Feb. 23, 1965 R. STEIN 3,170,595

HOPPER AND FEED MECHANISM

Filed Jan. 15, 1962 2 Sheets-Sheet 1

Fig. 1

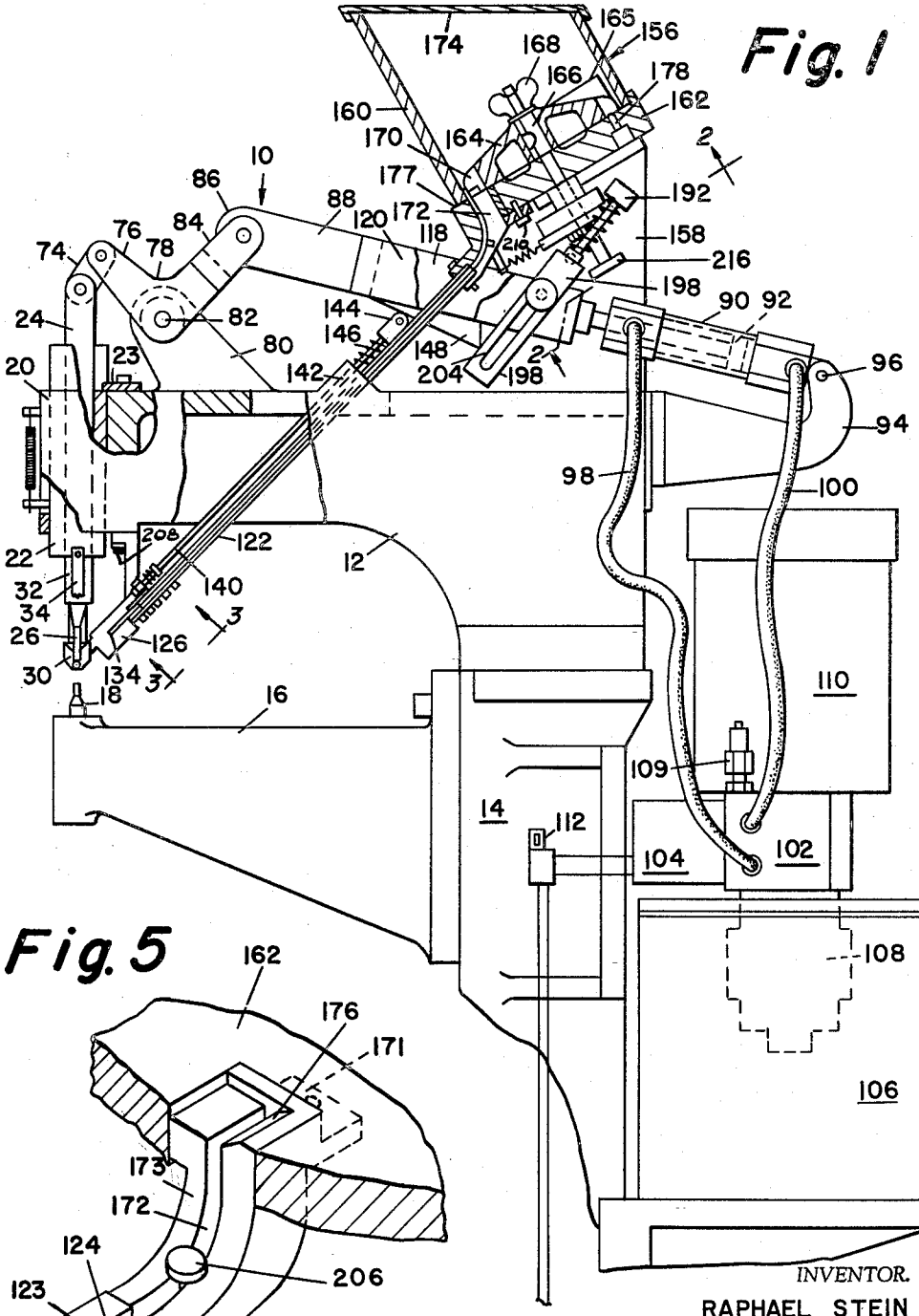


Fig. 5

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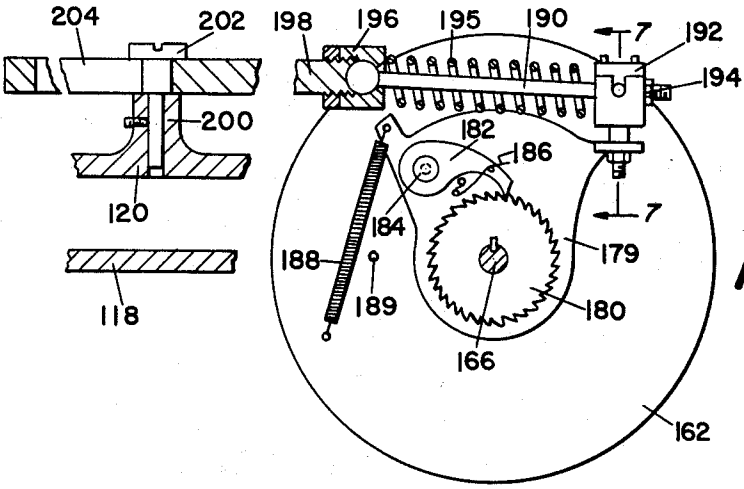


Fig. 2

Fig. 3

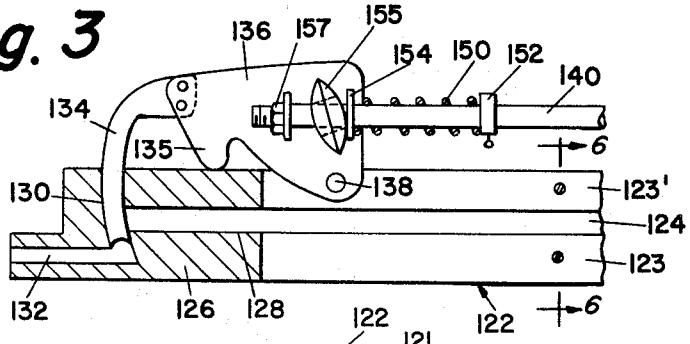


Fig. 6

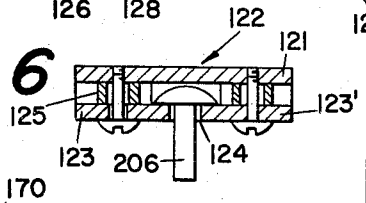
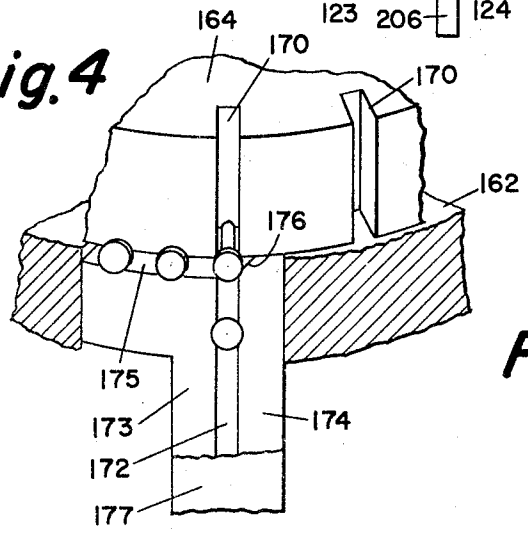


Fig. 4



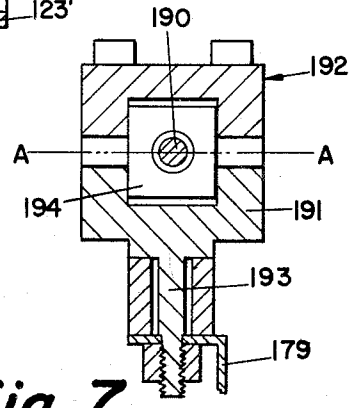


Fig. 7

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HOPPER AND FEED MECHANISM

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Filed Jan. 15, 1962, Ser. No. 166,088
11 Claims. (Cl. 221—182)

This invention relates to a hopper and feed mechanism. In particular, this invention relates to a hopper and feed mechanism which is adaptable for use on rivet setting machines, eyelet machines, etc.

The hopper and feed mechanism of the present invention is illustrated as being attached to a rivet setting machine. The hopper and feed mechanism is adapted to continuously and automatically feed elements to a desired point. In rivet setting machines proposed heretofore, it has been conventional to transfer rivets from a raceway to a throat block or the like by means of a reciprocating shuttle. Shuttles of this nature have not been entirely satisfactory since small amounts of oil, dirt or burrs on the rivets prevent the lowermost rivet from entering the slot in the shuttle. As a result thereof, jamming of the shuttle and rivets has been common heretofore.

The present invention utilizes a positive transfer means. The positive transfer means comprises an arcuate finger which rubs against the lowermost rivet in the raceway thereby rotating the same. Constant rotation of the lowermost rivet in the raceway assures the dropping of said rivet into the transfer slot, wherein such finger will physically push the rivet to the feed slot of the throat block or plate.

The hopper is of the type wherein quantities of rivets may be manually placed therein. A rotor in the hopper automatically separates the rivets and feeds the same to a raceway. The rotor is the only element of the hopper which need be replaced when converting from one size rivet to another. When converting from one size rivet to another, the entire raceway may be removed by merely adjusting two bolts. Thus, the hopper and feed mechanism of the present invention facilitates the rapid conversion from one size rivet to another. This invention is a substantial change over the prior art wherein the entire hopper and raceway had to be replaced when converting from one size rivet to another. The changes associated with the prior art were quite extensive and resulted in a substantial amount of down time for the machine.

It is an object of the present invention to provide a novel hopper and feed mechanism.

It is another object of the present invention to provide a novel hopper and feed mechanism which facilitates the rapid conversion from one size of the element being dispensed to another size.

It is still another object of the present invention to provide a novel transfer mechanism for feeding rivets or the like from the raceway to the throat plate.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is an elevation view of a rivet setting machine incorporating the hopper and feed mechanism of the present invention, with portions broken away for purposes of illustration.

FIGURE 2 is a bottom view of the hopper as taken along the lines 2—2 in FIGURE 1.

FIGURE 3 is a view taken along the lines 3—3 in FIGURE 1.

FIGURE 4 is a partial elevation view of the rotor in the hopper.

FIGURE 5 is a perspective view of the uppermost end of the raceway, illustrating the means for securing the raceway to the hopper.

FIGURE 6 is a section view taken along the lines 6—6 in FIGURE 3.

FIGURE 7 is a sectional view taken along lines 7—7 in FIGURE 2.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a rivet setting machine designated generally as **10**.

The rivet setting machine **10** includes a frame **12** cast from metal. The frame **12** may be mounted on a table, or as illustrated on a pedestal support **14**. An anvil arm **16** having an anvil **18** extends from the pedestal support **14** in the same direction and below the horizontally extending arm of the frame **12**.

The horizontally extending arm of the frame **12** terminates in a guide portion **20** having an upright bore therethrough. A cylindrical driver guide sleeve **22** is reciprocally secured within such bore in the portion **20**. A cylindrical driver mechanism **24** is reciprocally disposed within and guided by a longitudinally extending bore in the driver guide sleeve **22**. Spring means are provided to bias sleeve **22** against limit stop **23**. A reciprocally disposed driver **26** extends from the lowermost end of the driver mechanism **24**. The lowermost end of the driver **26** extends between a pair of spaced jaws **30**. Only one jaw **30** is illustrated in FIGURE 1.

The jaws **30** are supported from the guide sleeve **22** by a pair of flat flexible jaw springs **32** and **34**. The manner in which the driver **26** co-operates with the jaws **30** to force a rivet through aligned holes in superimposed members is set forth in detail in my co-pending application Serial No. 141,398 filed on September 28, 1961 and entitled Rivet Setting Machine.

One end of a link **74** is pivotally connected to the uppermost end of the driver mechanism **24**. The other end of the link **74** is rotatably connected between a pair of ears on an arm **76**. The arm **76** forms one leg of L-shaped link **78**. The link **78** is rotatably secured between a pair of ears **80** by means of a pin **82**.

The arm **84** terminates in a pair of spaced ears and forms the other leg of the L-shaped link **78**. The arm **84** is rotatably secured to an end **86** of piston rod **88**. The other end of piston rod **88** extends into a power cylinder **90** and terminates at a piston **92**. The power cylinder **90** has one end rotatably supported by a bracket **94** having spaced ears through which a pivot pin **96** extends.

Flexible conduits **98** and **100** extend from opposite ends of the power cylinder **90**. The conduits **98** and **100** extend from a valve **102**. The valve **102** is provided with a solenoid operator **104**. Oil or a comparable hydraulic liquid is pumped from the reservoir **106** by means of pump **108** through the valve **102** and the conduits **98** and **100**. The pump **108** is operated by means of a motor **110**. A main control switch **112** is provided on the support **14** for controlling the supply of electricity to the machine **10**. After the main switch **112** has been turned on, the operator of the machine may initiate operation of the machine **10** by means of a foot pedal operated switch coupled to the switch **112** and the solenoid operator **104**.

As shown more clearly in FIGURES 1 and 2, the piston rod **88** is provided with an O-shaped portion intermediate its ends. The O-shaped portion includes a pair of spaced parallel arms **118** and **120**. A raceway or rivet guide means **122** extends through the O-shaped portion between the arms **118** and **120**. As shown more clearly in FIGURE 6, the raceway **122** includes a top plate **121** having spaced bottom plates **123** and **123'** secured thereto by screws or the like. The space between the plates **123** and **123'** define a slot **124** through which the shank portion of a rivet may extend. Spacers **125** are provided between

the top plate 121 and the bottom plates so as to accommodate the thickness of the head of the rivet.

As shown more clearly in FIGURE 3, the raceway 122 terminates in a throat plate 126. The plate 126 has a slot 128 forming a continuation of the slot 124. The slot 128 terminates at an arcuate transversely extending slot 130. One end of the slot 130 extends through a side wall of the plate 126. The other end of the slot 130 terminates in a slot 132 which is parallel to the slots 124 and 128. The arcuate nature of the slot 130 prevents rivets from climbing uphill to the slot 132 from the slot 128.

Rivets are fed between the jaws 30 from the slot 132. An arcuate finger 134 extends into the slot 130 until limit stop 135 on plate 136 contacts a side of plate 126. As the finger 134 reciprocates in the slot 130, it is always in rolling contact with the shank portion of the lowermost rivet in the slot 128. Finger 134 is integrally connected to one end of an arm 136. The arm 136 is rotatably supported for rotation about a pivot pin 138.

Rotation of the arm 136, and hence reciprocation of the finger 134 within the slot 130 is caused by an actuator rod 140. The rod 140 extends through a boss 142 on the horizontally disposed arm of the frame 12 and terminates in a cam follower 144. A spring 146 surrounds the rod 140 and extends between the cam follower 144 and the boss 142. The cam follower 144 co-operates with a cam surface 148 and the lowermost surface of the arm 120.

A coil spring 150 surrounds the rod 140 adjacent its lowermost end. The spring 150 extends between an adjustable collar 152 and washer 154. The washer 154 is in abutting contact with a bushing 155 mounted on the arm 136. The lowermost end of the rod 140 extends through an enlarged bore in bushing 155 and terminates in a threaded nut 157. Accordingly, as the rod 140 moves to the left in FIGURE 3 as a result of movement of the cam surface 148 to the left in FIGURE 1, a portion of the left hand end of rod 140 overtravels the bushing 157 thereby compressing the spring 150. The energy of the compressed spring 150 rotates the arm 136 in a counterclockwise direction in FIGURE 3. Such movement of the arm 136 causes reciprocation of the finger 134 so that it may move the next rivet in slot 128 into the slot 132. If a rivet jams, the overtravel of rod 140 with respect to bushing 155 prevents the elements from breaking.

A hopper 156 is supported adjacent to top portion of the machine 10 by means of a bracket 158. The hopper 156 comprises a hollow cylinder 160 mounted in a planar base 162. A rotor 164 is rotatably mounted within the cylinder 160 on the base 162. The rotor 164 is keyed to a shaft 166 which extends through the base 162. The rotor 164 is maintained in contact with the juxtaposed surface of the base 162 by means of a wing nut 168. The rotor 164 is provided with a fin 165 for stirring the rivets.

The outer peripheral surface of the rotor 164 is spaced from the inner peripheral surface of the cylinder 160 by a distance slightly larger than the thickness of the head portion of the rivet currently being used on the machine 10. A plurality of radially extending recesses 170 are provided on the outer periphery of the rotor 164. The width and length of the recesses 170 are slightly larger than the corresponding dimensions of the shank portion of the rivet currently being used on the machine. The upper surface of the rotor 164 slopes from the shaft 166 toward the cylinder 160. The width of the slots 170 are smaller than the transverse dimensions of the head portions of the rivets currently being used.

The base 162 is provided with a peripheral slot which receives the mounting means for the upper end of the raceway 122. Such mounting means includes an L-shaped bracket 171 integrally secured to a throat plate 173. A throat plate 174 is juxtaposed and spaced from the plate 173 thereby forming a slot 172 which is a continuation of the slot 124. The ends of the plates 173 and 174 are adapted to be secured to the uppermost ends of the plates 123 and 123', respectively. Plates 173 and 174 and bracket 171 are preferably one integral piece.

The uppermost surface of the bracket 171 and the throat plate 174 are flush with the uppermost surface of the base 162. The uppermost surface of the throat plate 173 is spaced from the uppermost surface of the base 162 thereby defining a lead slot 175. The leading edge of the throat plate 174 is tapered at 176 to assure that all rivets drop through the slot 172.

Each of the plates 173 and 174 are removably secured to a cover plate 177 by means of threaded fasteners not shown. Spacers are provided between the cover plate 177 and the plates 173 and 174 so as to accommodate the thickness of the head portion of the rivets. A spring biased repicrocably mounted detent 178 extends through the base 162 diametrically opposite the slot 172 to cause the rotor 164 to hesitate slightly as it passes thereover to assure that the rivets will fall through the slot 172.

An actuator plate 179 and a ratchet 180 are supported on the shaft 166 below the base 162. The ratchet 180 is keyed to the shaft 166. A pawl 182 is rotatably supported on the plate 179 for rotation about pin 184. A hair spring 186 biases the pawl 182 into engagement with the ratchet 180. A coil spring 188 biases the plate 179 toward limit stop 189. Limit stop 189 may be a rod depending from base 162.

The bias of spring 188 is opposed by the force imparted to the plate 179 by shaft 190. One end of shaft 190 is connected to plate 179 by means of a universal connection 192. Connection 192 includes a housing 191 rotatable about the longitudinal axis of its stem 193. The stem 193 is releasably connected to plate 179 as shown more clearly in FIGURE 7. Shaft 190 extends through a roller 194 adapted to rotate within housing 191 about axis A—A in FIGURE 7.

Shaft 190 terminates in a threaded end having a nut 194 thereon. A spring 195 surrounds shaft 190 and biases housing 191 to the right in FIGURE 2. In this manner, shaft 190 can overtravel housing 191 if the rotor 164 jams. The rotor 164 would jam, for example, if someone put a penny in hopper 156. The other end of shaft 190 is connected to an actuator arm 198 by a ball and socket connection 196. The arm 198 is supported by arm 120. The shank portion of a bolt 202 extends through a longitudinally extending slot 204 on arm 198 and is threadably secured to stud 200.

The lowermost end of the shaft 166 terminates in a hand knob 216. Manipulation of the hand knob 216 facilitates manual rotation of the rotor 164. Such manual rotation of the rotor 164 enables the initial rivets to be fed down the raceway 122. The bracket 171 is removably secured to the base 162 by means of a threaded fastener 210. The plate 126 is removably secured to the horizontal arm of the frame 12 by means of a threaded fastener 208. The fasteners 208 and 210 are the only fastener means holding the raceway 122 in operative disposition of the machine 10.

The operation of the rivet setting machine 10 is set forth in detail in my above-mentioned co-pending application. Accordingly, only that portion of the operation of the machine 10 which is necessary to understand the operation of the hopper and feeding mechanism will be set forth hereinafter.

It will be assumed that the elements are in the position illustrated in the various figures of the drawing. The hopper 156 will have an adequate supply of rivets therein. To retain the rivets within the hopper 156, the pivotably mounted cover for the hopper will be in its closed disposition as illustrated in FIGURE 1. The knob 216 will be manually rotated so as to feed a sufficient number of rivets 206 down the raceway 122 to assure initial starting of the machine 10. One rivet 206 will be disposed between the jaws 30. The main switch 112 will be on and

a pair of sheet-like members will be disposed one over the other with aligned holes superimposed over the anvil **18** below the jaws **30**.

When the operator steps on the foot pedal operated switch, the piston rod **88** reciprocates to the left in FIGURE 1 thereby causing the driver **26** to force a rivet through the aligned holes in the sheet-like member. As the piston rod **88** reciprocates to the left, the cam surface **148** co-operates with the cam follower **144** to reciprocate the rod **140** in a direction toward the jaws **30**. Such movement of the rod **140** results in the compression of the spring **146**. As shown more clearly in FIGURE 3, the rod **140** passes through the bushing supported by the arm **136** thereby compressing the spring **150** between the adjustable collar **152** and the washer **154**.

Compression of the spring **150** results in a smooth application of pressure to the arm **136** thereby rotating the same in a counterclockwise direction in FIGURE 3. Such rotation of the arm **136** causes the finger **134** to reciprocate in the slot **130** and push the next rivet to slot **132**. As the finger **134** reciprocates in the slot **130**, a side edge thereof engages the shank portion of the lowermost rivet thereby rotating the same. Such rotation of the lowermost rivet assures that it will be free to fall into the slot **130** as soon as the end of the finger **134** clears the slot **128** on its return stroke.

As the piston rod **88** moves to the left in FIGURE 1, the stud **200** and the bolt **202** on the arm **120** likewise move to the left. Such movement of the arm **120** enables the spring **188** to rotate the plate **179** in a counterclockwise direction in FIGURE 2 until the plate **179** abuts the limit stop **189**. This rotation of the plate **179** repositions the pawl **182** with respect to the teeth on the ratchet **180**. The ball and socket joint **196** and the connection **192** facilitate the pivoting and reciprocating motion of the arm **198**.

After the rivet **205** has been set and deformed so as to fixedly secure the sheet-like materials together, the spool within the valve **102** will resume its normal disposition wherein oil is being pumped from the reservoir **106** through conduit **98** into the cylinder **90**. In such disposition, the flow of oil into the cylinder **90** causes the piston rod **88** and piston **92** to reciprocate to the right to the position illustrated in FIGURE 1. Such movement of the piston rod **88** to the right in FIGURE 1 enables the spring **146** to expand thereby keeping the cam follower **144** in contact with the cam surface **158**. Also, the rod **140** reciprocates in the direction away from the jaws **30**. At the same time, the spring **150** expands thereby enabling the arm **136** to rotate in a clockwise direction in FIGURE 3. Such rotation of the arm **136** causes the finger **134** to return to a position where it pushes another rivet on its next stroke. Contact between the nut on the end of the rod **140** and the arm **136** assures a full return stroke of the finger **134**.

After a predetermined amount of travel of the piston rod **88** to the right in FIGURE 1, the shank portion of the bolt **202** contacts the end of the slot **204** thereby causing the arm **190** to rotate the plate **179** to the solid line position illustrated in FIGURE 2. Such rotary movement of the plate **179** causes the pawl **182** to rotate the ratchet **180**. Since the ratchet **180** is keyed to the shaft **166**, the rotor **164** rotates through a predetermined arc so as to place another recess **170** over the slot **172**. As a result of the rotary movement of the plate **179**, the spring **188** is expanded so that it may maintain contact between the bolt **202** and the arm **198** on the next stroke.

When it is desired to convert to one size rivet to another, bolts **208** and **210** are removed. This enables the raceway **122** to be free from securement with respect to the machine **10** so that a different size raceway may be substituted therefor. The rotor **164** may be removed by manipulation of the wing nut **168**. Thereafter, a new rotor may be substituted. Thus, it will be seen that the machine **10** may be converted from one size rivet to another in a very expeditious manner resulting in very little down time. The surfaces of the raceway **122** should be kept smooth and clean as well as free from oil and dust. This facilitates free feeding of the rivets under the effect of gravity. While the present invention has been illustrated in connection with rivets and a rivet setting machine, it will be appreciated that it is within the scope of the present invention to utilize the hopper and feed mechanism with any rod-like member having a head or flange at one end. Accordingly, the rivets may be referred to hereinafter as rod-like members.

Particular attention is directed to FIGURES 1 and 4 wherein it will be noted that the hopper **156** is disposed at a 30 degree angle with respect to the vertical. The slot **172** is in line with a radius of the base **162**. Therefore, the slot **172** is positioned at the lowest point on the base **162**. Since the lead slot **175** is disposed to the left of slot **172** in FIGURE 5, the rotor **164** is adapted to rotate in a counterclockwise direction in FIGURE 4 as indicated by the arrow.

Since the hopper **156** is tilted in the illustrated embodiment, there is positive assurance that the rivets in the hopper will be located in a position wherein the rivets can be dispensed. The fin **165** on the rotor **164** stirs the rivets within the hopper **156** to keep the rivets moving in a circular path.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. Apparatus comprising a hopper, a raceway extending downwardly from said hopper, said raceway having a longitudinally extending slot, said hopper including a base, an upstanding housing on said base, a rotor on said base, said rotor being secured to a shaft extending through said base, said rotor having a plurality of peripheral recesses adapted to be placed in communication with said raceway slot, and a means for intermittently rotating said shaft, said means including a universal connection, a rod extending through said connection and capable of overtraveling the same, a ratchet means connected to said shaft, and spring biased elements interconnecting said ratchet means and said connection.

2. Apparatus comprising a hopper adapted to receive a plurality of rod-like members, a raceway depending from said hopper, means for transferring rod-like members from said hopper to a slot extending along said raceway, a throat plate having a slot offset from said raceway slot, and an arcuate slot in the throat plate connecting the lower end of said raceway slot to the upper end of the said throat plate slot, the lower end of said raceway slot being lower than the upper end of said throat plate slot, and means for intermittently pushing a rod-like member from said raceway slot to said throat plate slot, said means including an arcuate finger reciprocally mounted within said arcuate slot.

3. Apparatus in accordance with claim 2 wherein said intermittent pushing means includes a rotatably mounted arm having one end connected to said finger, an actuator rod reciprocable along said raceway, and means interconnecting said arm with said rod so that reciprocation of said rod causes reciprocation of said finger, said rod extending through said interconnection means and capable of overtraveling the same.

4. Apparatus comprising a hopper adapted to receive a plurality of rod-like members, a raceway depending from said hopper means for transferring rod-like members from said hopper to a slot extending along said raceway, a throat plate having a slot offset from said raceway slot, means providing communication between said slots, means reciprocably slideable within said communication means for intermittently pushing a rod-like member from said

raceway slot to said throat plate slot, an actuator rod reciprocable along said raceway, and means interconnecting said pushing means with said rod so that reciprocation of said rod causes reciprocation of said pushing means, said rod extending through said interconnecting means and capable of overtraveling the same.

5. Apparatus comprising a hopper adapted to receive a plurality of rod-like members, a raceway extending downwardly from said hopper, said raceway having a longitudinally extending slot, a throat plate, said throat plate having a slot, means providing communication between said slots, a reciprocable finger in said communication means for intermittently pushing a rod-like member from said raceway slot to said throat plate slot, said hopper including a base, a rotor on said base, said rotor being secured to a shaft extending through said base, said rotor having a plurality of peripheral recesses adapted to be intermittently placed in communication with said raceway slot, an actuator rod reciprocable along said raceway, first means interconnecting said actuator rod with said finger so that reciprocation of said rod causes reciprocation of said finger, means for intermittently rotating said rotor shaft, a reciprocatory member, and second means interconnecting said reciprocatory member with the intermittent rotation means for said rotor shaft and the reciprocable actuator rod for operating the same during reciprocal movement of said member.

6. The apparatus of claim 5 wherein said hopper includes a stationary housing within which said rotor rotates, said rotor having a single fin thereon for stirring rod-like members in said hopper.

7. Apparatus in accordance with claim 5 wherein said second interconnecting means includes a cam on said reciprocatory member, means on the end of said actuator rod for urging said rod into contact with a surface on said cam, reciprocation of said member imparting reciprocatory motion to said rod through said camming surface.

8. Apparatus in accordance with claim 7 wherein said second interconnecting means includes a universal connection, a rod slideably and rotatably connected to said reciprocatory member at one end and extending through said universal connection at its opposite end and capable of overtraveling the same, said means for intermittently rotating said rotor shaft including a ratchet connected to said shaft, and spring biased elements interconnecting said ratchet and said universal connection.

9. Apparatus comprising a hopper adapted to receive a plurality of rod-like members, a raceway depending from said hopper, means for transferring rod-like members from said hopper to a slot extending along the length of said raceway, a first throat plate having a slot parallel to but offset from said raceway slot, means providing a communication between said slots, means slideable within said communication means for intermittently pushing a rod-like member from said raceway slot to said first throat plate slot, said transfer means including a second throat plate between said hopper and said raceway, said second throat plate having a slot in line with the raceway slot and a lead slot communicating with said second throat plate slot, said lead slot being partially defined by a surface of said second throat plate disposed below the uppermost end of said second throat plate slot.

10. Apparatus comprising a hopper adapted to receive a plurality of rod-like members, a rotatably mounted substantially flat rotor in said hopper, said rotor having a plurality of radially inwardly directed slots on its periphery adapted to receive rod-like members, a reciprocable mechanism, means coupled to said rotor for intermittently rotating said rotor in response to reciprocation of said mechanism, a raceway depending from said hopper, a throat plate between said hopper and said raceway, said throat plate having a slot in line with the raceway slot, a lead slot partially defined by a surface of said throat plate below the plane of said rotor for receiving rod-like members from said rotor slots, one end of said lead slot communicating directly with the upper end of said throat plate slot.

11. Apparatus in accordance with claim 10 including means within said hopper for causing said rotor to hesitate when said rotor slot passes by said throat plate slot.

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