Dec. 3, 1929. H. W. COOPER 1,738,097

APPARATUS FOR FORMING COMMUTATOR RINGS

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Fig. 3

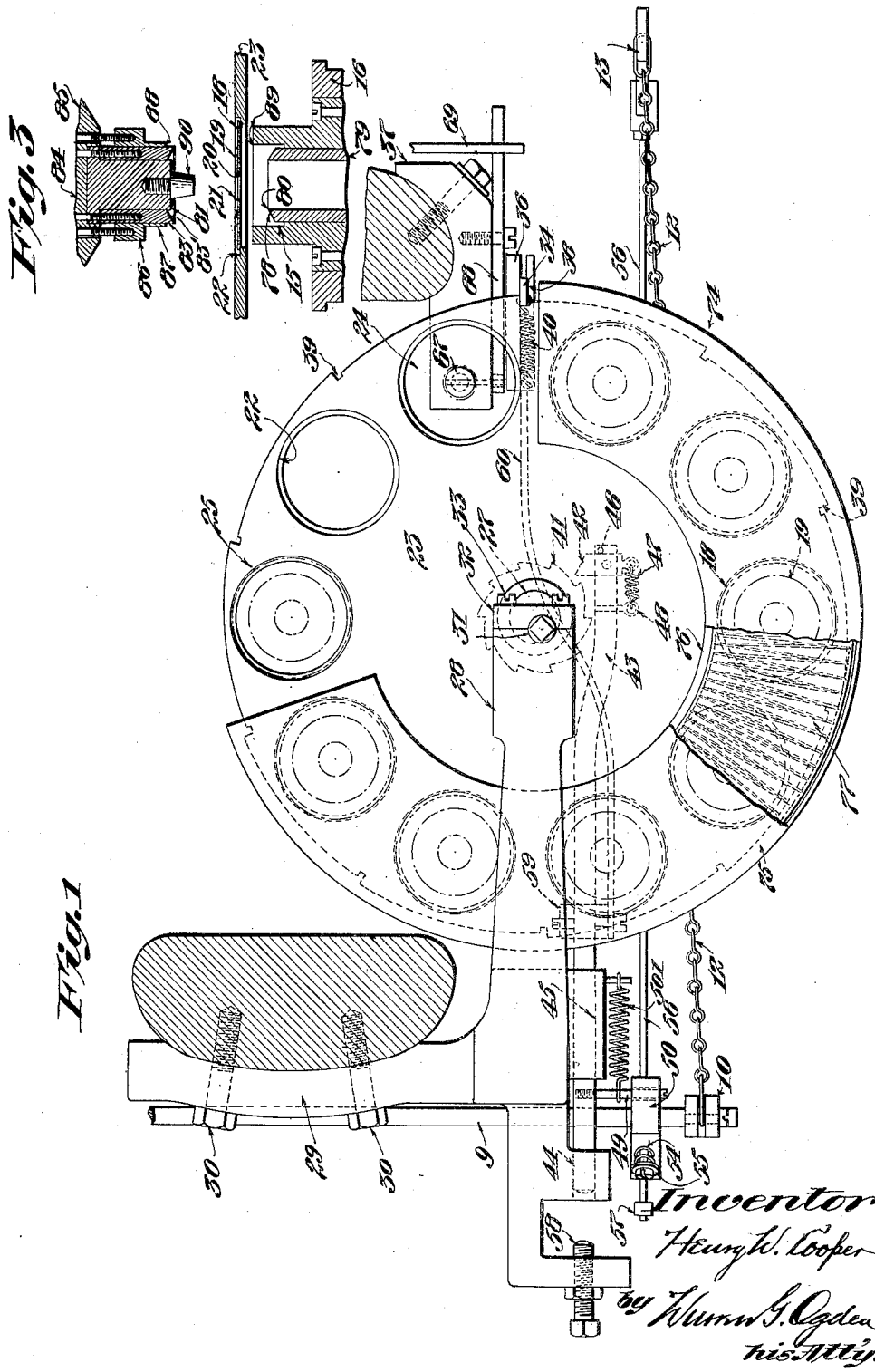


Fig. 1

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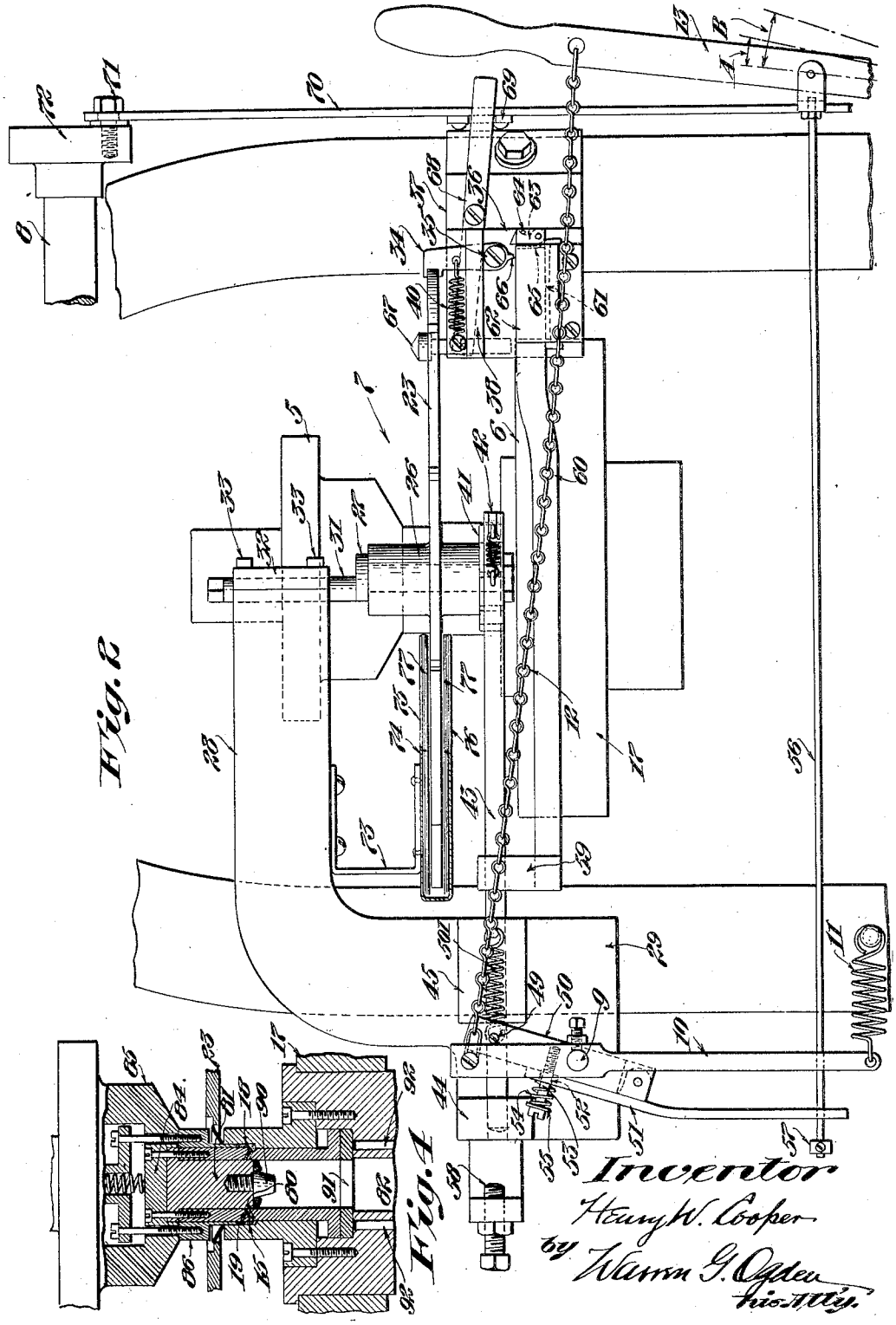


Fig. 2

Fig. 4

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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING COMMUTATOR RINGS

Application filed January 14, 1927. Serial No. 161,092.

This invention relates to an apparatus for forming annular members from sheet material such, for instance, as commutator rings.

Commutator rings comprise an upwardly flaring centrally perforated bottom portion integrally connected with a vertical annular wall. In a co-pending application filed by Edward Cooper April 17, 1924, Serial No. 707,303, there is disclosed an apparatus for producing commutator rings from a single sheet of laminated mica. For increased efficiency it is desirable to reinforce the bottoms of commutator rings and it is the principal object of the present invention to provide novel and efficient apparatus for handling and molding the material required for forming commutator rings having reinforced bottoms.

To the accomplishment of this object, and such others as may hereinafter appear, the various features of the present invention relate to certain devices, combinations and arrangements of parts fully set forth hereinafter, the advantages of which will be readily understood by those skilled in the art.

The various features of the present invention will be readily understood from an inspection of the accompanying drawings illustrating the best form of the invention at present devised, in which:

Figure 1 is a plan of a portion of the apparatus;

Fig. 2 is a front elevation;

Fig. 3 is a detail in sectional elevation of the molding elements separated, and

Fig. 4 is a detail in sectional elevation of the molding elements in molding position.

Referring to the drawings, 5 and 6 represent, respectively the movable and stationary members of a punch press indicated by the general reference numeral 7, and which may be of any usual or preferred construction, preferably of the single cycle type in which the movable member 5 of the press comprises a reciprocatory ram intermittently actuated by connections (not shown) from a main crank shaft 8 (Fig. 2). The main shaft 8 is provided with a clutch (not shown) of the half-revolution type controlled from a rock-shaft 9 (Figs. 1 and 2). Secure to one end of the rock-shaft 9 is an arm 10, the lower end of which is connected to the frame of the press by a coiled spring 11, and the upper end of which is connected through a chain 12 to an operating lever 13 pivoted (at a point not shown) to the frame of the press. Movement of the lever 13 to the right, Fig. 2, oscillates the rock-shaft 9 against the tension of the spring 11 to throw in the clutch and thus actuate the shaft 8 to move the movable press member 5 to its position of pressure. The lever 13 and rock-shaft 9 are returned to their normal inoperative positions by the spring 11. The clutch is thrown out automatically at the end of a half revolution whereupon the movable press member 5 is held in its position of pressure until the lever 13 is reactuated to throw in the clutch which is again thrown out of operation when the movable press member 5 returns to its position of clearance.

The stationary press member 6 is herein shown as provided with a cup-shaped mold 15 (Figs. 3 and 4) secured to a block 16 affixed in and carried by a stationary portion 17 (Fig. 2) of the press frame. For the production of commutator rings having reinforced bottoms two disks 18 and 19 (Fig. 3) of laminated mica having different diameters and central openings 20 and 21, respectively, are superimposed with the openings in registry in a pocket 22 arranged to extend over the mouth of the cup-shaped mold 15 preparatory to the descent of a complementary molding element or member 83 carried by the movable press member 5.

The pocket 22 may be a stationary member into which the disks 18 and 19 are fed by hand for the molding operation. It is preferred, however, to form a series of pockets 22 in a rotary table 23 and to feed the disks 18 and 19 into the pockets 22 when one of the pockets 22 is located at a loading station 24 (Fig. 1). The table 23 is indexed clockwise after each molding operation to bring one of the filled pockets 22 to the molding station 25 and one of the pockets, from which the molded ring has been removed, to the loading station 24. To this end the table 23 is provided with a hub 26 (Fig. 2), which

is journaled on a vertical axle 27 supported from an overhanging arm 28 projecting from a bracket 29 (Fig. 1) secured by bolts 30 to the press frame. The axle 27 is provided with a reduced eccentric portion 31 which is clamped between the end of the arm 28 and a plate 32 secured to the arm by screws 33. This construction is provided so that the portion 31 may be preliminarily rotated on the arm 28 to shift the table 23 relatively to the mold 15 and thus insure the successive registry of the pockets 22 with the molding elements at the molding station 25.

During the molding operation the table 23 is locked from rotation by a locking pawl 34 pivoted at 35 (Fig. 2) on a block 36 secured to a bracket 37 bolted to the press-frame. The pawl 34 moves on the block 36 behind a strap 38 secured to the block. The pawl 34, which is shaped to embrace the peripheral edge of the table 23, is normally held in engagement with one of a series of notches 39 formed in the periphery of the table 23 by a coiled spring 40 (Fig. 2) one end of which is secured to the pawl 34 and the other end of which is secured to the block 36.

In order to index the table 23 clockwise to transfer the pockets 22 step-by-step from the loading station 24 to the molding station 25, the hub 26 carries a ratchet 41 (Fig. 1) which is engaged by a feeding pawl 42 pivoted on a feed bar 43 mounted to slide in ways 44 and 45 on the bracket 29. The feeding pawl is normally held against a pin 46 (Fig. 1) on the feed bar 43 by a coiled spring 47 one end of which is secured to the pawl 42 and the other end of which is secured to an eye-headed pin 48 screwed into the feed bar 43.

The feed bar 43 is reciprocated in its ways 44 and 45, to cause the pawl 42 to engage the ratchet 41 and thus index the table 23, by connections from the lever 13. To this end the feed bar 43 is connected by a pin 49 (Fig. 1) to a block 50 pivotally mounted on the rock-shaft 9. Pivoted on the lower end of the block 50 is a lever 51 provided with an opening 52 which loosely embraces a pin 53 secured to the block 50. The lever 51 is normally held in engagement with the block 50 by a spring 54 coiled about the pin 53 and interposed between the lever 51 and a washer 55 on the end of the pin 53. The lower end of the lever 51 loosely embraces a rod 56 one end of which is operatively connected to the lever 13 and the other end of which is provided with a block 57 normally spaced from the lever 51.

With this construction the lever 13 may be pulled through the arc A (Fig. 2) to throw in the half-revolution clutch to bring the movable press member 5 into a position of pressure without, however, causing the block 57 to actuate the lever 51. When the lever 13 is pulled to return the movable press member 5 to a position of clearance the lever 13 may be pulled through the longer arc B (Fig. 2) so that in addition to throwing in the clutch the rod 56 is advanced sufficiently to cause the block 57 to engage and actuate the lever 51. When the block 57 engages the lever 51 the lever and the block 50 move as a unit to reciprocate the feed bar 43 to the left (Fig. 1) until its end engages an adjustable stop 58 secured to the bracket 29. The stop 58 limits the movement of the feed bar 43 and the block 50, but the lever 51 may move further owing to its yielding pivotal connection on the block 50.

In order that the table 23 may be unlocked to permit it to be indexed by the reciprocation of the feed bar, connections are provided between the reciprocating feed bar 43 and the locking pawl 34 whereby the locking pawl is withdrawn from the table 23 prior to the engagement of the feeding pawl 42 with the ratchet 41. To this end the feed bar 43 is provided with a block 59 (Fig. 2) to which is pivotally connected one end of a lock bar 60 (dotted lines in Fig. 1) the other end of which is mounted to slide on a ledge 61 on the block 36 which carries a strap 62 to guide and confine the lock bar. The free end of the lock bar 60 carries a pivoted dog 63 which is held outwardly against a pin 64 on the lock bar by a leaf spring 65. The dog 63, when the lock bar 60 is reciprocated to the left (Fig. 2), engages a tail 66 on the locking pawl 34 and withdraws the locking pawl from the table 23. The locking pawl is withdrawn from the table 23 before the feeding pawl 43 engages the ratchet 41 so that the table 23 may be free for the indexing movement.

When the lever 13 is released a spring 501 connecting the block 50 to the frame returns the feed bar 43 and the lock bar 60 to their inoperative positions. During this return the springs 47 and 65 permit the pawl 42 and the dog 63 to turn on their pivots as they pass, respectively, by the ratchet 41 and the locking pawl 34. The spring 40, immediately rotation of the table 23 is commenced, returns the locking pawl 34 to a position where it embraces the periphery of the table which continues to rotate under the momentum imparted by the feeding pawl 42 until the locking pawl 34 slips into the next of the series of locking recesses 39.

In order to facilitate the loading by hand of the mica plate disks 18 and 19 in the open pocket 22 at the loading station 24 the bracket 37 supports a pin 67 which, when the table 23 is locked from movement, projects upwardly through the center of the pocket 22 in position to receive the disks 18 and 19 by engagement within the openings 20 and 21 thereof. In order to disengage the pin 67 from the disks and thus permit the table 23

to be indexed the pin is connected by a pin (Fig. 1) to one end of a lever 68 pivoted on the bracket 37. The other end of the lever 68 is embraced by a yoke 69 carried by a crank 70 pivoted on a crank pin 71 secured to a disk 72 on the main shaft 8.

In order to heat the disks 18 and 19, during their passage from the loading station 24 to the molding station 25 to prepare them for the shaping operation and also cause them to stick together in their superposed relation, the overhanging arm 28 carries a bracket 73 to which a tunnel 74 is secured. This tunnel 74 has faces 75 and 76 arranged parallel and adjacent respectively to the top and bottom faces of the disks 18 and 19 during their passage therebetween. The tunnel faces 75 and 76 carry electric heating elements 77.

Returning now to a description of the molding elements at the molding station 25, in order to shape the disks into a commutator ring having an upwardly-flaring reinforced bottom provided with a central opening larger than the openings 20 and 21 and an annular wall, the bottom of the cup-shaped mold 15 is arranged to taper or incline upwardly towards the center of the mold, and as herein shown, this tapered or inclined portion 78 of the mold is formed upon the upper surface of a plunger 79, slidably mounted within the cup-shaped mold and capable of movement from the position shown in Fig. 3 to that shown in Fig. 4.

In forming commutator rings of the type described provision is made for dieing out the central portion of the disks 18 and 19 to form a central opening in the ring, and also for trimming the free edge of the annular wall to size. For this purpose, as herein shown, the plunger 79 is hollow, providing a cutting edge 80 with which cooperates a cylindrical central cutter member or die 81 carried by the movable press member 5 so as to be capable of descent with the movable member into the position illustrated in Fig. 4. The engagement of the cylindrical cutting die 81 with the cutting edge 80 upon the plunger 79 operates, as will be apparent from an inspection of Fig. 4, to die out a circular piece from the center of the blanks 18 and 19 and thus form an enlarged central perforation in the reinforced bottom portion. The disks of material died out in this manner are permitted to fall downwardly through the hollow plunger 79 and through an aligned opening 82 (Fig. 4) in the block 16. As herein shown, the molding member 83 comprises a cylinder surrounding the cutting die 81 and having its lower surface 83′ tapered or inclined complementary to the inclined or tapered surface 78 upon the upper end of the plunger 79. The cylindrical molding member 83 together with the cutting die 81 are screwed or otherwise secured to a cross web 84 (Fig. 4) of a housing 85 secured to the movable press member 5 and comprise a part thereof.

The disk 18 is slightly larger than is required to form the finished ring but provision is made for accurately trimming the disk 18 to size. For this purpose a trimming member 86 is provided herein shown as comprising a cylindrical sleeve movable on the molding element 83. The lower portion of the trimming member 86 is cut away to form a relatively narrow wall 87 having a blunt end, the outer lower edge 88 of which comprises a cutting edge which is adapted to cooperate with a cutting edge 89 upon the upper end of the mold 15 so that when the parts of the apparatus move into the position illustrated in Fig. 4, the cutting edges 88 and 89 cooperate to trim the waste material and cut the disk 18 to exact size. During the downward stroke of the movable press member 5 the trimming member 86 is engaged by the cross web 84 of the housing as in Fig. 4 so that the parts move as a unit to perform this cutting operation.

The material is fed to the position shown by Fig. 3 at a time in the cycle of operation of the machine when the movable press member 5 is in its raised position. Then the operator pulls the lever 13 through its shorter arc A to cause said movable press member to be depressed and as the parts carried thereby descend into the position illustrated in Fig. 4 the superimposed disks are recentered, if they have been jarred or otherwise shifted from their central position, by a centering pin 90 carried by the cutting die 81. Then as the parts continue to descend, the disks 18 and 19 are forced down into the mold 15 by the molding member 83, the marginal portion of the disk 18 being formed to a cylindrically shaped or annular portion extending around the periphery of the cylindrical member 83 and between it and the internal wall of the mold 15. As the parts descend, the disks of material forming the reinforced bottom of said annular portion are engaged between the lower surface of the molding element 83 and the upper surface 78 of the hollow plunger 79, the latter having been held by the friction of the parts in the position illustrated in Fig. 3 from the previous cycle of operation, and as the parts continue to descend the hollow plunger 79 is forced down by the molding element 83 with the partially molded ring still held between the upper and lower surfaces of the plunger and molding element, respectively. During this movement, the cutting edge 87 upon the trimming member 86 passes the cutting edge 89 on the upper end of the mold 15, thus trimming the waste material from the rim of the annular portion and reducing the ring to finished size (see Fig. 4). After the ring has been thus trimmed to size by the trimmer 86, the parts

and the trimmed ring continue to be moved downwardly into the mold until the hollow plunger 79 seats upon the contact plate 91 (Fig. 4). The movement of the movable press member 5 is designed to cause the molding element 83 and associated parts carried by said movable member to move downwardly a short distance after the hollow plunger 79 is seated upon the contact plate 91, to thereby compress the molded ring, and also to enable the cutting die 81 to die out the central portion of said disks to form the central perforation in the finished ring. During this movement of the parts, the material comprising the annular wall of the ring is compressed by a downward movement of the blunt end of the narrow wall 87 of the trimmer 86 as described in said co-pending application, and is thus brought to exact height. It will be understood that suitable clearances may be provided to accommodate the cutter dies to the character and thickness of the material.

After the commutator ring has thus been formed, the movable press member 5 is returned to its position of clearance and provision is made for loosening the ring within the cup-shape mold 15 so that it may be readily removed by the operator. For this purpose, provision is made for mechanically raising the plunger 79 into the position illustrated in Fig. 3 through a lifting device, operated from the crank 70, secured to the rods 92 which bear against the contact plate 91 (Fig. 4) as described in said co-pending application. When the plunger 79 is raised in the manner described, the molded ring is thus raised into a position within the mold 15 from which it may be readily removed by the operator.

While the invention has been illustrated and described in connection with a die-press constructed to produce commutator rings, those skilled in the art will recognize that certain features of the invention may be employed with any die-press.

What is claimed as new, is:—

1. A machine of the class described having, in combination, a molding station having molding elements, means for moving one of the molding elements from a position of pressure to a position of clearance including a clutch control shaft, a table having a plurality of pockets each adapted to hold two disks of different diameters superimposed concentrically, means for indexing the table to register each pocket successively with the molding elements at the molding station, means for locking the table from movement during the molding operation, means for unlocking the table to permit it to be indexed, an actuating lever, and connections from the lever to the clutch control shaft, to the unlocking means and to the indexing means to successively operate the clutch to return the movable molding element to a position of clearance, to unlock the table, and to index the table.

2. A machine of the class described having, in combination, a molding station having molding elements, means for moving one of the molding elements from a position of pressure to a position of clearance including a driving shaft and a clutch control shaft, a table having a plurality of pockets each adapted to hold two disks of different diameters superimposed concentrically, a loading station having means concentric with one of the pockets and movable from a position above the table to a position below the table for facilitating the loading of the disks in the pockets, means for indexing the table to register each pocket successively with the molding elements at the molding station and with the positioning means at the loading station, means for locking the table from movement during the molding and loading operations, means for unlocking the table to permit it to be indexed, connections from the driving shaft to the positioning means for withdrawing it below the table to permit it to be indexed, an actuating lever, and connections from the lever to the clutch control shaft, to the unlocking means and to the indexing means to successively drive the driving shaft and thus return the movable molding element to a position of clearance and withdraw the positioning means to a position below the table, to unlock the table and to index the table.

3. A machine of the class described having, in combination, a molding station, a loading station, a carrier having a plurality of pockets each adapted to hold material to be molded at the molding station, means for indexing the carrier to transfer a pocket from the loading station to the molding station, and means interposed between the stations for heating the material during its transfer from the loading station to the molding station.

4. A machine of the class described having, in combination, a molding station, a loading station, a carrier having a plurality of circular pockets adapted to hold disks of material to be molded, circular molds at said molding station, means for indexing the carrier to transfer a pocket to a position between said molds and halt it in registy therewith, means at the loading station to center a disk of material in a pocket, and means at the molding station to re-center said disk prior to being deformed.

5. A machine of the class described having, in combination, a pair of relatively movable molds at a molding station, means for operating said molds, an actuating lever for said means, a carrier for transferring material to be molded from a loading station to said

molds, means for advancing said carrier, and operative connections between said lever and said carrier advancing means constructed and arranged to cause an advance of the carrier only when the lever is moved to a greater degree than is required for operating said molds.

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