The invention relates to a material handling device and applies more particularly to a mechanism for removing a die forming operation. The invention has for one of its objects to provide an improved work removing mechanism.

The invention has for another object to provide a work removing mechanism which makes provision for the necessary relative movement of the parts of the apparatus after the die forming operation before the mechanism operates.

With these and other objects in view the invention resides in the novel features of construction and combinations and arrangements of parts as more fully hereinafter set forth.

In the drawings:

Figure 1 is a cross section on the line 1—1 of Figure 3 through a rim forming apparatus embodying the invention and showing the parts in positions assumed when the ram is in its lowermost position.

Figure 2 is a similar view showing the parts in positions assumed during the raising of the ram.

Figure 3 is a cross section on the line 3—3 of Figure 1.

Figure 4 is a cross section on the line 4—4 of Figure 2.

Figure 5 is a top plan view with the ram removed.

Figure 6 is a cross section on the line 6—6 of Figure 1.


In general, the press is a rim forming apparatus having outer die sections movable radially inwardly into engagement with an annular blank and inner die sections relatively moveable axially toward each other and into engagement with the blank and cooperating with the outer die sections to shape the blank to the desired cross sectional contour. In the present instance, the outer die sections comprise the segmental die sections 1 arranged in an annular series and supported on the plate 2 which is vertically moveable relative to the bolster 3. The inner die sections comprise the axially aligned lower and upper annular die sections 4 and 5 respectively, the lower die section being mounted on the bolster 3 and the upper die section being mounted on the ram 6 which is vertically moveable axially of the bolster.

Each outer die section 1 is keyed and fixedly secured to the bolster 7 having concentric inner and outer faces 8 and 9 respectively, the outer die section being secured against the inner face. The holder is slidable in the radial channel 10 in the upper portion of the plate 2 and is slidable engaged by the gib 11 secured to the plate. The plate is guided and centered with respect to the bolster by the pair of diagonally opposite short and long pins 12 and 13 respectively and is mounted on the annular supporting plate 14 which is above the bolster. The supporting plate is centered with respect to the bolster by the upwardly extending annular flange 15 at the inner edge of the supporting plate fitting the central opening 16 of the plate 2, this central opening having its center in axial alignment with the center of the bolster.

For radially moving the holders 7 and consequently the outer die sections 1 in unison, there is the cam ring 17 rotatably mounted on the supporting plate 14 and located within and guided by the recess 18 in the lower portion of the plate 2 and concentric with its central opening. The cam ring is formed with the cam slots 19 correspondingly inclined to the radii passing through the slots and the plate 2 is provided with the radial slots 20 intersecting the cam slots 19. 21 are vertical pins secured to and depending from the holders 7 and extending through the radial slots and within the cam slots, there being a single pin, single radial slot and single cam slot for each holder. Each pin has an enlarged portion slidable engaging its associated radial slot and has journeled on its lower end the roller 22 engaging the associated cam slot.

To rotate the cam ring it has secured thereon the arm 23 having connected to its outer end the rod 24 of a piston slidable in the cylinder 25. This cylinder is carried by the bracket 26 which is mounted on one corner of the plate 2. The cylinder is provided with ports at its ends admitting and exhausting compressed air to move the piston in opposite directions and thereby rotate the cam ring in opposite directions through a predetermined distance.

The lower inner die section 4 is secured to the upper face of the central plate 27 which is secured to the upper face of the bolster 3 and centered by fitting within the annular recess 28 of the bolster. The lower die section also secures the annular sleeve 29 to the central plate, this sleeve having its upper end portion extending above the upper surface of the lower die section. The sleeve is centered by telescopically engaging the annular shoulder 30 on the central plate and the sleeve in turn centers the lower die section.

The upper inner die section 5 is secured to the lower face of the plate 31 which is carried by the ram 6, the plate being guided by the pair of long pins 13. The plate 31 has at its inner edge the depending concentric annular flange 32 engaging and encircled by and centering the upper die section. The plate 31 also has secured to its lower face the outer ring 33 which is provided with the annular inner bushing 34 for slidable engaging the radially outer faces 9 of the holders 7 during the downward movement of the ram 6. The ring and bushing are centered by forming the plate 31 with the annular shoulder 35 engaging and encircled by the bushing.

For yieldingly urging the supporting plate 14 upwardly and holding it in its uppermost position when the ram 6 is raised, fluid pressure operated means is provided. This means comprises the compressed air cylinder 36 of conventional construction, the annular series of vertical pins 37 and 38 and the plate 39 connected to the piston of the cylinder. The cylinder is located below the bolster 3 in axial alignment therewith and as shown is carried by the bolts 40 secured to and depending from the plate 41 supporting the bolster. The pins 37 are slidable in the bolster and abut the supporting plate 14 while the pins 38 are slidable in the plate 41 and abut the pins 37 and the plate 39 which latter is slidable on the bolster 3. The pressure within the cylinder is substantially constant at all times and is sufficient to normally hold the supporting plate and the parts carried thereby in uppermost position determined by the annular flange 15 abutting the lower die section 4.

To position the annular blank which is to be fashioned by the press the plungers 42 are provided engageable with the lower edge of the annular blank when inserted into the press when the parts are in their off position.
These plungers are slidably mounted in angularly spaced radial slots 43 in the upper portion of the plate 2 and are resiliently urged radially inwardly by the coil springs 45 located in positions limited by the radially inner ends of the plungers engaging the lower die section 4.

The radially inner ends are cammed by being inclined downwardly and radially outwardly with respect to the axis of the press so that upon downward movement of the supporting plate 14 and the parts carried thereby, the lower die section forces the plungers radially outwardly to positions clearing the annular rim blank and the working faces of the lower die section to permit the desired fashioning of the annular rim blank.

For removing the rim after it has been formed by the die sections there are the angularly spaced devices 45 carried by the plate 31. Each device comprises an L-shaped member supported by the pivot pin 46 on the blocks 47 which are mounted in an upwardly opening pocket in the plate 31. Each L-shaped member has the arm 48 extending radially inwardly from the pivot pin in a radial slot in the plate 31 and the arm 49 depending between adjacent outer die sections 1 and their holders 7. The arm 48 is resiliently held upwardly against the ram 6 by the coil spring 50.

51 is a rim engaging member carried by the depending arm 49, there being a lost motion connection between the two. In detail, the rim engaging member is formed with the head 52 having the finger 53 and with the hollowed or tubular shank 54 which extends upwardly within the bore 55 extending longitudinally of the depending arm 49. The shank is formed intermediate its ends with the reduced portion 56 providing at its upper and lower sides the shoulders 57 and 38 respectively. 59 is a shoulder bolt threaded at its upper end into the upper shoulder 57 and at the lower end of the depending arm 49 and extending axially of the shank 54 and, as an axially aligned opening in the head 52. The bolt has at its lower end the head 60 which is adapted to engage the lower shoulder 58. The rim engaging member is normally urged downwardly by the coil spring 61. A butt ing the upper end of the bore 55 and the upper shoulder 57, the downward movement being limited by abutment of the head 52 with the plate 2.

In operation, assuming the ram 6 and supporting plate 14 to be in their uppermost positions and a rim blank which is to be formed by the press to be resting on the plungers 42, a valve is turned by the operator to admit air to the righthand end of the air cylinder 25 thereby rotating the cam ring 17 in a clockwise direction. The cam ring operates through the rollers 22 upon the pins 21 which are guided by the radial openings 20 in the plate 2 to move in unison the holders 7 and their associated outer die sections 1 radially inwardly to engage and tightly grip the portion of smallest diameter of the rim blank to be formed. This portion forms the base portion of the well of the rim blank formed by the press. Then the operator pushes the button controlling the operation of the ram 6 and the ram is lowered during which time it carries downwardly the plate 31, the rim removing devices 45, the upper die section 5 and the retaining ring 33. The lower radially inner cammed faces of the fingers 53 of the rim removing devices slidably engage the upper edges of the rim blank to be formed and compel the L-shaped members of these devices to swing against the resistance offered by the coil springs 56 allowing the fingers to pass the upper edges. The retaining ring 33 and its bushing slidably engage the holders 7 to assist in holding these holders and the outer die sections 1 in their radially innermost positions. The upper die section 5 slidably engages the slab 29 end is guided thereby and engages the rim blank to be formed and moves the rim blank downwardly along with the outer die sections 1, their holders 7, the supporting plate 14 and the parts therebetween, during which the plungers 42 are cammed radially outwardly by the lower die section 4 after which the rim blank to be formed is forced into engagement with the lower die section. The downward movement of the ram continues to its lowermost position at which time, as shown in Figure 1, the lower and upper die sections of the blanker and the pivot and the rotating blanker which is in angular conjunction with the outer die sections completed the forming of the rim blank to its desired cross sectional contour. The ram is then raised and after the retaining ring 33 and its bushing 34 have cleared the holders 7, air is admitted to the lefthand end of the air cylinder 25 to rotate the cam ring 17 in a counter clockwise direction and return the same to its original position thereby returning the outer die sections 1 to their radially outermost positions.

Then the fingers 53 of the rim removing devices 45 contact with the upper fire retaining flange of the completed rim, as shown in Figure 2 to raise the rim. The raising is continued to provide space beneath the rim for the insertion of the conventional shovelf after which the arms 48 of the rim removing devices contact with the stationary pin 62 which compels the L-shaped members to swing to positions releasing the fingers 53 from the rim so that it may drop onto the shovelf.

What I claim my invention is:

1. In an apparatus for forming a rim from an annular blank, which apparatus has axially aligned relatively axially movable inner die sections, an annular series of outer die sections movable radially relative to said first mentioned die sections and a plate carrying a said first mentioned die sections, means for removing the rim comprising an L-shaped member pivotally mounted within said portion and the pivot of said member to permit relative movement of said finger and plate in addition to the pivotal movement of said member.

2. In an apparatus for forming a rim from an annular blank, which apparatus has axially aligned relatively axially movable inner die sections, an annular series of outer die sections movable radially relative to said first mentioned die sections and a plate carrying one of said first mentioned die sections, means for removing the formed rim comprising an L-shaped member pivotally mounted on said plate and having an arm extending radially inwardly from the pivot and a depending arm, a spring for resiliently urging said first mentioned arm upwardly and a rim engaging member having an engaging finger and a tubular shank extending upwardly within and longitudinally of said depending arm and formed with internal oppositely facing upper and lower shoulders between its ends, a shoulder bolt extending axially of and within said tubular shank and depending arm and threaded at its upper end into said L-shaped member, said bolt having a head at its lower end engageable with said lower shoulder, and a coil spring within said depending arm and abutting said upper shoulder.

3. In a press having upper and lower dies and upper and lower members supporting said dies and relatively movable downwardly and upwardly toward and away from each other, mechanism for removing the work from the lower die comprising a member pivotally mounted on said upper supporting member and having a depending arm, means acting on said member to yieldably move said arm toward the work and a work engaging member having a work engaging finger and an upwardly extending shank slidably engaging and guided by said arm and having a lost motion connection with said member between said finger and the pivot of said pivotally mounted member to permit relative movement of said work engaging finger and said upper supporting member.

4. In an apparatus for die forming an annular blank, which apparatus has axially aligned relatively axially movable upper and lower inner die sections engageable with the blank and a member supporting said upper inner
die section, mechanism for removing the formed blank comprising L-shaped members pivotally mounted on said supporting member, each L-shaped member having an arm extending radially inwardly beyond the associated pivot and a depending arm externally of said inner die sections, a member movable longitudinally of said depending arm and having a finger for engaging the formed blank, means acting on said L-shaped member to yieldably urge said depending arm toward the formed blank, and means engageable with the radially inner end portions of said radially inwardly extending arms for swinging said L-shaped members in a direction to move said depending arms away from the formed blank.

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