May 20, 1930. L. T. FREDERICK 1,759,500

COMMUTATOR ASSEMBLY APPARATUS

Filed June 7, 1927 2 Sheets-Sheet 1

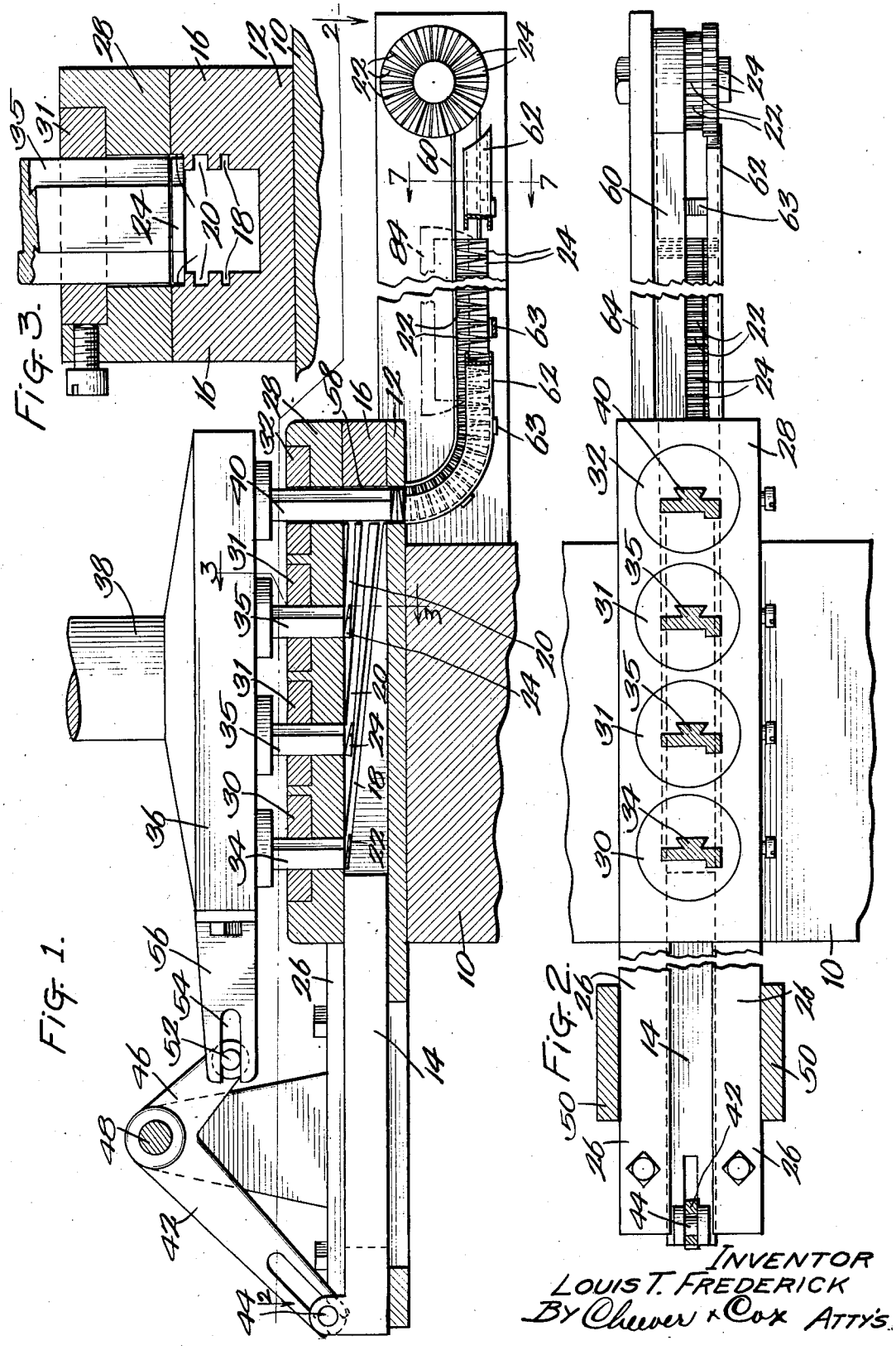


FIG. 3.

FIG. 1.

FIG. 2.

INVENTOR
LOUIS T. FREDERICK
BY Cleaver & Cox ATTY'S.

May 20, 1930. L. T. FREDERICK 1,759,500

COMMUTATOR ASSEMBLY APPARATUS

Filed June 7, 1927 2 Sheets-Sheet 2

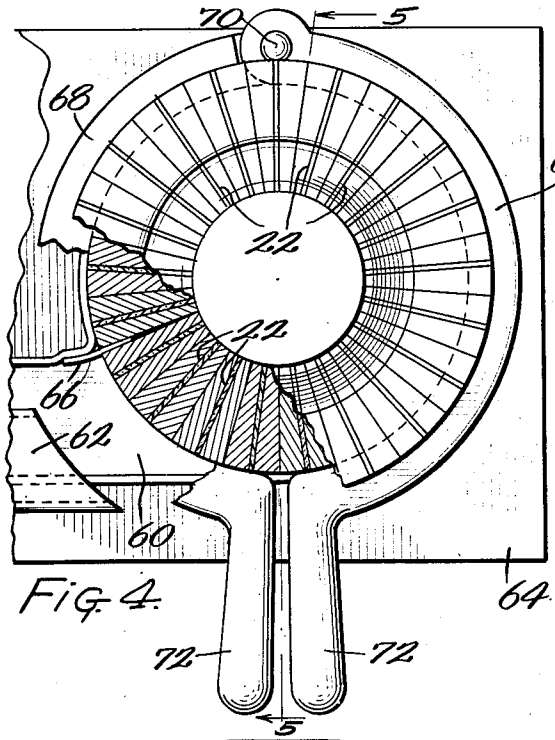


Fig. 4.

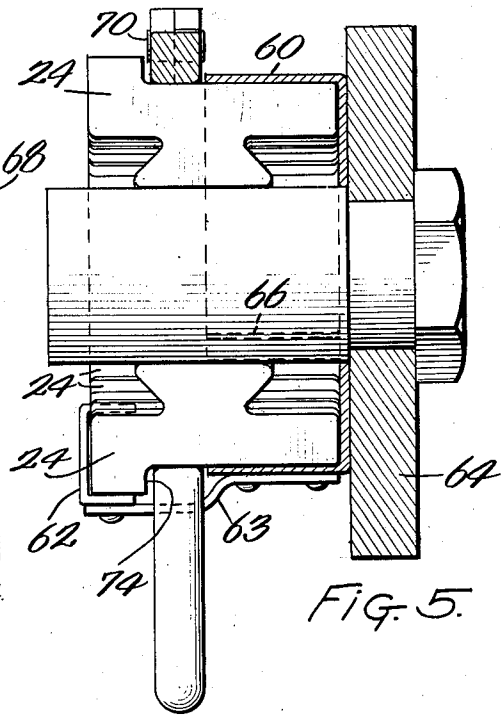


Fig. 5.

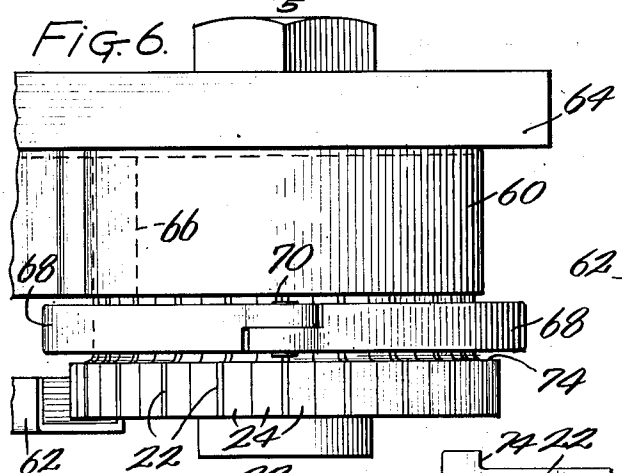


Fig. 6.

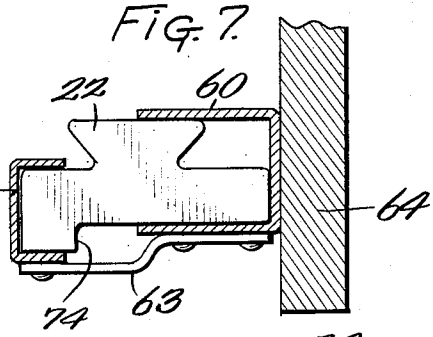


Fig. 7.

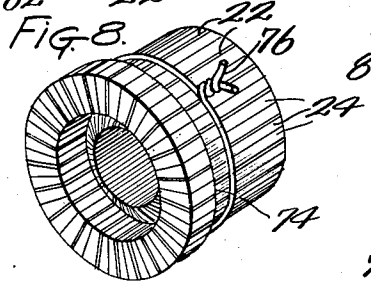


Fig. 8.

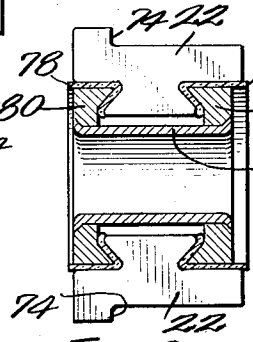


Fig. 9.

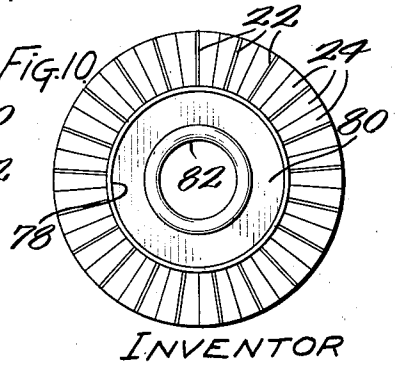


Fig. 10.

INVENTOR
LOUIS T. FREDERICK
BY Cheever & Cox ATTY'S.

Patented May 20, 1930

1,759,500

UNITED STATES PATENT OFFICE

LOUIS T. FREDERICK, OF VALPARAISO, INDIANA

COMMUTATOR-ASSEMBLY APPARATUS

Application filed June 7, 1927. Serial No. 197,145.

My invention relates to machines for making multi-part objects of which commutators are a typical example. The invention contemplates both means for assembling the parts and also for producing them, and in the most highly developed form the same machine which produces the elements assembles them in the proper sequence and then, without hand manipulation, arranges them in circular form. As the machine is especially applicable to the production of commutators I will refer to the machine as a commutator-making machine, although it will be understood that the principles of the invention might be applied to other articles of like nature. The machine is intended primarily for commutators of the smaller sizes, for example those used for starting or lighting in motor vehicles, although commutators of larger sizes may also be produced to advantage in machines embodying the invention.

Commutators comprise copper segments alternated with segments of suitable insulating material. According to the most usual present-day practice the insulating element consists of punchings from mica plate, the latter consisting of mica flakes held in overlapping relation by a small percentage of shellac or other binder.

So far as I am aware the assembling of the commutator parts has heretofore been accomplished manually. The custom has been to pick up the segments by hand and assemble them circularly in proper sequence, the insulating segments being placed between the copper segments to keep the latter properly insulated. On account of the exigencies of manufacture, the copper segment lying between two insulating segments is sometimes split and made in two parts, but whether the copper segments are made in two parts or one, it will be understood that the total number of individual segments in a commutator is considerable, and the assembling thereof when accomplished by hand involves considerable labor. This is expensive, as it is imperative that the sequence of the cover and insulating segments be absolutely correct in order that the finished commutator may function properly. It will also be understood that when the commutators are assembled manually careful inspection is required in order to insure the production of a perfect, operative structure. The general purpose of my invention is to provide mechanism for eliminating so far as possible the manual labor heretofore involved in producing articles of this type.

As contributing to the general purpose of the invention one of the objects is to provide means for automatically grouping the commutator segments, by which I mean the copper and the insulating segments, in circular form. Another object is to provide mechanism for automatically arranging the segments in proper sequence, the insulating segments being located between adjacent copper segments. In the particular form illustrated two copper half-segments are arranged between adjacent insulating segments. Another object is to provide mechanism by which for this type of commutator two copper segments may be produced for each single insulating segment, thus to provide the proper proportion of parts. Another object is to provide means for conveying the commutator segments from the mechanism where they are produced to the assembly point where they are arranged in circular form. Other contributing objects will become apparent as the description proceeds.

These objects are accomplished by the mechanism illustrated in the accompanying drawing, in which

Figure 1 is an assembly view of the chief operating parts of the machine, the same being shown in side elevation, partly in section upon a vertical plane passing through the center of the dies.

Figure 2 is a plan section taken on the line 2—2 Figure 1.

Figure 3 is a vertical section taken on the line 3—3 Figure 1.

Figure 4 is a side elevation partly in section showing the curved channel wherein the commutator elements are arranged in circular form. This figure also shows the entrance to such channel and also a clamp by which the circular grouping can be completed and the grouped elements removed

from the machine for subsequent operations such as applying the hub portions.

Figure 5 is a sectional view on the line 5—5 Figure 4.

Figure 6 is a top plan view of the parts shown in Fig. 4.

Figure 7 is a sectional view on the line 7—7 Figure 1.

Figure 8 is a perspective view of the copper segments with their intervening insulating segments after they are taken from the assembling machine, and a wire has been substituted for the clamp for holding the parts together temporarily while the hub elements are being applied.

Figure 9 is a diametral section of a finished commutator after the hub segments have been applied; and

Figure 10 is an end view of the commutator looking toward the right in Figure 9.

Like numerals denote like parts throughout the several views.

In the form selected to illustrate the principles of the invention there is a main frame 10 which supports, among other things, a plate 12 which forms a seat for a reciprocating feed plunger 14. Plate 12 also supports guide blocks 16 which are arranged longitudinally of the machine to form side guides for plunger 14. Their inner walls have slots 18 and 20 which extend obliquely forward and downward, the lower slots 18 serving to guide the insulating segment 22, and the upper slots 20 serving to guide the copper segments 24. For convenience I will refer to these as copper, although it will be understood that other conducting material might be substituted.

At the rear end of the machine the plunger 14 is held down by gibs 26. Above the blocks 16 is a die holder 28 into which are countersunk dies 30, 31, and a plunger guide 32. Cooperating with dies 30, 31 are punches 34, 35 respectively, secured to a vertically reciprocating punch holder or head 36. This punch holder is operated by a vertically reciprocating stem 38 or other appropriate means. It will be understood, of course, that the form of punches and dies will be changed to produce segments of different sizes and shapes. A feed plunger 40 is also fastened to the under side of the punch holder 36, its purpose being to advance the segments along the main guide channel hereinafter described.

The plunger 14 is operated by means of a slotted arm 42, which engages a pin 44 mounted at the rear end of the plunger. Arm 42 is rigidly connected to a second arm 46, the two forming a bell crank pivoted upon a pin 48 supported in stationary standards 50 near the rear end of the machine, as best shown in Figures 1 and 2. At the free end of arm 46 is a pin 52 which works within a slot 54 formed in an arm 56 fastened to the die holder 36. The construction is such that as the die holder moves up and down to produce the punchings the feed plunger 14 moves back and forth in timed relation therewith to advance the segments 22, 24 along the guide slots 18, 20 to the main guide channel, presently to be described.

In the operation of the segment-producing mechanism above described mica plate will be fed by hand or otherwise across the top surface of the die 30 shown at the left of Figures 1 and 2, and when the punch holder descends the punch 34 will punch out an insulating segment 22. Similarly wedge-shaped copper strips will be fed across the top of the dies 31, and as the die holder descends the punches 35 will punch out copper segments 24. As these segments 22, 24 descend they enter into the communicating end of the guide slots 18, 20 respectively, and are then pushed forwardly along said slots by the feed plunger 14. In the illustrated design the slot 18 is lowest, and the two slots 20 are above, and hence it follows that when the segments reach the forward end of the guide slots they will be in vertical alinement, with the insulating segment lowermost, and as this operation is repeated in subsequent operations of the machine it follows that the sequence of the segments will always be the same, i. e. two copper segments between successive insulating segments. It will be evident that the vertical portion 58 of the chute or guide channel may be regarded as a magazine having segment inlet ducts 18 and 20 entering from the side at different points along it whereby when the segments are introduced simultaneously through the ducts they will occupy a predetermined relation to each other in the duct.

At the forward end of the ducts or slots 18, 20 there is a chute 58 into which the segments are pushed by plunger 14. This chute as illustrated is vertical and communicates at the bottom with a main guide channel presently to be described, which comprises a continuation of the chute 58. After the segments have dropped into this chute they are pushed downward into and along the guide channel by the vertically reciprocating plunger 40.

According to the illustrated design the main guide channel is formed in two parts 60, 62 as shown in detail in Figure 7. This two-part arrangement is employed partly for convenience of manufacture owing to the peculiar form of the segments employed in the selected design, and partly to afford access, visual and otherwise, to the segments as they are traveling along the main guide channel. The inner part 60 is bolted or otherwise secured to a plate 64 fastened to the main frame 10. The outer part 62 is supported at intervals by brackets 64 secured to the under side of channel 60. In the illustrated form the channel members 60, 62 are U-shaped with their parallel edges arranged horizontally and facing toward each other. Considering them as a whole they extend vertically down-

ward at the point where they meet the chute 58, but soon straighten out to extend horizontally toward the forward end of the machine where the segments are to be put into circular arrangement.

Now referring to the forward end of the guide channel, where the segments are caused to assume circular form, attention is called particularly to Figures 4, 5 and 6 where the details are more clearly illustrated.

The outer part 62 of the guide channel terminates just short of what may be termed the "ring chamber" while the inner part 60 continues but in circular form instead of straight. Thus it may be said that the chute enters the ring chamber tangentially and it will be evident that as the segments move forward step by step under the intermittent operation of the feed plunger 40 they will gradually fill the ring chamber until the foremost segment reaches a stop 66 located at the near edge of the mouth of the guide channel. When the present design is employed, i. e. with the ring chamber arranged in a vertical plane about a horizontal axis, the stop 66 will be located at the roof of the guide channel, although it will be understood that the position in space of the axis of the ring chamber may be varied without departing from the spirit of the invention.

In the operation of the main chute and the ring chamber the feed plunger 40 when it rises permits a fresh set of segments to fall into the top of the chute. Then, as the plunger descends, it forces the segments intermittently down and forward to the ring chamber. When they reach the ring chamber they begin to travel upwards and around until the forward one reaches stop 66. The operator then stops the machine for a moment and adjusts a clamp around a sufficient number of them to make a complete circle and form the entire commutator so far as the segments are concerned. In the form illustrated this clamp consists of two half rings 68 pivoted together by a pin 70 and provided with handles 72 as best shown in Figures 4, 5 and 6.

In the illustrated form the segments have shoulders 74, and as the outer part 62 of the chute is absent in front of the ring chamber it is possible for the clamp to be adjusted behind the shoulders 74 and in front of the guide part 60. Consequently when the parts are thus engaged by the clamp they may be withdrawn horizontally from the ring chamber and will retain their form so long as the clamp remains closed. When the process has reached this stage the operator may apply a tie wire 76 around the segments as shown in Figure 8, which will hold the parts assembled and permit the clamp to be removed for use again.

While the succeeding steps of the process are not intimately connected with the machine itself, it is of interest in this connection to point out that after the segments have been thus arranged in circular form and tied, the commutator may be completed by inserting insulating ring 78 in the usual manner, then applying ring bushings 80, and finally inserting a central tube 82, all as shown in Figures 9 and 10. The parts may then be locked in position by crimping or expanding the outer ends of the tube 82.

It will be understood that certain portions of the machine may perform a useful function without cooperation from all the other portions of the machine. For example, it would reduce labor over a completely manual process to employ the punches and dies together with the slots which guide the punchings to the main chute, and the plunger 40 which advances the punching along the main chute. The punchings would have their proper sequence and a sufficient number might then be lifted out of the chute to form a single commutator. The proper number to withdraw could easily be arrived at by counting or, better, by employing a measuring stick 84 shown near the right end of Figure 1. It is also evident that the segments might be introduced in proper sequence in the main chute by hand and then forced into the ring chamber, which would automatically arrange the segments in circular form. It will be evident, however, that it is of advantage to employ the machine in its more developed and completed form, as illustrated and described.

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

1. In a machine for assembling commutator segments, a ring chamber for arranging the segments circularly, and a guide for the segments terminating in the ring chamber.

2. In a commutator making machine, a ring chamber having an opening at one side for the introduction of commutator segments tangentially, said chamber being open at the front to permit withdrawal of the segments after they have been circularly arranged.

3. Means for assembling commutator segments in circular form comprising a ring chamber, a guide entering it tangentially, and a stop at one side of the mouth of the chute where it enters the ring chamber for temporarily supporting the foremost segment and holding it out of the way of the segments entering the ring chamber.

4. In a commutator making machine, a chute for guiding commutator segments, said chute curving at the forward end to arrange the segments substantially circularly, the curved portion being of less depth than the segments whereby the ends of the latter may project and thus afford an opportunity for

them to be grasped and withdrawn in an axial direction.

5. In a commutator making machine, a ring chamber for arranging commutator segments circularly having an opening at one point of its periphery, and a main chute approaching the opening tangentially, said chute having two parts, one at the front and one at the back for guiding the segments, the front part terminating short of the ring chamber whereby one end of the segments in the ring chamber may project to enable them to be grasped and withdrawn from the ring chamber in an axial direction.

6. In a commutator making machine, a ring chamber for arranging commutator segments circularly, a main chute for conducting the commutator segments to the ring chamber, and means for introducing said segments into said chute in a definite sequence.

7. In a machine of the class described, a magazine for receiving commutator segments, a plurality of ducts leading into said magazine from the side at different points along the magazine and means for introducing segments into the magazine simultaneously through the different ducts whereby they will be arranged in the magazine in a predetermined sequence.

8. In a machine of the class described, a magazine for receiving commutator segments, a plurality of ducts leading into said magazine from the side at different points along the magazine, and means for advancing the segments simultaneously into the magazine from the ducts whereby to arrange the segments in predetermined relation.

9. In a machine of the class described, a magazine for receiving commutator segments, a plurality of ducts leading into said magazine from the side at different points along the magazine, means for advancing the segments simultaneously into the magazine from the ducts whereby to arrange the segments in predetermined relation, and means for intermittently advancing the segments in the magazine after they have been introduced thereinto.

10. In a machine for producing and arranging commutator segments, a plurality of punches with their cooperating dies, ducts for receiving the different punchings individually, a magazine into which the ducts enter at different points, and a plunger capable of simultaneously engaging the different segments in their respective ducts and advancing them into the magazine whereby in the magazine the segments will assume a predetermined sequence.

11. In a machine for producing and arranging commutator segments, a plurality of punches with their cooperating dies, ducts for receiving the different punchings individually, a magazine into which the ducts enter at different points, and a plunger capable of simultaneously engaging the different segments in their respective ducts and advancing them into the magazine whereby in the magazine the segments will assume a predetermined sequence, the plunger being connected to the punches by which it operates in timed relation with them.

12. In a machine for producing and arranging commutator segments, a plurality of punches rigidly fastened together to operate in unison, dies for cooperating with the punches, a duct having guide slots in the side communicating individually with the dies for receiving the punchings therefrom, and a plunger reciprocating within said duct to thereby engage the punchings and advance them along the slots to deliver them from the slots in predetermined relation with each other.

13. In a machine of the class described a plurality of punches rigidly fastened together to operate in unison, dies for cooperating with the punches, a duct having guide slots in the sides communicating individually with the die for receiving the punchings from them, a magazine having a vertical portion into which said slots enter from the side at different elevations, and means operating in timed relation with the punches for advancing the punchings along the slots to thereby stack them in proper sequence in the vertical portion of the magazine.

14. In a machine of the class described, a plurality of punches rigidly fastened together to operate in unison, dies for cooperating with the punches, a duct having guide slots in the sides communicating individually with the die for receiving the punchings from them, a magazine having a vertical portion into which said slots enter from the side at different elevations, means operating in timed relation with the punches for advancing the punchings along the slots to thereby stack them in proper sequence in the vertical portion of the magazine, and a plunger operating in timed relation with the punches for intermittently forcing the punchings forward in the magazine.

15. In a machine of the class described, a ring chamber having a guide channel entering into it tangentially, a plurality of reciprocating punches, dies cooperating with said punches, ducts leading from each of the dies to the main guide channel at different points along it for guiding the punchings toward said channel, means operating in timed relation with the punches for advancing the punchings along said ducts into said guide channel, and other means also operating in timed relation with said punches for intermittently advancing the punchings along the duct to the ring chamber.

16. In a machine of the class described, a ring chamber having a guide channel entering into it tangentially, a plurality of re-

ciprocating punches, dies cooperating with said punches, ducts leading from each of the dies to the main guide channel at different points along it for guiding the punchings toward said channel, means operating in timed relation with the punches for advancing the punchings along said ducts into said guide channel, other means also operating in timed relation with said punches for intermittently advancing the punchings along the duct to the ring chamber, and means for arresting the punchings when said chamber has been filled.

17. In a machine of the class described, a ring chamber having a guide channel entering into it tangentially, a plurality of reciprocating punches, dies cooperating with said punches, ducts leading from each of the dies to the main guide channel at different points along it for guiding the punchings toward said channel, means operating in timed relation with the punches for advancing the punchings along said ducts into said guide channel, other means also operating in timed relation with said punches for intermittently advancing the punchings along the duct to the ring chamber, and a stop projecting into the ring chamber at one side of the entrance of the guide channel for arresting the punchings when the chamber has been filled, and preventing the punchings from clogging the entrance to the ring chamber.

18. In a machine for assembling a commutator, a main chute for receiving commutator segments, a plurality of ducts each introducing a segment into the chute and a member for simultaneously feeding a segment from each duct into the chute, said ducts entering the chute at intervals therealong.

19. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation in circular arrangement comprising a ring chamber, a guide through which the segments may be moved laterally to the ring chamber, and means for so moving the segments.

20. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation in circular arrangement, the combination of a ring chamber, a guide channel entering the ring chamber tangentially and through which the segments may be advanced laterally, means for so advancing the segments through the channel and means formed and arranged in the ring chamber whereby the segments may be removed therefrom axially after having been circularly arranged therein.

21. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation, a ring chamber for arranging the segments circularly, a guide extending tangentially of the ring chamber and through which the segments may be moved laterally to the ring chamber, means for introducing segments into the ring chamber and means for moving the segments laterally through the guide.

22. In a device for assembling elements circularly, a ring chamber for arranging the elements circularly, a guide extending tangentially of the ring chamber and means for introducing the elements through the guide into the ring chamber.

In witness whereof, I have hereunto subscribed my name.

LOUIS T. FREDERICK.

DISCLAIMER

1,759,500.—*Louis T. Frederick*, Valparaiso, Ind. COMMUTATOR-ASSEMBLY APPARATUS. Patent dated May 20, 1930. Disclaimer filed December 3, 1931, by the assignee, *Continental-Diamond Fibre Company*.

Hereby enters this disclaimer to claims 1, 2, 3, 4, 5, 6, 19, 20, 21, and 22 in said patent, which are in the following words, to wit:

"1. In a machine for assembling commutator segments, a ring chamber for arranging the segments circularly, and a guide for the segments terminating in the ring chamber.

"2. In a commutator making machine, a ring chamber having an opening at one side for the introduction of commutator segments tangentially, said chamber being open at the front to permit withdrawal of the segments after they have been circularly arranged.

"3. Means for assembling commutator segments in circular form comprising a ring chamber, a guide entering it tangentially, and a stop at one side of the mouth of the chute where it enters the ring chamber for temporarily supporting the foremost segment and holding it out of the way of the segments entering the ring chamber.

"4. In a commutator making machine, a chute for guiding commutator segments, said chute curving at the forward end to arrange the segments substantially circularly, the curved portion being of less depth than the segments whereby the ends of the latter may project and thus afford an opportunity for them to be grasped and withdrawn in an axial direction.

"5. In a commutator making machine, a ring chamber for arranging commutator segments circularly having an opening at one point of its periphery, and a main chute approaching the opening tangentially, said chute having two parts, one at the front and one at the back for guiding the segments, the front part terminating short of the ring chamber whereby one end of the segments in the ring chamber may project to enable them to be grasped and withdrawn from the ring chamber in an axial direction.

"6. In a commutator making machine, a ring chamber for arranging commutator segments circularly, a main chute for conducting the commutator segments to the ring chamber, and means for introducing said segments into said chute in a definite sequence."

"19. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation in circular arrangement comprising a ring chamber, a guide through which the segments may be moved laterally to the ring chamber, and means for so moving the segments.

"20. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation in circular arrangement, the combination of a ring chamber, a guide channel entering the ring chamber tangentially and through which the segments may be advanced laterally, means for so advancing the segments through the channel and means formed and arranged in the ring chamber whereby the segments may be removed therefrom axially after having been circularly arranged therein.

"21. In a machine for assembling prismatic segments having wedge-shaped cross sectional conformation, a ring chamber for arranging the segments circularly, a guide extending tangentially of the ring chamber and through which the segments may be moved laterally to the ring chamber, means for introducing segments into the ring chamber and means for moving the segments laterally through the guide.

"22. In a device for assembling elements circularly, a ring chamber for arranging the elements circularly, a guide extending tangentially of the ring chamber and means for introducing the elements through the guide into the ring chamber."

[*Official Gazette December 22, 1931*]