Dec. 15, 1942. A. T. COLWELL ET AL 2,305,064

MACHINE FOR MAKING FLEXIBLE VALVE SEAT INSERTS

Filed Nov. 25, 1940 4 Sheets-Sheet 1

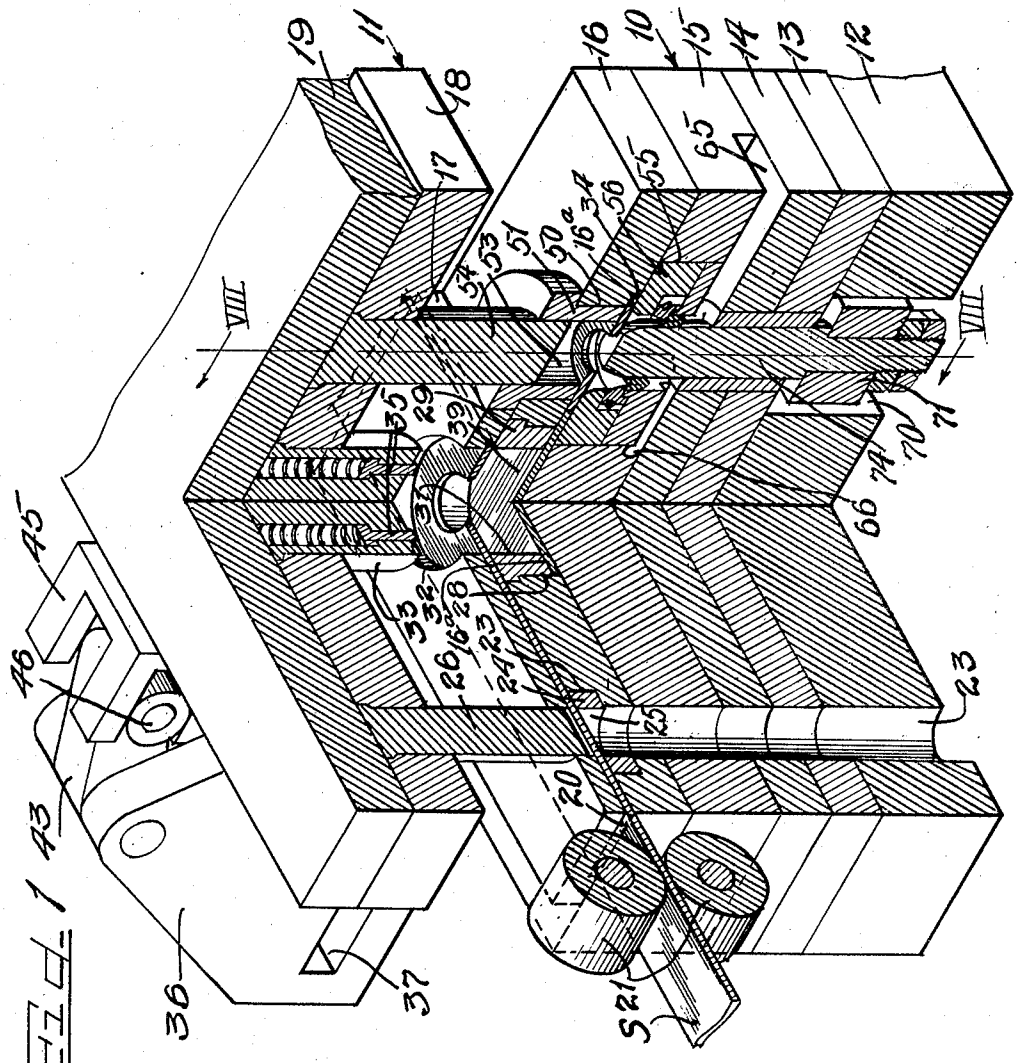


FIG. 1

Inventors
Archie T. Colwell
Samuel H. Norton.
By Charles R. Hill Attys.

Dec. 15, 1942. A. T. COLWELL ET AL 2,305,064

MACHINE FOR MAKING FLEXIBLE VALVE SEAT INSERTS

Filed Nov. 25, 1940 4 Sheets-Sheet 2

Fig. 2

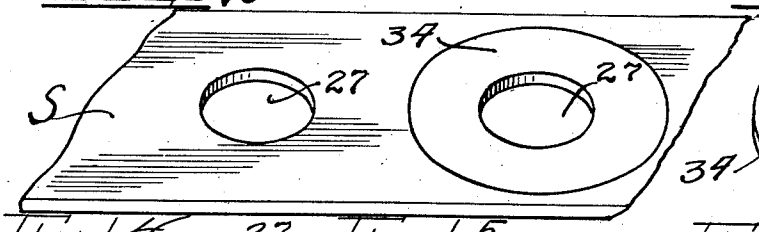


Fig. 3

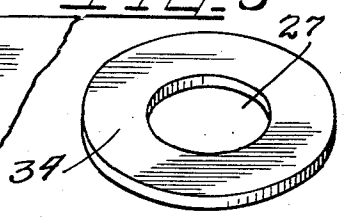


Fig. 4

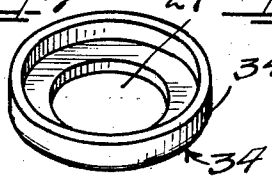


Fig. 5

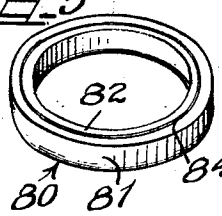


Fig. 6

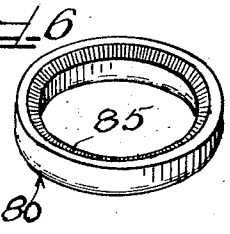


Fig. 7

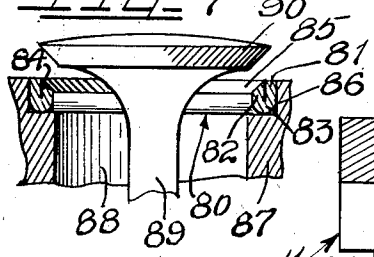
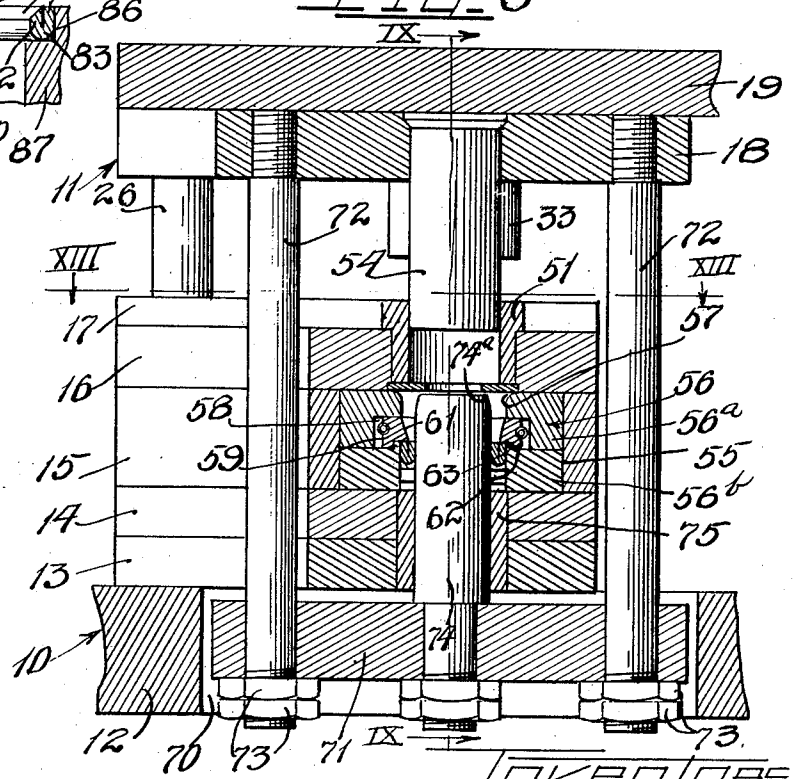


Fig. 8



Inventors
Archie T. Colwell
Samuel H. Norton.
By Charles O'Neill Attys.

Dec. 15, 1942. A. T. COLWELL ET AL 2,305,064

MACHINE FOR MAKING FLEXIBLE VALVE SEAT INSERTS

Filed Nov. 25, 1940 4 Sheets-Sheet 3

Fig 9

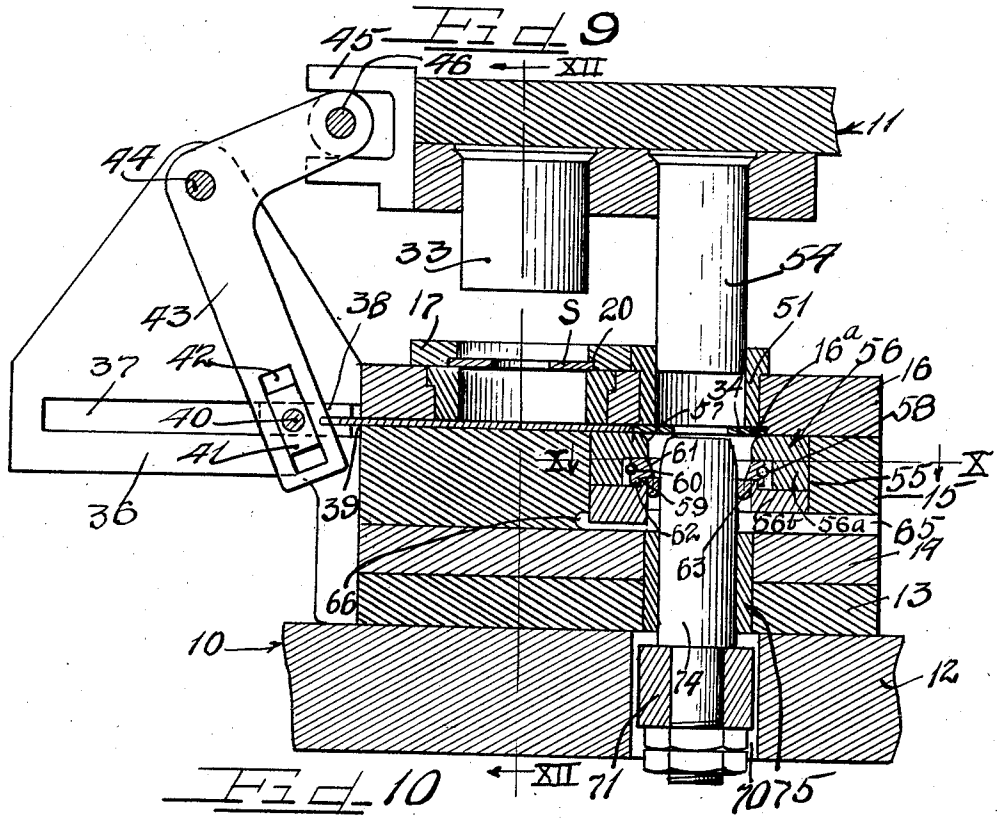
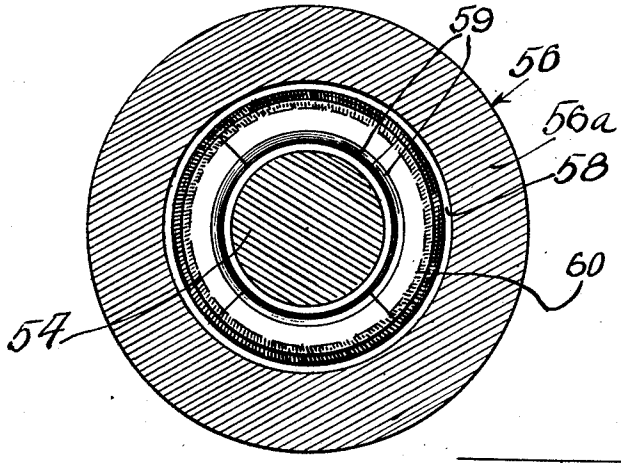


Fig 10



INVENTORS
Archie T. Colwell
Samuel H. Norton.
BY Charles R. Hill ATTY.

Dec. 15, 1942. A. T. COLWELL ET AL 2,305,064

MACHINE FOR MAKING FLEXIBLE VALVE SEAT INSERTS

Filed Nov. 25, 1940 4 Sheets-Sheet 4

Fig. 11

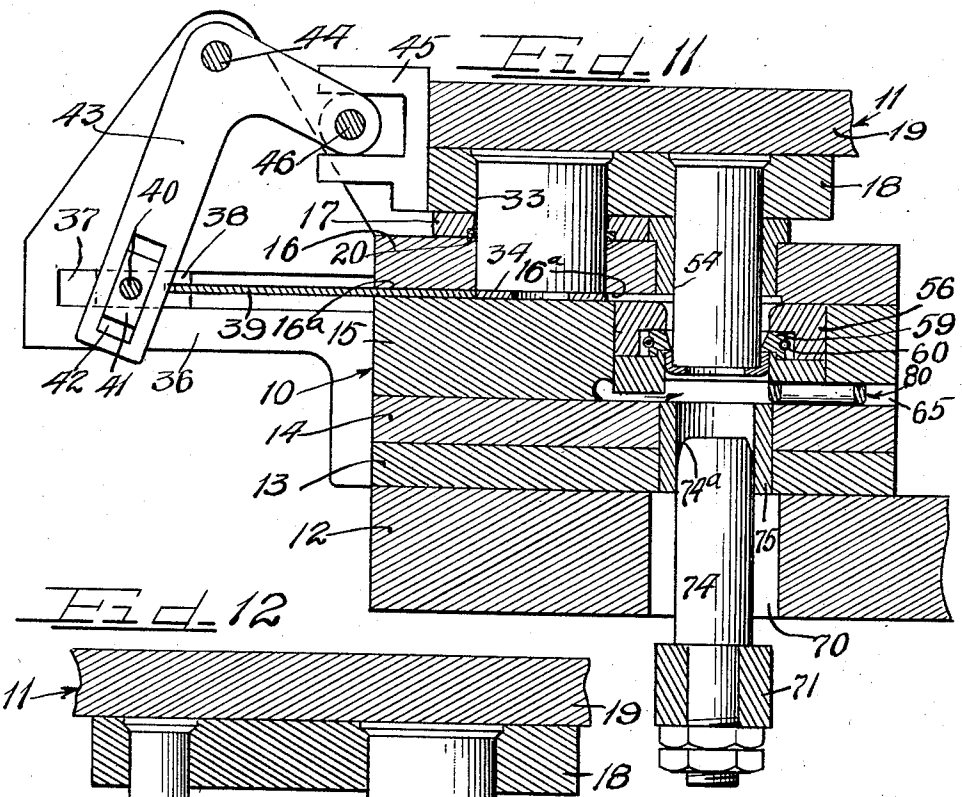


Fig. 12

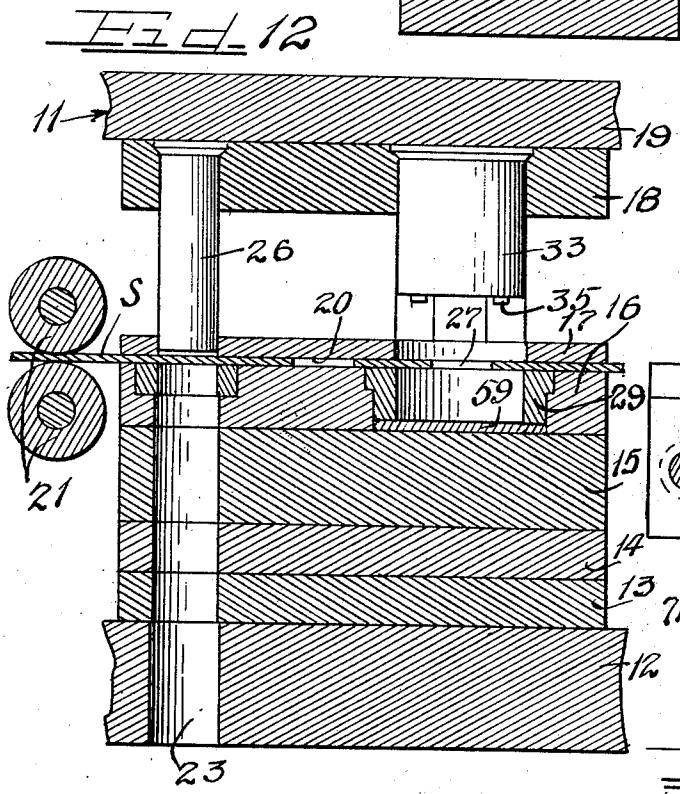
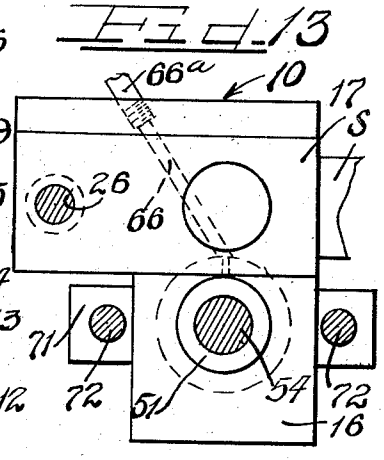


Fig. 13



Inventors
Archie T. Colwell
Samuel H. Norton.
By Charles R. Hill
Attys

Patented Dec. 15, 1942

2,305,064

UNITED STATES PATENT OFFICE

2,305,064

MACHINE FOR MAKING FLEXIBLE VALVE SEAT INSERTS

Archie T. Colwell and Samuel H. Norton, Cleveland, Ohio, assignors to Thompson Products Incorporated, Cleveland, Ohio, a corporation of Ohio

Application November 25, 1940, Serial No. 367,002

5 Claims. (Cl. 113—42)

This invention relates to a compact machine for continuously manufacturing valve seat inserts from metal strip stock.

More specifically, the invention relates to the making of flexible valve seat inserts having an annular slot between the inside and outside diameters thereof extending part way through the inserts to cushion the seating force of the valves and to permit the seat to adjust itself to minor misalignments.

Most valves have replaceable annular seats. It is highly desirable, however, that these annular valve seats have an inherent flexibility to cushion the seating force of the valve closure member such as a poppet valve in order that minor misalignments can be automatically compensated.

According to the present invention, such flexible valve seats are made from flat strip stock in a highly efficient and inexpensive manner. Specifically, the valve seats are made by punching circular holes at spaced intervals in the strip stock, blanking out centrally apertured flat disks from the strip stock, forming an upturned flange around the outer periphery of the disks, folding the inner peripheral portion of the disks against the upturned flange, and beveling the free end of the folded inner portion to provide the seating surface for the poppet valve or like closure member.

The resulting structure is therefore a ring having flat inner and outer walls, a slot between the inner and outer walls to impart flexibility to the beveled seating surface on the inner wall, and a rounded bottom portion.

The present invention provides a machine having a feeding mechanism for the strip stock, a punching mechanism for forming circular holes in the strip stock, a blanking mechanism for cutting disks from the strip stock, and a double-acting folding or bending mechanism for converting the flat apertured disks into seat insert form with inner and outer rings or walls connected through an integral rounded bottom. The machine of this invention has the punching and blanking out stations at one level, the bending station at a lower level, and a compressed air discharge passageway beneath the bending station.

It is, then, an object of the invention to form flexible valve seat inserts from flat centrally apertured circular disks by a simple bending or folding operation.

Another object of the invention is to provide a compact machine for making flexible valve seat inserts from strip stock.

A further object of the invention is to provide punching, blanking, and bending apparatus for forming strip stock into flexible valve seat inserts.

A specific object of the invention is to provide a compact machine having aligned punching and blanking stations on one level, and a blank folding station at a lower level in laterally spaced relation from the punching and blanking stations together with a pusher to move the blanks to the folding station.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of example, disclose a preferred embodiment of the invention.

On the drawings:

Figure 1 is a fragmentary isometric view, with parts cut away and shown in vertical cross section, of a machine for making flexible valve seat inserts from metal strips according to this invention.

Figure 2 is an isometric view of a metal strip illustrating the punching and blanking operation according to this invention.

Figure 3 is an isometric view of a centrally apertured flat circular disk formed as an intermediate product according to this invention.

Figure 4 is an isometric view of a partially folded disk illustrating another step according to this invention.

Figure 5 is an isometric view of a completely folded valve seat insert member formed according to this invention.

Figure 6 is an isometric view of a finished flexible valve seat insert having a beveled seating surface.

Figure 7 is a fragmentary vertical cross-sectional view, with parts in elevation, illustrating a valve seat insert according to this invention mounted in the port of a poppet valve and port assembly in an internal combustion engine.

Figure 8 is a fragmentary vertical cross-sectional view taken along the line VIII—VIII of Figure 1.

Figure 9 is a fragmentary vertical cross-sectional view, with parts in elevation, taken along the line IX—IX of Figure 8.

Figure 10 is a horizontal cross-sectional view, with parts in elevation, taken along the line X—X of Figure 9.

Figure 11 is a view similar to Figure 9 and illustrating the machine parts in a different position.

Figure 12 is a vertical cross-sectional view taken along the line XII—XII of Figure 9 and showing

the male punching and blanking dies in side elevation.

Figure 13 is a horizontal cross-sectional view taken along the line XIII—XIII of Figure 8.

As shown on the drawings:

As shown in Figure 1, the machine is composed of a stationary female platform portion 10 and a superimposed vertically reciprocal male platform portion 11.

The stationary platform portion 10 is built up from a plurality of metal blocks 12 to 16 inclusive and a top rectangular block 17 (Figures 1 and 13). The blocks are fixedly mounted together in superimposed relation.

The movable male platform portion 11 is built up from secured together metal blocks 18 and 19.

The top block 17 of the stationary portion 10 is of smaller size than the rest of the blocks and extends only over a portion of the platform from the front to the rear end thereof as shown. This top block 17 has a longitudinally channeled bottom 20 defining a passageway for a strip "S" of metal to be formed into the flexible valve seat insert by the machine. The strip of metal is fed to the machine between feed rolls 21 mounted in front of the passageway provided by the channeled block 17 and the strip passes through the machine from the front to the rear end thereof while being pushed by the feed rollers 21. It should be understood, of course, that the feed rollers can be replaced with any other suitable feeding mechanism, or that the strip can be hand fed.

The blocks 12 to 17 have a vertical aperture 23 therethrough communicating with the strip S at a point adjacent the inlet or feeding end of the machine. The block 16 is counterbored as at 23 to provide a seat for a die 24 having a central circular aperture 25 communicating with the aperture 23 and presenting a punching or cutting edge to the strip S.

A plunger or punch 26 depends from the block 18 of the movable platform 11 and extends through the aperture in the block 17 of the stationary platform 10 as shown. This plunger 26 is adapted to cooperate with the die 24 to punch circular holes in the strip S. The plunger and die assembly 24 and 26 thereby form the first station of the machine and punch circular holes 27 in the strip S, as best shown in Figure 2.

The block 16 has a channeled bottom portion 16a defining a passageway extending transversely of the strip-receiving passageway from the rear side of the machine into spaced relation from the front side of the machine. The block 16 is also vertically apertured as at 28 to provide a receptacle for a die 29. The die 29 communicates with the strip S and has a circular aperture 31 therethrough. The aperture 31 has a larger diameter than the aperture 25 of the die 24. The top plate 17 is also apertured as at 32 above the aperture 31 of the die.

The block 18 of the movable platform 11 carries a plunger or circular male die 33 adapted to fit through the aperture 32 and cooperate with the die 29 for blanking out the disks 34 from the strip S, as shown in Figures 2 and 3. These disks 34 have the apertures 27 through the center thereof and present a flat annulus with concentric inner and outer edges.

The plunger or die 33 has spring-pressed ejector pins 35 slidably mounted therein and projecting from the bottom face of the die. These ejectors will propel the disks 34 downwardly after the blanking out operation to the lower level passageway provided by the channeled bottom portion 16a of the block 16.

The dies 29 and 33 therefore provide the second station of the machine and effect the blanking out of circular disks from the apertured strip. This second station of the machine is longitudinally aligned with the first station.

As best shown in Figures 9 and 11, the stationary platform 10 supports a bracket 36 on the rear side thereof. This bracket is slotted as at 37 in alignment with the open end of the passageway provided by the channeled bottom 16a of the block 16. A block or carriage 38 is slidably mounted in this slot 37 and is connected to a pusher plate 39 slidable in the passageway. The leading end of the pusher plate engages a disk 34 deposited by the ejectors 35 into the passageway and pushes the disk to the next station of the machine.

The carriage 38 is pivotally connected through a pin 40 to a block 41 slidably mounted in a rectangular slot 42 of a bell crank 43. The bell crank is pivoted at the angle thereof to the apex of the bracket 36 by means of a pin 44. The bell crank has a forwardly projecting leg pivotally connected to a bracket 45 secured on the movable platform 11. A pin 46 can be used to join the forwardly projecting leg of the bell crank to the bracket 45.

As shown in Figure 11 the pusher plate 39 is in a retracted position clear of the aperture in which the plunger 33 operates. The disk 34 is thus deposited in the passageway formed by the channel groove 16a formed in the bottom of the block 16. However, as shown in Figure 9, when the platform 11 is moved upwardly to retract the plunger 33 from the die, the upward movement of the platform also raises the forwardly projecting leg of the bell crank 43 to slide the carriage 38 in the slot 37 toward the passageway and thus move the pusher plate 39 to push the disk 34 to the next station of the machine at the end of the channeled groove 16a. The disk is thus moved out of alignment with the strip and is at a lower level than the strip. The feeding mechanism at the same time advances the remaining waste portion of the strip out of the rear end of the machine, as best shown in Figures 1 and 13.

The block 16 has a vertical bore 50 therethrough receiving a die 51 which has a circular aperture 53 therethrough receiving a plunger or male die 54 depending from the movable platform 11. The pusher plate 39 pushes the disk 34 under the die 51 and the aperture 53 of the die has a diameter greater than the diameter of the hole through the disk but less than the diameter of the disk so that the plunger 54 will act on an inner marginal portion of the disk.

The block 15 has a vertical bore 55 therethrough beneath the bore 50 of the block 16 and of larger diameter than the bore 50 as shown in Figure 1. A two-piece die 56 is seated in the bore 55. As best shown in Figures 8 and 9, the die 56 is composed of an upper portion 56a and a lower portion 56b. The upper portion 56a has a central aperture therethrough provided with a rounded mouth 57 for acting on the disk 34. The portion 56a is counterbored at the bottom thereof to provide a recess 58 receiving arcuate grippers 59. As shown in Figure 10, four grippers 59 are provided to complete an annulus, and these grippers have a coiled spring 60 wrapped therearound to urge the same inwardly into the die aperture. Each gripper 59 presents a ta-

pered surface 61 projecting into the die aperture and converging toward the bottom of the die. As shown in Figures 8 and 9, the grippers have dependent flanges 62 projecting from the bottom thereof and abutted by upturned flanges 63 on the die member 56b.

The die 56 is thus equipped with expansible grippers projecting into the aperture of the die but capable of being retracted into the countersunk recess 58 of the die, upon application of radial expanding forces.

The bottom of the die 56 and the bottom of the block 15 has a cut-out portion to provide a discharge passageway 65 as shown in Figures 1 and 9. This discharge passageway extends from the front side of the machine under the die 56 to a bore 66 receiving a tube 66a from a source of compressed air (Fig. 13).

The base 12 of the stationary platform 10 is slotted as at 70 (Figures 1, 8, 9 and 11). A bar 71 is suspended for movement into and out of this slot by means of posts 72 (Figure 8) depending from the movable platform 11. These posts 72 can be threaded into the block 18 of the movable platform and can extend alongside of the legs of the stationary blocks 13 to 17 which provides the third station of the machine. Nuts 73 are threaded on the bottom ends of the posts 72 to carry the bar 71.

The bar 71 in turn carries a cylindrical male die or plunger 74 slidably mounted in a guide 75 which is carried by the stationary blocks 13 and 14. The plunger 74 is therefore raised and lowered with the raising and lowering of the movable platform 11 and has a beveled free upper end 74a movable from the retracted position shown in Figure 11 to a position just under the disk 34 as shown in Figures 8 and 9. When the platform 11 is lowered to force the disk 34 into the aperture of the die 56 as shown in Figure 11, the plunger 74 is lowered beneath the die 56.

As indicated in Figure 1, the disk 34 is fed under the die 51 and over the die 56 by the push plate 39. The plunger 74 then depresses the central marginal portion of the disk as shown in Figure 11 to turn up a flange 34a on the disk as best shown in Figure 4. The plunger 54 moves the flanged disk beyond the grippers 59 as shown in Figure 11. As soon as the flanged disk clears the grippers, the spring wrapped around the grippers will force the grippers back into the aperture of the die 56 for abutting the upper end of the turned up flange. On the upstroke of the machine the plunger 74 is raised to move the beveled upper end 74a thereof against the depressed central portion of the flanged disk and fold up this central portion against the flange as illustrated in Figures 8 and 9. The grippers 59 will hold the flanged disk against upward movement. At the completion of the upstroke, the plunger 74 has converted the flanged disk into a flexible valve seat 80, best shown in Figure 5. The valve seat 80 has a flat cylindrical outer wall 81, a flat cylindrical inner wall 82 in nested relation to the outer wall and a rounded bottom 83 (Figure 7) connecting the walls 81 and 82. The inner wall 82 is resiliently disposed relative to the outer wall by virtue of the slot 84 between the walls. While the walls may be in adjacent relation, a slight gap or slot, about 1/64 of an inch in width, is provided between the walls to provide a certain degree of resiliency because the inner wall 82 is only connected to the outer wall at the rounded base 83.

The plunger 74, in effect, is forced through the flanged disk 34 to form the insert 80 and, on the lowering stroke of the plunger, this insert will be carried into the passageway 65 by the plunger. It will be stripped from the plunger as the plunger is retracted into the guide 75. A jet of air is then released from the bore 66 to blow the valve seat out of the passageway 65 and out of the machine as illustrated in Figure 11.

The third station of the machine is therefore composed of two spaced opposed plungers moving together as a unit into and out of a die. The die is equipped with expansible grippers which permit the upper plunger to push the flanged disk to the lower portion of the die. The flanged disk is then stripped from the plunger since the grippers will automatically project into the die aperture as soon as the flanged disk has cleared the same. On the upstroke, the flanged disk will be acted upon by the lower plunger and held for such action by the grippers. The depressed central portion of the disk is then folded up against the turned-up flange.

The third station of the machine thus draws a centrally apertured circular metal disk into valve seat insert form to provide inner and outer flat vertical flanges separated by a slot of the order of 1/64 of an inch and connected through a rounded base.

The valve seat inserts formed by the machine need only be machined or ground to provide a beveled seat 85 (Figure 6) on the free end of the inner wall portion 82.

The valve seats 80 of this invention are press-fitted into the counterbores 86 of an engine block 87 around the valve port 88 of the block. A poppet valve 89 will thus have the seat portion 90 thereof engageable with the beveled seat 85 of the insert, as shown in Figure 7. Since the valve inserts are, in effect, equipped with separated inner and outer rings, they will readily adjust themselves to any minor misalignment due to their inherent flexibility and will maintain full seating engagement with the poppet valve.

From the above descriptions it will be understood that this invention now provides a machine of a simple, compact nature including a stationary platform having three stations in spaced relation along an L-shaped path. A movable platform carries plungers cooperating with the stations provided by the stationary platform to punch holes in a metal strip, to blank out circular disks from the metal strip, and to draw the circular metal disks into valve insert form. The machine will produce a finished valve seat insert on every stroke. Thus, on the downstroke of the machine, the strip is apertured, a disk is blanked out from the strip, and the previously blanked-out strip is provided with an upturned flange. On the upstroke of the machine, the flanged disk is drawn into valve seat insert form and the metal strip from which the disks are formed is advanced through the machine to move different portions thereof to the first two stations.

The machine can be operated at high speeds, can be driven by any reciprocating mechanism, such as a punch press, is inexpensive to produce, and automatically turns out flexible valve seat inserts which only need to be ground to form a beveled seating surface thereon.

It will, of course, be understood that various details of the invention may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon

otherwise than necessitated by the scope of the appended claims.

We claim as our invention:

1. Apparatus for making valve seat inserts comprising means for feeding a strip of metal along a predetermined path, a punching mechanism intersecting said path to cut apertures in the metal, a blanking out mechanism intersecting said path in spaced relation from the punching mechanism for blanking out disks from the apertured metal strip, a pusher for advancing the disks along a path beneath the path of said strip, and a forming mechanism intersecting said lower path for successively receiving said disks to turn up inner and outer peripheral flanges thereon.

2. A machine for making valve seat inserts comprising stationary means defining a first passageway through the machine, a second passageway communicating with said first pasasgeway and extending at right angles thereto at a level beneath the first passageway, and a discharge pasageway communicating with said second passageway at a level beneath the second passageway, a punch for forming apertures in a strip of metal fed through said first passageway, blanking out mechanism for cutting disks from the apertured strip passing through said first passageway to deposit said disks into said second passageway, a pusher slidably mounted in said second passageway to advance the disks therein and drawing mechanism intersecting said second passageway to bend the disks supplied thereto by the pusher for forming inner and outer peripheral flanges thereon and for moving the flanged disks to said discharge passageway.

3. In a machine for making valve seat inserts, a stationary platform having a vertical bore therethrough and a discharge passageway intersecting said bore, a female die intermediate the ends of said bore above said passageway adapted to receive an apertured metal disk thereover, a vertically reciprocal platform, a plunger depending downwardly from said platform to depress the central marginal portion of a disk into said die to form an upturned outer peripheral flange on the disk, expansible grippers mounted in said die providing a retaining shoulder for the flange on the disk, a second plunger carried by said platform and projecting upwardly into said die to fold the inner marginal portion of the flanged disk toward the flange and to pull the resulting article into said discharge passageway, and means for ejecting the articles from the passageway whereby a valve seat insert body will be formed on each stroke of the machine.

4. A ring making machine comprising a pair of aligned spaced opposed plungers, a pair of aligned communicating dies for said plungers, an expansible gripper between said dies allowing passage of material between the dies in one direction only, means for feeding apertured disks to one die, means effecting relative movement between said one die and its cooperating plunger to bend the disk in one direction and feed the bent disk through the gripper to the other die, and means effecting reverse relative movement between the other die and its cooperating plunger for bending the bent disk in the opposite direction against the gripper.

5. A ring making machine comprising a pair of superimposed aligned communicating female dies, means defining a passageway for apertured disks to the top die, a plunger movable downwardly in said top die to depress the inner marginal portion of an apertured disk into the die for forming a peripheral flange on the disk, said plunger being movable into the bottom die for conveying the flanged disk thereto, an expansible gripper between said dies allowing passage of the flanged disk to the second die but abutting the flange on the disk for resisting reverse movement back to the top die, a second plunger movable upwardly into the bottom die for forming an inner flange on said flanged disk to provide a ring around said second plunger, means defining a discharge passageway below said bottom die, means for retracting said second plunger from the bottom die to carry the ring to said discharge passageway, and a stripper for releasing the ring from said second plunger whereby the ring can be discharged out of the discharge passageway.

ARCHIE T. COLWELL.
SAMUEL H. NORTON.