Sept. 15, 1953 A. R. HAVENER 2,652,167

AUTOMATIC RIVETING MACHINE

Filed Dec. 29, 1949 3 Sheets-Sheet 1

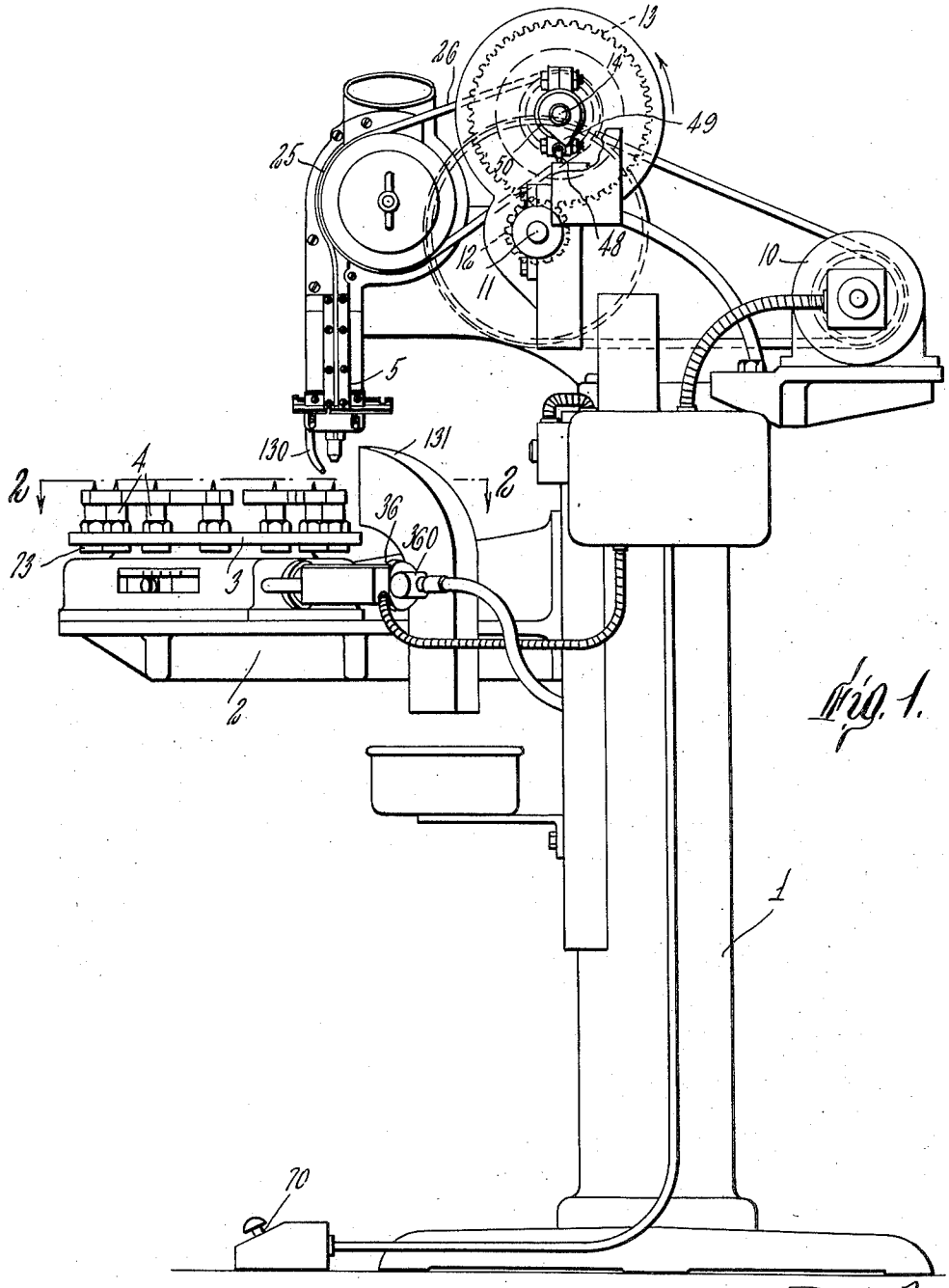


Fig. 1.

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Fig. 2.

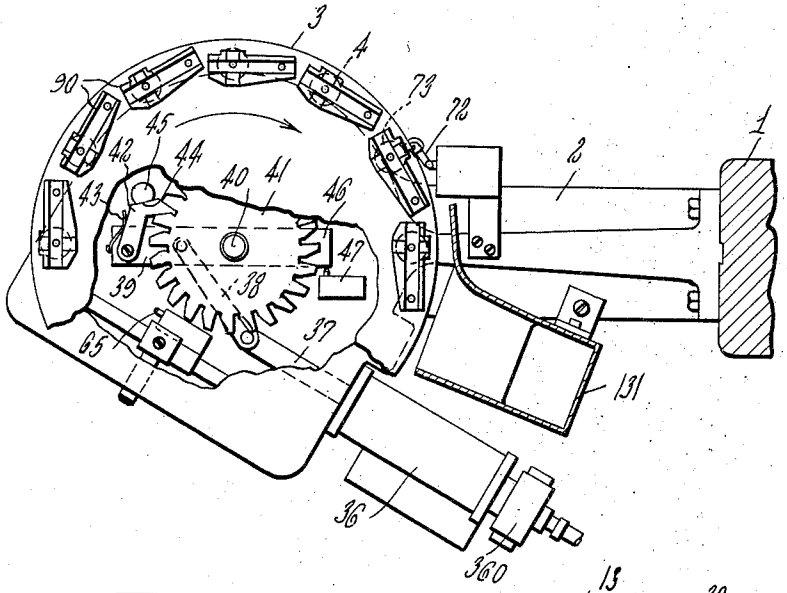
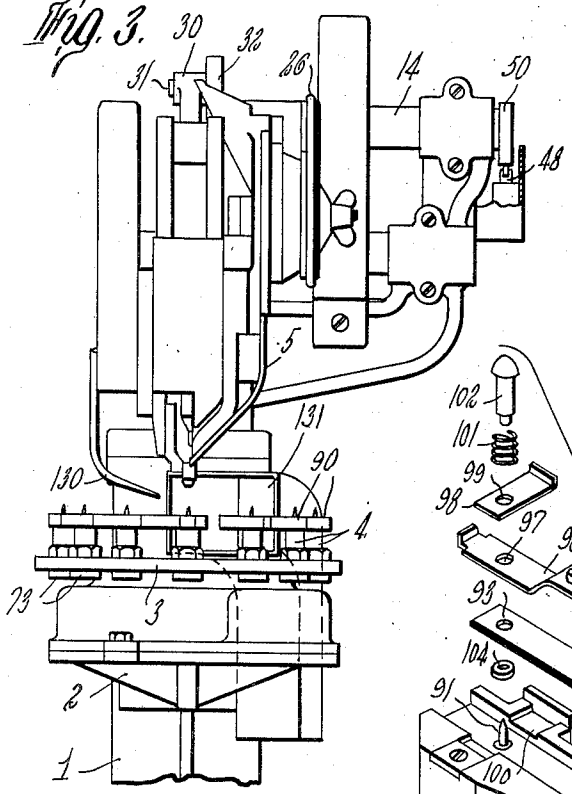


Fig. 3.



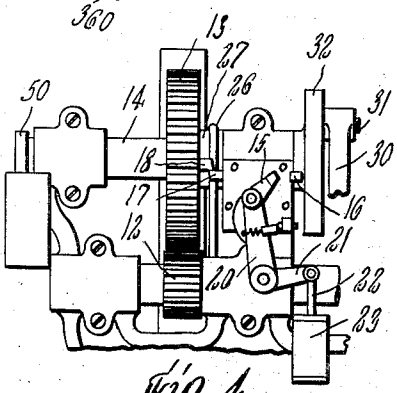


Fig. 4.

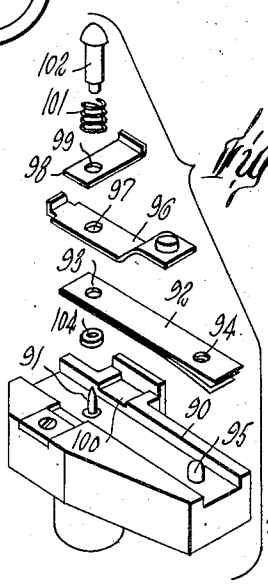


Fig. 5.

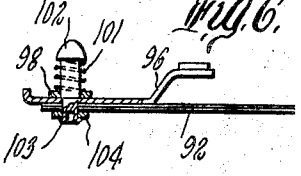


Fig. 6.

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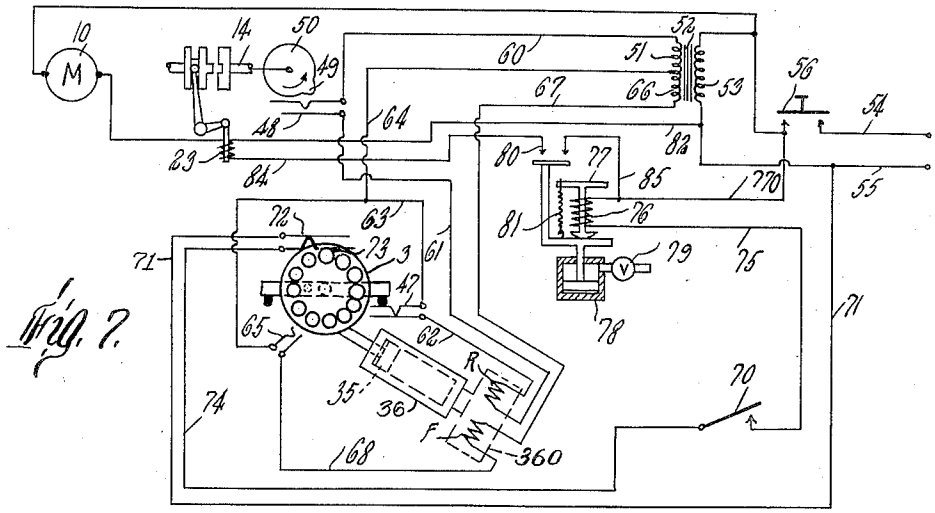


Fig. 7.

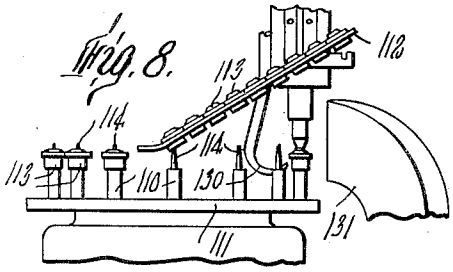


Fig. 8.

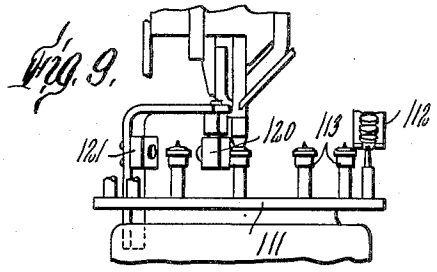


Fig. 9.

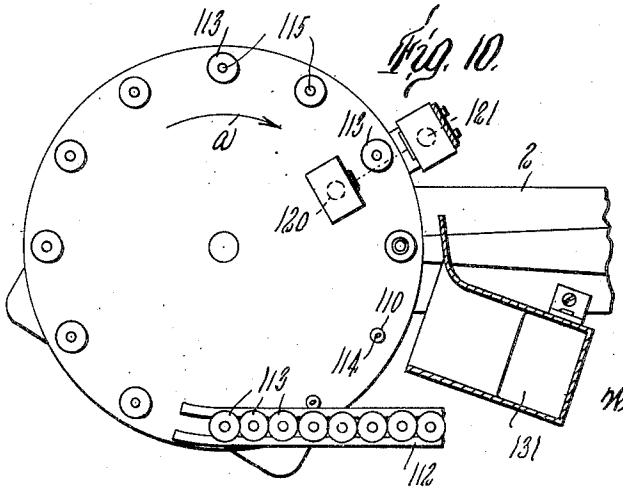


Fig. 10.

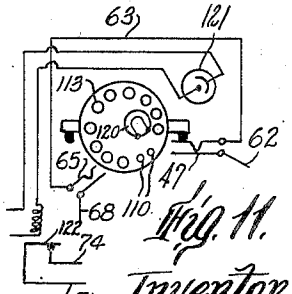


Fig. 11.

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AUTOMATIC RIVETING MACHINE

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Application December 29, 1949, Serial No. 135,785

7 Claims. (Cl. 218—2)

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This invention relates to machines for setting rivets and has for one object to provide controls for the rivet setting mechanism which will cause automatic repeated setting operations at intervals of time adjustable in length so that the intervals may correspond to the time required by the operator to condition the parts for the setting operation, as, for example, to assemble various parts which are to be joined together by each rivet.

A further object is to permit wide adjustment of such intervals without in any way affecting the normal rate of actuation of the setting mechanism itself, so that this latter is done under the most favorable conditions.

A further object of the invention is to provide means for preventing the actuation of the setting mechanism when setting conditions are not proper, as, for example, when the work piece or pieces are not in proper position when the setting is due to take place.

Further objects and advantages will appear from a description of certain embodiments of the invention shown in the accompanying drawings in which

Figure 1 is a side elevational view of an automatic riveting machine embodying the invention, a portion of the machine being broken away.

Figure 2 is a horizontal sectional view on line 2—2 of Figure 1.

Figure 3 is a front elevational view of the upper portion of the machine.

Figure 4 is a fragmentary rear elevational view of the setting actuating mechanism.

Figure 5 is an exploded perspective view of a work holding anvil and several parts which are to be supported on the anvil and secured together during a riveting operation.

Figure 6 is a view partly in side elevation and partly broken away and in section showing the parts of Figure 5 secured together by the rivet.

Figure 7 is a wiring diagram of the mechanism of Figures 1 to 4, inclusive.

Figures 8 and 9 are fragmentary elevations taken at right angles to each other of a modified machine showing means for feeding certain parts to the setting anvils.

Figure 10 is a view partly in top plan and partly in horizontal section of the mechanism shown in Figures 8 and 9.

Figure 11 is a fragmentary wiring diagram to be substituted for a portion of the diagram of Figure 7 for use in connection with the machine of Figures 8 to 10, inclusive.

Referring to Figures 1 to 4, there is illustrated a riveting machine comprising a stand 1 having a

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table 2 extending outwardly therefrom. Upon this table are supported rivet-setting anvils which are arranged to be presented successively into riveting position. For this purpose they are shown as arranged on a rotatable turret 3, the anvils being shown thereon at 4. Above one station of this turret is arranged a rivet setting mechanism of any suitable description as shown at 5, and the turret carrying the rivets is arranged to be turned step by step about its axis to present the various anvils with the work pieces carried thereby into cooperative relation with the setting mechanism. The particular type of setting mechanism per se forms no part of the present invention. It may, however, be provided with an actuating mechanism comprising a motor 10 belt-connected to a drive shaft 11. This drive shaft 11 is provided with a driving pinion 12 which meshes with a gear 13 journaled on a shaft 14 (see particularly Figure 4). The particular rivet setting mechanism herein shown is that shown in the Rhodes Patent No. 2,319,748, granted May 18, 1943. Gear 13 may be clutched to rotate this shaft 14 by a clutch of the Horton type which may be freed for clutching engagement by a dog 15 (see Figure 4) which may engage a lug 16 on a latch pin 17 and retract this pin from a stop lug 18 on the gear 13. On release of the member 18, the gear 13 becomes clutched to drive the shaft 14. The dog 15 is carried on a pivoted arm 20 which is connected through a second arm 21 to a solenoid-actuated rod 22, the solenoid being shown at 23.

At 25 is shown a hopper for a supply of rivets and provided with an agitator of any suitable type driven through a belt 26 from a pulley 27 carried by the shaft 14 so that whenever the shaft 14 is rotated, as during a rivet-setting operation, the rivet agitator is turned.

The rivet setting mechanism as shown in the Rhodes patent hereinbefore mentioned is actuated by rotation of the shaft 14 through an actuating bar 30 carried by a crank arm 31 extending outwardly from a crank disk 32 carried by one end of the shaft 14. The turret anvil is rotated step by step to bring the anvils successively into riveting position by any suitable means, but as herein shown this is accomplished by reciprocation of a piston 35 (see the diagram of Figure 7) in an air cylinder 36. Its piston rod 37 is connected through a link 38 to a bar 39 which is pivoted on the shaft 40. This shaft 40 carries the toothed wheel 41 which is secured to and turns with the turret 3. At one end of the bar 39, a dog 42 is pivoted, this dog being normally

spring pressed by a spring 43 into engagement between the teeth of the wheel 41, and in the position shown in Figure 2, an inclined face portion 44 of this dog has impinged upon a flattened side portion of a pin 45 fixed to the table 2 which wedges the dog 44 into engagement with the wheel 41 and locks the wheel and the turret against turning. In this position of the parts the opposite end portion 46 of the bar 39 is in engagement with a switch at 47 maintaining the switch closed in the stop position of the turret shown in the diagram of Figure 7.

The piston 35 of fluid pressure cylinder 36 is controlled by a solenoid valve at 360 having two controlling solenoids marked R and F in Figure 7. The R solenoid, which when energized positions the valve 360 to retract the piston 35, is arranged in series with the switch 47 and also in series with a switch 48, the latter being open in the position shown in Figure 7, but arranged to be closed by a cam projection 49 on a cam 50 fixed on the shaft 14. Just before this cam 50 reaches the stop position of the turret shown in Figures 1 and 7, the switch 48 is momentarily closed, the switch 47 having been previously closed. The primary 53 of the transformer 52 is energized from the lines 54 and 55 by the closing of a main switch 56. Whenever the switch 48 is closed, as toward the end of a rotation of the shaft 14 at which time a riveting action has been completed, a circuit is made through the actuating solenoid R from the half 51 of the transformer secondary through the lead 60, closed switch 48, lead 61, valve solenoid R, lead 62, closed switch 47, leads 63 and 64, back to the mid-point of the transformer secondary. This causes the solenoid valve to make the fluid connections to retract the piston 35, turning the bar 39 in counterclockwise direction, the dog 44 being cammed out from between the teeth of the wheel 41 until the bar 39 strikes and closes a switch at 65. This motion of the bar 39 also permits the switch 47 to open. The closing of the switch at 65 closes a circuit from the other half 66 of the transformer secondary through lead 67, valve solenoid F, lead 68, switch 65 and leads 63 and 64, back to the mid-point of the transformer secondary. This energizes the solenoid F, the solenoid R having been de-energized on the opening of the switch 47, which causes the bar 39 to be turned in clockwise direction, the dog 44 engaging between teeth of the wheel 41 and returning the bar 39 to the position shown in Figures 2 and 7, stepping around the wheel 41, and with it the turret, to bring the next anvil in line with the riveting mechanism while removing the anvil previously in riveting position therefrom and also to bring the next pin 73 into position to close the switch 72.

The parts are now in position for a succeeding riveting operation. The operator first closes the foot switch 70, which closes a circuit from the line 55 through lead 71, a normally open switch 72 which was closed by a pin 73 on the turret 3 when the turret was brought into proper indexed position, lead 74, switch 70, lead 75, solenoid 76, lead 770, closed main switch 56 and back to the line 54. There is a pin 73 for each index position of the turret, these pins coming into operative position successively.

The solenoid 76 is a portion of a time delay mechanism and acts upon an armature plunger 77, raising the same at a rate controlled by the discharge of air from a dashpot 78 through an adjustable valve 79 until such time as the switch

80 is closed. This closing of the switch 80 is effected through a spring connection 81 between the armature 77 of the solenoid 76 and the switch 80, the movement of which in closing direction is controlled by the dashpot. As soon as the switch 80 is closed, a circuit is established from the line 55 through the lead 82, a clutch solenoid 23, lead 84, switch 80 and leads 85 and 770 back to the main switch 56 and lead 54. Closing of the clutch, by energization of the solenoid 23, acts to actuate the rod 22 (Fig. 4) to connect the riveting mechanism to the drive shaft 12 for one revolution of the shaft 14 as driven by the motor 10 which is in continuous operation as long as the main switch 56 is closed. This provides for the riveting actuation. Toward the end of a complete rotation of the shaft 14, as previously described, the switch 48 is closed by cam 49, which closing starts the turret feed actuation. The turret feed actuation, by pulling the last-acting pin 73 away from the switch 72, allows the switch 72 to open which interrupts the circuit to the solenoid 76. This re-sets the timer so that upon subsequent closing of the switch 72 the solenoid 76 is again energized, causing the next riveting action to take place automatically after the desired time delay provided the switch 70 remains closed by continued depression of the foot. Thus the riveting action is repeated after time delays of predetermined extent so long as the operator holds the foot switch 70 closed, and this delay in this actuation of the riveting mechanism is adjusted by setting of the valve 79 as desired in order to allow sufficient time for the operator to place on another anvil, then out of riveting position, the part or parts in which it is desired to have the rivet set. For example, as best illustrated in Figures 2 and 5, each anvil may comprise a trough-shaped support 90 having a rivet spindle 91 presented opposite to the rivet. This trough-shaped member 90 provides a guiding support for several parts intended to be riveted together as, for example, a plurality of light leaf springs 92 shown in Figure 5 provided at one end with a perforation 93 for engagement over the pin 91 and mating perforations 94 for engagement over a locating pin 95. Superposed on these springs 92 is a strip 96 having a hole 97 for engagement over the spindle 91 and also retained between the side walls of the trough 90. Superposed on the member 96 is a second strip member 98 arranged transverse to the strip 96 and having a hole 99 to thread over the spindle 91 and being retained in a guide groove 100 positioned transverse to the main groove in which the members 92 and 96 are placed. Likewise a coil spring 101 is placed over the spindle 91, and the rivet 102 is presented to these parts with its lower tubular end 103 as shown extended through the other parts and riveted against a washer 104 beneath the spring elements 92.

It will be noted that where several parts are to be assembled on the anvil prior to the riveting actuation, sufficient time must be allowed, through adjustment of the timer valve 79, for the operator to assemble these various parts before the riveting actuation in order that the proper assembly may be made prior to each rivet setting. It is also important that the parts to be riveted be presented accurately into relation to the riveting mechanism, and for this reason the switch at 72 has been provided, as should for any reason the indexing motion of the turret be interrupted before its full stroke has been made, this switch 72 will fail to close and con-

sequently the controlling circuit for actuating the riveting mechanism will not be completed as the switch 80 will not be closed.

In Figures 8 to 11 a modified construction is shown intended particularly for applying rivets to parts at least some of which are automatically fed to the setting anvils, the mechanism being so arranged that should an anvil fail to receive one of these automatically fed parts, the riveting mechanism will not function. Referring to these figures, the anvils 110 are arranged on a turret 111 which may be fed step by step so that the anvils are presented in succession into riveting position. At 112 is shown a raceway extending down from a suitable hopper, this raceway supporting a series of elements 113 in which it is desired to have rivets set, one such element 113 being presented to each of the anvils 110. As shown in Figure 8, the raceway 112 slopes downwardly in position for the usual retractable spindle 114 of each anvil to enter a hole 115 centrally through the element 113, thus to pick these elements off from the lower end of the raceway and present them to the rivet setting mechanism when an anvil reaches setting position.

At a suitable point prior to setting position in the normal direction of feed, which is shown by the arrow *a* of Figure 10, means are provided by which should the particular anvil not have picked off an element 113, the next riveting action will not take place. As shown, the means for detecting whether or not an element 113 has been properly picked off, comprises an electric eye mechanism which is substituted for the switch 72 and the pins 73 of the above described modification. A source of light at 120 is arranged to project a beam across the path of motion of the anvils 110 and the element 113 carried thereby to a light sensitive cell 121. Where this light beam is cut-off by the presence of the element 113, the switch 122, which is normally open, is closed to allow current to pass therethrough, this switch being used in lieu of the switch 72 in the diagram of Figure 7, but should there be no element 113 in position, so that light falls upon the cell 121, the switch 122 remains open so that the rivet actuating mechanism is held against operation. Thus should any interruption of the feed of elements 113 occur, the machine will automatically stop.

The operation of this form of the machine is similar to that of the machine shown in Figures 1 to 7, inclusive, except that the electric eye mechanism and the switch 122 have been substituted for the switch 72 shown in Figure 7. After the main switch 56 has been closed by the operator, he closes the switch 70 by depressing his foot and so holds it as long as he desires the automatic action of the machine to continue. This closes a circuit through the solenoid 76, the switch 122 being closed by the electric eye mechanism when the article following the one to be riveted is in position. After the desired time delay the switch 80 closes, closing the chuck and starting the shaft 14 rotating which performs the riveting action. When the switch 48 is closed at the end of this action, the solenoid R is energized, causing the indexing of the turret by the fluid pressure actuated mechanism. The turret feed opens the switch 122 by causing the article which previously interrupted the light beam of the electric eye mechanism to pass beyond its interrupting position and brings a successive article, if one is present, into interrupting position. If an article is present, the switch 122 is again closed which

energizes the timer solenoid 76 and, provided the switches 56 and 70 remain closed, the riveting action is repeated after the desired time delay. Should no article be present in the light beam, no riveting action will take place since the switch 122 will remain open and the machine will remain inoperative until an article is placed in the controlling position.

The riveted assembly may be removed from its anvil at the next station after the riveting operation, in either of the machines illustrated by any suitable means, but as shown, this is accomplished by a jet of compressed air from a nozzle 130 which delivers it into a chute 131.

From the foregoing description of certain embodiments of this invention it will be evident to those skilled in the art that various further changes and modifications may be made without departing from its spirit or scope.

I claim:

1. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said mechanism, means for actuating said driving mechanism, means controlled by said actuating means after a rivet driving action to activate said anvil-moving means to present the succeeding anvil into cooperative relation to said driving mechanism, an adjustable time delay mechanism, and means operatively connected to said anvil moving means and said driving mechanism, and controlled by said time delay mechanism, said time delay mechanism determining the time interval between the presentation of an anvil and the actuation of said driving mechanism to set parts carried by said presented anvil.

2. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, means for actuating said driving mechanism, means activated by said actuating means after a rivet-driving action to actuate said anvil-moving means to present the succeeding anvil into cooperative relation to said driving mechanism, an adjustable time delay mechanism, and means connected to said anvil moving means and said driving mechanism, and controlled by said delay mechanism, said time delay mechanism controlling the time interval between the presentation of an anvil and the actuation of said driving mechanism to set parts carried by said presented anvil, and means effective to permit subsequent actuation of said driving means only when a part to be riveted is in riveting relation to an anvil approaching the riveting position by actuation of said anvil-moving means.

3. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, means for actuating said driving mechanism, means actuated by said driving mechanism after each driving action to activate said anvil-moving

means to present the succeeding anvil into cooperative relation to said driving mechanism, and means operatively connected thereto effective to permit subsequent actuation of said driving means only when a part to be riveted is in riveting relation to an anvil approaching riveting position by actuation of said anvil-moving means.

4. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, electrically controlled means for actuating said driving mechanism for single rivet-driving actuation, means activated by said driving mechanism at the end of a riveting action to activate said anvil-moving means, and a time delay in the circuit of said electrically controlled means adjustable to determine the time elapsing between activation of said anvil-moving means and the next actuation of said driving mechanism.

5. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, electrically controlled means for actuating said driving mechanism for single rivet-driving actuation, means actuated by said driving mechanism at the end of each rivet-driving operation for activating said anvil-moving means, a time delay in the circuit of said controlled means adjustable to determine the time elapsing between actuations of said anvil-moving means and said driving mechanism, and a controlling switch in said circuit closed only when parts are positioned on one of said anvils in relation to be riveted by said mechanism.

6. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, electrically controlled means for actuating said driving mechanism for single rivet-driving actuation, means actuated by said driving mechanism at the end of each setting action to activate said anvil-moving means, and a switch in the controlling circuit for said electrically controlled means closed to permit actuation of said mechanism only when an anvil and a part to be riveted are in proper relative relation.

7. In a riveting machine, rivet-driving mechanism, a plurality of anvils mounted for successive presentation to said mechanism, means for moving said anvils successively to presenting position, certain anvils not in presenting position being accessible for receiving parts to be riveted by said driving mechanism, electrically controlled means for actuating said driving mechanism for single rivet-driving actuation, means actuated by said driving mechanism at the end of each rivet-driving operation to activate said anvil-moving means, an electric eye, means directing a beam of light toward said eye, and means responsive to an element to be riveted on an anvil subsequently to be moved to presenting position and interrupting said light beam for conditioning said electrical control means to actuate said driving means.

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