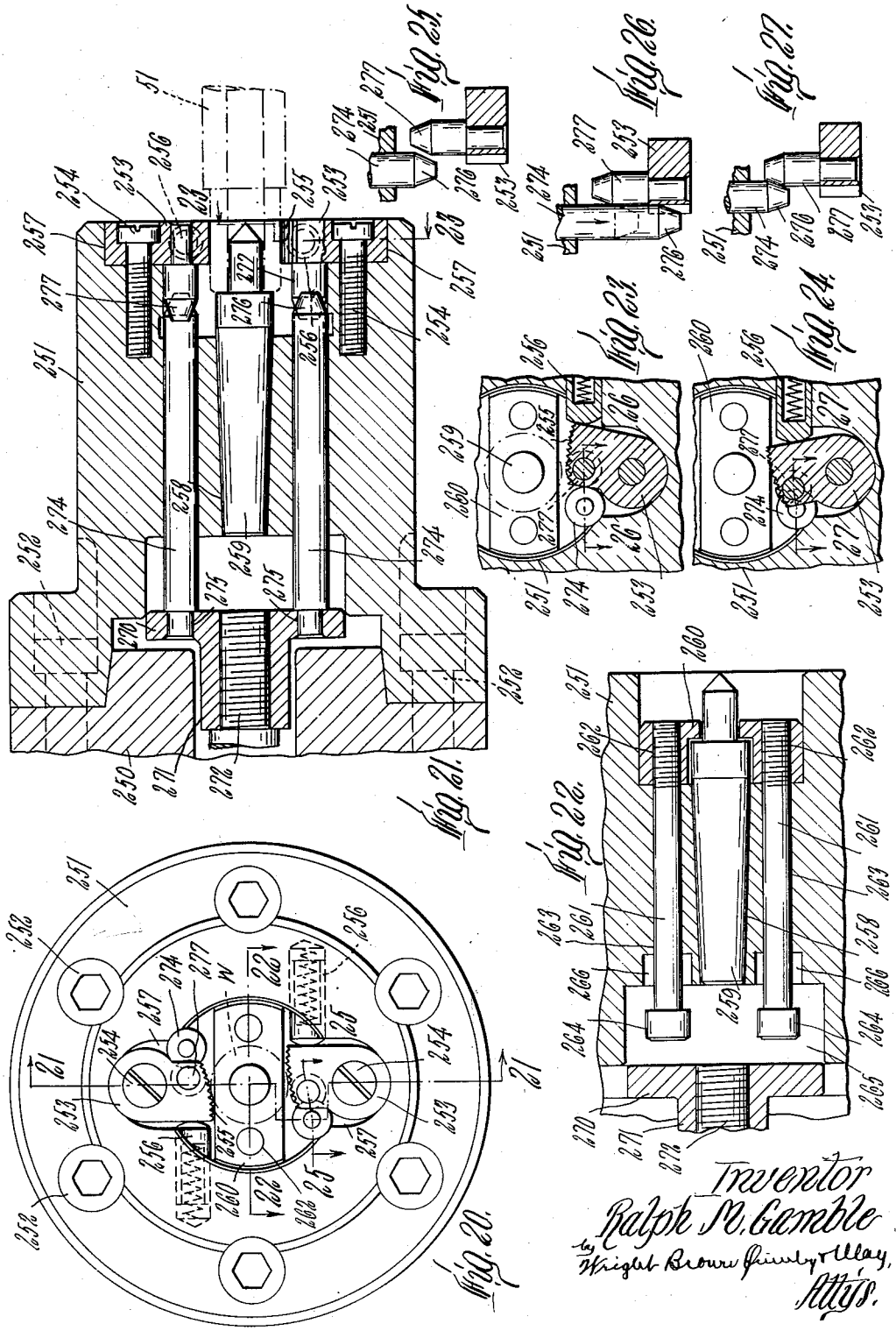


Fig. 21.

Fig. 20.

Fig. 25.

Fig. 26.

Fig. 27.

Fig. 23.

Fig. 24.

Fig. 22.

Inventor
Ralph M. Gamble
by Wright Brown Quinby & Clay,
Attys.

Patented Oct. 9, 1951

2,570,660

UNITED STATES PATENT OFFICE

2,570,660

TRANSFER MECHANISM

Ralph M. Gamble, Springfield, Vt., assignor to Jones & Lamson Machine Company, Springfield, Vt., a corporation of Vermont

Application April 6, 1945, Serial No. 586,935

3 Claims. (Cl. 214—1)

1

This invention relates to mechanism for transferring work pieces from a supply station to a tooling station, and from the tooling station to a delivery station.

One object of the invention is to provide such a mechanism whereby a piece of work is taken from a tooling station while another work piece is being taken from a supply station, the first work piece removed from the tooling station being moved to a delivery station, while the second work piece is being moved from the supply station to the tooling station. The mechanism then retires to an intermediate position out of the way where it remains during a tooling operation on the work piece positioned at the tooling station.

A further object of the invention is to provide such a mechanism well adapted to be carried by an automatic machine tool such as a lathe, and to be actuated by machine control mechanism automatically in time with the operative cycle of the machine tool. If desired, also, the transfer mechanism may be made to positively grip the work, the work being automatically released at suitable times in the cycle.

A further object of the invention is to provide for accurate positioning of the work piece, particularly at the tooling station, and for manipulation of the work holding means at the tooling station in proper timed relation to the actuation of the transfer mechanism.

For a complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a fragmentary front elevation of an automatic lathe of the well known Fay type showing the mechanism embodying the invention applied thereto.

Figure 1*a* is a fragmentary view partly in section showing the work hold-back for the tailstock, which is also shown to a smaller scale and in a different position in Figure 1.

Figure 2 is a fragmentary rear elevation of the same.

Figure 3 is an end elevation of the mechanism, certain of the lathe parts being shown in relation thereto.

Figure 4 is a perspective view of a work piece engaging element of the mechanism.

Figure 5 is a view similar to a portion of Figure 3, but to a larger scale and with certain parts being shown in section.

Figure 6 is a view similar to another portion of Figure 3, but to a larger scale and omitting certain dotted lines.

2

Figure 7 is a view similar to Figure 3, but showing a modification.

Figure 8 is a view to a larger scale of a portion of Figure 7.

Figure 9 is a fragmentary view partly in section but showing a work piece in the tooling station.

Figures 10, 11 and 12 are front elevations of the chuck shown in Figure 9 but in driving, open, and empty conditions, respectively.

Figure 13 is a sectional view on line 13—13 of Figure 9.

Figure 14 is an exploded isometric view of certain of the parts shown in Figure 9.

Figure 15 is an end elevation of a work transfer arm provided with a work gripper in operative relation to a work holding spindle.

Figure 16 is a fragmentary view partly in elevation and partly in section showing the work centers and the transfer mechanism in position to engage a work piece of a diffeernt type than shown in Figure 9 between the centers.

Figures 17 and 18 are detail sectional views on lines 17—17 and 18—18, respectively, of Figure 16.

Figure 19 is a perspective view of a work piece also shown in Figure 16.

Figure 20 is a view similar to Figure 11, but to a larger scale and showing a modified construction, the chuck being closed onto the work shown in broken lines.

Figure 21 is a sectional view on line 21—21 of Figure 20.

Figure 22 is a detail sectional view on line 22—22 of Figure 20.

Figure 23 is a detail section on line 23—23 of Figure 21, but showing the chuck jaw open.

Figure 24 is a view similar to Figure 23, but showing the chuck jaw closed and the chuck empty.

Figures 25, 26 and 27 are fragmentary views partly in elevation and partly in section showing the relationship between a work-gripping jaw and its opening member, corresponding to the jaw positions of Figures 20, 23 and 27, respectively.

Referring to Figures 1 to 8, the subject matter of this invention is shown as applied to a lathe of the well known Fay type. This lathe comprises a bed 1 having a headstock 2, a tailstock 3, and a pair of rockable tool bars 4 and 5, the bar 4 being also axially movable and the bar 5 sometimes also being axially movable.

The front bar 4 has secured thereto, a tool carriage 6 having suitable tools as 7 and provided with a shoe 8 at its forward end which rides on a

former cam 9. This former cam is moved generally lengthwise of the machine, and if desired in an inclined direction, by suitable cams carried by a cam drum 10. This cam drum 10 and second and third cam drums 11 and 12 secured to a common cam drum shaft determine the cycle of operations of the machine. The tool bar 5 carries the back tool arm 15 provided with one or more tools at 16. This arm 15 is also controlled by a former cam 15a (Figure 2) somewhat similar to the former cam 9 at the back of the machine. This is the standard construction of the well known Fay lathe.

For the purpose of the present invention, the headstock 2 has mounted thereon a support 20 to which a bracket 21 is attached. This bracket 21 has fixed thereto a pivot member 22 on which is journaled a pair of blocks 23 and 24. These blocks 23 and 24 form parts of a pair of transfer arms, each arm comprising a pair of parallel bars 25 and 26 spaced on opposite sides of the pivot 22 and slidable through their respective blocks 23 or 24. The bars 25 and 26 are connected together at their end portions by the cross members 27 and 28, and as best shown in Figure 6, the cross members 27 at the upper ends of the pairs of bars have, between the bars 25 and 26, threaded stops 29 which may be fixed in adjusted position as by means of set screws 30. These stops 29, when they engage against the blocks 23 or 24, determine the limits to which the arms may be extended from the pivot 22 and thus determine the final extended positions of these arms when a work engaging element 31 carried by each end member 28 is positioned to present the work into the tooling position between the centers 35 and 36 of the head and tailstocks or into the extreme supply or delivery positions. The tailstock center 36 is mounted for axial motion in order to free the work piece from between the centers when desired, this being accomplished by the rocking of a lever 40 pivoted at 41 on the front face of the machine, the upper end of this lever operatively engaging a slide 42 in the well known manner which carries the tailstock center 36. One ejector rod 43a for the center is normally held retracted therefrom as by means of a spring 43. The lower end of the lever 40 is connected through a link 44 to a slide 45 actuated by cams on the cam drum 12 by which the tailstock center is retracted and advanced at suitable times in the automatic cycle of the machine.

The headstock spindle is also provided with work-ejecting means movable in time with the retraction and advancement of the tailstock center, one such means being shown in Figures 9 to 14, inclusive, the ejector 50 engaging the end of the work piece 51 and being movable axially of the center 35 by axial motion of a rod 52 which extends entirely through the headstock and is actuated by the rocking of a lever 55 fulcrumed on a fixed pivot 56. The upper end of this lever 55 carries a member 58 which engages the outer end of the ejector rod 57 and the lower end of the lever 55 extends down into the operative relation to suitable cams on the drum 11 by which the lever 55 may be oscillated in proper timed relation in the machine cycle. The head and tailstock centers define between them a tooling station for the work pieces.

A work piece 51 may be held against retraction all the way with the tailstock center by a bracket 400 having a hole through which the dead center may project and carried by a spring pressed plunger 401 slidable within a casing 402 secured to the slide 42. When the tailstock is in its projected position shown in Figure 1, the tailstock center projects through the hole in the bracket 400 and into engagement with the work piece, and the head 403 of the plunger 401 is out of contact with the tailstock. As the tailstock slide is retracted, the head 403 of the plunger contacts the tailstock and stops retraction of the bracket 400 as shown in Figure 1a, while the tailstock slide continues to retract to the dotted line position with its center retracted from the forward face of the bracket 400. This allows the work to be ejected from the headstock spindle as far as the bracket, the hole in the bracket through which the dead center extends being too small to pas the work piece. Thus after the work piece has been engaged by the transfer arm, as will later appear, the ejector frees the work from the headstock center and the bracket 400 insures the separation of the work piece from the tailstock center so that the work piece is free to be removed by the transfer mechanism and another work piece placed in position between the centers. The tailstock center may then be advanced to engage the work piece and then move it axially, while retracting the ejector, into engagement with the headstock center ready for a succeeding machining operation.

One of the work transferring arms comprising a pair of rods 25 and 26 shown in Figures 1 to 6, inclusive, as the one nearest to the bracket 21, is arranged to take the work pieces one by one from the tooling station and move them to a delivery station at 60, while the other transfer arm is adapted to move between the tooling station and a work supply station 61 to transfer work pieces one by one from the supply station to the tooling station.

The work piece 51 is shown as a cylindrical piece provided with a hole therethrough, this cylindrical piece being adapted to be gripped at the headstock in the tooling station as shown in Figures 10 and 11 by a pair of gripping jaws 65 having gripping surfaces 66 eccentric to the pivots 67 about which the jaws 65 are turnable. These jaws are normally urged toward the gripping position shown in Figure 10 with the jaw portions 66 engaging the work piece 51 as by spring pressed plugs 68.

The ejector 50 as shown best in Figure 14, has an enlarged diameter portion 70 provided with a pair of angularly disposed slots 71 within which ride pins 72 projecting inwardly from a sleeve 73 within which the portion 70 is axially slidable. The forward end of the sleeve 73 is provided with a pair of arcuate fingers 74 which are adapted to extend between the jaws 65 and to be rockable about the axis of the ejector rod 52 between the positions shown in Figures 10, 11 and 12. In Figure 10, these fingers 74 are out of contact with the jaws 65 and permit the jaws to grip the work piece. By rocking the sleeve 73 in counterclockwise direction from the position shown in Figure 10 to that shown in Figure 11, the fingers 74 engage the jaws 65 and retract them, freeing the work piece, the jaws then being open as shown in Figure 11. In Figure 12 the sleeve 74 has been returned to the angular position of Figure 10 which allows the jaws 65 to take the position shown therein in case no work piece is positioned between them. This rocking action of the sleeve 73 is occasioned by the relative axial motion between the portion 70 and the sleeve 73, and when the work has been

released, forward axial motion of the rod 52 pushes the ejector 50 forward and ejects the work 51 from the headstock center 35, this being done in time with the retraction of the tailstock center so that the work is freed from both. This ejection of the work causes the work to be moved axially, and this is done while the work-engaging member 31 of the transfer arm which is to remove the work piece from the tooling station and transfer it to the delivery station is in engagement therewith.

As shown in Figure 4, this work-engaging member 31 comprises a pair of spring jaws 80 having curved portions 81 adapted to embrace the work and flaring end portions 82, which when pressed against the work, cause the jaws to be sprung apart to permit the work to enter between the curved portions 81. These spring portions 80 are secured to a block 83 positioned therebetween, which, in turn, is secured to the end piece 28 of each of the transfer arms.

The reverse motion of the head and tailstock centers by which the tailstock center is advanced to contact a work piece and force the work piece onto the headstock center while the ejector is in retracted position is accomplished while the work-engaging element 31 of that arm which is moved to transfer the work pieces one by one from the supply station to the tooling station is at the tooling station, the work sliding through the work holding member 31 but in the reverse direction to that when the work piece is to be removed from the tooling station.

In Figures 3 and 5 a supply station is illustrated, comprising a suitable hopper 100 having a bottom wall 101 sloping downwardly and an end wall 102 spaced therefrom at a distance such as to permit a single layer of work pieces only to pass between the two. The lowest of these work pieces in this layer comes to rest against a dog 103 pivoted at 104 to the bottom wall 101 and normally held in position to obstruct the free passage of the work pieces as by a spring pressed plug 105 which engages its under side. A second dog 106 is fulcrumed at 107 on an extension 108 from the wall 102 and is provided with a downwardly projecting hump 109. This hump 109 is adapted to be contacted by the end wall 29 of one of the transfer arms and to be rocked upwardly as shown in full lines in Figure 5 out of obstructing relation to the lowest work piece 51 in the single layer which has passed beneath the end wall 102. This permits the work-engaging member of the transfer arm to be pushed over this lowest work piece so that when this arm is retracted therefrom, it carries the lowest work piece therewith, causing the dog 103 to be depressed against the action of the plug 105 to free the last work piece from the delivery station, while the dog 106 drops back into position to hold back the next work piece until such time as the dog 103 has been permitted to return to its obstructing position.

The transfer arm is then moved axially and about the pivot 22 to present the work into the loading position. This is accomplished by the swinging of a lever 115 pivoted to the end plate 28 of this transfer arm, this lever 115 being fulcrumed at 116 and connected as through bell crank lever 117 to the upper end of an arm 118. The lower end of this arm 118 is connected through a universal joint 119 to one arm of a bell crank lever 120. This bell crank lever is fulcrumed on the fixed pivot 121 and its lower end is pivoted at 122 to a slide 123 movable along a guide bar 124 and controlled by suitable cams on the cam drum 10.

The other transfer arm is at the same time moved from a position where its work-engaging member 31 engages a work piece at the tooling station, to the delivery station 60. This is accomplished by the swinging of an arm 125 fulcrumed at 126 on a fixed frame member 127 which also carries the pivot 116, this arm 125 being actuated by the same link 118 through an arm 128 of the bell crank lever 117 which is connected through an adjustable link 129 to an arm 130 connected to the arm 125.

The delivery station comprises means for stripping a work piece from the work-engaging element 31. This consists of a base member 135 secured to a portion of the bracket 21 and having a lower wall member 136 onto which the work piece is presented by the transfer arm. A pivoted dog 137 supported above the work piece yields to permit the work piece to be pushed therepast and then falls down back of it in the position shown in Figure 3, with its lower end engaging the work piece, its upper end at 138 being pressed against a stop member 139 of the stripper which prevents the dog from counterclockwise rotation from the position shown in Figure 3, so that when the member 31 is retracted it forcibly moves the work piece out from between the work piece jaws. The work thus freed rolls down the support 136 and falls into a suitable receptacle 140 beneath it as shown in Figure 3.

During the tooling operation performed on the work at the tooling station, the transfer arms are moved to positions of rest between the end positions and out of contact with the work, such positions of rest being shown in dotted lines in Figure 3, the arm for transferring the work from the tooling station to the delivery station being shown as substantially vertical, and the arm for delivering from the supply station to the tooling station being shown substantially horizontal.

In Figure 7 a modification is shown in which the supply and delivery stations are on opposite sides of the tooling station from that shown in Figure 3, the forward transfer arm then taking the work piece from the receiving station 150 and transferring it to the tooling station while a work piece at the tooling station is transferred therefrom to the delivery station at 151. The receiving station 150 as shown in Figures 7 and 8, comprises a chute in which a single layer of work pieces may roll toward its mouth, the lowest of the work pieces in the chute being normally stopped by a dog 152 fulcrumed at 153 and pressed upward by a leaf spring 154 into position to receive the lowest work piece in a depression 155 therein, a stop pin 156 limiting the upward movement of the dog 152. Above this dog 152 is pivoted at 157 a second dog 158, the lower end portion 159 of which is held by gravity in obstructing relation to the lowest work piece held in the depression 155 of the dog 152. A stop pin 160 limits this downward limit of motion. The dog 158 is provided with a projection 161 adapted to be contacted by the end member 28 of the transfer arm and to be rocked up thereby so that the work-engaging element 31 may grasp the lowest work piece. Then by outward motion of the element 31, this work piece is removed from the dog 152, the dog 158 dropping as the transfer arm leaves to prevent the release of the next work piece which then takes its position as the lowest work piece at the station when the dog

152 springs upwardly into the position shown in Figure 8.

The delivery station 151 shown in Figure 7 comprises a chute for a single layer of work pieces at 165 inclined downwardly with its upper end adapted to be normally somewhat obstructed by a dog 166. This dog 166 is gravity pressed against a stop pin 167 in such position that after it has been lifted by the introduction of a work piece beneath it into the chute 165, and drops into the obstructing position shown it prevents the removal of the work piece by the transfer arm on retraction of the transfer arm therefrom.

In some cases it may be found desirable to firmly grip the work while it is being transferred, locking it from accidental lateral displacement from the work-engaging portions of the transfer mechanism. Such a construction is shown in Figures 15 to 17, and a work piece of a somewhat different form than that previously described, and which may be handled by such mechanism, is shown in Figure 19. Only one of the transfer arms is illustrated in these figures, but it should be understood that two arms of identical construction would be employed. In place of the spring jaws previously described, the work-engaging part of the transfer arm comprises a head 200, this head having sockets to receive the ends of the bars 25 and 26 which are secured therein as by the pins 201. The head 200 is provided with a pair of spaced side plates 203 between which are pivoted on the pivots 204, a pair of jaws 205. The upper portions of these jaws above the pivots 204 are formed on their adjacent edges with tapered walls 206 which may be engaged by the outer faces of a pair of spring pressed plungers 207. Each of these plungers has an enlarged diameter portion 208 mounted for sliding motion through openings in one of the side plates 203, the other side plate having bushings 209 seated in the corresponding openings and forming guides for reduced diameter shank portions 210 of the plungers 207. These reduced diameter portions extend through enlarged diameter sockets 211 in the bushings 209 and are normally pressed axially into the position shown in Figure 17 by coil springs 212 surrounding these shanks and reacting between the bases of the sockets 120 and heads 214 pinned to the end portions of the shanks. In the position shown in Figure 17 with the enlarged diameter portions 208 of the plungers located between the jaws 205, the lower ends of these jaws are pressed toward each other in the position shown in Figure 18 to close about the work. The outer faces of the upper end portions of the jaws may engage stop pins 215 which limit the closed positions of the jaws. Above the stop pins a spring 217 is housed within telescopically related casing members 218 and 219 which engage upward extremities of the jaws and tend to hold them in closed position. The end plates 203 are provided with serrated edge portions 220 which coact with widened extremities 221 of the jaws to engage the work and hold it firmly.

At each of the stations where the work is to be released is positioned a cam plate 225 (see Figure 16), such a plate being shown at the tooling station and having a hole for the passage of the retractible tailstock center 226. This plate 225 is so related to the transfer arms that when these arms are brought into the corresponding position, the cam plate 225 engages against the caps 214 of the plungers and pushes these plungers inwardly, bringing the smaller diameter portions of the shanks 210 opposite to the jaws 205, thus releasing these jaws so that their lower ends may be swung outwardly when subjected to pressure from the work, as it is when placed or removed from between the jaws. A work piece which may be held by the jaws 205 is shown in Figure 19 and comprises a cylindrical portion 230, provided at one end with a head 231 extending diametrically outwardly from the portion 230. The portion 230 is arranged to be held by the gripping arms 205 and to be slid axially thereof by the action of the tailstock center when it moves forwardly and presses the work piece against the headstock center 235 in the position shown in Figure 16.

For machining purposes, the headstock spindle chuck 235 is shown as provided with a pair of driving dogs 236 having flat face portions 237 for engagement with the sides of the extensions 231 of the work piece. The work may be ejected from the headstock center when the tailstock center is retracted, by spring pressed ejector plugs 240 carried by the chuck and engaging the adjacent end face of the work. Each plug may be removably secured in the chuck 235 by a set screw 241 having a reduced extremity with which the plug slidably engages through a slot 242 in the plug.

When work pieces of the type shown in Figure 19 are to be machined, it is desirable that the work spindle be stationary in a predetermined angular position when work pieces are being removed and replaced but as mechanism for accomplishing this forms no part of the present invention it has not been illustrated herein.

In Figures 20 to 27 is shown work gripping and ejecting mechanism of a type somewhat modified from the construction shown in Figures 10 to 14. Referring first to Figure 21, at 250 is shown the nose of the spindle to which is secured a chuck comprising a body 251, this body being secured to the spindle nose as by the screws 252 shown in Figure 20. The forward face of the body 251 is recessed as at 257 and within the recess are pivoted a pair of work-engaging jaws 253, screws 254 forming the pivots for these jaws. Each of the jaws has a serrated work-engaging face 255 eccentric to its pivot 254 and the jaws are normally held toward closed angular positions by means of a pair of spring pressed plugs 256 seated in sockets in the body 251 and bearing against one edge of each of the jaws 253. Centrally of the body it is provided with a tapered hole 258 for the reception of a headstock center 259, the outer end of which is formed to engage within the central bore of the work piece 51 shown in broken lines in Figure 21.

The forward end of the center 259 extends into a deepened portion of the recess 257 and within this deepened portion is positioned a work ejector 260 which has a hole therethrough, as shown in Figure 22, through which the center 259 projects, so that the ejector is in a position to impinge upon the end of the work piece and by outward motion exerted thereon eject it from engagement with the center 259. In order to produce this ejecting motion, the ejector 260 is provided with a pair of rods 261 (see Figure 20), each of which is formed as a headed screw threaded through holes 262 in the ejector and extending slidably through holes 263 through the body, the heads 264 of these screws riding within a recess 265 in the back face of the body and provided with extensions 266 into which the heads 264 may be pressed. In line with the heads 264 is an ac-

tuating member 270 which, as shown, is a circular plate having a rearwardly extended hub 271 into which the forward end of an actuating rod 272 is threaded. This rod extends through the head stock of the machine and takes the place of the bar 57 shown in Figure 1. The actuator 270 has secured therein a pair of forwardly extending rods 274 slidable through holes through the head 251 and parallel to the rods 261 of the ejector and to the axis of the work. These rods 274 are provided with reduced rear extremities riveted over in holes 275 through the actuator 270. Their forward ends are formed frusto conical as at 276 and cooperate with mating faces of a pair of plugs 277 projecting from the rear faces of the jaws 253.

When the actuator 270 is in its fully retracted position shown in Figure 21, the rods 274 are retracted and engage the jaw plugs 277 in the position shown in Figures 24 and 27 when the chuck is empty. When a work piece is between the jaws, the gripping faces are somewhat more widely spaced, depending in amount upon the precise diameter of the work piece, the parts then being in the positions in Figures 23 and 25, the jaws being rocked somewhat toward open position with their plugs 277 out of contact with the chuck-opening rods 274.

When a work piece is to be ejected, the actuator 270 is moved to the right as shown in Figures 21 and 22, this action projecting the rods 274 and causing their cone faces to contact with the cone faces of the corresponding jaws and to wedge the jaws apart to their open positions, one jaw being shown in that position in Figure 23 and its rod 274 in the dotted line position of Figure 26. When the jaws have been moved to fully open position, but while the actuator 270 is still back from its extreme forward position, it contacts with the heads 264 of the ejector rods 261. Further forward motion of the actuator 270 which has no further opening action on the jaws, then moves the ejector outwardly and forces the work off of the center 259, the opening rods 274 then taking the full line position of Figure 26. It will be noted that the jaw motion takes place during lost motion between the actuator 270 and the motion of the ejector. On retraction of the actuator 270, when a new work piece is positioned between the centers by the transfer mechanism, the forward motion of the tailstock center engaging the work, moves the ejector 260 to its backward position as the work is forced onto the headstock center 259, and as the actuator 270 further retracts, it permits the spring pressed plugs 256 to close the jaws in upon the new work piece as soon as the work piece has been moved to fully loaded position between the jaws. At the end of the machining operation, the tailstock center retracts and the ejector then forces the work out of the chuck after releasing the jaws therefrom, the work sliding axially within the work holder of the transfer mechanism.

From the foregoing description of an embodiment of this invention, it should be evident to those skilled in the art that various changes and modifications might be made without departing from the spirit or scope of this invention.

I claim:

1. A work transfer mechanism comprising two pairs of parallel bars, a fixed pivot between the bars of each pair and with reference to which said bars may pivot and move axially, a work gripper carried by each pair of bars, a pivoted arm for each pair of bars having connection thereto, a lever connected to both of said arms, and means for rocking said lever, said arms and bars being proportioned and related to cause one of said work grippers to move away from one position while the other of said work grippers is moving toward said position as said lever is rocked.

2. A work transfer mechanism comprising a pair of elongated members each having a work gripper at one end, a pivot about which both of said members may rock and move lengthwise, a rock member, and connections between said rock member and elongated members causing simultaneous motions of said elongated members as said rock member is rocked, said elongated members being proportioned and related to cause one of said work grippers to move toward a predetermined position while the other of said gripper members is moving away from the same position.

3. The combination of a pair of spaced work-supporting means, a stationary pivot member spaced from said supporting means, two pairs of bars, the bars of each pair being parallel and spaced apart on opposite sides of said pivot to rock on said pivot and move lengthwise of said bars, the bars of the two pairs being movable in two parallel planes, a work-engaging element carried by each pair of bars for engagement with a work piece, and means for moving said pairs of bars lengthwise and about said pivot, one pair of bars with its work-engaging element from one to the other of said work-supporting means to transfer work pieces one at a time from the one to the other of said work-supporting means, and the other of said pairs of bars with its work-engaging element from said other work-supporting means to transfer work pieces one by one away from said other work-supporting means.

RALPH M. GAMBLE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
447,144	Clyne	Feb. 24, 1891
644,279	Couch	Feb. 27, 1900
666,486	Brown	Jan. 22, 1901
959,456	Campbell	May 31, 1910
1,596,733	Higgins	Aug. 17, 1926
1,645,123	Thacher	Oct. 11, 1927
1,817,099	Reed	Aug. 4, 1931
1,838,692	Lovely	Dec. 29, 1931
1,841,988	Smith	Jan. 19, 1932
1,933,226	Smith et al.	Oct. 31, 1933
1,993,754	Smith et al.	Mar. 12, 1935
1,994,242	Clouse	Mar. 12, 1935
2,059,546	Brandenburg	Nov. 3, 1936