Aug. 26, 1952 E. C. TAYLOR ET AL 2,608,317

BASE ASSEMBLING APPARATUS

Filed April 21, 1949 4 Sheets-Sheet 1

Fig. 1.

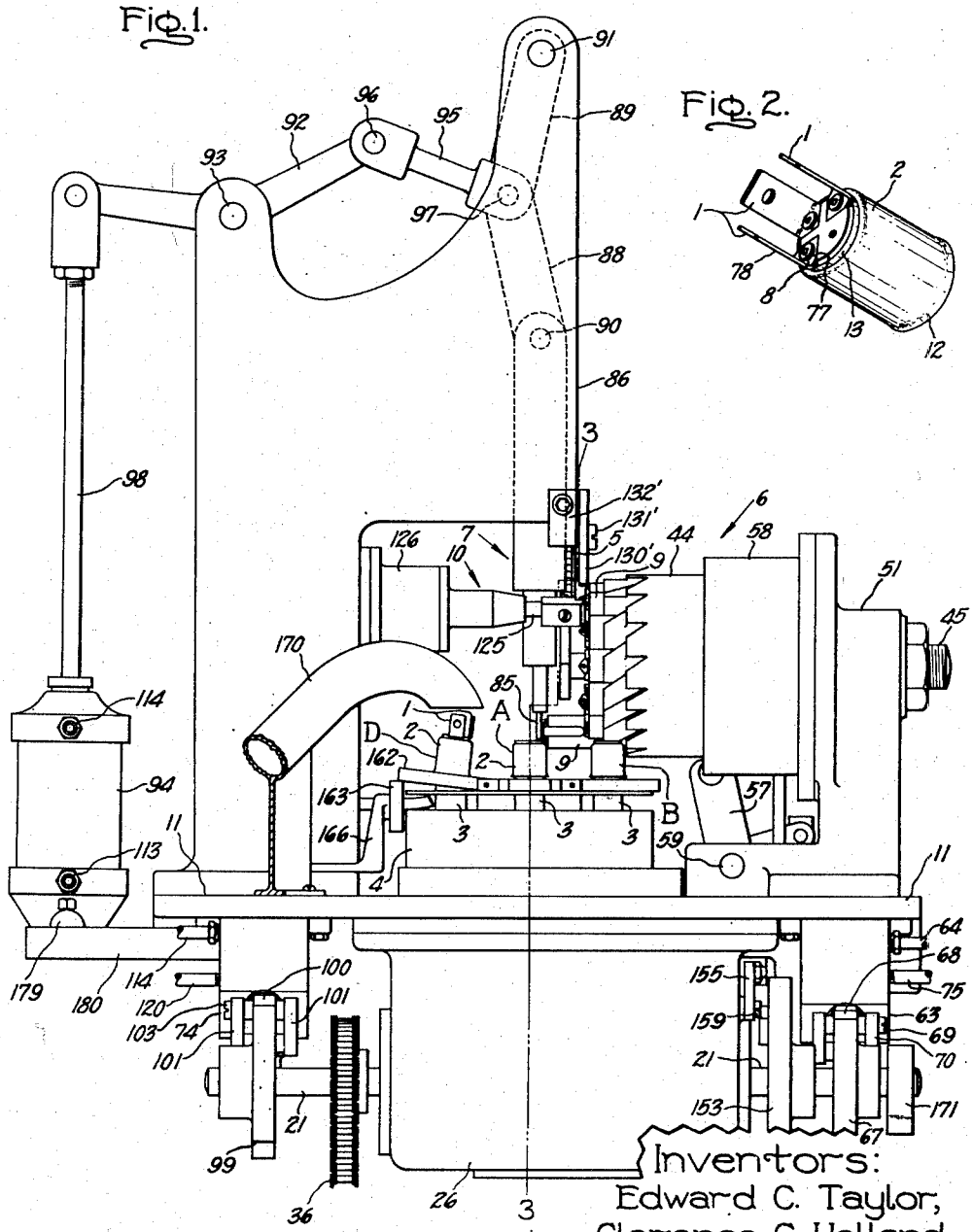

Fig. 2.

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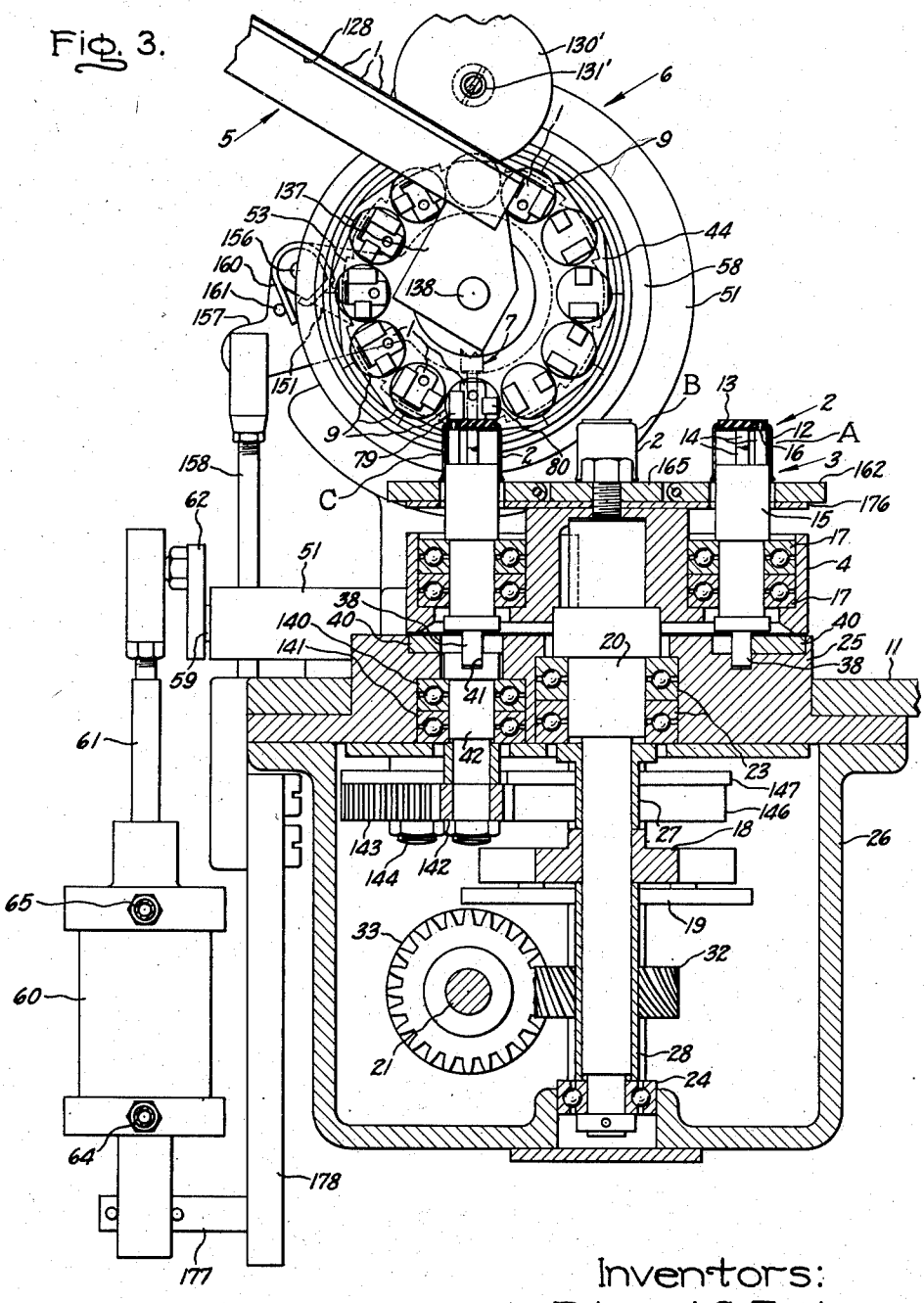
Fig. 3.



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BASE ASSEMBLING APPARATUS

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Fig. 4.

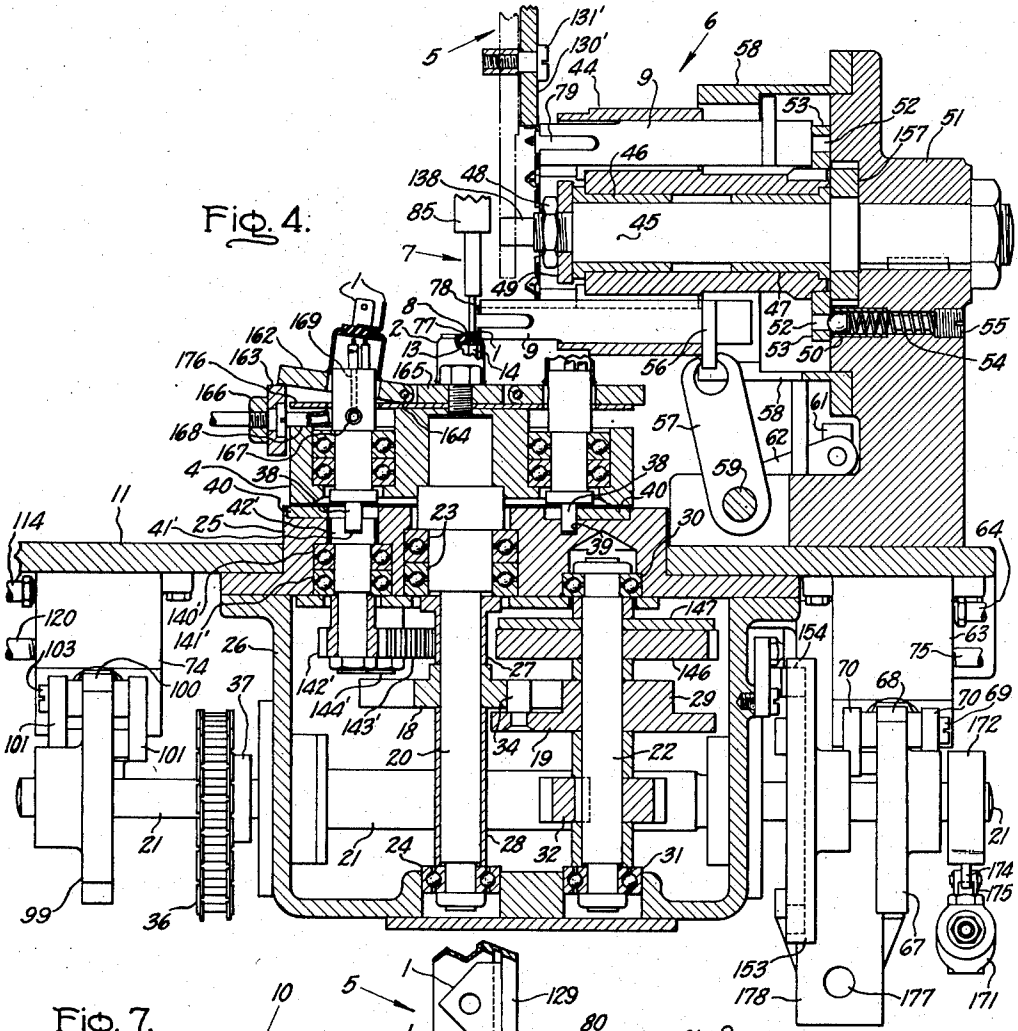


Fig. 7.

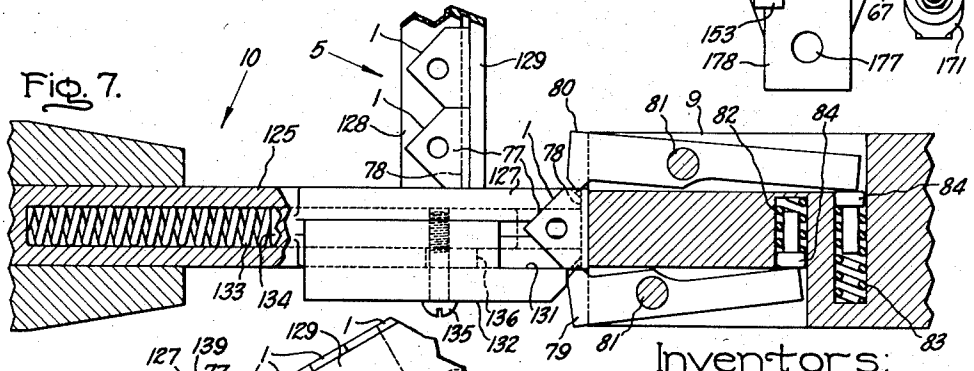
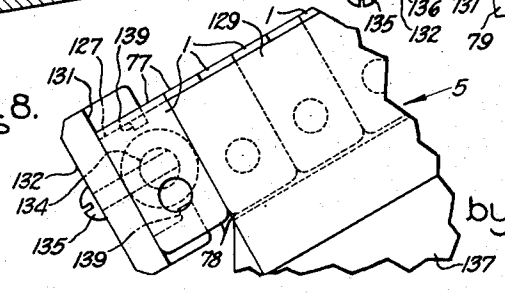


Fig. 8.



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BASE ASSEMBLING APPARATUS

Filed April 21, 1949 4 Sheets-Sheet 4

Fig. 5.

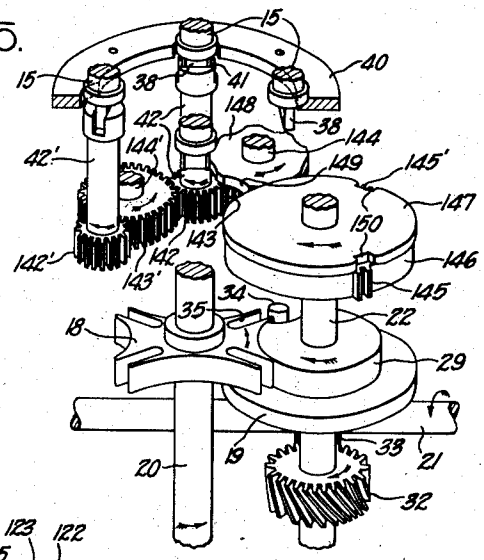


Fig. 6.

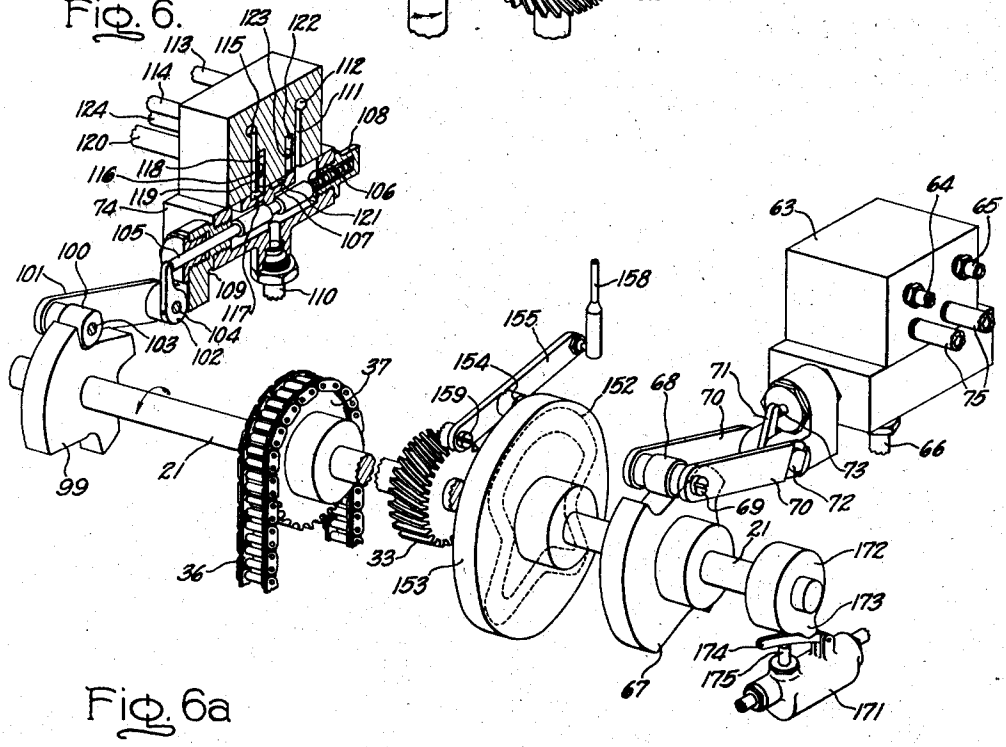
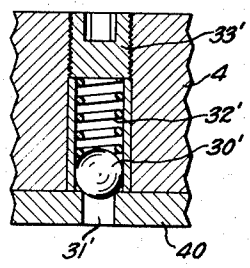


Fig. 6a



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2,608,317

UNITED STATES PATENT OFFICE

2,608,317

BASE ASSEMBLING APPARATUS

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Application April 21, 1949, Serial No. 88,812

7 Claims. (Cl. 218—1)

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Our invention relates to apparatus for automatically riveting contacts to lamp or radio tube bases and the like. More particularly our invention relates to automatically operated apparatus for riveting a plurality of metal contacts at respective positions to the insulation button at one end of such bases.

One object of our invention is to provide automatically operated apparatus for effecting the attachment of a plurality of prong-shaped contacts to the insulation button at the end of lamp and radio tube bases. A further object is to reduce the manual skill required for the assembly of these parts and increase the uniformity and quality of the base and contact assembly over that produced through manual operations. Our apparatus is less fatiguing to operate than other manually actuated means and greatly reduces the cost of the assembly operation, much increased speed and efficiency are also realized by the use of the automatic apparatus.

Another object of our invention is to provide apparatus for automatically presenting bases at operative relation to riveting apparatus, for advancing contacts from feeding means to a position in operative relation to said riveting apparatus and for periodically indexing the base to present adjacent portions thereof at said operative position and effect the attachment of a contact to each of said portions. A further object of our invention is to provide apparatus for the above-referred to operations which is of the utmost practicability and which is capable of operating satisfactorily for extended periods in the manufacture of large numbers of bases.

Still other objects and advantages of our apparatus will appear from the following detailed description of a species thereof and from the accompanying drawing.

In the drawing, Fig. 1 is a front elevation of one species of apparatus comprising our invention; Fig. 2 is a perspective view of a complete lamp base after attachment of the base contacts by our apparatus; Fig. 3 is a vertical transverse section through the center of the apparatus along line 3—3 of Fig. 1 showing the right hand portion thereof; Fig. 4 is a composite vertical section through the base advancing turret, the driving means therefor and the contact placing means of the apparatus with the adjoining back of the apparatus appearing in elevation; Fig. 5 is a perspective view of the essential driving elements of the base advancing turret and the base supporting arbor; Fig. 6 is an expanded perspective view of the main drive shaft and the cams

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and other control means associated with the base advancing turret, one of the control valves being shown in section; Fig. 6A is fragmentary section through a peripheral portion of the work holding turret showing the positioning means therefor; Fig. 7 is a plan view on a large scale of the adjacent ends of the feed chute, the transferring plunger, and a placing plunger; and Fig. 8 is a side elevation, also on a large scale of the ends of the feed chute and the transfer plunger.

The apparatus shown in the drawing provides for the attachment of three L-shaped base prongs or contacts 1 to a base assembly 2 in the course of the movement of said base assembly 2 through the four work stations A, B, C, and D of said apparatus. The various operations effecting the attachment are brought about automatically and are under the visual supervision of a machine attendant, seated opposite work station A, who initiates the cycle of operation by placing a base assembly 2 on a work supporting head 3 of the apparatus presented at said work station A. Successive movements of the work supporting head 3, which is one of four such heads mounted at 90 degree intervals about a rotatable turret 4, advance the base assembly 2 to the other work stations B, C, and D in turn and then return the head 3 to station A where it is again in a position to start a succeeding cycle of operation.

Of these work stations, station A is made use of by the machine attendant in inserting the base assembly 2 into the apparatus, and station B is an idle station also usable for loading, if desired.

Work station C is used to effect the successive arrangement and riveting of each of the three base prongs or contacts 1 (Fig. 2) to the base assembly 2, and in that connection has located adjacent thereto the discharge end of the feeding means 5 (only partially shown, Figs. 1, 3, and 4) presenting said contacts 1 in a correspondingly orientated position. Also located adjacent station C is the placing means 6 for carrying the contacts 1 from a position adjacent the feeding means 5 to proper mounting relation to the base assembly 2 and the riveting means 7 for feeding and driving tubular rivets 8 through aligned openings in said contacts 1 and said base assembly 2. Each contact 1 is handled independently and follows a course of movement wherein it is carried from the feeding means 5 to one of the plungers 9 of the placing means 6 by operations of the transferring means 10 at the same time as another contact 1, held by another plunger 9 of the placing means 6, is being advanced to mount-

ing relation to the base assembly 2 at station C. After the initial contact is attached to the base assembly 2 at station C, a rotative indexing movement occurs in the head 3 at said station C whereby a second portion of said base assembly 2 is arranged at operative relation to the placing and riveting means 6 and 7, respectively, so that the second contact 1 is fastened to the base assembly 2 at a spaced relation to the first contact 1. The index movement of the head 3 at station C again occurs after the second contact 1 is attached so that the third contact 1 is attached to the base assembly 2 at still another position. The various operations of the placing means 6, the riveting means 7 and the transferring means 10 are brought about in properly timed relation to the indexing movements of the head 3 and the turret 4 by common driving and control means located below the supporting table 11 for all of the apparatus.

At station D, the last in the cycle of operation, the completed base is loosened from the head 3 by being forced upward mechanically and is then blown therefrom by a jet of air directed out through the top of said head 3.

Now to the details of the apparatus, and the course of manufacture which is initiated by the insertion of the base assembly 2 comprised of the cylindrical base shell 12 (Figs. 2 and 3) and the integral end button 13 of insulation material. The machine attendant places the base assembly 2 upon the work supporting head 3 located at station A, as shown in Fig. 3, by moving and orienting said base assembly 2 so that the open end thereof passes over the three upstanding rivet sets 14 and the set-supporting arbor 15, and the ends of said rivet sets 14 pass into three correspondingly spaced openings in the end button 13 of said base assembly 2. At the limit of the inserting motion, the inner surface of the button 13 rests upon the shoulders 16 on the rivet sets 14 and the lower rim of the base shell 12 is spaced from all supporting surfaces. No further operations take place at station A.

The next occurring operation in the cycle is an indexing movement of the turret 4 which advances the head 3 and the base assembly 2 to station B and which is brought about automatically at a fixed moment by means of a left-to-right movement of said turret 4. The head 3, as represented by the arbor 15, is supported by bearings 17—17 retained by the turret 4 and is advanced in accord with the design of the Geneva wheel and gear 18 and 19 (Figs. 3, 4, and 5) which convert the constant motion of the driving means to intermittent motion required. Other directly associated means comprises vertical supporting spindle 20 joining the Geneva wheel 18 and the turret 4, and the main drive shaft 21 which actuates the adjacent vertical auxiliary drive shaft 22 supporting Geneva gear 19. The support spindle 20, which is journalled in the bearings 23 and 24 retained by the base 25 and the housing 26, respectively, is attached to the Geneva wheel 18, which is located between the spacing sleeves 27 and 28 thereon, and is positioned throughout the operation cycle by the shape of the portion of the Geneva gear 19 in engagement with said wheel 18. At such times as the turret 4 and the head 3 are at rest, a circular portion 29 of the Geneva gear 19 is in engagement with a concave portion of the Geneva wheel 18 and no movement can occur in said turret 4 and head 3, although the auxiliary drive shaft 22 is in constant rotation. The indexing motion occurs when the auxiliary drive shaft 22, which is journalled in the bearings 30 and 31 in the base 25 and the drive housing 26, respectively, and which is driven from the main drive shaft 21 through spiral gears 32 and 33, is turned to such an extent that the stud 34 of the Geneva gear 19 enters one of the radial slots 35 in the Geneva wheel 18 and turns said wheel 18. At such times, recesses in the edge of the gear 19 adjacent the stud 34 provide clearance for the protruding portions of the wheel 18 on opposite sides of the slot 35. This arrangement of means provides for a relatively long rest period and a short indexing movement in the head 3 during each revolution of the auxiliary and main drive shafts 21 and 22 and provides for the repetition of said rest periods and indexing movements at regularly occuring intervals. Further assurance of the accurate arrangement of the head 3 at each of the work stations is provided by the engagement of a ball 30' (Fig. 6A) carried by the turret 4 with suitably positioned openings 31' in the ring 40 attached to the bed 25 of the apparatus. The ball 30' is located within an opening in the turret 4 between two of the heads 3 thereon and is pressed against the ring 40 by the expansion force of the helical spring 32' located between it and safety set screw 33'. The main drive shaft 21 is driven from a constantly operated source, such as an electric motor and speed reducer through the chain 36 and the sprocket 37. Further control over the position of the turret 4 is provided by the engagement of the spring pressed ball with openings in the plate at the rest positions of the turret 4.

During indexing intervals and all other periods of operation of the apparatus, a control is effected over the orientation of the base assembly 2 by means fixing the rotative position of the arbor 15 of the head 3. At the time the base assembly 2 is at station A and in the directly succeeding course of movement of the head 3, the arbor 15 is caused to remain at the same position within the turret 4 by the presence of a flat tongue 38 on the lower end thereof in a groove 39 in the base 25 directly along said course of movement. Other means for holding the arbor 15 in position is provided by the ring-shaped insert 40 in the upper surface of the base 25 which bears against the outer face of the tongue 38 at such times and which presents a wear-resistant surface for the outer face of the groove 39.

Arrangement of the head 3 at work station B is not instrumental in advancing the manufacturing operation of the apparatus, as work station B is an idle station and no work is done on the base assembly 2 thereat. After the rest period of the turret 4 expires, the head 3 is advanced to station C in the manner of the previously described movement of the index of said turret 4.

The movement of the head 3 into station C advances the lower end of the arbor 15 into operative relation to other means for controlling the rotative position thereof and arranges the base assembly 2 carried by the head 3 at a definite relation to the various means having to do with the feeding and riveting of the contacts 1 thereto. The presently considered means for orientating the arbor 15 becomes effective when the tongue 38 on the lower end of the arbor 15 passes into the transverse slot 41 (Figs. 3 and 5) in the upper end of the spindle 42 which occupies an opening in the insert 40 and the bed 25 at work station C and is presently concerned only with the extension of the time said head 3 remains at the initially taken position in the turret

4. The base assembly 2 is, at such times, held so that one opening in the end button 13 thereof and the associated riveting set 14 lies directly opposite the contact placing means 6 and the other openings and associated rivet sets 14 lie at 90 degree intervals in a counter-clockwise direction therefrom.

The next occurring operation of the apparatus is an operation of the contact placing means 6 which is actuated immediately upon arrangement of the base assembly 2 and the head 3 at station C. Actuation of the placing means 6 results in the placing plunger 9 directly opposite said head 3 being advanced toward the base assembly 2, and the base contact 1 carried thereby being positioned at mounting relation to said base assembly 2. As shown particularly in Figs. 3 and 4, the placing means 6 comprises a plurality of such plungers 9 which are arranged about the edge of the turret or drum 44 at positions permitting an interchange of the plungers 9 opposite the head 3 by rotative movements of said turret 44 about the support spindle 45 and at any one moment are only adapted to advance the single contact 1 held by placing plunger 9 opposite said head 3. The placing means 6 is supported through the turret 44 which provides bushing-type bearings 46 and 47 for engagement with the stationary support spindle 45 which is held in place thereon by the nut 48 and washer 49 on the end of said spindle 45. The rotative positive of the turret 44 determines the alignment of the plungers 9 with the head 3 at station C and is presently under the control of the engagement of the spring-pressed ball 50, which is retained by the stationary support standard 51 for spindle 45, with an opening 52 in the disc 53, which is keyed to the inner end of said turret 44. Corresponding openings 52 in the disc 53 permit the turret 44 to hold each of the plungers 9 opposite the head 3 in the course of the operation of the apparatus. The pressure of engagement of the ball 50 is sufficiently great to fix the alignment of the plunger 9 accurately with the head 3 inasmuch as said ball 50 is backed by the relatively strong helical spring 54 behind the plug 55 in the opening in the standard 51. The end-wise longitudinal advance of the placing plunger 9 to operative relation to the head 3 is brought about by means engaging the lateral flange 56 on the end of the plunger 9 near the standard 51 and moves said plunger 9 from a retracted position, where said end butts against the face of the disc 53, to the extended position shown where said flange 56 butts against the adjacent shoulder of the turret 44. In effecting this lineal displacement of the plunger 9, the arm 57, which extends through a slot in the shield 58 to engagement with the flange 56, is swung to one side by the rotation of the lay shaft 59 journalled in the base of the standard 51, and is under the influence of the entrance of compressed air behind the piston (not shown) within the cylinder 60 (Fig. 3), which piston is connected to shaft 59 through rod 61 and arm 62. Control over the above operation is afforded by the valve 63 (Figs. 1 and 6) which is connected to the head and base ends of the cylinder 60 by the pipes 64 and 65 (only partially shown) and the main air supply through pipe 66, and which is actuated by the rotation of variations in the cam 67 into engagement with the roller 68 of operating means therefor during the course of the rotation of the drive shaft 21. The other elements of the operating means comprises the pin 69 joining two corresponding operating arms 70, the triggering arm 71 lying between and attached by pivot pin 72 to said operating arms 70 and the control pin 73. Further details of the valve 63, which is a purchased commercial product, can be deduced by reference to the corresponding valve 74 in Fig. 6 and indicate the manner by which compressed air is directed to one end of the cylinder 60 while the opposite end is vented to an exhaust flue through a pipe 75 on the side of valve 63.

The advancing movement of the placing plunger 9 directs the pointed foot 77 (Fig. 2) of the base contact 1 into a correspondingly shaped recess in the crown of the end button 13 of the base assembly 2, which crown is located above the rim of the shell 12, and when complete holds the contact 1 so that the end of said foot 77 butts against the walls of said recess. The accuracy of the advance of the contact 1 is in part due to the definite position of said contact 1 on the plunger 9. This arrangement of the contact 1 is caused by the seating of the angular prong portion 78 thereof against the end of the placing plunger 9 and the definite orientation thereof by the closing action of the relatively broad faces of the jaws 79 and 80 on the plunger 9. As shown in the enlarged section of the end of the plunger 9 in Fig. 7, the wedge form of the ends of the jaws 79 and 80, which are located on pivot pins 81 within longitudinal recesses in the sides of the plunger 9, press the prong portion 78 against the end of plunger 9 by their closing action which is effected by the expansion force of the helical springs 82 and 83 engaging said jaws 79 and 80 through the push pins 84.

The order of operation of the apparatus next brings about the riveting operation by which the base contact 1 is fastened to the base assembly 2 and effects this operation by causing the punch 85 of the press 86 to force a tubular rivet 8 (Fig. 4) down through aligned openings in the foot 77 of the base contact 1 and the end button 13 of the base assembly 2. The press 86 and associated rivet-feeding means (not shown) make up the riveting means 7 of the aparatus and function in combination with the rivet sets 14 of the head 3. The riveting operation is accomplished by the vertically movable punch 85 which carries downward in each stroke thereof a single tubular rivet advanced thereto by the rivet-feeding means. The movement of the punch 85 as shown in Fig. 1 is effected through the rearrangement of the toggle joint comprised of the links 88 and 89 which are attached to the punch 85 by pin 90 and to the stationary press 86 by pin 91, respectively, and by the rotative movement of the rocker arm 92 about the pivot pin 93 upon initiation by the entrance of air into the cylinder 94. A third link 95, attached to one end of the rocker arm 92 by pin 96 and to the toggle links 88 and 89 by pin 97, and a rod 98, joining the other end of the rocker arm 92 and the piston (not shown) within the cylinder 94, complete the operating means. The timing of the operation of the riveting means 7 initiated by the actuation of valve 74 is in the cam 99 on the main drive shaft 21, which cam 99 actuates the valve 74 through the roller 100 (Fig. 6), arms 101, and the triggering arm 102. The riveting operation is initiated by the rotation of a notch in the edge of the cam 99 below the roller 100, as shown, and the consequent rotation of the arms 101 to which the roller 100 is attached by pin 103, so that pin 104 joining the opposite ends of arms 101 and the triggering arm 102 are turned. At such times, the triggering arm 102 is moved

away from the main body of the valve 74 and the control pin 105 is influenced to the left as in Fig. 6 by the expansion force of the spring 106 and moves the valving slide 107, which is keyed to the mid-portion thereof, to the presently considered position. Bearings for the control pin 105 are provided in the cap 108 around the spring 106 at one end thereof and in the packing gland 109, which also supports pin 104, at the opposite end thereof. The valving slide 107 allows the compressed air of a source connected to the valve 74 by pipe 110 to pass from the center chamber thereof to passage 111 and thence through passage 112 to the pipe 113 connected to the head end of the cylinder 94 and the air to escape from the opposite end of said cylinder 94 through pipe 114, connected passages 115 and 116, the pocket 117 in the slide 107, connected passages 118 and 119 and the exhaust pipe connection 120. The valve 74 has no metering function in regard to the flow of air to the actuating cylinder 94 and all control related to the rate of the riveting operation lies in the pressure of the compressed air supplied thereto. The downward movement of the punch 85 forces the lower end of the tubular portion of the rivet 8 against the flare of the upper end of the rivet set 14, which is carrying the full weight of the base assembly 2, and in so doing causes said end of the tubular portion to be flared outward over the adjacent portion of the base button 13. Finally, the movement progresses to an extent where the flange or flare formed on the lower end of the rivet 8 is pressed against the lower surface of the base button 13 and is set by the squeezing action of the punch 85 and the set 14.

The withdrawal movement of the placing plunger 9, which is the next occurring operation of the apparatus, is brought about while the riveting punch 85 is pressed tightly against the base assembly 2 and separates the plunger 9 from the base contact 1, which is now a part of the base assembly 2. The pressure of engagement between the riveting punch 85 and the rivet set 14 with the base assembly 2 serves to hold said base assembly 2 in place while the longitudinal motion of the placing plunger 9 pulls the spring-pressed jaws 79 and 80 from the base contact 1. This withdrawal movement of the placing plunger 9 retracts it into the turret 44 to a position corresponding to the other placer plungers 9 therein and is initiated by a reverse movement of the operating means therefor upon readjustment of the valve 63 as the further rotation of the cam 57 advances the roller 68 from the notch therein. At the present adjustment of the valve 63, compressed air is admitted through pipe 65 into one end of the actuating cylinder 60 and the head end of said cylinder 60 is vented through pipe 64 and one of the exhaust connections 75 on the side of valve 63.

The completion of the riveting cycle is effected by the upward return movement occurring in the punch 85 of the riveting means 7. This operation is effected by a readjustment of the control valve 74 as the continuing rotation of the main drive shaft 21 and the cam 99 carries the roller 100 from the notch in said cam 99 and the control pin 105 of said valve 74 is pushed back. In the presently taken position, the control pin 105 holds the valving slide 107 so that the compressed air in the center chamber of the valve 74 is free to pass into the end of passage 116 and circulate to one end of the actuating cylinder 94 and so that the passage 111 leading to the head end of the cylinder 94 is vented through the pocket 121 in said slide 107, passages 122 and 123, and the exhaust connection 124.

The above-described placing and riveting operations occur during a time interval when the transfer means 10 (Figs. 1, 7, and 8) is effecting the insertion of another base contact 1 between the jaws 79 and 80 of another of the plungers 9 located almost directly above the plunger 9 which is in operative relation to the head 3. This function of the apparatus is to prepare that particular plunger 9 of the placing means 6 for the cycle of operation when it is to deliver the base contact 1 to riveting relation to a base assembly 2 and is performed by the axial movement of the transfer plunger 125 from a position opposite the end of the feed chute 5 (Fig. 8) to a position against the end of the placing plunger 9 (Fig. 7). The transfer plunger 125, as shown in Fig. 1, is supported by the air cylinder 126 which is mounted upon the adjacent face of the press 86 and, at the moment the cycle of operation begins, is positioned to the left (Figs. 1 and 7) and is retracted into the cylinder 126. At such times, the endmost base contact 1 on the feed chute 5 is free to slide onto the oblong end portion 127 of said plunger 125. The base contacts 1 are arranged one after the other upon the feed chute 5 and are advanced therealong to the transferring means 10 by gravity and the sloping position of the chute 5, which provides in rail 128 a smooth inclined surface along which the feet 77 of the contacts 1 can slide. The prongs 78 of the contacts 1, on the other hand, hang into the channel formed by the adjacent vertical faces of the rail 128 and the rail 129 and orientates the contacts 1 correspondingly so that the foot 77 of the endmost contact 1 on the chute 5 slides freely onto the correspondingly sloping upper surface of the end portion 127 of the plunger 125 and so that the prong 78 thereof passes to a juxtaposed position with reference to the flat end surface of said end portion 127. At the limit of the movement of the contact 1, the forward edge thereof butts against lip 131 on the movable slide 132 carried by the end portion 127 of the plunger 125 and orientates the contact 1, which is then clear of the ends of the rails 128 and 129 on said plunger 125. The arrangement of the slide 132 at the described position is due to the expansion force of the helical spring 133 within a longitudinal passage in the plunger 125, which spring 133 bears against a piston 134 attached by screw 135 to said slide 132 and pushes the slide 132 endwise of said plunger 125 to a position where the shank of the screw 135 butts against the end of the slot 136 in the plunger 125 in which it is accommodated. The contact 1 located upon the transfer plunger 125 blocks movement of other contacts 1 from the feed chute 5 which is adapted to supply an endless succession of said contacts 1 because of its association with other automatic feeding means (not shown). The upper end of the chute 5 is preferably associated with one of the known types of feeding means which is adapted to place the contacts 1 in a correspondingly orientated position between the rails 128 and 129, whereas the lower end of the chute 5 is held at the terminus of the retracted movement of the transferring means 10 by a plate 137 (Fig. 3) engaging the stationary stud 138 extending from the end of the turret support spindle 45.

The transferring movement of the plunger 125 is brought about at a moment in the cycle of operation when the lowermost plunger 9 is ad-

vanced to operative relation to the base assembly 2 and is initiated by manipulation of the valve 63, which also controls the operation of said plunger 9. Branch piping (not shown) connected to the valve 63 through pipes 64 and 65 provides the means of making the necessary connections to the opposite ends of the actuating cylinder 126 for the transfer plunger 125 and introduce compressed air into one end of said cylinder 126 while venting the air from the opposite end. The movement of the transfer plunger 125 continues until interrupted by passage of the prong 78 of the contact 1 between the jaws 79 and 80 of the plunger 9 and by the seating of said prong 78 against the end surface of the placing plunger 9. The orientation of the contact 1 is ordinarily not disturbed during the transfer operation as said contact 1 rests against the top surface of the end portion 127 of the plunger 125 and against the lip 131 of the slide 132. Finally, however, the end of the lip 131 butts against the end of the jaw 79 of the placing plunger 9 and the entire slide 132 is forced back relatively on the transfer plunger 125 against the resistance of the spring 133. The separation of the lip 131 from the prong 78 of the contact 1 at this time does not allow said contact 1 to swing from position as said prong 78 immediately engages the relatively wide face of the jaw 79 which keeps it in the desired orientation so that said transferring operation is effective in placing the contact 1 at a specific location at the end of the placing plunger 9. Tongues 139 on the top and bottom overlapping portions of the slide 132, which are the means of holding said slide 132 in place on the plunger 125, move in grooves in the end portion 127 of the plunger 125 during the separate movement of said slide 132. As shown in Fig. 7, the oblong end portion 127 of the plunger 125 extends sufficiently along the length thereof to block movement of succeeding contacts 1 from the chute 5 at all moments when the plunger 125 is advanced. The subsequent retraction of the transfer plunger 125 occurs when the placing plunger 9 adjacent the base assembly 2 is retracted by the readjustment of the valve 63 and separates the contact 1 from said transfer plunger 125 as the contact 1 is gripped and retained by the jaws 79 and 80 of the placing plunger 9.

Further positioning of the contact 1 with respect to the placing plunger 9 occurs during a directly following interval when the indexed rotation of the turret 44 advances said plunger 9 laterally and said contact 1 passes below the roller 130'. The function of the roller is to reposition the contacts 1 within the jaws 79 and 80 of the plunger 9 so that the foot 77 of said contact 1 will pass above the edge of the button 13 to correct mounting relation thereto during the later function of said plunger 9 and prevents said contact 1 from extending laterally of the plunger 9 sufficiently to strike the side of the button 13. The rearrangement of the contact 1 occurs when the lateral movement of the plunger 9 carries the extending foot 77 of the contact 1 against the roller which retains a fixed elevation and presses said contact 1 down to a definite limit. The roller 130' is mounted upon a pivot screw 131' extending from a bracket 132' fastened to the press 86.

The retraction of the placing plunger 9 opposite the head 3 completes the operations associated with the attachment of one base contact 1 to the base assembly 2 and is followed by a rotative indexing movement of the head 3, which arranges a second portion of the base assembly 2 at the riveting position, and in indexing movement of the placing means 6, which arranges another plunger 9 holding a second base contact 1 in position to be advanced to the base assembly 2. Both indexing movements are for the purpose of preparing the apparatus for a second series of operations, corresponding to those previously described, which place the base contact 1 at the proper relation to the base assembly 2 and rivet said contact 1 thereto. The third base contact 1 is attached to the base assembly 2 in a corresponding manner by operations of the apparatus, including repeat indexing movements of head 3 and the placing means 6 and succeeding placing and riveting movements. The entire group of operations occur during the portion of the cycle of operations of the apparatus when the head 3 and base assembly 2 are located at station C.

The indexing movements of the head 3, which prepare the base assembly 2 for the reception of the second and third base contacts 1, are brought about by rotative movements of the set-supporting arbor 15 of the head 3 through corresponding movements of the spindle 42, previously referred to, engaging the tongue 38 on the lower end thereof at this particular station (C). The spindle 42, which is carried in the ball bearings 140 and 141 in the base 25 of the apparatus, has a gear 142 upon its lower end portion which meshes with a second gear 143 (Fig. 5) on an intermediate idler shaft 144 and is, in turn, held in position by the rotative position of the intermediate shaft 144 which takes a rotative position controlled by means actuated by the auxiliary drive shaft 22. At the operating intervals when the indexing movements of the head 3 occur, the rotation of the auxiliary drive shaft 22 causes one of the groups of teeth 145, 145' on the interrupted gear 146 to engage and turn the gear 143 and the stop means, comprised of the notched cam discs 147 and 148 on the auxiliary drive shaft 22 and the intermediate shaft 144, respectively, to relinquish control over said intermediate shaft 144. At all other times said head 3 and, accordingly, the base assembly 2 are fixed in position by the stop means and the rotation of auxiliary drive shaft 22 has no effect on the intermediate shaft 144 as a smooth portion of the gear 146, which is devoid of teeth, is opposite the gear 143. At such times a concentric portion of the disc 147 of the stop means is passing opposite the intermediate drive shaft 144, in which position it is located within one of a plurality of peripheral hollows 149 in the disc 148, and movement of the intermediate drive shaft 144 is prevented since the concentric portions block passage of wider portions of the disc 148 to positions therebetween. The holding function of the stop means is only relinquished when the indexing movements take place as then one of the notches 150 in the disc 147 accommodates the wider portion of disc 148 adjacent the hollows 149 therein. Each index is complete when the intermediate shaft 144 has turned sufficiently to rotate the head 3 and base assembly 2 ninety degrees, at which time another adjacent peripheral hollow 149 in disc 148 is opposite the disc 147. Since the head 3 is indexed twice during its period of arrangement at station C, 180 degrees of rotation occurs in said head 3 and the tongue 38 on the set-holding spindle 15 thereof is again aligned with the course of movement to the next adjacent station at the end of this period.

The hereinbefore referred to indexing move-

ments of the placing means 6 occur at the same moment as the indexing movements of the head 3 and are followed by still a third duplicate indexing movement during the succeeding operations of the apparatus when the presently considered head 3 is moved from station C and another head 3 is advanced thereto. Each of these indexing movements of the placing means 6 is brought about mechanically by downward travel of a ratchet pawl 151 (Fig. 3) engaging the notched periphery of the disc 53 (Figs. 3 and 4) upon rotation of a directional variation in the groove 152 (Fig. 6) in the cam 153 on the main drive shaft 21 into engagement with the roller 154 on the actuating arm 155. The variation in the groove 152 effects the downward travel in the ratchet pawl 151, which is pivoted upon the pin 156 extending from the arm 157, by causing a corresponding motion in the actuating arm 155, which is connected to said arm 157 by link 158, about the stationary pivot pin 159 extending from the drive enclosing housing 26 of the apparatus. The arm 157 is pivoted within a central opening about a portion of the support spindle 43 in the standard 51 and turns about said spindle 45 an amount causing the ratchet pawl 151 to rotate the discs 53 and accordingly the turret 44 sufficiently to interchange the placing plungers 9 in a counter-clockwise direction. The pressure of the wire spring 160 located about the outer end of the pawl 151 keeps said pawl 151 against the periphery of the notched disc 53 at all times and permits the said pawl 151 to swing outwardly over the teeth of said disc 53 in the return upward movement thereof immediately effected by the cam 153. The spring 160, which is hooked down under the lower surface of the pawl 151 and which bears against the post 161 extending from the arm 157, is not capable of pressing the pawl 151 against the disc 53 with sufficient pressure to dislodge it in the return movement of the arm 157 as the spring-pressed ball 50 (Fig. 4) enters another opening in the ratchet disc 53 when it is properly located and resists any movement thereof. As indicated by the shape of the groove 152 in the cam 153, the pawl 151 remains at the upper position for a longer interval during the period the heads 3 are moved to and from station C.

The operations of the apparatus associated with station C automatically effect the attachment of three base contacts 1, spaced 90 degrees apart, to the base assembly 2 by duplicated series of operations, each responsible for the attachment of a single contact 1, and are completed with the attaching apparatus in position to again function in the same manner when another base assembly 2 is presented at said station. The head 3 carrying the completed base assembly 2 has, however, turned 180 degrees from its initial position at the end of these series of operations and in the indexing movement of the turret 4 advancing said head 3 from station C to D, the next in order, is moved so that the tongue 38 on the set-supporting arbor 15 is carried laterally from the slot 41 in the spindle 42 and is caused to wipe the edge of an adjacent further extent of the insert 40. Rotation of the head 3 is prevented by the insert 40 during the presently considered index, which finally advances the tongue 38 into the transverse slot 41' (Fig. 4) in the spindle 42' located at station D.

The unloading functions of the apparatus occurring at station D begin when the head 3 is taking that station as the responsibility for the rotative position of the head 3 is then transferred to the spindle 42' and as the hinged plate 162 located around the upper portion of the set-holding arbor 15 of said head 3 then engages and rides up onto the stationary roller 163. This latter operation tilts the plate 162 about the hinge pin 164, by which it is attached to the spider 165 mounted on the top of the turret 4, inasmuch as the roller 163 is held at a fixed position by the bracket 166 extending from the press 26 and causes said plate 162 to force the base assembly 2 upward from the rivet sets 14. During the dwell of the head 3 at station D, two rotative indexing movements, corresponding to that produced at station C, occur in the head 3 and cause diametrically opposite rim portions of the base assembly 2 to ride upon the high part of the plate 162 so that the full periphery of the base assembly 2 is forced upward equally. The rotation of the head 3 is brought about by movements of the spindle 42', which is a duplication of spindle 42 at station C and which is rotated in synchronism therewith, as gear 142' on the lower end thereof meshes with a second idler gear 143' engaging gear 142. The spindle 142' is mounted on the ball bearings 149' and 141' carried by the bed 25, which also supports the idler spindle 144' holding gear 143'. Rotation of the head 3 also effects movement of the lateral passageway 167 in the set-supporting arbor 15 into alignment with the outlet of the nozzle 168 and rearranges the head 3 at the position at which it must start the cycle of operation. At a still subsequent moment in the course of the operation, air is caused to be discharged from the nozzle 168 so that it will pass into the lateral passage 167, pass up the connected vertical passage 169 and blow the base assembly 2 into the discharge tube 170 which carries it away from the apparatus. The air emitted by the nozzle 168 is controlled by the valve 171 opposite the cam 172 on the main drive shaft 21 and is discharged at a particular time in the cycle of operation, during which the hump 173 on the cam 172 depresses the control arm 174, and effects movement of the metering pin 175.

The subsequent indexing movement of the turret 4 carries the head 3 followed by this description again to station A, thereby completing one cycle of operation and preparation of said head 3 for a succeeding cycle of operation. In this last indexing movement, the plate 162 passes beyond the roller 163 and drops down onto the flat circular plate 176 which supports it until the roller 163 is again encountered at station D.

All elements of the apparatus have a common support in the flat table 11 which is preferably mounted on legs (not shown) and which provides for the incorporation of the main driving and other necessary means (not shown) of a unitary machine with the described apparatus. The base 25 of the apparatus is mounted in a central opening in the table 11 and has mounted thereabout the support standard 51 of the placing means 6 and the press 26 of the riveting means 7. The operation controlling valves 63 and 74 are attached directly to the lower surface of the table 11 whereas the operation cylinders 60 and 94 are attached to the edges thereof through pivot pin 177 and bracket 178, and pivot pin 179 and bracket 180, respectively.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about

their own axes and each having a plurality of rivet sets extending longitudinally therefrom at regular angularly spaced intervals about its axis, means to index said turret to carry the heads to successive stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon.

2. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes and each having a plurality of rivet sets extending longtiudinally therefrom at regular angularly spaced intervals about its axis, means to index said turret to carry the heads to successive stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, and means engageable with said heads at a station subsequent to said riveting station and operable to rotatively index each head about its axis an amount sufficient to return it to the rotative position originally occupied thereby in the turret prior to its indexing movements of the said riveting station.

3. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes and each having a plurality of rivet sets extending longitudinally therefrom at regular angularly spaced intervals about its axis, means to index said turret to carry the heads to successive stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, a rotatable placing means mounted adjacent said riveting station and including a plurality of members each adapted to grip a contact and mounted for movement toward and away from the head at said station, means to index said placing means, means to actuate said placing means members, and means operable to correlate rotative indexing of said placing means and successive advancement of said members thereon toward said head with successive indexes of said head during its dwell at said riveting station.

4. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes and each having a plurality of rivet sets extending longitudinally therefrom at regular angularly spaced intervals about its axis, means to index said turret to carry the heads to successive stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, placing means comprising a rotatable drum mounted adjacent said riveting station and including a plurality of plunger members adapted to grip a contact and mounted about the periphery of the drum for rectilinear movement longitudinally thereof and toward and away from the head at said station, means to index said drum, means to actuate said plunger members, and means operable to correlate rotative indexing of said drum and successive advancement of said plunger members thereon toward said head with successive indexes of said head during its dwell at said riveting station.

5. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes and each having a plurality of rivet sets extending longitudinally therefrom at regular angularly spaced intervals about its axis, means to index said turret to carry the heads to successive stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, means to feed contacts, a rotatable placing means mounted adjacent said riveting station and said feed means and including a plurality of transfer members each adapted to receive and grip a contact from said feed means, means to index said placing means to carry the transfer members thereon to a position opposite the head at said riveting station, said transfer members being mounted for movement on said placing means and toward and away from said head, and means operable to correlate operation of said feed means, indexing of said placing means and advancement of said transfer members toward said head with successive indexes of said head during its dwell at said riveting station.

6. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes, each said head having a plurality of rivet sets extending therefrom parallel to its axis and at regular angularly spaced intervals about said axis, said rivet sets having reduced shouldered ends for supporting a lamp base by engagement with openings in an insulation button on said base, means to index said turret to carry the heads to a plurality of stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, placing means mounted adjacent said riveting station and including a plurality of members each adapted to grip a contact and mounted for movement toward and away from the head at said station to place a contact on the base button thereat with an apertured portion of said contact in alignment with a rivet set, a riveting plunger at said riveting station and mounted in alignment with the head thereat for movement toward and away from the rivet set to press a rivet through the aligned openings in a contact and a base button and to upset the rivet against said rivet set, and means coordinating a sequential operation of said placing means members together with successive operations of said riveting plunger and successive indexes of the head at said riveting station to effect attachment of contacts corresponding in number to the number of said rivet sets during the dwell of the head at said rivet station.

7. In apparatus of the class described, the combination of a turret, a plurality of heads mounted about said turret for rotation about their own axes, each said head having a plurality of rivet sets extending therefrom parallel to its axis and at regular angularly spaced intervals

about said axis, said rivet sets having reduced shouldered ends for supporting a lamp base by engagement with openings in an insulation button on said base, means to index said turret to carry the heads to a plurality of stations including a riveting station, means engageable with a head at said riveting station and operable during the dwell of the head at said station to rotatively index the head about its own axis in angular increments corresponding to the angular spacing of the rivet sets thereon, placing means comprising a rotatable drum mounted adjacent said riveting station and including a plurality of plunger members adapted to grip a contact and mounted about the periphery of the drum for successive rectilinear movement longitudinally thereof and toward and away from the head at said station to place a contact on the base button thereat with an apertured portion of said contact in alignment with a rivet set, means to rotatively index said drum to carry said plunger members successively into a position opposite said head at the riveting station and means to effect the rectilinear movement of a plunger member located at said position, a riveting plunger at said riveting station and mounted in alignment with the head thereat for movement toward and away from the rivet set to press a rivet through the aligned openings in a contact and a base button and to upset the rivet against said rivet set, and means coordinating a sequential operation of said placing means plunger members together with successive operations of said riveting plunger and successive indexes of the head at said riveting station to effect attachment of contacts corresponding in number to the number of said rivet sets during the dwell of the head at said rivet station.

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