March 21, 1933. B. J. CONLON 1,902,762

RIVET DRILLING MACHINE

Filed March 18, 1931 5 Sheets-Sheet 1

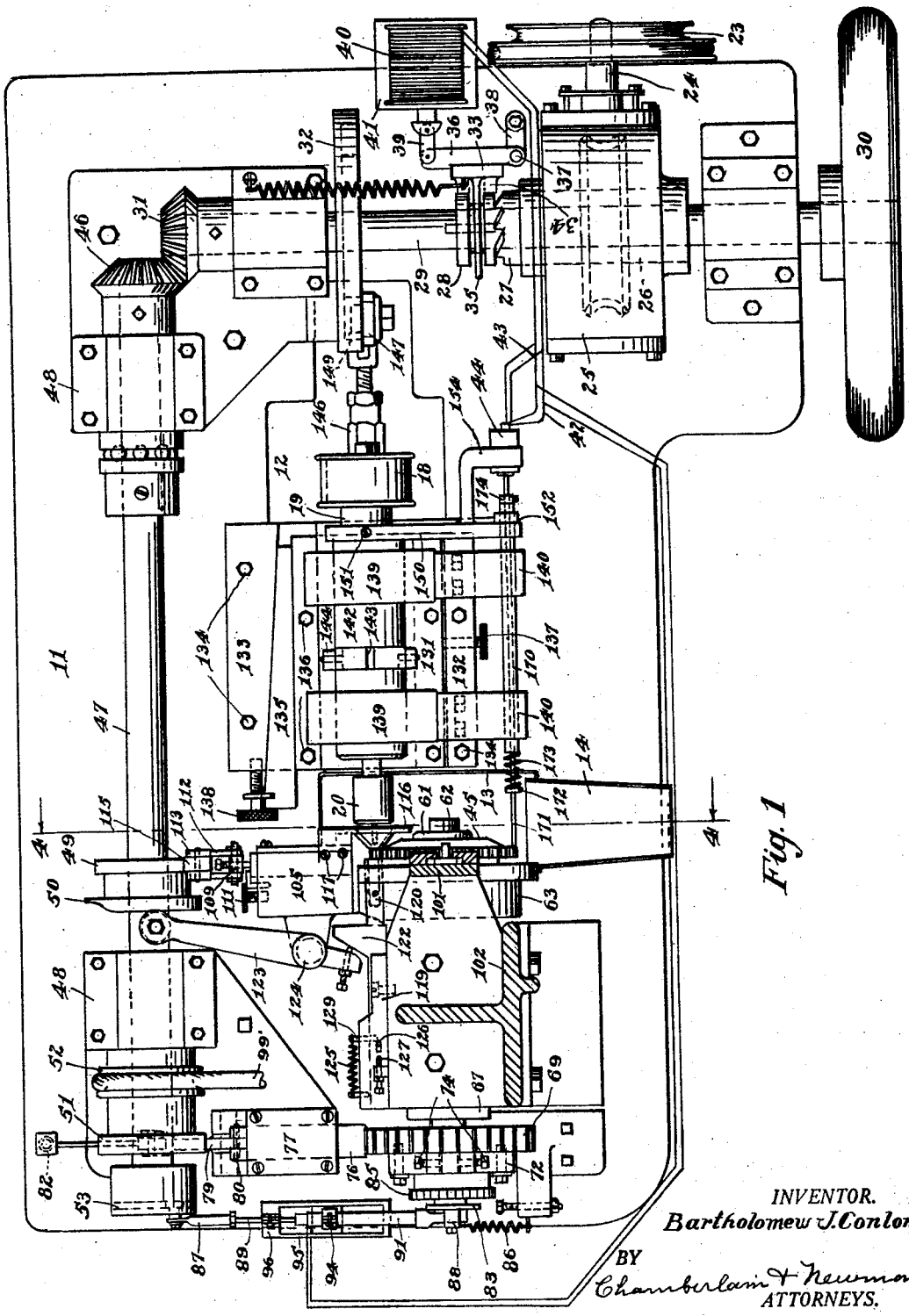


Fig. 1

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RIVET DRILLING MACHINE

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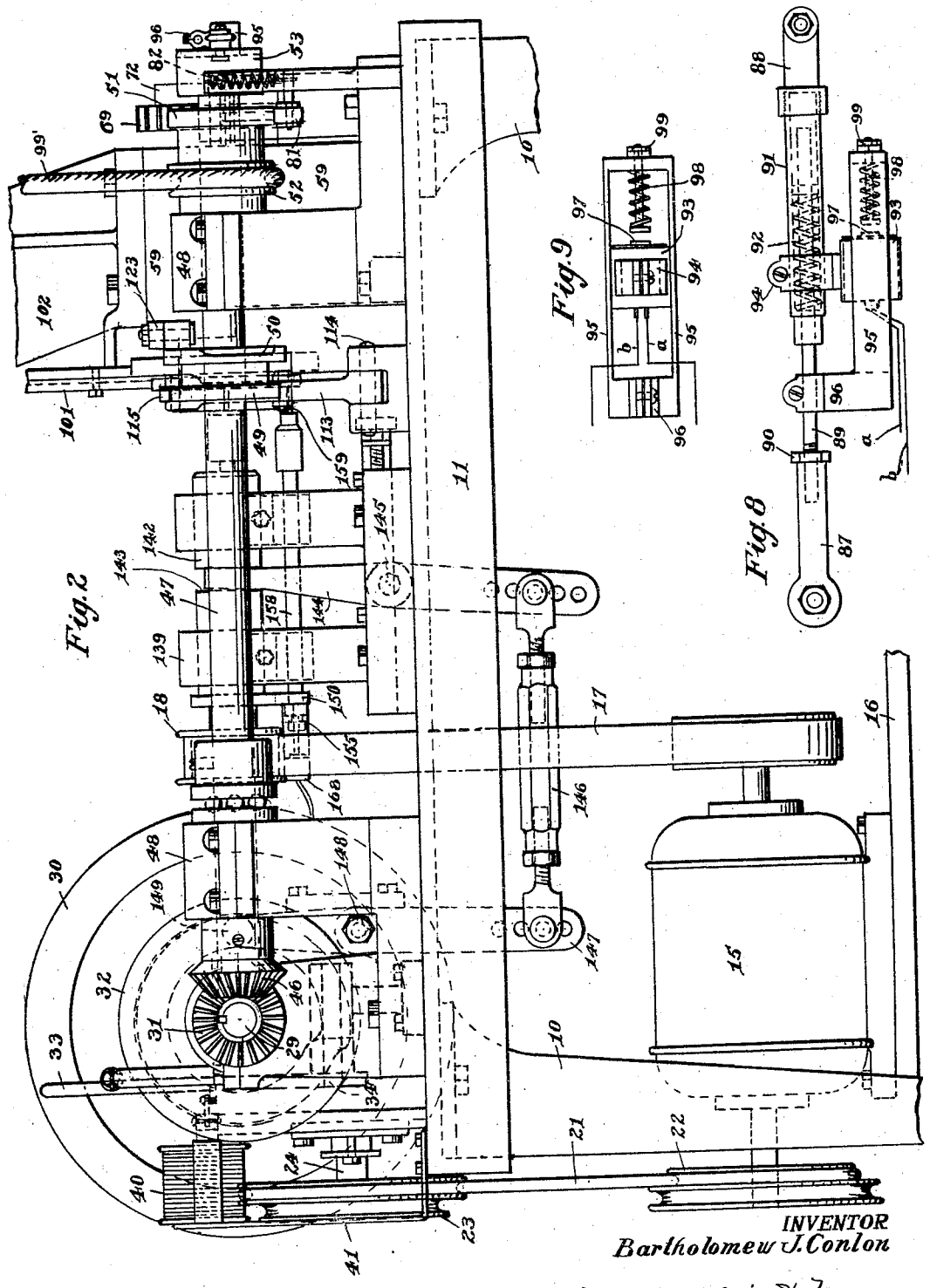


Fig. 2

Fig. 9

Fig. 8

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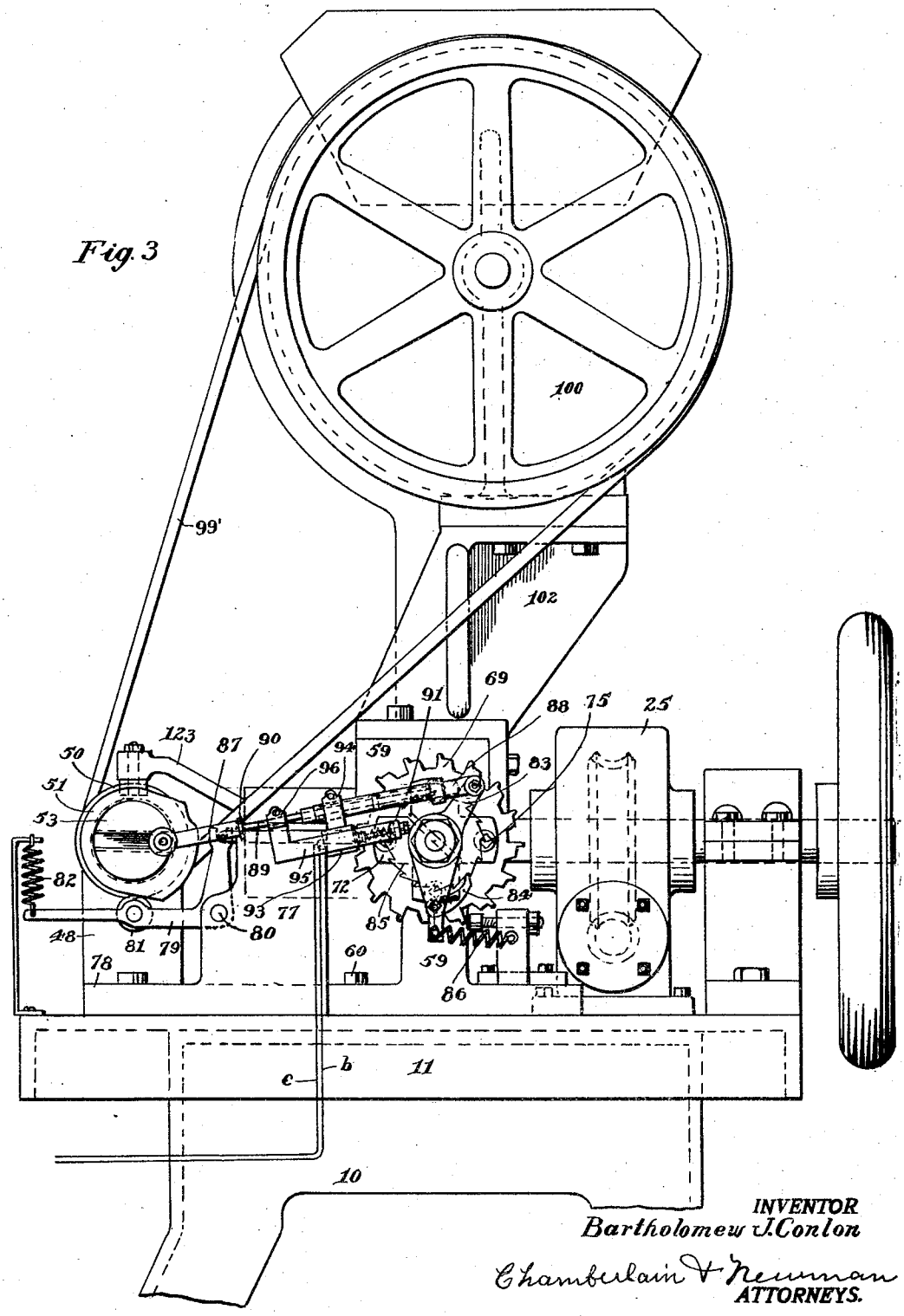
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RIVET DRILLING MACHINE

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Fig. 3



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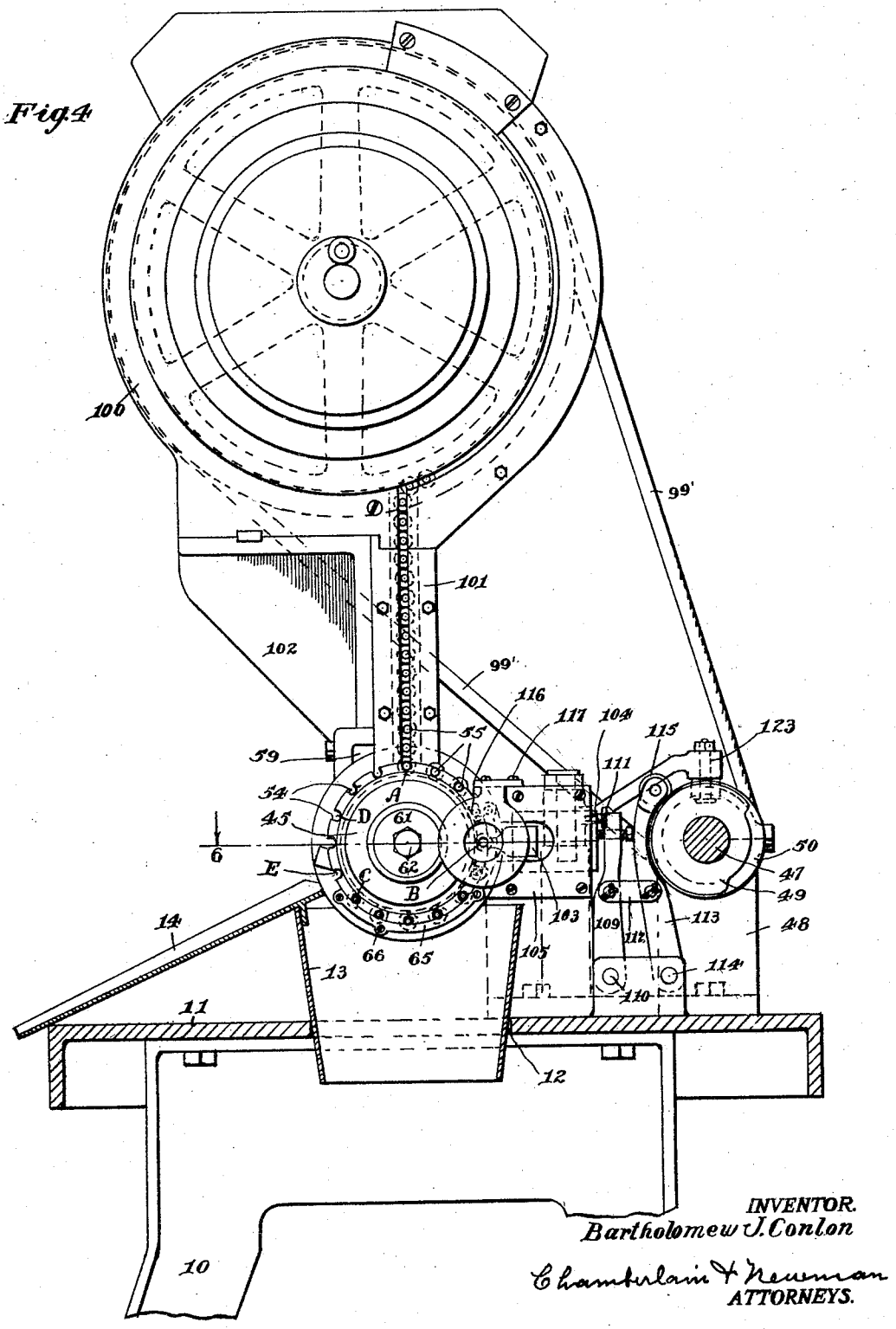
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RIVET DRILLING MACHINE

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Fig 4



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RIVET DRILLING MACHINE

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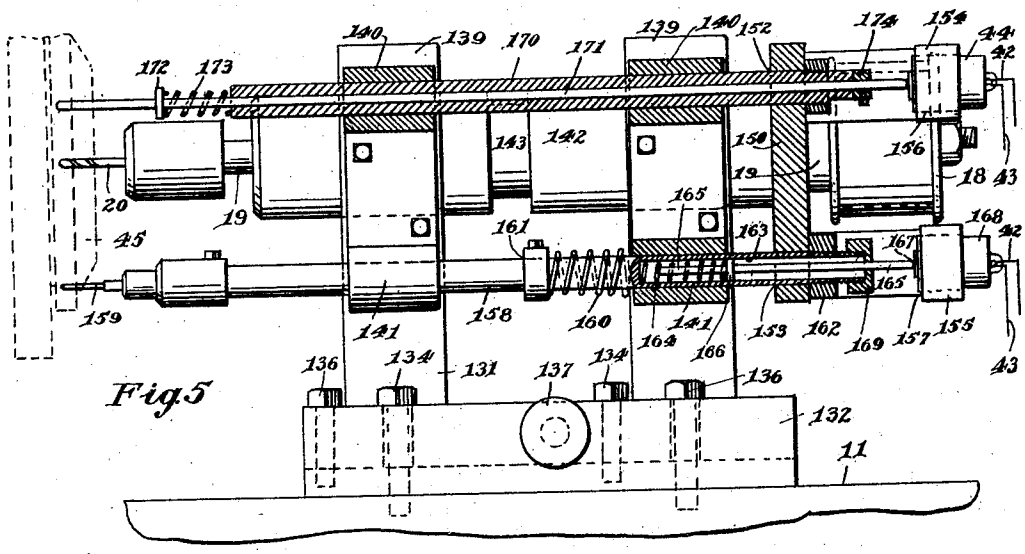


Fig. 5

Fig. 7

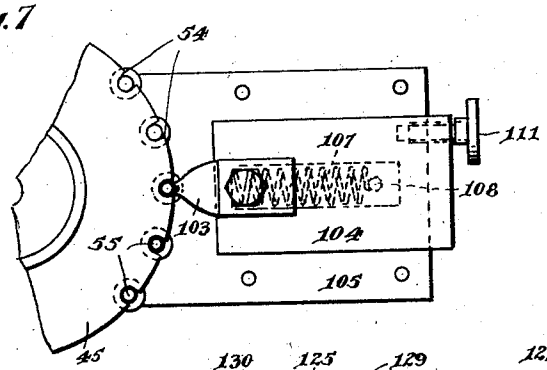


Fig. 6

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Patented Mar. 21, 1933 1,902,762

UNITED STATES PATENT OFFICE

BARTHOLOMEW J. CONLON, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO THE CONLON MANUFACTURING COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF CONNECTICUT

RIVET DRILLING MACHINE

Application filed March 18, 1931. Serial No. 523,507.

My invention refers to an automatic drilling machine and more particularly to a special type of machine adapted for performing longitudinal drilling operations in rivets or the like.

The machine is specially designed for producing brass, aluminum or steel tubular rivets, having an elongated hollow shank portion and a suitable head, such as are very generally used for fuse plugs and for attaching brake linings to brake shoes, and like purposes.

The object of the invention is to simplify and generally improve upon the construction of rivet drilling machines of this class, by providing a rotatable station type carrier for receiving and supporting the rivet and whereby the work is conveyed in a circular, rather than a horizontal path, from the receiving station to the work station, and from the work station to an inspection station, and from the inspection station to an ejection station and further to provide a registering mechanism to determine whether or not the carrier has indexed correctly.

Further to provide an improved form of electric stop mechanism, whereby the operation of the machine is quickly stopped, should the carrier receive an imperfect rivet from the hopper and convey it to the drill and inspection stations. While these imperfect rivets are few, yet, they do appear occasionally, and in rare instances, good rivets receive an imperfect operation by the drill, should it become worn or broken, thereby producing an imperfect rivet which, when carried to the inspection station, causes the machine to stop.

A still further object of the invention is to provide connections with the foregoing registering mechanism with the electric stop mechanism, whereby the machine is automatically stopped, should the carrier, for any reason, fail to properly and completely index, so as to bring the series of rivets carried thereby into proper position for the drilling operation.

The machine includes a hopper in which the solid or undrilled rivets are placed and from which, by suitable automatic feeding mechanism, they are fed down through a race-way to a rotatable carrier that serves to receive them at a loading station and convey them to a work station where the operation of drilling out the shank of the rivet is performed.

This carrier is a station type of carrier and serves to convey the rivets predetermined distances with each successive operation of the carrier. After the drilling operation is completed the rivets are conveyed by the carrier, step by step, to the inspecting station, where means are employed to automatically stop the machine, if for any reason, the rivet may not have been drilled to the required depth, or if improperly drilled. In case there is no imperfect rivet to stop the machine, the carrier continues in its step by step rotary movement to carry the rivets to the ejection station where they are guided out of the pockets of the carrier and directed through a chute from the machine. Further operations of the carrier bring the respective pockets in line with a longitudinally movable mechanism, but which registers with the pocket in the carrier and determines whether or not the same has properly indexed, so as to bring the rivets to be drilled, in proper alignment with the rotatable drill and so that the hole to be drilled in the rivet will be positioned absolutely central and longitudinal thereof.

In the drawings accompanying and forming a part of the present specification, I have shown an embodiment of the invention such as will enable those skilled in the art, together with the accompanying description, to understand and practice the same, it being obvious that slight variations from the structure shown may be resorted to without departure from the spirit of the invention as defined by the claims following this description.

Fig. 1 shows a top plan view of my improved rivet drilling machine, the hopper being removed;

Fig. 2 is a side elevation of the machine as seen from the near side of Fig. 1;

Fig. 3 is an end view as seen from the right of Figs. 1 and 2;

Fig. 4 shows a sectional elevation taken on line 4—4 of Fig. 1 looking in the direction of the arrow;

Fig. 5 is an enlarged sectional elevation of the bearing bracket and its associated drill spindle, inspector and stop rod mechanism, shown in Fig. 1;

Fig. 6 is a horizontal longitudinal section, drawn on an enlarged scale, and taken on line 6 of Fig. 4; see also Fig. 1;

Fig. 7 shows an enlarged front elevation of the rotatable carrier and associated rivet holding parts;

Fig. 8 is an enlarged detached side view of the electrical contacting link means for connecting the eccentric and pawl and ratchet for indexing carrier; and

Fig. 9 is a detached plan view of a part of this link means.

Referring in detail to the characters of reference marked upon the drawings, 10 represents the legs of a table including a bed 11 having an elongated opening 12 therethrough, which serves, in part, to receive a sheet metal shield 13 whereby the chips from the drill are guided down through the bed into a receptacle, not shown. In this connection, it will also be seen that one end of a trough 14 is supported in an inclined position, on the shield and the edge of the base whereby the rivets, when discharged from the carrier, will be guided from the machine into a receptacle, not shown. The machine, as shown, is designed to be driven by a motor 15 that is positioned upon a shelf 16 supported by the legs 10, and is provided with a belt 17 that extends up through the opening 12 and around a pulley 18 mounted upon a spindle 19 that carries the drill 20.

A second belt 21 connects a pulley 22 on the other end of the motor shaft with a cone pulley 23 for driving the principal parts of the machine, said pulley 23 being mounted on a shaft 24 journaled in the housing 25 enclosing suitable gearing through which a sleeve 26 is operated and which carries a clutch member 27 that is engaged by a movable clutch member 28 mounted on a transverse shaft 29, whereby the said shaft 29 may be operatively connected with and disconnected from the driven sleeve. Shaft 29 is journaled in bearings of suitable brackets secured to the bed. A balance wheel 30 is secured on one end of this shaft and a beveled pinion 31 upon the other end and a cam 32 intermediate the wheel and pinion. The clutch 28 is adapted to be automatically disengaged through the operation of an arm 33 that is hingedly supported as at 34 to a bracket secured to the bed, see Fig. 2, and is provided with a yoke 35 that engages an annular groove of the movable clutch 28. One end of a latch 36 is hingedly supported as at 37 to a link 38 mounted on a post secured to the bed of the machine, and the other end is connected through a link 39 with the stem of a solenoid 40 supported on a bracket 41 secured to the base and connected by wires 42 and 43 to an electric push button type of switch 44 of the inspecting and index registering mechanism, which will later be described and whereby the clutch is automatically operated and the machine stopped, with the presentation of an imperfect rivet at the inspecting station, or the failure of the carrier 45 to properly index.

The beveled pinion 31 meshes with and drives a similar beveled gear 46 mounted upon a longitudinal shaft 47 journaled in bearings 48 secured to the bed. This shaft carries cams 49, 50 and 51, a pulley 52, and an eccentric 53 each for operating different mechanisms of the machine, as will later be described.

The rivet carrier 45, see Figs. 4 and 6, is disklike and substantially round in form, and includes a series of pockets 54 in its peripheral portion to receive the shanks of the rivets 55. The carrier is further provided with a central hole to receive the hub 56 on the front side of the head 57 of a rotatable spindle 58 that is journaled in a bracket 59 secured to the bed of the machine by screw bolts 60. A plate 61 and a screw 62 serve to clamp the carrier to said head in a way to assure the turning of the carrier with the head and spindle.

A flanged sleeve 63, see Fig. 6, is secured to the bracket 59 and serves to enclose the head of the spindle and form an annular smooth side face, in spaced relation to the rear surface of the carrier, against which the flat head of the rivets are slid by the movement of the carrier from one station to another, there being a pocket 64 thus formed for the head of the rivet, between the said annular face and the back of the carrier.

A circular guide plate 65 is secured to the lower and front side portion of the face of the flange of the fixed sleeve by means of screws 66. The thickness of this circular plate is such as to insure the front face thereof finishing flush with the outer annular face of the carrier, whereby an annular recess is formed in the under or attached side to accommodate the head of the rivet which is moved through the space 64 by the rotary movements of the carrier. The carrier spindle is provided with means for imparting thereto, step by step, rotary movements, which means comprises, in part, a ratchet mechanism and holding device which will next be described.

A collar 67 is secured to the threaded portion 68 of the spindle in a way to hold the latter against longitudinal movement. A stop wheel 69 is adjustably secured on a re-

duced end portion of the spindle adjacent the collar and is provided with a lug 70 that is adjustably positioned in an opening 71 of a spider 72 which is positioned beside the said stop wheel and secured to the reduced end of the spindle by a pin 73. Adjusting screws 74 are mounted in aligned holes in one of the arms of the spider with their inner ends in engagement with opposite sides of the lug 70 of the stop wheel, so that by the adjustment of the set screws, the stop wheel may be rotatably adjusted upon the spindle, and at the same time be secured thereto, after which it is locked in said adjustment by the clamping screws 75, which are loosely mounted in the remaining three arms of the spider and in threadable engagement with said stop wheel. This fine adjustment is obviously important, since it serves to insure the proper alignment of the pockets and rivets carried therein with the axis of the spindle and drill carried thereby. This stop wheel is provided with a series of pockets that are engaged by a locking bolt 76 slidably mounted in a post 77 of a bracket 78 attached to the bed. This bolt is operated by the cam 51 upon the shaft 47 through a bell crank lever 79 hingedly supported as at 80 to the said post 77 and carries a roller 81 that is normally held in engagement with the said cam 51 by means of a spring 82. This cam and mechanism is so constructed and timed as to insure the insertion and withdrawal of the locking bolt 76 with the pockets of the wheel as to lock and release the same at proper intervals to hold the carrier and rivet in proper position at the respective operating stations, and to permit of its free movement between said operations.

A rocker arm 83 is operatively mounted to swing on the outer reduced end portion of the spindle, see Figs. 1 and 3, and 6 and carries a spring actuated pawl 84 upon one of its branches for engagement with the teeth of the ratchet wheel 85. One end of a special form of link mechanism, see Figs. 1 and 3, is connected to the upwardly extended branch of this rocker arm, for operating the same against the action of a spring 86, that connects the pawl branch of the arm with a fixed post, carrying an adjustable stop screw for the rocker arm.

This link mechanism, see Figs. 8 and 9, is of a compressible character and includes an electric contacting device that is adapted to be operated under unusual conditions, through the lengthening of the link for the automatic stoppage of the machine through a solenoid operated clutch mechanism, before referred to and which is also adapted to be operated from other sources. The other end of this link mechanism is connected to be operated by the before mentioned eccentric 53 and includes a member 87 that is adjustably connected with a member 88 connected with the before mentioned rocker arm 83. This member 87 includes a tapped longitudinal hole to receive the threaded end of a rod 89 and upon which a lock nut 90 is also mounted. The other end portion of this rod is positioned for slidable movement in a tubular member 91 that is threadably connected to the before mentioned member 88. A spring 92 is mounted upon the rod 89 within the tubular member 91 and between the headed end of said rod and the end of said tubular member, so as to normally tend to draw the rod into the tubular member and thus provide a yieldable connection as between them and the eccentric and ratchet arm, in a way to normally retain them at a maximum distance apart, but adapted under sufficient resistance of the operated end 88 or its connected parts, to be compressed. By compressed, I mean that the two ends 87 and 88 are moved out with relation to each other against the compressed resistance of the spring 92. This unusual and independent movement of the two end portions with respect to each other, serves to provide means for contacting the electric switch 93 that is supported in a bracket 94 carried by the before mentioned tube 91, the bracket being projected downward from the tube to support a switch carried between the bifurcated members 95 of an arm 96 secured to the before mentioned rod 89. The wires *a* and *b* are connected to one end of the switch opposite its push button 97. This push button is aligned with a spring actuated operating plunger 98 secured as by means of a nut 99 to the connected ends of the members 95. It will thus be seen that a relative outward movement of the members 89 and 91 with respect to each other will bring the free end of the plunger 98 into engagement with the push button 97, in a way to operate the latter and thus cause the operation of the solenoid and connecting mechanism for operating the clutch 28 before mentioned, for the purpose of promptly stopping the machine without damaging any if its mechanism.

As will be seen from Fig. 4, the rivets are loaded into the pockets of the carrier as the pockets reach their uppermost position referred to as the loading station A, and are carried step by step until arriving around on the right side, designated as the operating or drilling station B, which may be on a horizontal plane with the axis of the carrier and in alignment with the axis of the drill carried by the drill spindle and whereby the drilling operation is performed in the shank of the rivet. C represents the inspecting station, D the registering station, where it is determined whether or not the carrier has indexed properly, and E is the ejection station. The rivets are contained

in a hopper 100 which includes mechanism, not shown, but operated through the belt 99 from the before mentioned pulley 52, for picking up and placing them in the race-way 101 that guides them to the pockets of the carrier. This hopper mechanism may be of any usual or preferred construction and does not necessarily form a material part of this invention. It is sufficient perhaps to say that the hopper is positioned, as shown, above the carrier upon a suitable bracket 102 which in turn is secured upon the before mentioned bearing bracket 59 and and is operated from the pulley 52 on shaft 47. The race-way is T-shaped, in cross section, and wherein the heads and shank portions of the rivets are guided down by gravity with their ends projected from the T-slot, so that when the carrier is indexed and a vacant pocket is brought to register with the end of the T-slot, a single rivet will pass from the slot into the pocket, preparatory to being carried to the right, as shown in Fig. 4, to the operating station.

At the operating station I provide means for clamping the rivet radially with respect to the axis of the carrier so as to hold it down tight in the pocket during the drilling operation in a way to insure proper positioning of the rivet and centering of the hole to be formed therein. This is accomplished by a die 103 which is secured to a block 104 that is mounted for limited slidable movement in an arm 105 secured to the bearing bracket 59. This arm further includes a pocket 106 in which a spring 107 is positioned as between the end of the pocket and a pin 108 secured in the block, the purpose of said spring obviously being to normally hold the block and its die in an outer-most position in a way to free the rivet. A screw carried by the arm 105 serves to operate an adjustable stop also mounted in the arm for the block and die to limit its outward movement. The inward or clamping movement of the block and die, which movement is against the action of the spring 107, is effected by a lever 109 which is hingedly supported as at 110 in a bracket secured to the bed. This lever 109 is provided in its upper end with an adjusting screw and is connected by a link 112 with a cam actuated lever 113 that is hingedly supported as at 114 and carries a roller 115 upon its upper end that rides upon the before mentioned cam 49 for the operation of the said lever 109 and the die connected therewith. A conical shaped chip guard 116 surrounds the operating station and is secured to the before mentioned arm 105 by means of screws 117 and has a central opening therein which aligns with the rivet to be operated upon by the drill. The opening through the small end of the cone of the plate is of a diameter substantially the same as that of the diameter of the shank of the rivet and the end of this cone is positioned in close proximity to the surface of the carrier and the annular end portion of the rivet so as to receive all the chips from the drill and convey them out away from the working parts of the machine and guide them down into the shield 13 before mentioned, so that they will not interfere with the operation of the machine.

Means is also provided at the operating station for clamping the head of the rivet preparatory to and during the drilling operation so as to firmly hold the rivet. This means includes a holder 120 that is mounted in an adjustable reciprocatory slide 118, and is adapted to be removed and other holders having different shaped heads substituted. This slide 118 is mounted in a way 119 on the side of the bracket 59, and has a forwardly projected round end portion that is fitted to slide in a hole 121 in the flange of said sleeve. A lug 122 upon the slide is engaged by an adjustable screw carried in the short end of a cam lever 123 pivoted at 124 and is actuated by the cam 50 on shaft 47 against the action of a spring 125. A pin 126 carried by the slide extends through a slot in the way 119 and serves to engage an adjustable screw stop 127 mounted in a boss 128 formed on the top side of the way. The purpose of this adjustable stop is to limit the retractive movement of the slide as produced by the spring 125. One end of the before mentioned spring 125 is secured to a pin 129 carried by the slide and extending through a slot of the way and the other end is secured to a stationary pin 130 secured to the way, so that the action of the spring will tend to hold the slide back against the arm 123 and its cam.

131 represents a bracket that is adjustably secured to the top side of the bed, being provided with angle plates 132 and 133 that are secured to the bed by means of screws 134. A longitudinal adjustable gib 135 is positioned between the said angle plate 133 and the edge of the base of the bracket which is secured at opposite sides to the said plates by means of screws 136. The hole in the base, through which the screws pass is somewhat larger than the diameter of the screws 136, so as to allow for slight sidewise and longitudinal movement of the bracket with respect to the fixed angle plates, so as to properly align the drill with the rivets at the working station. A screw 137 is positioned in the angle plate 132 and abuts against the edge of the base of the bracket 131 in opposite relation to the gib 135 so that the bracket may be more readily adjusted, by the turning of the screw, when the gib is moved out by its adjusting screw 138. This bracket is provided with three pairs of aligned bearings 139, 140 and 141, the first mentioned pair serving to accommodate a

reciprocatory sleeve 142 having a central hole therethrough to receive and form a bearing for the drill spindle 19 upon which the pulley 18 is mounted. This reciprocatory bearing includes an annular groove 143 that serves to receive the aligned rollers of the forked arm 144 that is pivotally supported upon a pin 145 mounted in the bracket 131 and has its lower end portion extended down through the opening in the bed. The lower end portion of this arm is provided with a slot for the adjustable attachment of an adjustable link 146 that connects this arm with a somewhat similar arm 147 that extends up through the opening in the bed and is pivotally hung at 148 and provided with a roller 149 that operates in a groove in the side of the before mentioned cam 32 whereby the said parts are operated in a way to reciprocate the said bearing sleeve 142 to move the rotating drill to and from the work supported in the carrier, as will later be described.

A bracket 150 is secured upon the end of the bearing sleeve by means of a set screw 151 and includes a forwardly disposed end portion in which is provided an upper and lower hole 152 and 153 respectively, that align with the before mentioned bearings 140 and 141 in the bracket 131. This bracket 150 also includes arms 154 and 155, the forwardly disposed end of the former of which includes a hole 156 that aligns with the hole 152 while the lower arm 155 is provided with a similar hole 157 that aligns with the before mentioned hole 153. The hole 153 in the bracket 150 serves to receive the end portion of an inspector rod 158 that is slidably mounted in the said aligned bearings 141 and which carries a depth pin 159 on its forward end, there being a spring 160 positioned on the rod intermediate of one of the said bearings and a collar 161 secured to the rod, for yieldably supporting the same in a forwardly extended position. This rod is normally carried with the bracket 150. The end portion of this rod 158 extends through the hole 153 and is threaded to receive an adjustable nut 162 seated against the side of the bracket 150. This end portion of the rod includes a longitudinal hole 163 in which a spring 164 is positioned in a way to receive one end portion of a pin 165 that abuts against the shoulder of an enlargement 166 of said pin, the tendency of the spring being to retain the end of the pin in engagement with the button 167 of an electric switch 168 seated in the hole 153 of the lower arm of the bracket 150. A cap 169 serves to enclose the end of the hollow rod 158 as shown in the drawings. In this connection, it will be noted that the before mentioned wires 42 and 43 from the solenoid are connected with this switch 168.

Therefore, it will be apparent that when the spindle sleeve 142 and the bracket 150 move forward in the performance of a drilling operation, the rod 158 and its depth pin 159 are also carried forward in alignment with the drilled hole in the rivet, if any, but if there is no such hole in the rivet or if, the hole is not of proper depth, the movement of the rod will be retarded against the action of the spring 164 and the pin 165 will serve to operate the push button 167 to operate the switch and close the circuit causing the solenoid to release the arm 33 to disengage the clutch 28 in a way to stop the machine.

A tubular stop rod 170 is mounted to slide in the aligned bearings 140 of the bracket 131 and is connected in the hole 152 of the bracket 150 for reciprocatory movement. A spring actuated pin 171 extends through the tubular rod and is provided with a collar 172 against which one end of a spring 173 is positioned, while the other end abuts against the end of the tubular rod, the tendency of the spring being to retain the rod in a forward position with respect to the tubular stop rod but to allow the pin to recede back through the tubular rod, should its forward end become engaged. A collar 174 positioned upon the pin serves to limit its forward movement and determine its normal position. Under normal operative conditions the forward end of the pin enters the pockets 54 of the rotary carrier as they come forward in line therewith, but if for any reason the carrier does not properly index, and the pockets do not register with the end of the rod, then the end of the pin 170 will abut against the face of the carrier in a manner to cause longitudinal movement of the pin against the action of the spring 173 and in a way to also cause the opposite end of the pin to push in the push button of switch 44 which is also connected to the wires 42 and 43 and the solenoid in a manner to operate the same and stop the machine.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a rivet drilling machine of the class described, the combination of a rotatable carrier having a series of pockets in its peripheral edge portion, means for imparting step-by-step rotary movement to said carrier, comprising a rotatable spindle upon which the carrier is mounted, a stop wheel mounted upon the spindle, means for engagement with the wheel to lock it and the carrier in properly indexed positions, a pawl and ratchet wheel mounted on the spindle, means for adjusting the ratchet wheel upon the spindle, a solenoid, an eccentric and yieldable link connected for operating the pawl and ratchet, said link connection in-

cluding contacting means, means whereby incomplete indexing operations of the carrier and the locking device will operate the solenoid to stop the machine.

2. In a rivet drilling machine the combination with a hopper feed means, of a rotatable carrier having a series of pockets in its edge portions to receive rivets from the hopper feed, means for imparting step-by-step rotary movements to the carrier, said carrier having a loading station, a work station, an inspection station, an ejection station, and a station at which proper indexing of the carrier is determined, a longitudinally movable spindle bearing, a spindle and drill carried thereby for operating upon rivets while at the loading station, an inspection device also carried by the spindle bearing adapted to operate to and from the carrier and in line with a hole in a rivet, means also carried thereby for forming an electric contact in case said inspecting means fails to enter a rivet, a solenoid, and means connected with and operated by said inspecting electric contacting means for automatically stopping the machine if an imperfect rivet is brought to the inspection station.

3. In a rivet drilling machine, the combination with a hopper feed means, of a rotatable carrier having a series of pockets in its edge portion to receive rivets from the hopper, means for imparting step-by-step rotary movements to the carrier, said carrier having a loading station, a work station, an inspection station, a discharge station and a station at which proper indexing of the carrier is determined, a longitudinally movable rotatable spindle and drill for operating upon rivets while at the loading station, an inspection device in alignment with a station position of the hole in the rivets while in the carrier, electrical contacting means operated by said inspecting device for stopping the machine upon the presentation of an imperfect rivet at said inspecting station, means for automatically discharging the completed rivets from the carrier at the discharge station, means for determining improper registering movements of the carrier, and electrical means to stop the machine in case the carrier fails to properly index.

4. In a rivet drilling machine of the class described, the combination with a hopper feed means, of a rotatable carrier having a series of pockets in its peripheral edge portion to receive rivets from the hopper feed while at a loading station, means for imparting step-by-step rotary movement to said carrier comprising a rotatable spindle upon which the carrier is mounted, a stop wheel mounted upon the spindle, means to engage the wheel to lock it and the carrier in properly indexed positions, a pawl and ratchet wheel mounted on the spindle, means for adjusting the ratchet wheel upon the spindle, a solenoid, an eccentric and yieldable link connected for operating the pawl and ratchet, said link connection including contacting means whereby incomplete indexing operations of the carrier and the locking device will operate the solenoid to stop the machine, a longitudinally movable rotatable spindle and drill for operating upon rivets while at the work station of the carrier, an inspecting device positioned at another station of the carrier, rivet discharging means located at the fourth station of the carrier, and means for determining the proper registration of the carrier.

5. In a rivet drilling machine, the combination of a hopper feed means, of a rotatable carrier having a series of pockets in its edge portion to receive rivets from the hopper feed, means for imparting step-by-step rotary movement to the carrier, said carrier having a loading station, a work station, an inspection station, a discharge station, and a station at which proper indexing of the carrier is determined, a longitudinally movable rotatable spindle, a rotatable drill spindle at the loading station mounted for right angle longitudinal movement with respect to the face of the carrier to perform drilling operations in the rivet carried thereby, an inspection device also operatable at a right angle to the face of the carrier and adapted to determine the depth of the holes in the rivets, means for discharging the rivets at the discharge station, means also operating at a right angle to the face of the carrier for determining the proper registering movement of the carrier, an electric stop means connected with both the inspecting device and the means for determining the proper registering movement of the carrier whereby the machine is caused to stop if an imperfect rivet is presented for inspection or if the carrier fails to properly index.

Signed at Bridgeport in the county of Fairfield and State of Connecticut this 14th day of March, A. D. 1931.

BARTHOLOMEW J. CONLON.