Feb. 10, 1942. L. E. POOLE 2,272,850

ASSEMBLING MACHINE

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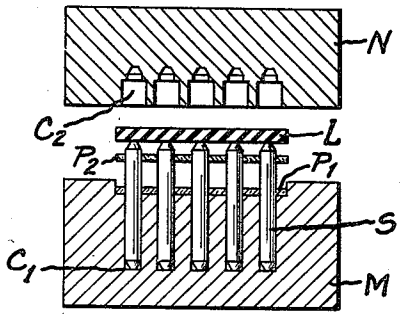


Fig. 3

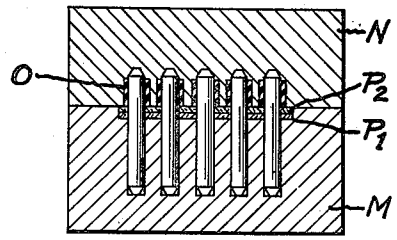


Fig. 4

Fig. 1



Fig. 5

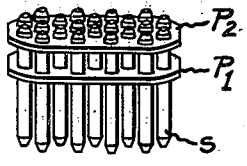


Fig. 2

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ASSEMBLING MACHINE

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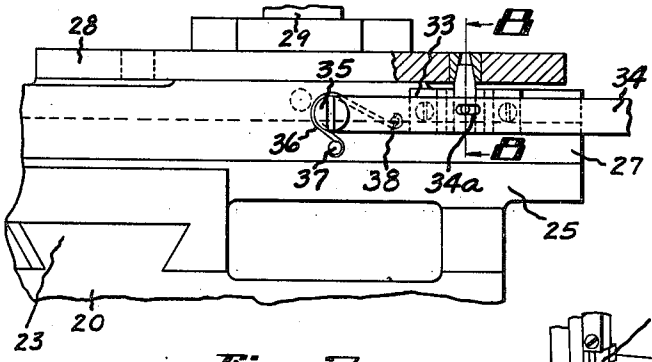


Fig. 7

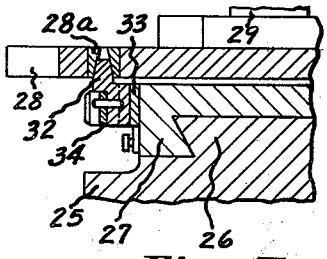
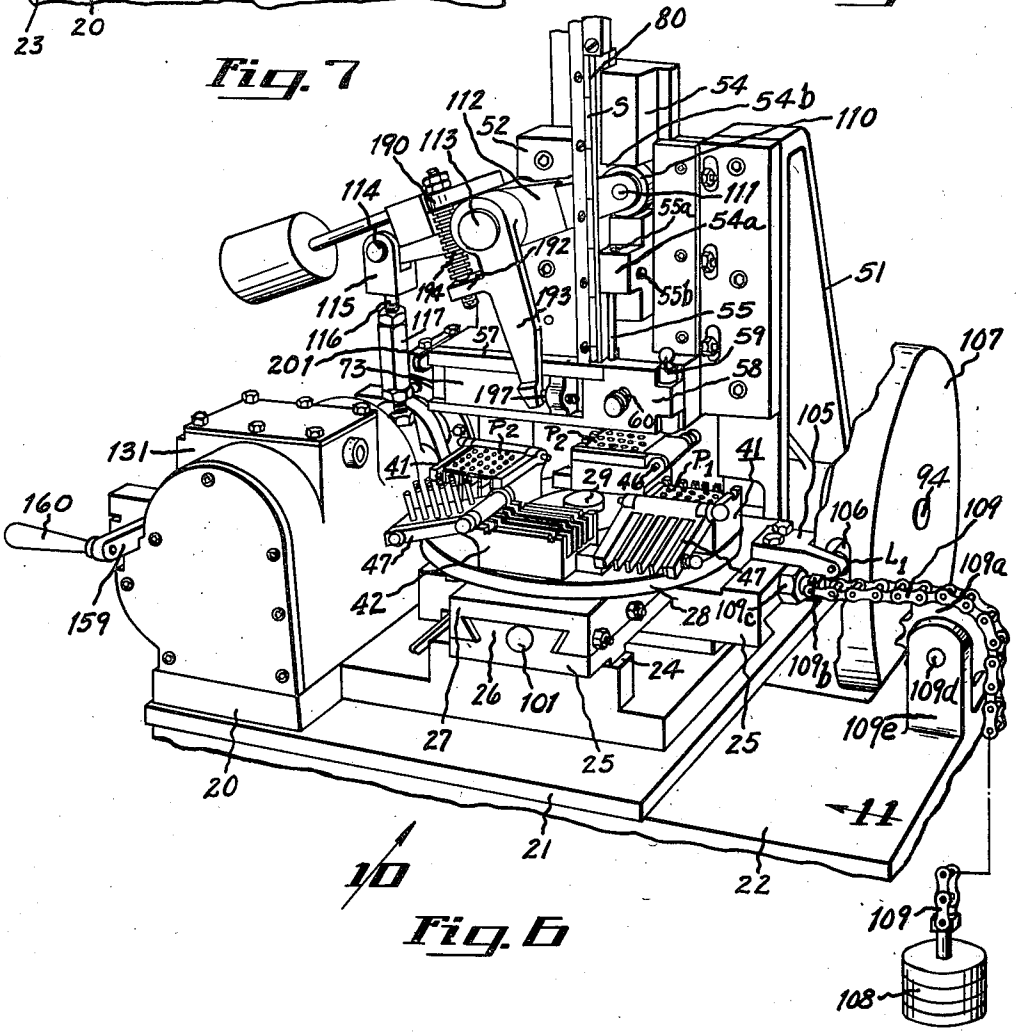


Fig. 8



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Fig. 6

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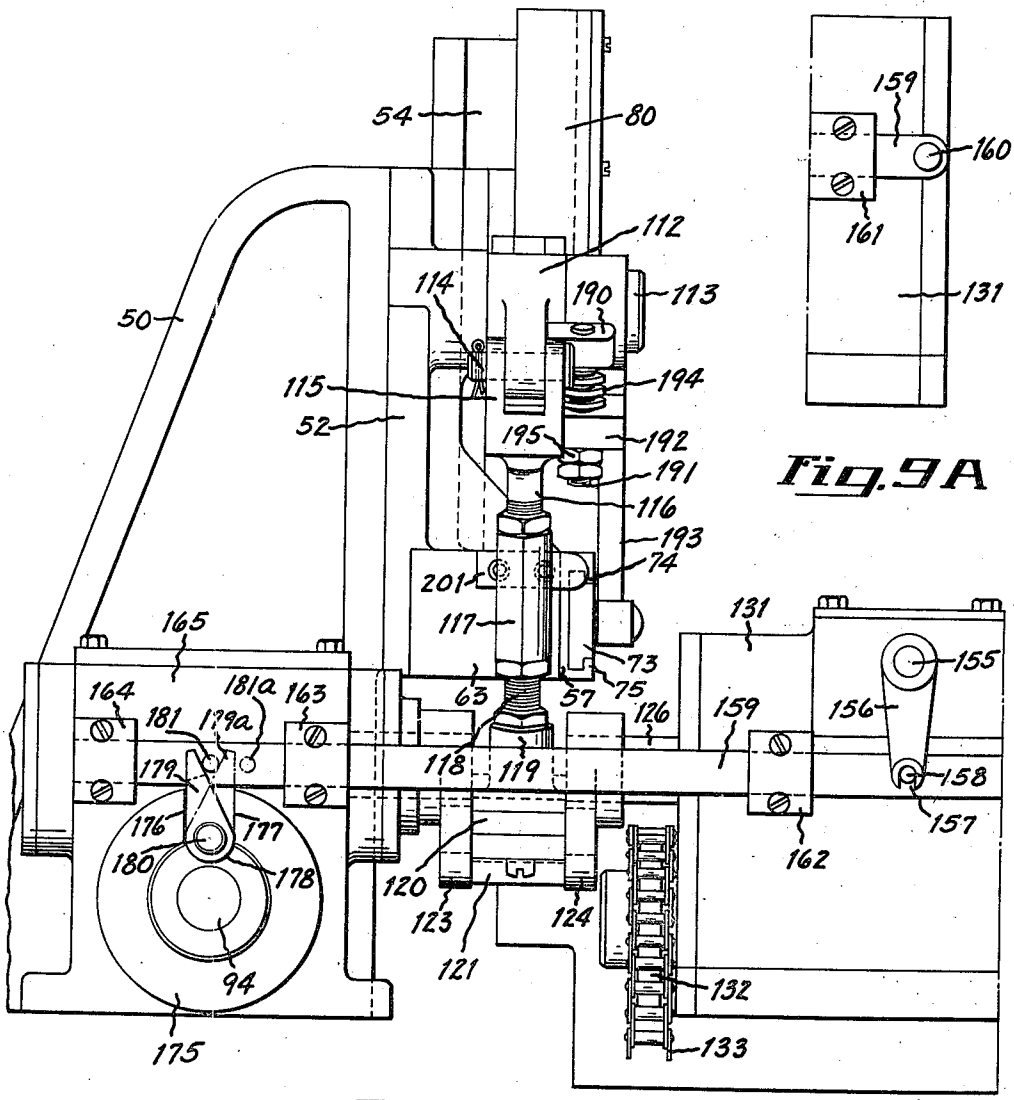


Fig. 9

Fig. 9A

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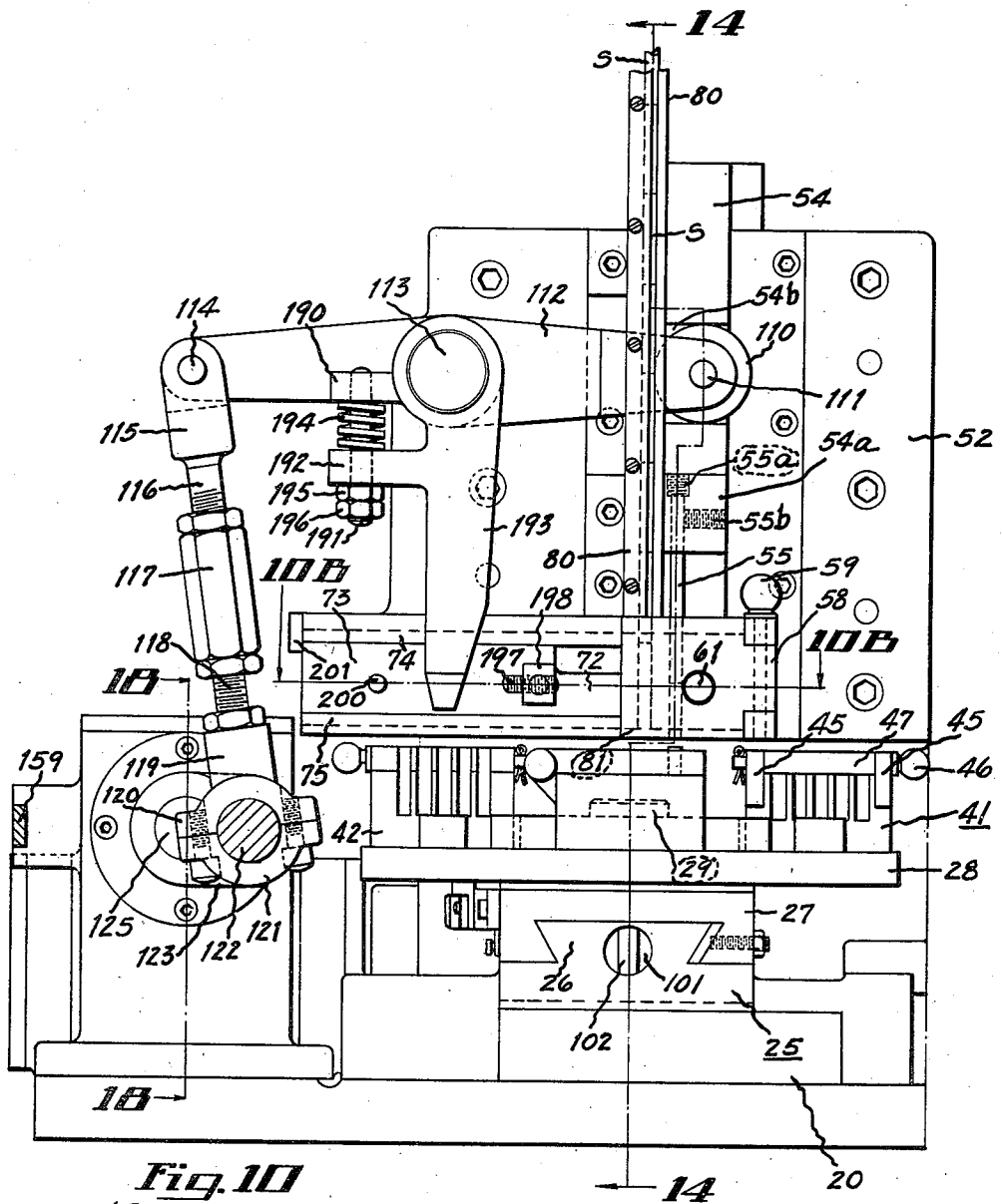


Fig. 10

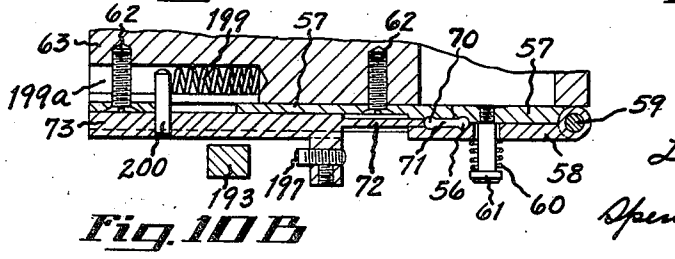


Fig. 10B

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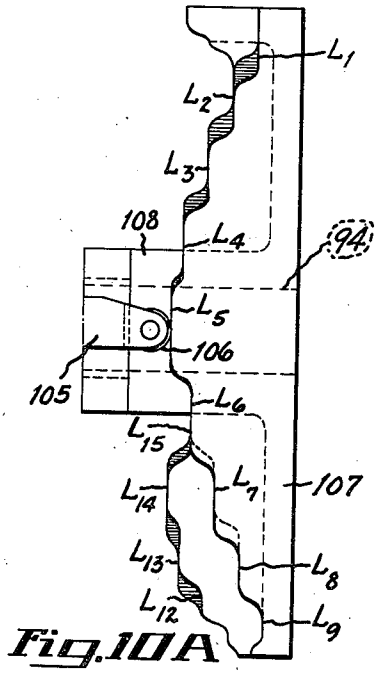


Fig. 10A

Fig. 11

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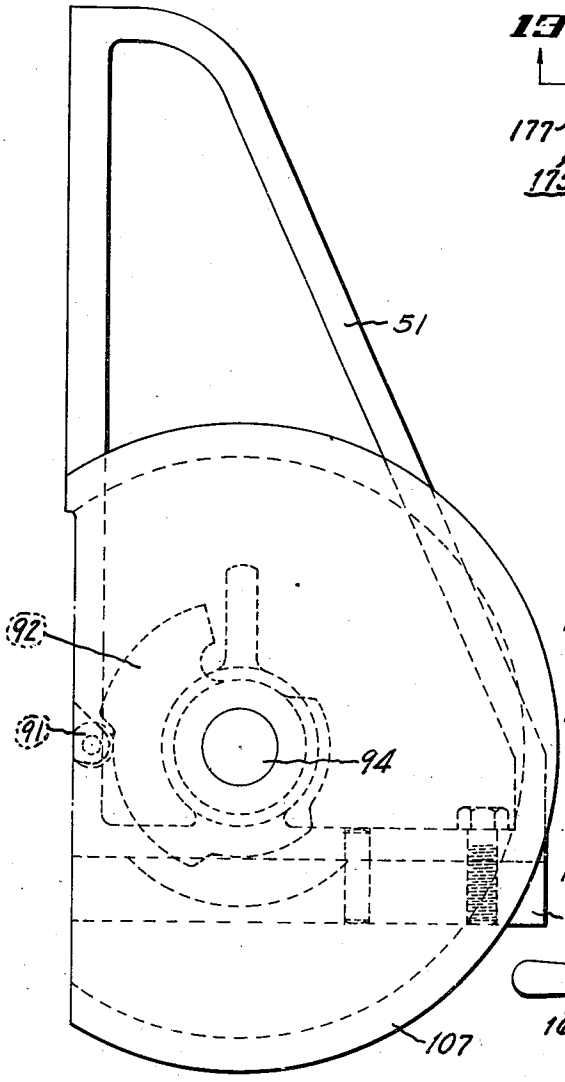


Fig. 11A

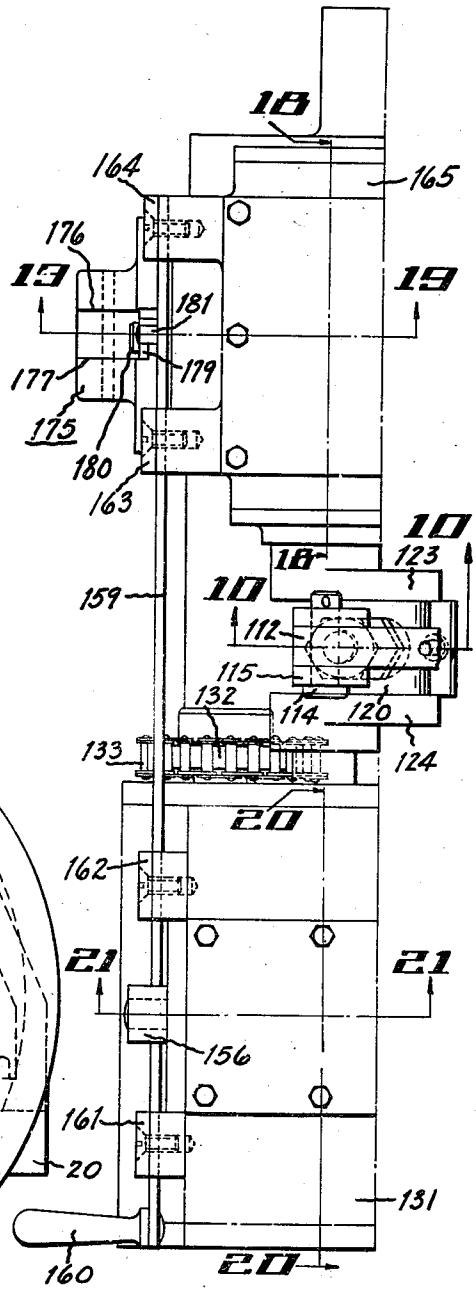


Fig. 12

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ASSEMBLING MACHINE

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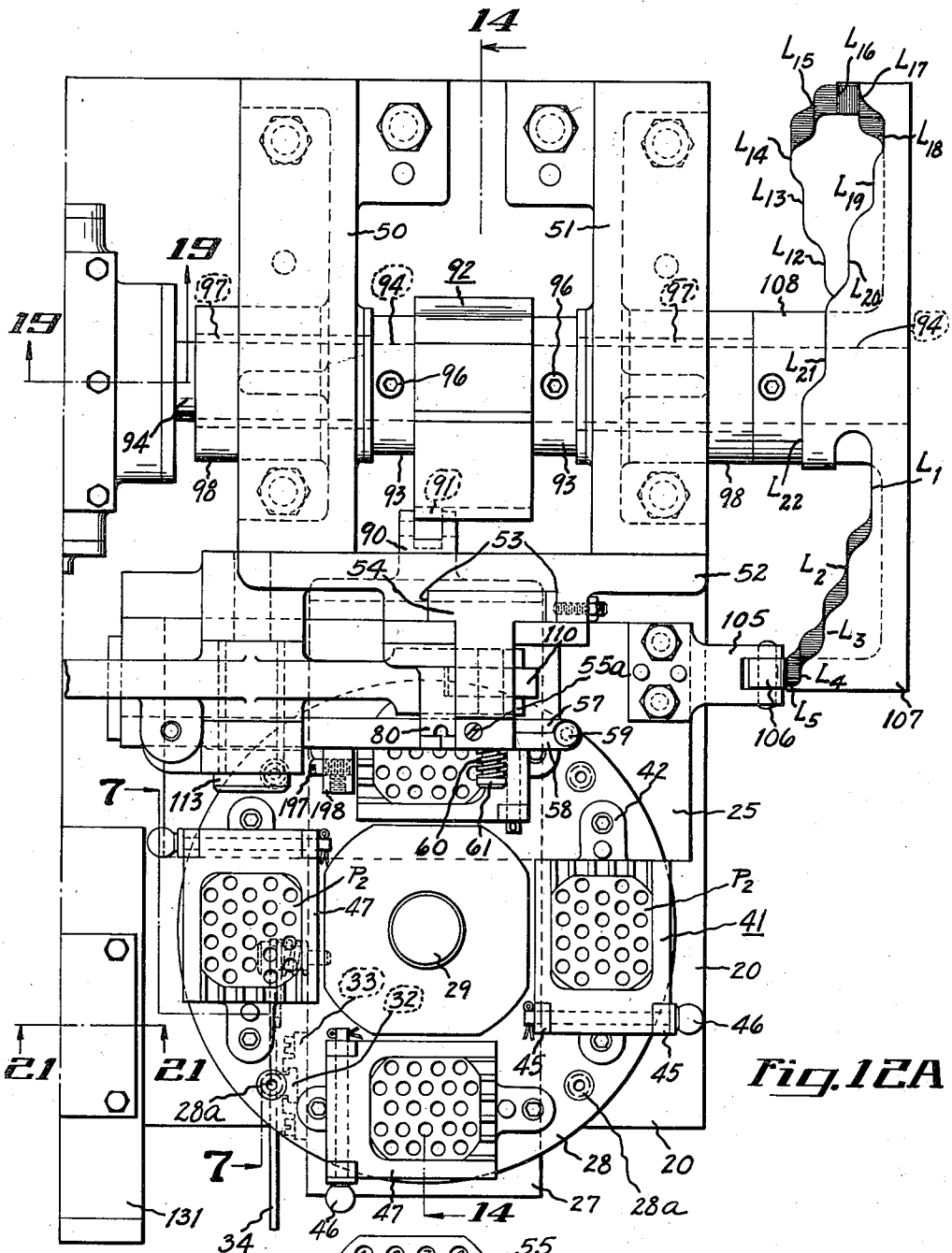


Fig. 12A

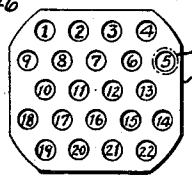


Fig. 13

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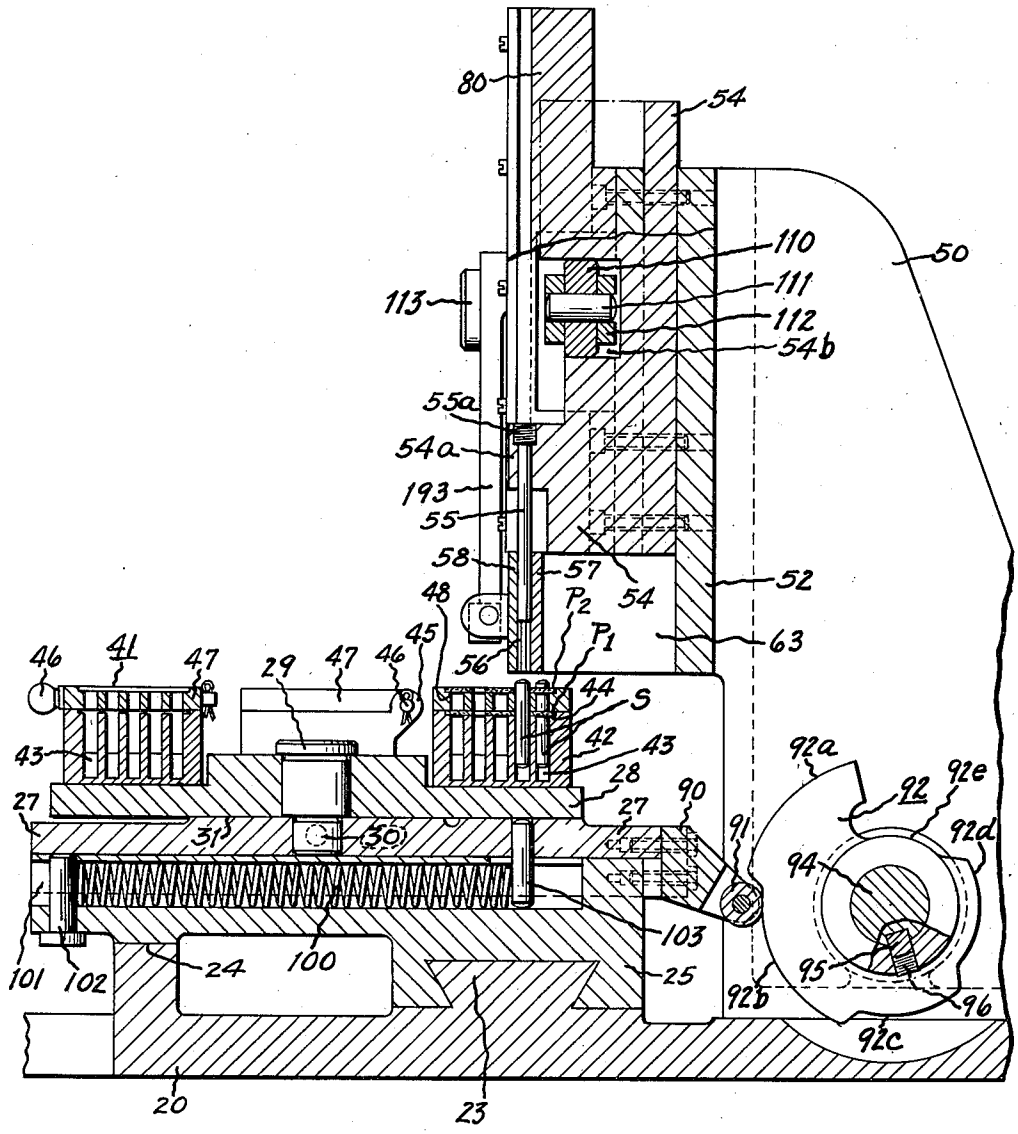


Fig. 14

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ASSEMBLING MACHINE

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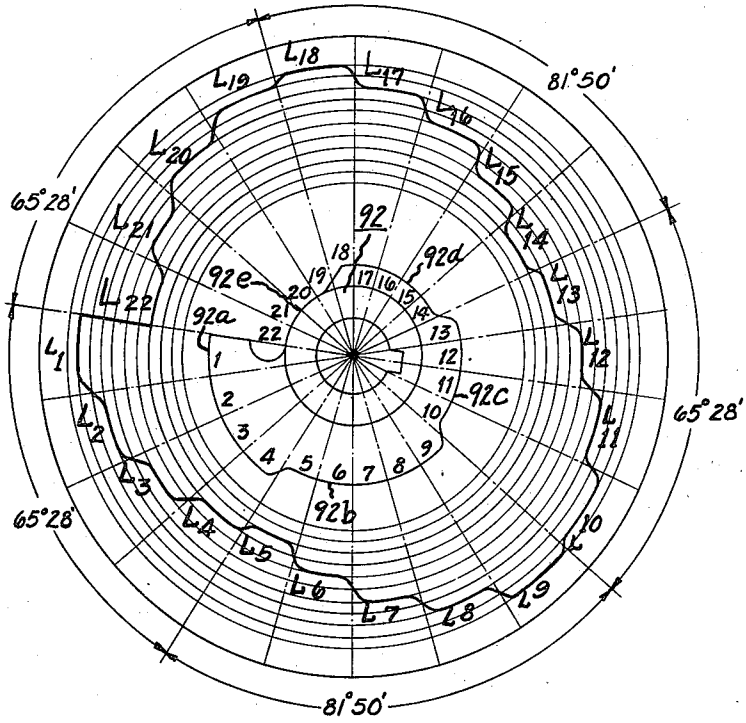


Fig. 15

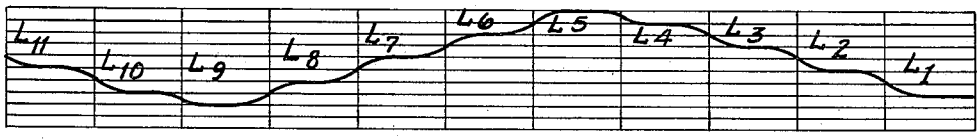


Fig. 16

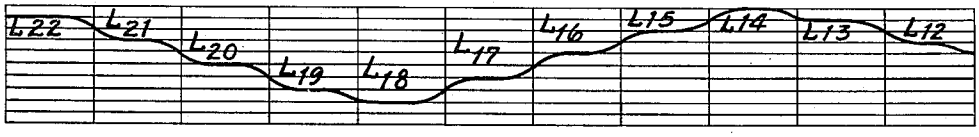


Fig. 17

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ASSEMBLING MACHINE

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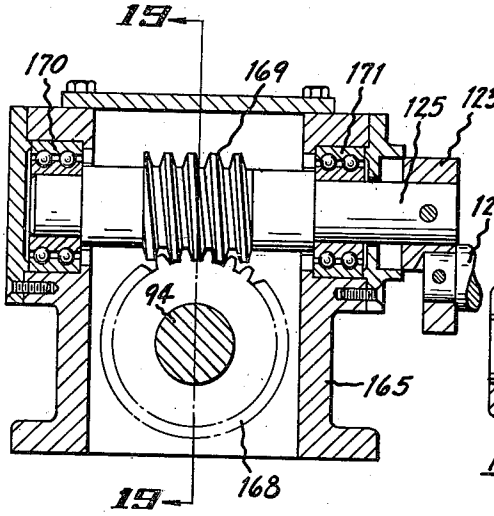


Fig. 18

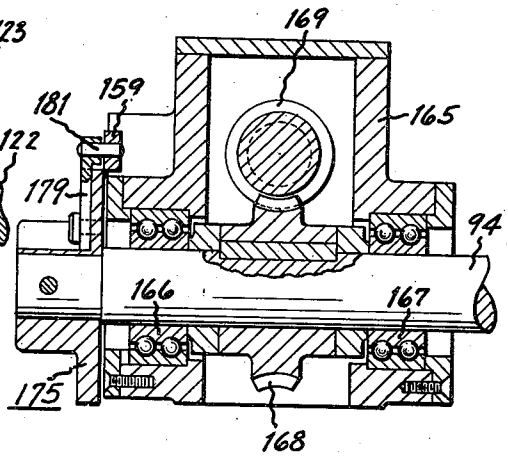


Fig. 19

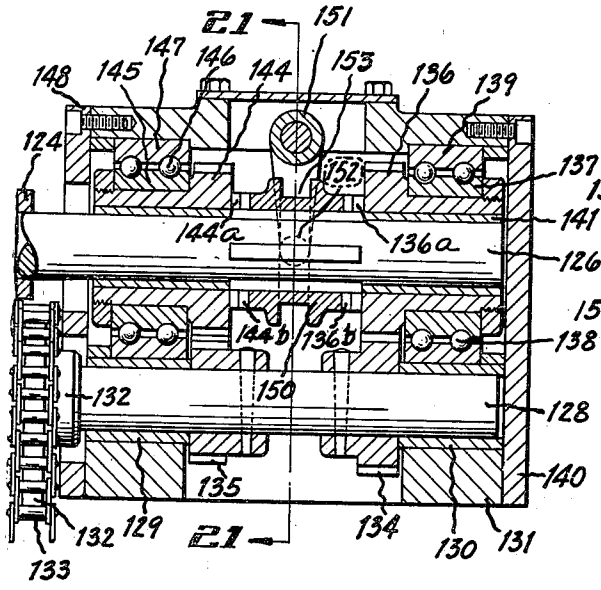


Fig. 20

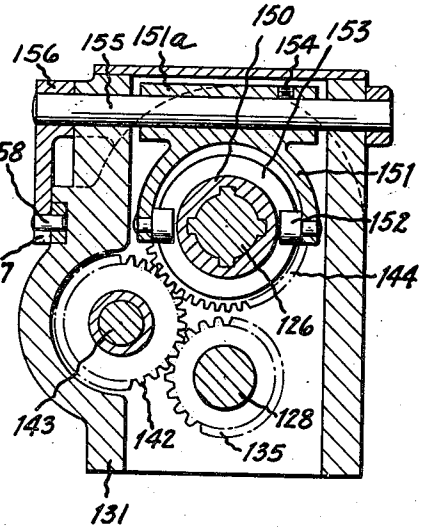


Fig. 21

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Patented Feb. 10, 1942 2,272,850

UNITED STATES PATENT OFFICE

2,272,850

ASSEMBLING MACHINE

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Application July 28, 1938, Serial No. 221,723

14 Claims. (Cl. 18—1)

This invention relates to assembling apparatus by which a number of small articles are located upon an aggregating support in an orderly fashion so that a group of such articles may be transported in assembled relation during a certain manufacturing operation.

As an example of a manufacturing operation in which the present invention is adapted to be used, mention is made of Bakelite-tipped brush holder studs for dynamo electric machines. The stud is a short length of steel rod around one end of which is molded a ring of Bakelite which is integral with the stud, the Bakelite ring being of the proper diameter to be fitted with a press fit within a recess or hole provided in the frame of a dynamo electric machine. The Bakelite ring anchors the stud in position and serves to insulate it from the frame of the machine. It has been the practice to assemble by hand a plurality of studs in an aggregating support which holds the studs in a definite orderly spaced relation. The aggregating support with studs assembled therewith is placed in the mold of a Bakelite press so that by one press operation a plurality of studs are provided simultaneously with the Bakelite insulating rings.

It is an object of the present invention to provide a machine which will automatically assemble a plurality of similar work pieces such as studs upon an aggregating support having recesses which are spaced apart in a predetermined manner, for example, in such manner as to conform to the spacing of the cavities of the Bakelite mold within which the aggregating support and assembled pieces are to be placed in a subsequent operation.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a perspective view of a machine embodying the present invention.

Fig. 2 is a perspective view of the assembly of the studs and plates which are assembled by the machine.

Figs. 3 and 4 are sectional views showing the open and closed position of a Bakelite mold in which the assembly shown in Fig. 2 is used.

Fig. 5 is a perspective view of a stud having molded thereon a ring of insulation as a result of the process carried out by the molds shown in Figs. 3 and 4.

Fig. 6 is a perspective view of the machine looking approximately in the direction of the arrow 6 of Fig. 1.

Fig. 7 is a fragmentary view partly in section taken on the line 7—7 of Fig. 12A.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7.

Figs. 9 and 9A taken together, constitute a side elevation of the machine viewed in the direction of arrow 9 of Fig. 1.

Figs. 10 and 10A taken together, constitute a front elevation of the machine looking in the direction of the arrow 10 of Fig. 6. That part of Fig. 10 which is in section is a sectional view taken on the line 10—10 of Fig. 12.

Fig. 10B is a sectional view on the line 10B—10B of Fig. 10.

Figs. 11 and 11A taken together, constitute a side elevation of the machine looking in the direction of the arrow 11 of Fig. 6.

Figs. 12 and 12A taken together, constitute a plan view of the machine.

Fig. 13 is a plan view of the plates which are assembled with studs by means of the present machine.

Fig. 14 is a sectional view taken on the line 14—14 of Fig. 10 and also the line 14—14 of Fig. 12A.

Fig. 15 is a diagram showing the relation of the cams which control the location of the work-holder carriage with respect to the device which forces a stud in the aligned holes provided by the stud-supporting plates.

Figs. 16 and 17 taken together, constitute a development of the outer cam shown in Fig. 15.

Fig. 18 is a sectional view on the line 18—18 of Fig. 10 and also the line 18—18 of Fig. 12.

Fig. 19 is a sectional view on the line 19—19 of Fig. 18 and also line 19—19 of Figs. 12 and 12A.

Fig. 20 is a sectional view on the line 20—20 of Fig. 12.

Fig. 21 is a sectional view on the line 21—21 of Figs. 12, 12A and 20.

Referring to Figs. 1 to 5, I will first explain one of the uses for which the machine embodying the present invention is adapted. The machine shown in Fig. 1 assembles similar work pieces, such as studs S, with an aggregating support, such as provided by spaced plates P_1 and P_2, as shown in Fig. 2. The spacing of the studs S conforms to the spacing of cavities C_1 and C_2 in Bakelite press molds M and N shown in Fig. 3. The assembly of plates P_1 and P_2 and studs S is placed in mold N and a preform L of uncured Bakelite is placed upon the assembly. Then the molds M and N, which are heated, are brought together

as shown in Fig. 4 to cause rings O of Bakelite to be molded around the studs S. The closing of these molds causes plate P_2 to engage P_1. Both plates serve as a dam to prevent the plastic Bakelite from creeping down into the lower cavities C_1. After molding as shown in Fig. 4, the assembly is removed from mold M, and the studs as shown in Fig. 5 are removed from the plates P_1 and P_2.

Referring now to Figs. 1, 6, 12A and 14, the machine comprises a main base **20** supported upon a sub-base **21** which in turn is supported upon a table top **22** having legs (not shown) which support the machine a suitable distance above the floor. As shown in Fig. 14, the base **20** has a machine dovetail guide **23** and a machined surface **24** which supports and guides a carriage or slide **25** which moves laterally, that is to the right or toward the left of the operator standing in front of the machine as viewed in Fig. 6. Carriage **25** provides a machined dovetail guide **26** for a carriage or slide **27** which is movable toward or away from the operator standing in front of the machine as viewed in Fig. 6. Movement of the carriage **27** is at right angles to the movement of the carriage **25**. Carriage **27** supports a turn table **28**, pivoted on a stud **29**, fixed at **30** to the carriage **27**, and carriage **27** has a plane surface **31** upon which the turntable **28** rests.

Turntable **28** is located upon carriage **27** in either one of the four positions by means of a plunger **32** which engages a hardened, tapered bushing **28***a* in table **28** as shown in Figs. 7 and 8. Plunger **32** is guided for vertical movement by a bracket **33** attached to carriage **27**. A pin **32***a* extends from plunger **32** into a slot **34***a* in a lever **34** which is pivoted upon a screw-stud **35** attached to carriage **27**. A spring **36** is coiled around the stud **35** and has one of its ends engaging a pin **37** attached to carriage **27** and the other engaging a pin **38** attached to the lever **34**. The spring **36** urges the lever **34** upwardly to force the plunger **32** into the tapered seat provided by the bushing **28***a*. Before the table **28** can be turned, the operator is required to push the lever **34** downwardly.

The turntable **28** supports four similar workholders **41** each comprising a base **42** provided with a plurality of grooves **43** adapted to receive studs S. The base **42** is provided with a shouldered recess **44** for receiving a stud plate P_1. Each base **42** has a pair of spaced ears **45** for supporting a rod **46** upon which is pivoted a cover plate **47** having a shouldered recess **48** for receiving a second stud plate P_2. Plates P_1 and P_2 are punched out from sheets of insulating fiber. As shown in Figs. 2 and 12A, there are **22** studs S, which are assembled with each pair of plates P_1 and P_2. Plates P_1 and P_2 comprise an aggregating support for the work pieces, the studs S. The studs S are arranged in five rows and in staggered relation, there being four studs in each of the first, third and fifth rows, and five studs in each of the second and fourth rows. Consequently the base **42** will have **5** grooves **43**, so located as to position the studs in the manner shown in Fig. 12A. The supporting plates P_1 and P_2 are provided with similarly arranged holes in alignment with the grooves of the base **42**, the holes in the plates P_1 and P_2 being such that the studs will have a press fit with the plates. The cover **47** is also provided with grooves, of such length or depth as to provide clearance for the studs S.

The base **20** supports pedestals **50** and **51**, as shown in Figs. 12A and 14, which are tied together by a bracket **52**, providing a vertical groove **53** (Fig. 12A) for a vertically reciprocable slide **54** carrying a plunger **55** (Fig. 14), the lower end of which moves through a passage **56**, which, as shown in Figs. 10B and 14 is provided between a stationary plate **57** and a movable plate **58** hingedly connected with plate **57** by the hinge pin **59**. Plate **58** is yieldingly urged toward the plate **57** by a spring **60** confined between plate **58** and the head of screw **61** threaded into the plate **57**. Plate **57** is attached by screws **62** to an extension **63** projecting out from the bracket **52**. The passage **56** which is provided by parts **57** and **58** constitutes the work piece receiving means since it receives a stud S. Plunger **55** constitutes the means for moving the work piece from the receiving means into an aligned recess in the aggregating support provided by plates P_1 and P_2.

As shown in Fig. 10B, the passage **56** within which the plunger **55** operates, is connected with a similar recess **70**, vertically offset therefrom, a passage **71** of such width as to receive a horizontal reciprocating ram **72** provided by a bar **73** which is supported by ways **74** and **75** integral with the plate **57** which is carried by the bracket extension **63**. This construction is also shown in Fig. 9. As shown in Fig. 10, the studs S descend by gravity to a chute or magazine **80** into which the studs are fed endwise by a hopper feed of conventional design which is not shown in the drawings since it forms no part of the present invention. The chute or magazine **80** is supported by the bracket **52** in such manner that the studs S will gravitate into the recess **70** and will rest upon a ledge **81** provided by the plate **57**. The ram **72** operates to force a stud S laterally or horizontally from the recess **70** to the passage **56**. Ram **72** constitutes means for moving a work piece from the magazine or chute **80** into the work piece receiving means provided by the passage **56**. Recess **70** is slightly larger in diameter than the stud so that the stud will freely drop into it. The passage **56** is slightly smaller in diameter than the stud S so that it will be gripped between the plates **57** and **58** and held there frictionally due to the pressure exerted by the spring **60**. As will be apparent in Fig. 14 the plunger **55** forces the stud S into the passage **56** and through the aligned holes in the aggregating support plates P_2 and P_1 and into the aligned recesses **43** provided by the work holder base **42**.

The means for moving the slides or carriages **25** and **27** so as to bring the grooves **43** of that work holder **41**, which has been manually located adjacent the passage **56**, successively into alignment with the passage **56** will now be described.

The upper carriage **27** carries a bracket **90** carrying a pivoted roller **91** which cooperates with a cam **92** having five lands numbered respectively **92***a*, **92***b*, **92***c*, **92***d* and **92***e*. The cam **92** has a hub **93** extending laterally beyond the lands of the cam as shown in Fig. 12A. The cam is mounted on a shaft **94** and located thereon by a key **95** which is fixed by two set screws **96**. Shaft **94** is journalled in bearings **97** fixed in hubs **98** integral with the brackets **50** and **51** as shown in Fig. 12A. The roller **91** of carriage **27** is yieldingly urged against the cam **92** by a spring **100**, positioned in a recess **101** provided in the dovetail guide **26** of carriage **25** and confined between a pin **102** fixed to carriage **25** and a pin

103 fixed to carriage 27. The lands 92a, 92b, 92c, 92d and 92e of the cam 92 respectively locate the carriage 27 and work holder 42 so that the five grooves 43 are brought successively into alignment with the recess 56 and the plunger 55.

In order to locate the work holder 42 so that each of the 5 recesses or grooves 43 therein is brought successively under the plunger 55, the carriage 25 is provided with a bracket 105 carrying a pivotally mounted roller 106 which cooperates with a cam 107 having a hub 108 fixed to the shaft 94 and having 22 lands which are marked L_1 to L_{22} respectively, as shown in Figs. 1, 10A, 12A, 15, 16 and 17. Fig. 6 shows the machine in the normal, at-rest position at the end of one of its cycles of operation. Hence the roller 106 bears against the land L_1 of cam 107. This figure shows that the roller 106 is urged toward the various lands of the cam 107 by means of a weight 108 attached to a chain 109 passing passing around a sprocket wheel 109a and fixed to the head of a screw 109b threaded into the carriage 25 and locked into position by nut 109c. Sprocket 109a is pivoted on a shaft 109d supported by ears 109e, integral with the table top 22.

According to the illustrations of the machine in Figs. 12A, and 14, carriages 25 and 27 have been located so that the workholder 41 attached and the plunger 55 have been positioned for locating the fifth stud S therein. This will be apparent from Fig. 13, which is a diagram showing the order in which the studs are positioned in the work holder and stud-supporting plates P_1 and P_2. It will be noted that the stud holder #5 is located in alignment with the plunger 55 represented by the dot-dash line circle marked 55. Accordingly it will be observed that roller 106 of carriage 25 is in engagement with land L_5 of cam 107, as shown in Fig. 12A; and, as shown in Fig. 14, roller 91 of carriage 27 is in engagement with the second land 92b of cam 92 and is in the first position on that land. As shown in Fig. 15 each land of cam 92 has as many positions with respect to the roller 91 as there are studs in each row. Referring now to Fig. 13, the first row of studs are numbered 1, 2, 3 and 4. Land 92a therefore has four positions which will maintain the carriage 27 in the proper position for the first row. Cam 107 has lands L_1 to L_4 which shift carriage 27 in a direction parallel to the cam shaft 94, while carriage 27 remains in the same distance from shaft 94. After the first row of studs, numbers 1 to 4 inclusive, have been inserted, carriage 27 must shift a little nearer to the shaft 94 in order to locate the second row in position for alignment with plunger 55. This is provided for by land 92b of cam 92. The difference between the radii of lands 92a and 92b equals the spacing between the first and second row. As the studs in the second row are staggered with respect to studs in the first row, there must be a corresponding shifting of the carriage 27 a distance equal to one-half the spacing between the studs in each row. Therefore, in order to locate hole #5 under plunger 55, land L_5 of cam 107 is spaced longitudinally with respect to the axis of cam shaft 94, a distance equal to one-half the spacing between lands L_1 to L_4 inclusive. Since there are five studs to be inserted in the second row, the cam 107 will have five lands L_5 to L_9 inclusive and the land 92b of cam 92 will have five positions. The land 92c locates the workholder in position for the third row in which the four studs are located. Movement of the carriage 27 laterally for the third row is obtained by the lands L_{10} to L_{13} inclusive of cam 107. Since the third row is staggered with respect to the second row, the lateral shifting from the position required for stud #9 to that required for stud #10 is only one-half the amount of lateral shifting required between stud #10 and stud #11. Therefore the spacing, longitudinally with respect to the axis of the shaft 94, between lands L_9 and L_{10} is only one-half the spacing between lands L_{10} and L_{11}. Land 92d of cam 92 and lands L_{14} to L_{18} of cam 107 control the position of the workholder for the assembling of studs S in the fourth row in positions 14 to 18 shown in Fig. 13. Land 92e of cam 92 and lands L_{19} to L_{22} inclusive of cam 107 control the positioning of the workholder for location of studs in the positions 19 to 22 inclusive shown in Fig. 13. It will be noted that the lateral shifting from position #4 to position #5, from position #9 to position #10, from position #13 to position #14, and from position #18 to position #19, is one-half the lateral shifting from the other positions; hence the difference in location, longitudinally with respect to the axis of cam 94 between lands L_4 and L_5, between lands L_9 and L_{10}, between lands L_{13} and L_{14} and between lands L_{18} and L_{19} is one-half the difference between the relative location of the other lands of cam 107.

As shown in the Figs. 14 and 15, the cams 92 and 107 rotate clockwise to effect the positioning of the workholder in the various positions 1 to 22. It will be seen that the movements of the workholder are intermittent; and, while the workholder is at rest after being located in a certain position, the plunger 55 descends to insert a stud in the aggregating support provided by plates P_1 and P_2. After the cams have made one revolution from the at-rest position shown in Fig. 6, all of the recesses numbered 1 to 22 will be successively filled with studs. By automatic means which will be described later, the machine comes to rest. When it is started again, the shaft 94 is caused to rotate counter-clockwise so that the reverse movement of the cams 92 and 107 takes place. In other words the workholder recesses #22 back to #1 are successively filled with studs. As will be explained later, this reversal of movement is effected automatically by a manually operated device by which the machine is set into operation again at the end of a cycle which produces a clockwise rotation of cams 92 and 107. This control mechanism is so arranged that the starting of the machine again into operation is bound to cause the cams to rotate counter-clockwise; then, after this counter-clockwise rotation of one revolution has been completed, the machine will automatically come to rest; and the starting of the machine into operation will reverse the rotation again so that the cams rotate clockwise. While the machine is at rest the operator will rotate the turntable 28 90° in order to bring an unfilled aggregating support into position adjacent the plunger 55.

Mechanism is provided for reciprocating the plunger 55 (shown in Fig. 10) vertically and the slide 72 (shown in Fig. 10B) horizontally in such manner that, as the plunger 55 moves up, the slide 72 moves to the right as shown in Figs. 10 and 10B and, when the plunger 55 moves down, the slide 72 moves toward the left. Plunger 55 has a threaded head 55a which is screwed into an extension 54a of the slide 54 and is held in desired position by set screw 55b. The slide 54 is provided with a notch 54b which receives a roller 110 mounted on a pin 111 carried by bi-

furcated lever 112 which rocks on a stud 113 extending from the bracket 52 as shown in Fig. 9. Lever 112 carries at its left end as shown in Fig. 10 a pin 114 which connects the lever with a bifurcated clevis 115 having a threaded shank 116 connected by a turn-buckle 117 with the screw 118 into a boss 119 of a connecting rod end 120 which cooperates with a connecting rod strap 121 to provide a bearing for a crank pin 122 which is integral with crank arms 123 and 124 as shown in Figs. 1 and 9. Crank arms 123 and 124 are attached respectively to shaft 125 (shown in Fig. 18) and shaft 126 (shown in Fig. 20). As shown in Figs. 20 and 21, the shaft 126 has a direct and a reverse gear connection with a drive shaft 128 supported in bearings 129 and 130 provided by a frame 131. Shaft 128 carries a sprocket 132 connected by a chain 133 with another sprocket (not shown) which is driven by an electric motor through a suitable speed reducer. Shaft 128 drives gears 134 and 135. Gear 134 directly meshes with a gear 136 having its hub fixed to an inner ball-bearing race 137 rotatably supported by balls 138 with respect to an outer bearing race 139 mounted within a suitable recess provided by the frame 131 and secured thereto by cover plate 140. The hub of gear 136 carries a bearing 141 for the shaft 126. Gear 135 meshes with an intermediate idle gear 142 rotatable on a stub shaft 143 and meshing with a gear 144, the hub of which is fixed to an inner bearing race 145 rotatably supported by balls 146 within an outer ball bearing race 147 secured within a suitable recess provided by the frame 131 and fixed therein by a cover plate 148. Gear 136 carries clutch teeth 136*a*, and gear 144 clutch teeth 144*a*. A clutch collar 150, which is splinedly connected to shaft 126, as shown in Fig. 21, is provided with clutch teeth 136*b* adapted to mate with teeth 136*a* of gear 136 to provide a driving connection between gear 136 and shaft 126. Clutch collar 150 is provided with clutch teeth 144*b* mating with teeth 144*a* of gear 144 to provide a driving connection between gear 144 and shaft 126. By shifting the collar 150 toward the right from its neutral position shown in Fig. 20 the gear 136 is connected with shaft 126 for effecting rotation of the shaft in a certain direction; and, when the collar 150 is shifted toward the left from its neutral position, bear 144 will be connected with the shaft 126 to effect rotation of the latter in the opposite direction. The shifting of the collar 150 is effected by a bifurcated shifting fork 151, each arm of which carries a stud 152 received within the groove 153 of the collar 150. The shifting arm 151 has a hub 151*a* fixed by set screw 154 to a shaft 155 supported by the side walls of the frame 131 and carrying a lever 156 having a notch 157 in its lower end for receiving a pin 158 carried by a horizontally slidable control bar 159 operated by handle 160, as shown in Fig. 6. As shown in Figs. 9 and 9A, the bar 159 slides in ways 161, 162, 163 and 164. Ways 161 and 162 are supported by the frame 131, and ways 163 and 164 are supported by frame 165 which, as shown in Fig. 19, carries ball bearings 166 and 167 supporting the cam shaft 94 carries a worm gear 168 meshing with a worm 169 carried by the shaft 125 journalled in ball bearings 170 and 171 also carried by the frame 165. The ratio of the gearing 169 and 168 is 22 to 1 whereby the crank shaft 125 will move 22 revolutions, or one revolution of the cam shaft 94. This motion is obviously required in order that the plunger 55 which is operated by the crank shaft 125 through the crank, to connecting rod comprising parts 121, 120, 119, 118, 117, 116, 115 lever 112 and roller 110 may make 22 reciprocations during one cycle of operation of the cams 92 and 107 carried by the cam shaft 94.

As stated before, it is a feature of the present machine to bring it to rest at the end of each cycle of movement of the cams at the end of one revolution of the cam shaft 94. To accomplish this, shaft 94 carries a disc 175 having a notch defined by the parallel sides 176 and 177 journalled by cylindrical side 178. Within this notch is located a pawl 179 mounted to a screw 180 carried by the disc 175. The pawl 179 has a position shown in full lines in Fig. 9 in which it bears against the notch side wall 176, and another position indicated at 179*a* in dot-dash lines in which it bears against the notch side wall 177. As shown in Fig. 9, the spacing between the two positions of the pawl 179 is V-shaped and is just wide enough to be occupied by a pin 181 carried by the control bar 159. When the machine is in the normal at-rest position the pin 181 will be in the neutral position shown in Fig. 9, corresponding to the neutral position of lever 156 shown at the right of this figure and corresponding to the neutral position of the clutch shifting fork 151 and clutch collar 150 as shown in Fig. 20. When the pawl 179 rises to the left of the pin 181, it blocks movement of the bar 159 toward the left as viewed in Fig. 9 therefore, there is only one way in which the bar can be moved, and that is toward the right of this figure. Such movement would cause the clutch collar 150 shown in Fig. 20 to move toward the right to connect the driving shaft 128 with the crank shafts 126 and 125 for one direction of movement of the cam shaft counter-clockwise as viewed in Fig. 9 and clockwise as viewed in Figs. 14, 15 and 16. This would effect rotation of the cam in such direction as to effect the positioning of the aggregating support plates P_1 and P_2 in consecutive position for inserting studs in the order of 1 to 22, as indicated in Fig. 13. During this cycle of operation of the machine, the pin 181 will be in the dot-dash line position 181*a* shown in Fig. 9. At the close of one cycle of operation of the machine during which the cam shaft 94 rotates counter-clockwise as viewed in Fig. 20, the pawl 179 will be turned counter-clockwise; and, during this movement of said pawl 179, it will engage the right-hand side of the pin at its position 181*a* and shift it back to the neutral position, thus causing the machine to stop with the pawl 179 located in the position 179*a*. In this position of pawl 179 it blocks movement of the bar 159 toward the right as viewed in Fig. 9; hence, the only way the machine can be started again is to move the pawl 179 toward the left as viewed in Fig. 9. Such movement of the pawl 179 will cause the clutch collar 150 to be moved toward the left, as viewed in Fig. 9, thereby connecting the crank shafts 125 and 126 with the drive shaft through an intermediate gearing which effects reverse rotation, thereby causing the cam shaft 94 to rotate clockwise as viewed in Fig. 9, or counter-clockwise as viewed in Figs. 14, 15 and 16. Such rotation of the cam will effect the reversal of the cycle of operation of the machine, causing studs to be stacked in the aggregating support plates P_1 and P_2 in the order of 22, 21, etc., back to 1.

The means for moving the slide bar 73 which

carries the ram 72 as shown in Fig. 10B is operated from the rocking lever 112, shown in Fig. 10. This figure shows the lever 112 in a mid-position corresponding to the mid-position of the crank 122. Assuming that the crank 122 moves clockwise as viewed in Fig. 10, as the crank moves downwardly the roller 110 carried by the lever 112 will move upwardly in order to move the ram 55 upwardly. At the same time it is desired that the slide 73 move toward the right in order that the ram 72 may move a stud from the recess 70 into the stud receiving passage 56, shown in Fig. 10B. To accomplish this, the lever 112 is provided with a lug 190 carrying a stud 191 which extends through a lug 192 integral with lever 193 loosely journalled in the stud 113. Between the lugs 190 and 192 is located a compression spring 194 surrounding the stud 191 and tending to separate the two lugs. The separation of these lugs is limited by nuts 195 and 196 threaded on the end of the stud 191. As the lever 112 rotates counter-clockwise to elevate the plunger 55, the lug 190 moves downwardly and causes the spring 194 to transmit movement of the lever 193 by causing it to move toward the right as viewed in Fig. 10 and to engage a stop screw 197 carried by lug 196 integral with the slide 73. The adjustment of the stop screw is such that, during upward movement of the plunger 55, the ram 72 will move a stud from the recess 70 to the passage 56 as shown in Fig. 10B. As one of the studs S is so moved, the stack of studs S in the chute above the ram 72 will rest upon the top of the ram. Then, during the clockwise rotation of the lever 112 which follows, the plunger 55 will descend to push that stud which is located in passage 56 down into the aligned holes of the workholder and stud plates below. Also, during this clockwise movement of lever 112, the lever 193 will release the screw pin 197 and permit a spring 199, confined in a recess 199a in Fig. 10B and pushing against a pin 100 attached to slide 73, to move the slide 73 into the position shown in Figs. 10 and 10B in which the ram 72 has been withdrawn from the recess 70, thereby permitting another stud to fall upon the bottom wall 81 of this recess. Movement by the spring 199 of the slide 73 toward the left in Figs. 10 and 10B is limited by a stop plate 201.

The amount of dwell on each of the lands L_1 to L_{22} of cam 107 is such that the workholder will remain stationary during the time a stud S is being forced downwardly from the stud receiving passage 56 by the ram 55 into the aggregating support plates P_1 and P_2 and at least until the stud S clears the lower end of the plates 57 and 58 which guide the ram.

To operate the machine, the operator sits in front of the machine, as viewed in Fig. 6, and uses his left hand to shift the control handle 160, and his right hand to load the aggregating support plates into the workholders. The workholder 41, which is at the right of all other workholders shown in Fig. 6, is in the loading position. It will be noted that an aggregating support plate P_1 has been located thereon. After doing this, the operator will rotate the cover 47 into the position shown in Fig. 14 and will place the other aggregating support plate P_2 upon the cover 47. The workholder is then loaded. Subsequently it passes into the operating position underneath the ram where the studs S are forced through the aligned openings in the aggregating support plates P_1 and P_2. The workholder 41 which is at the left of all other workholders carries an assembly of studs and stud plates. The work, however, is not unloaded from a workholder while in this position. When the workholder comes to the position nearest to the operator, then the cover 47 is turned back as shown and it carries with it the assembly of studs and aggregating support plates which can be readily removed from the cover 47 by moving the assembly away from the cover pivot pin. The studs thus assembled are ready to be transported to a Bakelite press where end portions of the studs are each tipped with a ring of molded Bakelite.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, means for effecting intermittently, longitudinally of the rows, a relative movement between the work piece receiving means and the holder for the aggregating support so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, means for effecting intermittently, transversely of the rows, a relative movement between the work piece receiving means and the holder so as to effect consecutive alignment of the rows and the work piece, and means for moving the work piece from the receiving means into an aligned recess of the aggregating support.

2. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, stationary means for receiving a work piece, means for shifting the work piece in the receiving means, a holder for the aggregating support, means for intermittently moving the holder relative to the work piece receiving means, longitudinally of the rows so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, means for intermittently moving the holder relative to the work piece receiving means transversely of the rows so as to effect consecutive alignment of the rows and the work piece, and means for moving the work piece from the receiving means into an aligned recess of the aggregating support.

3. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a row comprising, in combination, means for receiving a work piece, a holder for the aggregating support, power operated means for effecting intermittently, longitudinally of the row a relative movement between the work piece receiving means and the holder so as to effect consecutive alignment of the recesses in the aggregating support and the work piece, power operated means for moving the work piece from the receiving means into an aligned recess of the aggregating support, a clutch for connecting a source of mechanical power with the power operated means to rotate same, means for causing the clutch to disconnect the power operated means with the source of mechanical power for stopping the ma-

chine automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and manual control means for causing the clutch to connect the source of power for starting the machine and effecting reversal of the means which effects relative movement between the work piece receiving means and the holder in order to effect reversal of the order in which the recesses of the aggregating support are filled.

4. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a row comprising, in combination, means for receiving a work piece, a holder for the aggregating support, means for intermittently moving the holder relative to the work piece receiving means, longitudinally of the row, so as to effect consecutive alignment of the recesses in the support and the work piece, means for moving the work piece from the receiving means into an aligned recess of the aggregating support, a source of mechanical power; means for connecting the source of power with the moving means, means for disengaging the connecting means with the source of power and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and manual control means for engaging the connecting means with the source of power for starting the machine and effecting reversal of the means which effects the movement of the support relative to the work piece receiving means in order to effect reversal of the order in which the recesses of the aggregating support are filled.

5. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, power actuated means for effecting intermittently, longitudinally of the rows, a relative movement between the work piece receiving means and the holder for the aggregating support so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, power actuated means for effecting intermittently, transversely of the rows, a relative movement between the work piece receiving means and the holder for the aggregating support so as to effect consecutive alignment of the rows and the work piece, means for moving the work piece from the receiving means into an aligned recess of the aggregating support, a source of mechanical power, a clutch for connecting the source of power with the power actuated means to operate same, means to disengage the clutch and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and manual control means for connecting the clutch with the source of power starting the machine and effecting reversal of the means which effects relative movement between the work piece receiving means and the support in order to effect reversal of the order in which the recesses of the aggregating support are filled.

6. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, power actuated means for intermittently moving the holder relative to the work piece receiving means longitudinally of the rows so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, power actuated means for intermittently moving the holder relative to the work piece receiving means transversely of the rows so as to effect consecutive alignment of the rows and the work piece, means for moving the work piece from the receiving means into an aligned recess of the aggregating support, a source of mechanical power, a clutch for connecting the source of power with the power actuated means, means for disconnecting the clutch and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and means for connecting the clutch with the source of power for starting the machine and effecting reversal of the means which effects the movement of the holder relative to the work piece receiving means in order to effect reversal of the order in which the recesses of the aggregating support are filled.

7. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, a slide carrying the holder and movable transversely of the rows of recesses in the aggregating support, a cam for controlling movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable longitudinally of the rows, a cam for controlling the movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, a source of mechanical power, and coordinated mechanisms actuated by the source of power for operating the cams and for moving the work piece from the work piece receiving means into an aligned recess of the aggregating support.

8. A machine for assembling a plurality of similar work pieces with an aggregating support having workpiece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, a magazine for holding a plurality of work pieces, a slide carrying the holder and movable transversely of the rows of recesses in the aggregating support, a cam for controlling movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable longitudinally of the rows, a cam for controlling the movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, a source of mechanical power and coordinated mechanism actuated by the source of power for operating the cams and for moving the work pieces singly from the magazine to the receiving means and from the receiving means into an aligned recess of the aggregating support.

9. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, a magazine for holding a plurality of work pieces, a slide carrying the

holder and movable transversely of the rows of recesses in the aggregating support, a cam for controlling movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable in the direction of the rows, a cam for controlling the movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, coordinated mechanisms including a clutch to connect a source of power for operating the cams and for moving the work piece from the work piece receiving means into an aligned recess of the aggregating support, means disengaging the clutch and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and means for engaging the clutch for starting the machine and effecting reversal of the mechanism which operates the cams thereby effecting reversal of the order in which the recesses of the aggregating support are filled.

10. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a holder for the aggregating support, a magazine for holding a plurality of work pieces, a slide carrying the holder and movable transversely of the rows of recesses in the aggregating support, a cam for controlling movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable longitudinally of the rows, a cam for controlling the movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, coordinated mechanism including a clutch to connect a source of power for operating the cams and for moving the work pieces singly from the magazine to the receiving means and from the receiving means into an aligned recess of the aggregating support, means for disengaging the clutch and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and means for engaging the clutch to connect the source of power for operating the machine and effecting reversal of the mechanism which operates the cams thereby effecting reversal of the order in which the recesses of the aggregating support are filled.

11. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a rotatable table carrying a plurality of holders each adapted to receive an aggregating support, means for securing the table in various positions in each of which a holder is positioned for locating an aggregating support in position for assembly, means for effecting intermittently, longitudinally of the rows, a relative movement between the work piece receiving means and the aggregating support so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, means for effecting intermittently, transversely of the rows, a relative movement between the work piece receiving means and the holder for the aggregating support so as to effect consecutive alignment of the rows and the work piece, and means for moving the work piece from the receiving means into an aligned recess of the aggregating support.

12. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a rotatable table carrying a plurality of holders each adapted to receive an aggregating support, means for securing the table in various positions in each of which a holder is positioned for locating an aggregating support in position for assembly, a slide carrying the holder table and movable transversely of the rows of recesses in the aggregating support, a cam for controlling movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable longitudinally of the rows, a cam for controlling the movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, a source of mechanical power, coordinated mechanisms associated with the source of power for operating the cams and for moving the work piece from the work piece receiving means into an aligned recess of the aggregating support.

13. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination, means for receiving a work piece, a rotatable table carrying a plurality of holders each adapted to receive an aggregating support, means for securing the table in various positions in each of which a holder is positioned for locating an aggregating support in position for assembly, a magazine for holding a plurality of work pieces, power actuated means for effecting intermittently, longitudinally of the rows, a relative movement between the work piece receiving means and the aggregating support so as to effect consecutive alignment of the recesses in any one row in the support and the work piece, power actuated means for effecting intermittently, transversely of the rows, a relative movement between the work piece receiving means and the aggregating support so as to effect consecutive alignment of the rows and the work piece, a source of mechanical power, a clutch adapted to connect the power actuated means with the source of power, coordinated mechanisms for producing operation of the means which effects relative movement between the work piece receiving means and the aggregating support and for causing the work pieces to move singly from the magazine to the work piece receiving means and to move from the work piece receiving means to an aligned recess in the aggregating support, means rendering the clutch ineffective and causing the machine to stop automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and manual operated means for rendering the clutch effective and starting the machine and effecting reversal of the means which effects relative movement between the work piece receiving means and the support in order to effect reversal of the order in which the recesses of the aggregating support are filled.

14. A machine for assembling a plurality of similar work pieces with an aggregating support having work piece receiving recesses arranged in a plurality of rows comprising, in combination,

means for receiving a work piece, a rotatable table carrying a plurality of holders each adapted to receive an aggregating support, means for securing the table in various positions in each of which a holder is positioned for locating an aggregating support in position for assembly, a slide carrying the holder table and movable transversely to the direction of the rows of recesses in the aggregating support, a power actuated cam for controlling the transverse movement of the slide intermittently so as to align the rows of recesses consecutively with the work piece, a second slide carrying the first slide and movable longitudinally of the rows, a power actuated cam for controlling the longitudinal movement of the second slide so as to bring the recesses in any one row consecutively into alignment with the work piece, coordinated mechanisms for operating the cams and for moving the work piece from the work piece receiving means into an aligned recess of the aggregating support, coordinated means for operating the cams and for moving the work pieces singly from the magazine to the work piece receiving means, and from the work piece receiving means into an aligned recess of the aggregating support, a source of power, a clutch for connecting the power actuated cams with the source of power, means for disengaging the clutch for stopping the machine automatically after a predetermined number of assembling operations at which time the recesses of the aggregating support will be filled, and manual control means for starting the machine and effecting reversal of the mechanism which operates the power actuated cams thereby effecting reversal of the order in which the recesses of the aggregating support are filled.

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