Nov. 6, 1962 J. W. TOMKA 3,062,425

THIMBLE REMOVABLE PRESS

Filed Aug. 26, 1958 4 Sheets-Sheet 1

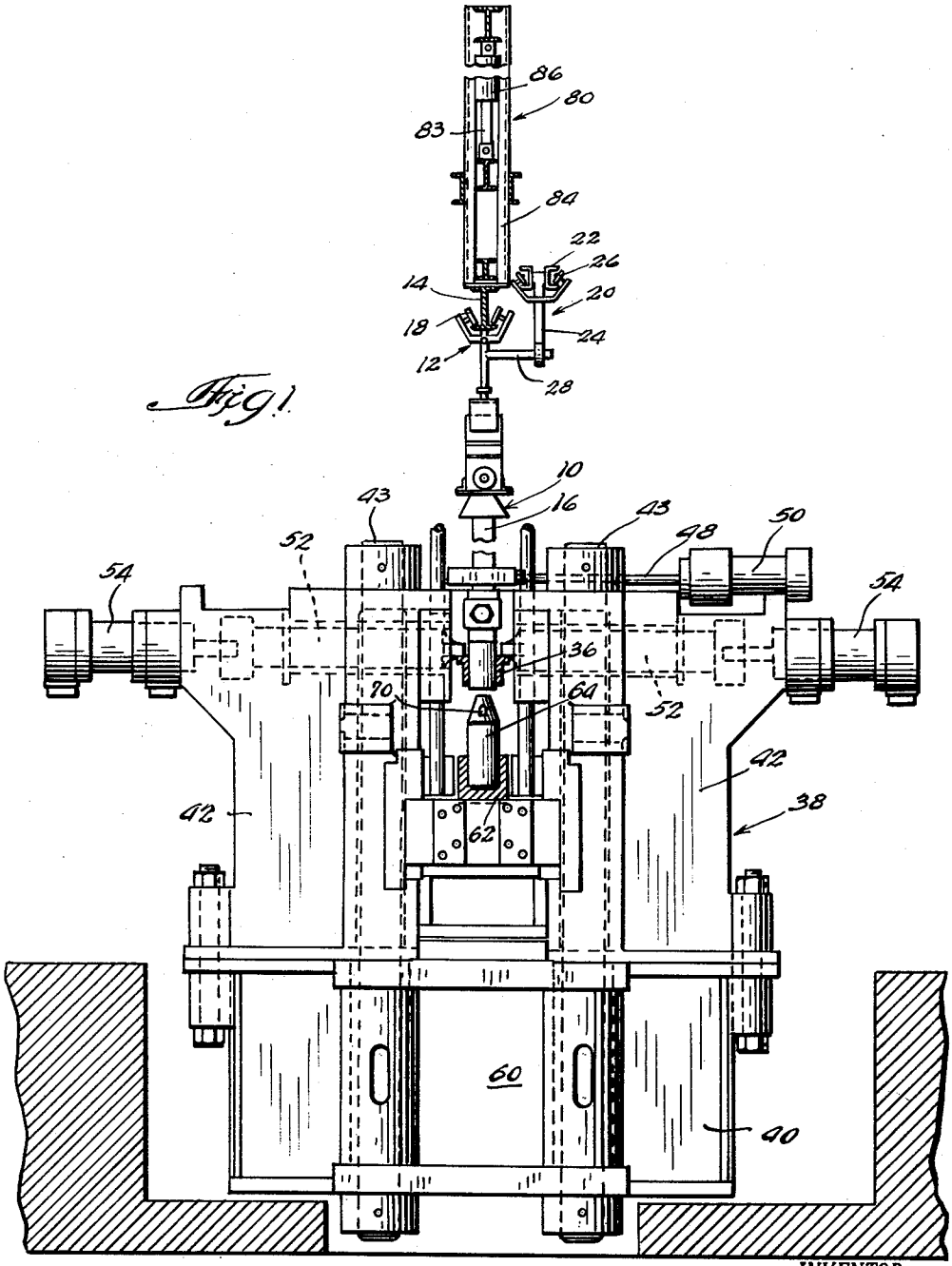

Fig. 1

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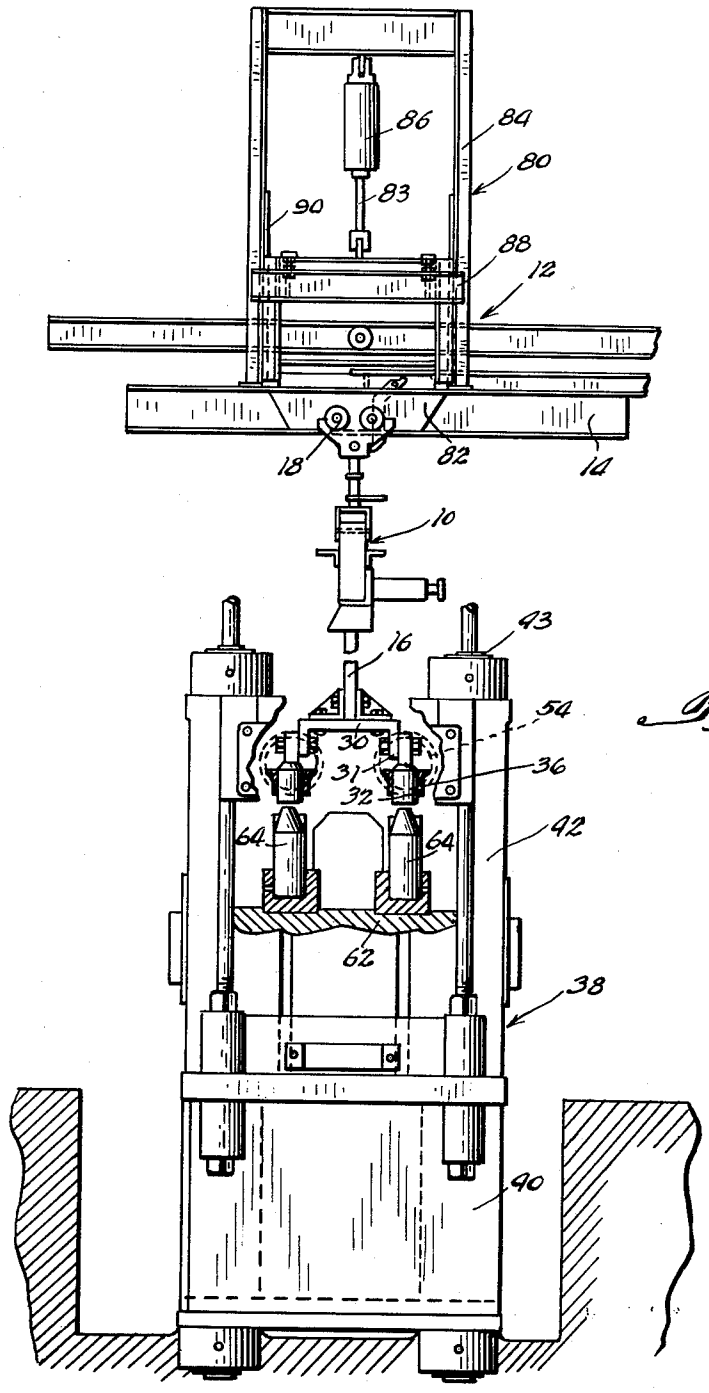

Fig. 2.

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Fig. 3.

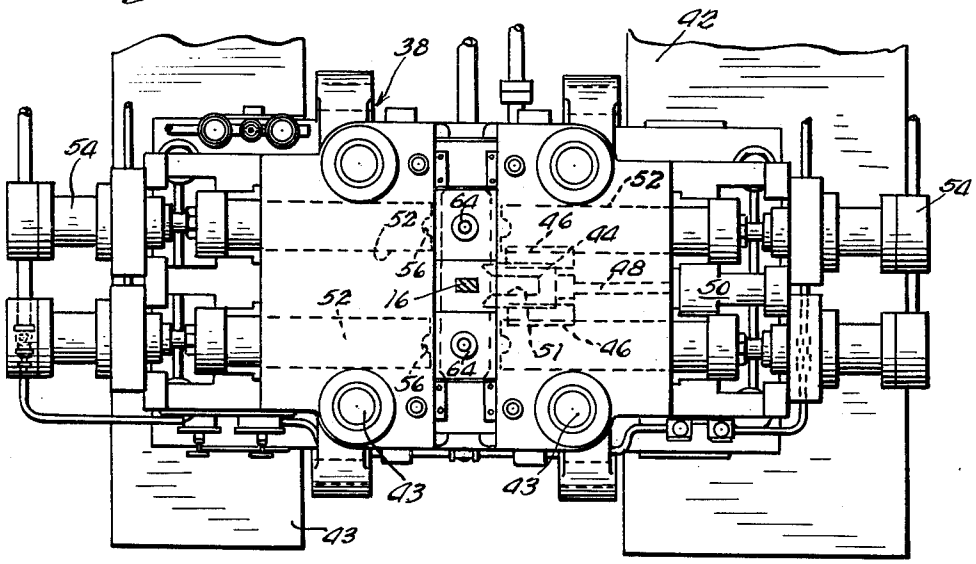


Fig. 4.

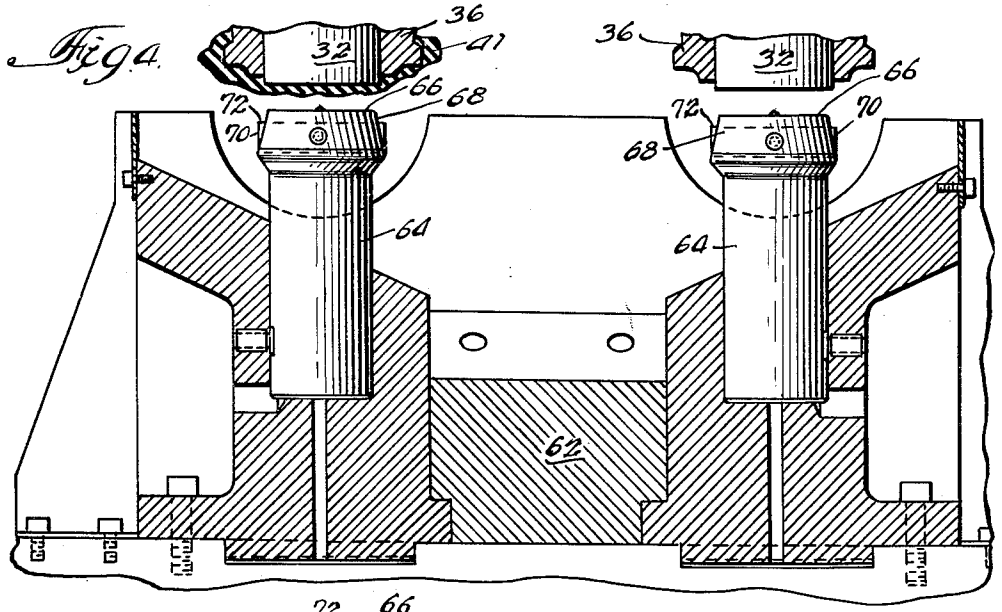
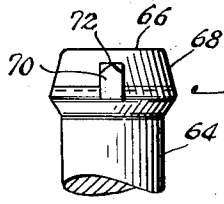


Fig. 5.



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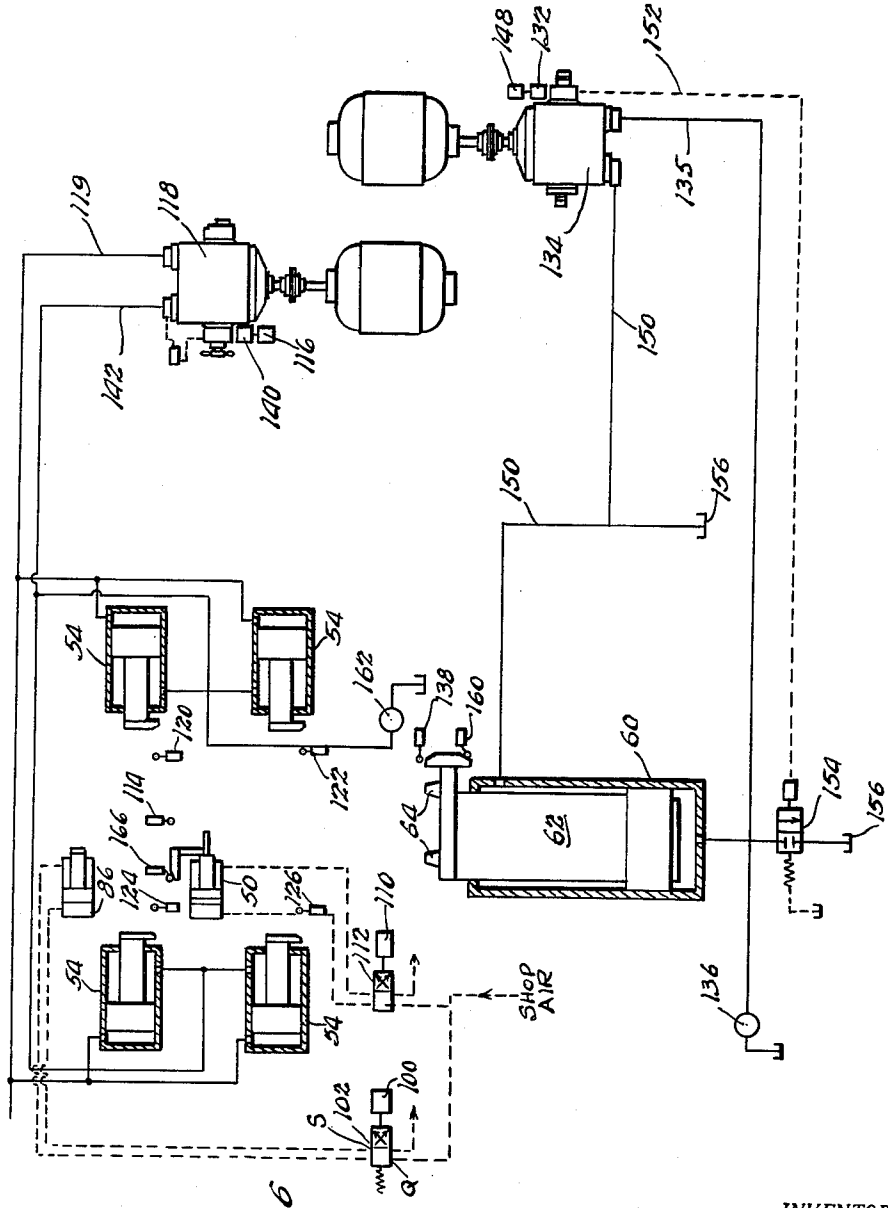

Fig 6

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3,062,425

THIMBLE REMOVAL PRESS

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7 Claims. (Cl. 225—103)

This invention relates to a device for removing frangible rings from a bar and particularly to a device for removing cast iron thimbles from anode bars utilized in the refining of aluminum.

The method most commonly utilized to produce commercially pure aluminum is to place a charge of refined ore called alumina in a carbon pot. A carbon block preferably comprising petroleum coke, pitch, and anthracite blended together and formed under pressure is lowered into the pot. An electrical current is passed through the block, which acts as the anode, and the pot, which acts as the cathode, whereupon the aluminum is melted out of the alumina ore and siphoned off. During the refining process, the carbon block burns down and must be replaced on the support bar on which it is carried.

The support bars are transported through the various operating stations by a conventional overhead conveyor system. The preformed carbon blocks are provided with a cored cavity arranged to receive a steel stub carried by the copper support bars. The block is bonded to the steel stub by pouring molten iron into the cavity surrounding the stub whereupon the iron hardens and firmly anchors the block to the stub. After the carbon block has been burned down, it is necessary that the small remaining portion of the block and the cast iron thimble, which anchored the block to the stub, be removed from the bar. In the past, the removal of the cast iron thimble has been done almost completely manually and the job was difficult, time consuming, and costly.

It is, therefore, a primary object of the present invention to provide a device for stripping such an iron thimble from the support bar stub in a fast, efficient, and inexpensive manner.

A further object of the invention is to provide an arrangement for removing such cast iron thimbles from the steel stubs of a support bar, without removing the bar from its overhead conveyor, by press means for forcing the stub and block against wedge type strippers which act to fracture the thimble and thereby cause its effective removal from the bar stub.

The invention is best illustrated with reference to the accompanying drawings wherein:

FIGURE 1 is a front elevational view, partly in section, of the preferred embodiment of the thimble removing press;

FIGURE 2 is a side elevational view, partially in section, of the structure of FIGURE 1;

FIGURE 3 is a top plan view of the structure of FIGURE 1;

FIGURE 4 is a fragmentary vertical sectional view of the stripper punch arrangement;

FIGURE 5 is a fragmentary side view of the stripper punch and,

FIGURE 6 is a schematic valve and piping layout for the arrangement.

Referring to the drawings and particularly to FIGURES 1 and 2, it is seen that a support bar, indicated generally at **10**, is carried by a conventional overhead conveyor arrangement **12**. The conveyor is formed of an I-beam **14** arranged to support an anode bar body **16** through rollers **18**. The moving force is supplied to the foregoing assembly by means of a drive conveyor, generally indicated at **20**, which similarly is formed of an

I-beam **22** arranged to support a plurality of spaced members **24** by means of rollers **26**. The spaced members **24** are secured to and driven by a chain (not shown) and drives the anode bar **16** through a drive rod **28** which is secured to the support bar **10**.

In the preferred form, each anode bar **16** is arranged to support a pair of carbon blocks. Obviously, however, each anode bar could be utilized to support a single carbon block. Referring to FIGURE 2, it is seen that a cross bar **30** is secured to the bar **16**. The ends of the cross bar **30** are turned down as at **31** and a steel stub **32** is bonded to each of the turned down portions. A schematic cast iron thimble is indicated at **36** in FIGURES 1 and 2 and the contour of the thimble, best seen in FIGURES 4 and 5, corresponds to the contour of the cored opening in the carbon block. The fragmentary burned down carbon block **41** is illustrated in only certain of the views because the primary concern of the invention is the removal of the cast iron thimble from the stub, and the carbon block fragment is removed simultaneously with the thimble.

The present invention contemplates the use of a press for removing the cast iron thimbles and is best illustrated in FIGURES 1 through 3. The press, indicated generally at **38**, comprises a base **40** on which are mounted spaced housings **42**, the assembly being held together by means of conventional tie bolts **43**. Each anode bar is conveyed to the press station in a manner which will be explained hereinafter. After arriving at the press stations, the anode bar is held in position and prevented from rotating by means of an ensnaring bar **44** (FIGURE 3) which is supported for horizontal movement in spaced guides **46**. The ensnaring bar **44** is secured to the piston rod **48** of an air cylinder **50** which, when activated, moves the ensnaring bar **44** to a position whereat the body **16** of the anode bar is received in the U-shaped opening **51**.

After the bar has been properly positioned, opposed stripper jaws **52** are moved into position by means of stripper jaw cylinders **54** so that the semi-cylindrical openings **56** surround, but do not contact the steel stubs **32**. As seen in FIGURE 1, the stripper jaws **52** move into position adjacent the upper surface of each thimble in order to restrain the thimble from upward movement during its removal from the steel stub.

The base **40** of the press **38** is provided with an hydraulic cylinder **60** which carries a ram **62** to the end of which is secured one or more stripper punches **64**. The stripper punch is best illustrated in FIGURES 4 and 5. The punch at its extreme end **66** has a diameter which is less than the internal diameter of the cast iron thimble and diverges outwardly therefrom to form wedge surfaces **68**. The wedge surfaces **68** may be provided at circumferentially spaced points on the punch, but preferably are formed as a single frustro-conical surface around the punch, and are formed so that their widest dimension exceeds the internal diameter of the cast iron thimble. The punch may also be provided with breaker points **70**, preferably in the form of a single rod extending through the punch and extending outwardly of the wedge surfaces, as best seen in FIGURE 4. The breaker points **70** are provided with knife edges **72** for a purpose to be described hereinafter.

Referring specifically to FIGURE 4, it is seen that as the punch **64** moves upwardly, the punch end **66** contacts the lower surface of the steel stub **32** and moves the stub upwardly out of the cast iron thimble which is restrained from movement by the stripper jaws **52**. As the punch continues its upward movement, the wedge surfaces **68** thereof contact the juncture of the lower surface of the thimble and the inner periphery thereof and by wedging action tend to expand the thimble. The thimble, how-

ever, being frangible, shatters and drops away from the steel stub **32**. The advantages of this type of removal are that a shorter press stroke may be utilized than would be required if the stub were forced completely out of the thimble and, furthermore, the cast iron thimble immediately drops completely away from the stub and the punch rather than being received around the punch which would be the case if the thimble were not broken. In the latter instance, a separate operation would be necessary to remove the thimble from around the punch.

The shattered thimble is preferably dropped into one or more chutes (not shown) down which it slides into scrap boxes. It is, therefore, desirable to force the thimble to break in a preferred manner so that the thimble pieces will fall according to a predetermined pattern. This is accomplished by means of the breaker points **70**. Referring to FIGURE 4, it is seen that, as the punch moves upwardly, the knife edges **72** are arranged to contact the bottom surface of the cast iron thimble at approximately the same time that the thimble is contacted by the wedge surfaces. The knife edges **72**, therefore, exert a pressure on the thimble which causes the thimble to shatter in an axial plane substantially aligned with the breaker points. The discharge chutes can, therefore, be arranged in the most convenient position with assurance that the pieces of the broken thimble will always fall into the chutes rather than into some other parts of the press. As explained heretofore, the thimble is held stationary during a stripping operation while the punch forces the steel stub, and with it the entire support bar **10**, in an upward direction. To accommodate this movement, the fixed conveyor **12** is provided with a movable portion **82** (FIGURE 2) which is free to move upwardly with the support bar.

A counter-balance, shown generally at **80**, is also provided to offset most of the weight of the conveyor portion **82** and of the support bar assembly **10** so that its entire weight need not be carried by the punch and the punch actuating ram. The counterbalance arrangement is best shown in FIGURE 2. It comprises a frame portion **84**, rigidly secured to the fixed conveyor rail **14**. A counterbalance cylinder **86** is carried by the frame and is provided with a cylinder rod **83** which in turn supports a guide assembly **88** arranged to ride in tracks **90** provided on the frame **84**. The movable conveyor portion is in turn supported by the guide assembly. During a stripping operation the cylinder **86** is actuated and is adjusted to provide an upward force which is just slightly less than the combined weight of the guide assembly, movable conveyor portion and support bar assembly. Thus, the stripper cylinder **60** need furnish only enough force to strip the thimble from the steel stub and can thus be made smaller than if it were required to support all of the structure above the stub.

The cycle of operation will be best understood with reference to the schematic diagram illustrated in FIGURE 6. When the support bar carrying one or more thimbles to be removed is fed into the press station, a limit switch (not shown) is tripped to energize a control relay (not shown). Energization of the relay energizes a solenoid **100** whereby the spool of valve **102** is shifted to accommodate flow of shop air from port Q of valve **102** to port S and thence to the head end of air cylinder **86** whereby a counterbalancing force is provided as explained heretofore. Simultaneously with the energization of solenoid **100**, solenoid **110** is energized to shift the spindle of valve **112** to supply air to the head end of ensnaring cylinder **50** which moves the ensnaring bar (FIGURE 3) into position to prevent further motion of the support bar **10**. When the ensnaring bar has reached its extreme position, limit switch **114** is tripped to complete a circuit to energize solenoid **116** of pressure compensating pump **118**. Oil is now pumped through line **119** to the head ends of the four stripper jaw cylinders **54** which move the stripper jaws into position immediately

adjacent the upper surfaces of the related thimbles and surrounding, but not contacting, the related steel stubs. Each of the stripper jaws, when reaching its proper position, trips an associated limit switch. These switches are designated **120**, **122**, **124**, and **126**. When all four limit switches have been tripped, a relay (not shown) is energized to complete a circuit to solenoid **132** of pressure compensating pump **134** whereby oil flows through line **135** into the head end of the stripper cylinder **60**. The ram **62**, together with the punch **64**, now moves upwardly as described heretofore to perform the stripping operation.

In certain instances sufficient tonnage may not be attained by the ram **62** to strip a thimble from the stub. To alleviate this situation, a pressure switch **136** is provided which is set at the maximum pressure of the pump **134** and which will trip when this pressure is reached in order to allow the ram **62** to return to its lowered position and, therefore, not stop the press cycle. In these instances, of course, the thimbles have to be removed by hand.

After the ram **62** has completed its stripping operation, it travels until limit switch **138** is tripped causing solenoid **116** to be de-energized and solenoid **140** to be energized. Oil now flows through line **142** into the rod ends of the four stripper jaw cylinders **54** and the stripper jaws are consequently moved away from the support bar assembly. Simultaneously, solenoid **132** of pump **134** is de-energized and solenoid **148** is energized. Oil now flows through line **150** and check valve **151** to the rod end of the cylinder **60** whereupon the ram **62** moves downwardly. At the same time, a pilot line **152** supplies oil pressure to the spindle of by-pass valve **154** to shift the valve to open position. Part of the oil, therefore, from the head end of cylinder **60**, is forced out of the cylinder through line **150** and back to the reservoir **156** while the excess oil travels through by-pass valve **154** to the reservoir **156**. When the ram **62** reaches its lowest position, limit switch **160** is tripped to de-energize solenoid **148** of pump **134** to neutralize the pressure in the lines leading from this pump.

When all four of the stripper jaw rams have completed their return stroke, pressure builds up at the rod end of the cylinders **54** until the pressure setting of switch **162** is reached. The switch **162** is thereby tripped and a circuit is completed to de-energize solenoid **140** of pump **118** to neutralize the pressure in this pump. Simultaneously, solenoids **100** and **110** are de-energized. De-energizing solenoid **100** reverses the ram of cylinder **86** to relieve the pressure in the counterbalance arrangement. De-energizing solenoid **110** reverses the ram of cylinder **50** whereupon the ensnaring bar **48** is moved to its retracted position. At this time, a limit switch **166** is tripped indicating the end of the cycle whereupon the conveyor mechanism **20** feeds the support bar out of the press and moves another support bar into the press to cause the cycle to be repeated.

I claim:

1. In an arrangement for removing a frangible thimble from a support bar, the combination of: means for restraining axial movement of the thimble; a punch aligned with the support bar nad movable axially thereof, said punch having wedge surfaces engageable with the thimble for exerting a wedging force against a portion of the internal periphery of the thimble to break the latter upon axial movement of the punch; and breaker means on said punch extending radially thereof and engageable with the end of the thimble adjacent the punch for exerting pressure at spaced points on said end and thereby controlling the manner of breaking of said thimble.

2. In an arrangement for removing a frangible, generally cylindrical, ring from a support bar, the combination of: stripper jaw means for restraining axial movement of said ring while accommodating axial movement of said support bar; a punch axially aligned with

the support bar and engageable therewith; power means to impart axial movement to the punch; said punch having an end diameter smaller than the internal diameter of the ring, said punch having wedge surfaces diverging outwardly from said punch end and engageable with the inner periphery of the ring to break the latter by wedging action; and breaker means on said punch engageable with the end of the ring adjacent the punch for controlling the manner of breaking of said ring.

3. In an hydraulic press arrangement for removing a cast iron ring from a support bar, the combination of: a conveyor rail; a support bar carried by said rail and movable along a path to a press station; a pair of jaws movable to a position substantially surrounding the support bar and adjacent the upper surface of said ring; a stripper punch axially aligned with said support bar and engageable with the bottom surface thereof; power means to move said punch to urge said support bar upwardly and out of said ring; wedge surfaces on said punch engageable with the juncture of the inner periphery and the lower surface of said ring whereby said ring is broken as said punch and support bar move upwardly; a portion of said conveyor rail being movable upwardly to accommodate the movement of said support bar.

4. In an hydraulic press arrangement for removing a cast iron ring from a support bar, the combination of: a conveyor rail; a support bar carried by said rail and movable along a path to a press station; a pair of jaws movable to a position substantially surrounding the support bar and adjacent the upper surface of said ring; a stripper punch axially aligned with said support bar and engageable with the bottom surface thereof; power means to move said punch to urge said support bar upwardly and out of said ring; wedge surfaces on said punch engageable with the juncture of the inner periphery and the lower surface of said ring whereby said ring is broken as said punch and support bar move upwardly; a portion of said conveyor rail being movable upwardly to accommodate the movement of said support bar; and knife edge means on said punch engageable with the lower surface of said ring for exerting pressure at spaced points thereof for causing the ring to break in a predetermined manner.

5. In an hydraulic pressure arrangement for removing a cast iron ring from a support bar, the combination of: a conveyor rail; a support bar carried by said rail and movable along a path to a press station; a pair of jaws movable to a position substantially surrounding the support bar and adjacent the upper surface of said ring; a stripper punch axially aligned with said support bar and engageable with the bottom surface thereof; power means

to move said punch to urge said support bar upwardly and out of said ring; wedge surfaces on said punch engageable with the juncture of the inner periphery and the lower surface of said ring whereby said ring is broken as said punch and support bar move upwardly to accommodate the movement of said support bar; and counterbalance means operatively connected to said support bar urging said support bar upwardly with a force slightly less than the combined weight of the support bar and ring.

6. In an arrangement for removing a frangible ring from a support member; stripper means for moving said ring and member relatively of each other in an axial direction; wedge means movable with the stripper means and engageable with a portion of the inner periphery of said ring for breaking the latter into at least two separable pieces; and a plurality of substantially knife edge means engageable with the ring at spaced points for controlling the manner of breaking of the ring.

7. In an arrangement for removing a frangible ring from a support member, stripper means for moving said ring and member relatively to each other in an axial direction, wedge means movable relative to said stripper means and engageable with at least a portion of the inner periphery of said ring causing said portion to move in a direction away from said support member, and breaker means associated with said wedge means and engageable with said ring for controlling the manner of breaking of said ring, said breaker means comprising an elongated body portion insertable into said wedge in a manner so as to have at least one end of said body portion extending beyond the surface of said wedge means, and a knife-like surface formed on said breaker means body portion for at times engaging said ring.

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