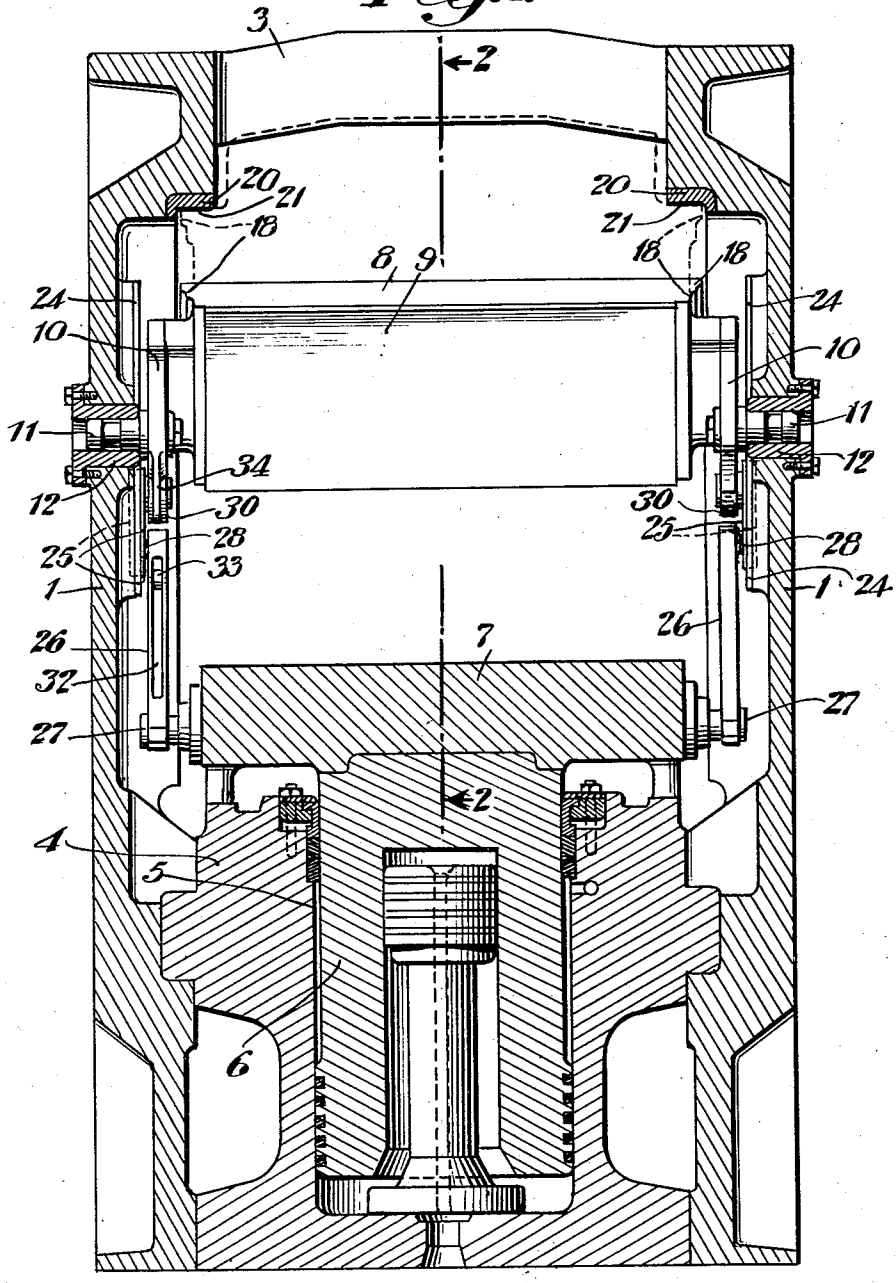
Dec. 12, 1939. E. A. STILLMAN ET AL 2,182,884

TILTING-HEAD PRESS

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Fig. 1.



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Fig. 2.

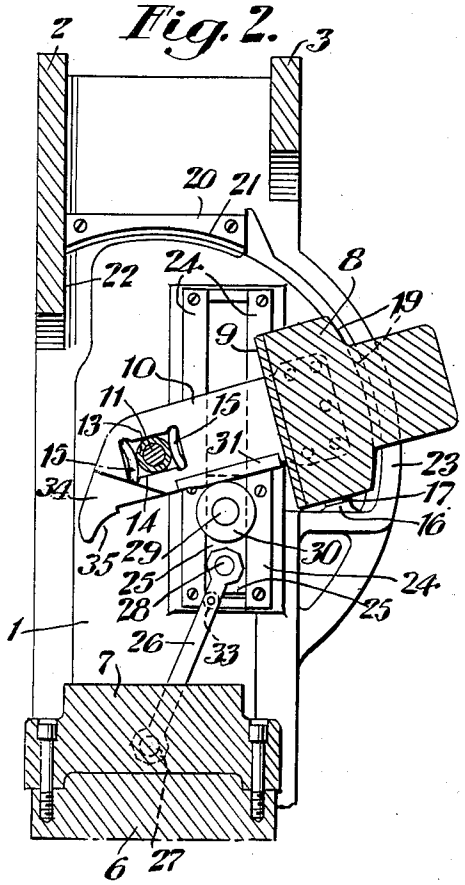


Fig. 3.

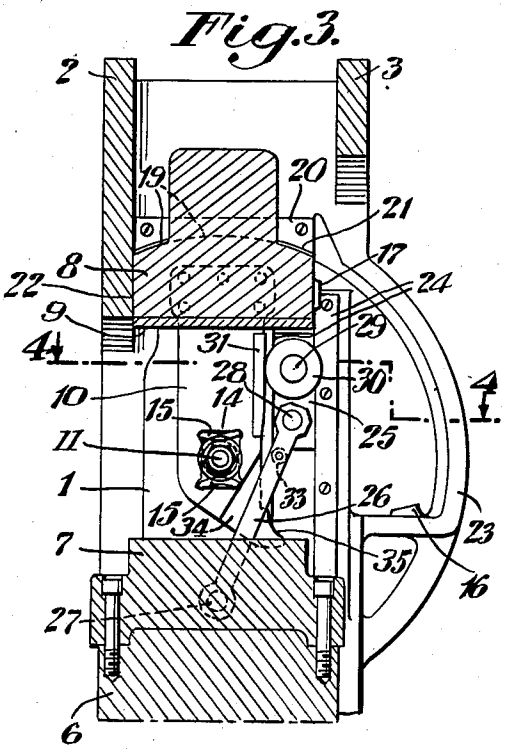
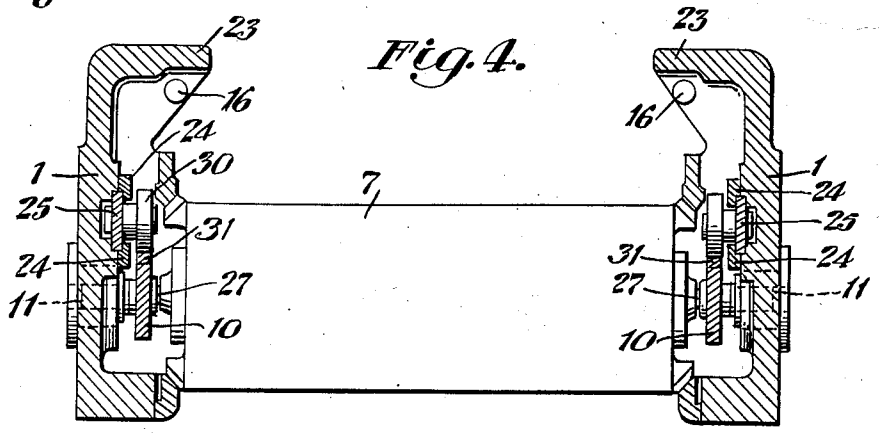


Fig. 4.



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UNITED STATES PATENT OFFICE

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TILTING-HEAD PRESS

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Application August 13, 1937, Serial No. 158,846

17 Claims. (Cl. 18—16)

This invention relates more particularly to molding presses of the type wherein a lower press head is mounted for vertical reciprocation and a cooperating upper head is tiltably mounted for shifting from an operative position in opposed relation to the lower press head to an inoperative position out of such opposition for ready access to and inspection of the molds and dies.

Important objects of the invention are to provide in such a press improved mechanism for shifting the tiltable press head to operative and inoperative positions by reciprocation of the lower press head; to provide improved means for locking or holding the tiltable press head in operative position; and to provide for the locking or holding of the tiltable press head in operative position by the mechanism employed to shift it.

Other objects of the invention will appear hereinafter.

In the drawings, Fig. 1 is a vertical sectional view, looking from front to rear, of a press embodying the invention;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1, showing the upper press head tilted to inoperative position;

Fig. 3 is a view similar to Fig. 2 showing the upper head held in its operative position; and

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3.

A pressure head must be massive and strong in order to withstand the full capacity pressure of the press apparatus. The massiveness increases in proportion to increase in press capacity. For that reason the employment of tilting pressure heads has usually been limited to presses of rather low capacity. It requires much power to move a very massive pressure head and heretofore the power for that purpose has been supplied by mechanism independent of the mechanism for reciprocating the lower press head. In many cases that necessitated the provision of timing mechanism to control the operation of said independent mechanisms, for proper sequential operation of the two heads.

The present invention is applicable to hydraulic presses of high pressure capacity because it provides for operation of the massive tiltable pressure head by power from the usual ram-and-cylinder mechanism employed for shifting the reciprocable head. The operative connection between said mechanism and the tiltable head is simple and direct and it automatically times the operation of the tiltable head in proper relation to the shift of the reciprocable head. Thereby the invention eliminates the complication and cost of the aforesaid independent mechanism and also the timing mechanism.

In addition to the advantage just stated the invention utilizes the weight of the tiltable pressure head to assist in retracting the lower pressure head. The tiltable head is mounted to swing downward by gravity from its pressing position and its weight exerts a downward thrust which is transmitted to assist the depression of the lower head. At the same time, the fluid pressure resistance to downward swing of the tiltable head controls the descent of the latter and causes it to be gently lowered to its inoperative position.

The invention is illustrated as embodied in a molding press apparatus including a rigid arch-like frame comprising vertical side members or columns 1 and spaced front and rear bridge plates 2 and 3 respectively, joining the upper ends of the columns. Between the lower portions of the columns there is mounted a cylinder block 4 cored out to form a vertically disposed hydraulic pressure cylinder 5 closed at its lower end and open at its upper end. A ram 6 is fitted to reciprocate in the cylinder and bears the lower press head 7 at its upper end. Said head has a flat, horizontal upper face which may be slotted for attachment of a mold or molds. The head may also have the usual ejectors for stripping molded articles from the molds. The head is here shown in its simplest form, the slots and ejectors being omitted in order to simplify the illustration. The means for controlling hydraulic pressure in the cylinder are also omitted as they form no part of the present invention.

An upper press head 8 is tiltably mounted for disposal in an upper operative position in opposed relation to the lower head 7 and for swinging downward and rearward to an inoperative position out of opposition to the press head. Said upper head comprises a metal block conforming substantially in plan to the lower head and having a flat under face 9 for disposal parallel to the upper face of the press head 7. The press head 8 may have the usual means, not shown, for attachment of dies or other molding elements to the face 9. The mounting for the head 8 comprises a pair of flat, rigid supporting arms 10 secured to the opposite ends of the head 8 and extending perpendicularly from the plane of the face 9. These arms are disposed adjacent to the inner faces of the frame columns 1, and at points spaced materially from the head 8 they are pivotally mounted upon the columns. Their pivotal mounting comprises a pair of trunnions 11 rotatably supported by bearing bushings 12

borne by the columns. The trunnions protrude inward from the columns and have collars 13 secured thereto and fitted in rectangular apertures 14 in the arms 10. At diametrically opposite sides of the collars 13, along lines extending lengthwise of the arms, shims 15 are fitted in the apertures 14. These shims are made of spring steel and they are bowed to bear against the collars and provide yieldable and resilient connections between the arms 10 and the trunnions.

The trunnions are mounted to rotate on a horizontal axis materially spaced above the lower press head, when the latter is in its lowered position, and also located midway between the front and rear edges of the lower head. The upper press head is supported for swinging about said axis between an operative upper position in which said head is in opposed, parallel relation to the lower head, and the arms 10 are vertical, and an inoperative lower position in which the upper head is rearwardly offset and faces forward and downward. In this latter position the arms 10 are obliquely disposed, as shown in Fig. 2. For stopping the downward swing of the head 8 and supporting it in said inoperative position fixed stop abutments 16 are formed on the columns 1 and are engageable by abutments 17 on the rear side of the head 8 and at the opposite ends thereof. The head 8 has end portions 18 of reduced depth formed with convex upper abutment surfaces 19 on an arc struck about the trunnion axis. The columns have fixed thereto abutment strips 20 spaced above the trunnion axis and formed with concave abutment surfaces 21 facing downward and extending in an arc struck about said axis. The said surfaces 19 are engageable with surfaces 21 during the pressing operation and the latter surfaces resist the pressing thrust the stress of which is transmitted to the columns 1. The shims 15 permit a yield at the trunnion connections of the arms 10 and prevent strain upon the trunnions by said thrust. The swing of the head 8 to operative position is limited by the inner surface 22 of the forward bridge plate 2 which forms a fixed stop abutment for the forward side of the head 8. The columns are also formed at their rear sides with arcuate flanges 23 struck about the trunnion axis and extending between the resistance abutment surfaces 21 and the lower stops 16 for the press head 8. These flanges shroud the abutment end surfaces 19 of the head 8 and serve to prevent outward radial displacement of the head 8 as it is swung about the trunnion axis.

A thrust mechanism is provided to swing the tiltable press head from its inoperative lower position to its operative upper position and then hold or lock it in operative position for the pressing operation. This thrust mechanism is operated by reciprocation of the lower press head 7. As part of this mechanism there are parallel vertical guides 24 fixed to the inner sides of the columns 1 and arranged rearwardly of the trunnions 11. A pair of slides or crossheads 25 are mounted for vertical reciprocation between said guides to points above and below the trunnion axis. A pair of thrust links 26 have pivotal connections 27 at one end with the opposite ends of the lower press head. These pivotal connections are located centrally of the ends of the press head, and they extend upward and have pivotal connections 28 with the crossheads 25. Thereby the crossheads are reciprocated along with the lower press head. Above the link pivots 28 the crossheads have stub shafts 29 upon which thrust rollers 30 are rotatably mounted. These rollers are made of hard, wear-resisting metal, and the supporting arms 10 of the upper press head have fixed to their rear edges track strips 31 also made of hard, wear-resisting metal. The track strips extend straight along the arms 10 and are arranged to be operatively engaged by the rollers.

As shown in Fig. 2, when the lower press head 7 is in its lowermost position the upper press head 8 is down in its inoperative tilted position and its radial supporting arms 10 with their track strips 31 extend directly across the paths of the thrust rollers 30. When the hydraulic pressure is admitted to the ram cylinder 5 the ram 6 and lower press head 7 will be forced upward and the links 26 will thrust the crossheads 25 upward in their guides. The rollers will then exert a camming thrust upon the tracks 31 to swing the arms 10 and press head 8 upward to operative position, as shown in Fig. 3. The head 8 will then be in contact with the fixed stop abutment 22. This shift of the head 8 to operative position will occur during the preliminary portion of the upward movement of the lower press head so that the upper head will be fully in operative position before the squeeze between the two heads occurs. The upward swing of the head 8 is gradually retarded as its arms 10 with their track strips 31 approach parallelism with the paths of the crossheads 25. Therefore the head 8 will be brought gently against stop abutment 22.

The track strips 31, the crossheads 25 and their rollers 30 are so arranged that when the press head 8 is in contact with the stop abutment 22 the tracks 31 will be parallel to the paths of movement of said rollers. Then the rollers will roll along the tracks and cooperate with the abutment 22 to hold the head 8 true with reference to the head 7 as the latter continues to rise for the squeezing operation. Thereby the thrust mechanism serves to both shift the upper head to operative position and lock it there by mere advance of the lower press head.

The press head 8 will be restored to its inoperative position by downward movement of the press head 7. When the head 7 is in its operative position it is centered, or on vertical dead center with respect to the axis of its trunnions. Means are provided to trip it out of dead center and initiate its downward swing when the press head 7 and the connected crossheads 25 move downward. One of the crosshead-shifting links 26 has a longitudinal slot 32 and a roller 33 mounted within the upper end portion of said slot. One of the arms 10 has a rigid cam extension 34 with an arcuate cam surface 35 at one edge. Said cam extension is adapted to enter the slot 32 and dispose the cam surface 35 beneath the roller 33, when the press head 8 is swung up to operative position. When the press head 7 and the connected links 26, crossheads 25 and thrust rollers 30 are shifted downward the roller 33 will operate upon the cam surface 35 to tilt the head 8 slightly off dead center and permit it to rest upon the rollers 30 and follow them downward until the head 8 rests upon the stop abutments 16. The head 8 then occupies a position for ready inspection of and access to molding dies or the like mounted thereon.

It will be seen that the invention provides extremely simple and reliable means for shifting the upper press into and out of its operative position by the ordinary working reciprocation of

the lower press head, and that the invention also provides simple and reliable means to lock the upper head automatically in its operative movement by upward shift of the lower head.

What we claim is:

1. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about a fixed axis parallel to and between said heads and midway of their width and comprising radial arms pivotally mounted to swing about said axis and bearing said upper head at their outer ends; fixed stop abutment means to limit swinging of the upper head to operative position; fixed resistance abutment means engageable by the upper head in its operative position to resist the pressing thrust; and a thrust mechanism to swing the upper head to operative position by upward shift of the lower head and comprising slides mounted for vertical reciprocation at one side of said axis, operative connections between the lower head and said slides to shift the slides upward and downward along with the lower head, and thrust elements borne by said slides and operable upon said radial arms to swing the upper head to operative position by shift of the lower head through a preliminary portion of the upward movement thereof, said thrust elements being arranged to travel along one edge of said arms and cooperate with said stop abutment means to hold the upper head in operative position during the remainder of the upward movement of the lower head.

2. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about a fixed axis parallel to and between said heads and midway of their width and comprising radial arms pivotally mounted to swing about said axis and bearing said upper head at their outer ends; fixed stop abutment means to limit swinging of the upper head to operative position, fixed resistance abutment means engageable by the upper head in its operative position to resist the pressing thrust; a thrust mechanism to swing the upper head to operative position by upward shift of the lower head and comprising slides mounted for vertical reciprocation at one side of said axis, operative connections between the lower head and said slides to shift the slides upward and downward along with the lower head, and thrust rollers borne by said slides and operable upon said radial arms to swing the upper head to operative position by shift of the lower head through a preliminary portion of the upward movement thereof, said rollers being arranged to travel along one edge of said arms and cooperate with said stop abutment means to hold the upper head in operative position during the remainder of the upward movement of the lower head; and trip means operable by retraction of the lower head from its uppermost position to tilt the upper head about said axis and permit it to swing downward to inoperative position as the lower head is retracted.

3. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about a fixed axis parallel to and between said heads and comprising radial arms pivotally mounted to swing about said axis and bearing said upper head at their outer ends; and a thrust mechanism to swing the upper head to operative position by upward shift of the lower head and comprising slides mounted for vertical reciprocation at one side of said axis, operative connections between the lower head and said slides to shift the slides upward and downward along with the lower head, and thrust elements borne by said slides and operable upon said radial arms to swing the upper head to operative position by upward shift of the lower head.

4. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head and a ram to force said lower head upward, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about an axis parallel to and between said heads and comprising a radial arm pivotally mounted to swing about said axis and bearing said upper head at its outer end; fixed stop abutment means to limit swinging of the upper head to operative position; fixed resistance abutment means engageable by the upper head in its operative position to resist the pressing thrust; a thrust mechanism to swing the upper head to operative position by operation of said ram to shift the lower head upward and comprising a thrust element mounted for vertical reciprocation at one side of said axis, and an operative connection between the ram and said thrust element to shift the latter upward and downward along with the lower head, said radial arm being arranged to extend across the path of said thrust element when the upper head is down in inoperative position, the thrust element being operable upon the arm to swing the upper head to operative position upon shift of the lower head through a preliminary portion of its upward movement, and the thrust element being arranged to travel along the arm and cooperate with said stop abutment means to hold the upper head in operative position during the remainder of the upward movement of the lower head; and trip means operable by retraction of the lower head from its uppermost position to tilt the upper head about said axis and permit it to swing downward to inoperative position as the lower head is retracted.

5. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head and a ram to force said lower head upward, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about an axis parallel to and between said heads and comprising a radial arm pivotally mounted to swing about said axis and bearing said upper head at its outer end; fixed stop abutment means to limit swinging of the upper head to operative position; fixed resistance abutment means engageable by the upper head in its operative posi-

tion to resist the pressing thrust; and a thrust mechanism to swing the upper head to operative position by operation of said ram to shift the lower head upward and comprising a thrust element mounted for vertical reciprocation at one side of said axis, and an operative connection between the ram and said thrust element to shift the latter upward and downward along with the lower head, said radial arm being arranged to extend across the path of said thrust element when the upper head is down in inoperative position, the thrust element being operable upon the arm to swing the upper head to operative position upon shift of the lower head through a preliminary portion of its upward movement, and the thrust element being arranged to travel along the arm and cooperate with said stop abutment means to hold the upper head in operative position during the remainder of the upward movement of the lower head.

6. In a press apparatus including a lower press head mounted for vertical reciprocation and a cooperating upper press head tiltable into and out of opposed relation to said lower head and a ram to force said lower head upward, a mounting for said upper head supporting it for swinging bodily upward into opposition to the lower head and downward out of said opposition thereto about an axis parallel to and between said heads and comprising a radial arm pivotally mounted to swing about said axis and bearing said upper head at its outer end; and a thrust mechanism to swing the upper head to operative position by operation of said ram to shift the lower head upward and comprising a thrust element mounted for vertical reciprocation at one side of said axis, and an operative connection between the ram and said thrust element to shift the latter upward and downward along with the lower head, said radial arm being arranged to extend across the path of said thrust element when the upper head is down in inoperative position, and the thrust element being operable upon the arm to swing the upper head to operative position upon upward shift of the lower head.

7. In a hydraulic press apparatus including a press frame, a lower pressure head mounted for vertical reciprocation, a cooperating massive upper pressure head tiltable into and out of opposed relation to said lower head, hydraulic power means for operating the lower head, a mounting for the tiltable head supporting it on the press frame for swinging about a single horizontal axis located between the lowermost position of the lower head and the uppermost position of the upper head, and an operative connection between said power means and the upper head and constructed and arranged to swing the upper head from an inoperative lower position to its operative upper position by operation of the power means to raise the lower head, and to lower the upper head about said axis upon retraction of the lower head and transmit the burden of the upper head to said power means to assist retraction of the lower head.

8. In a hydraulic press apparatus including a press frame, a lower pressure head mounted for vertical reciprocation, a cooperating tiltable upper pressure head, hydraulic power means comprising a cylinder and ram therein for reciprocating the lower head, a supporting arm for said tiltable head, a pivotal mounting for said arm supporting it for swinging the tiltable head upwardly into opposition to the reciprocable head about a single axis and downwardly and outwardly away from the reciprocable head, and means connected to the said ram and operable upon said arm by the shift of the reciprocable head on its working stroke to swing the tiltable head upwardly into pressing position, said means being also operable upon said arm at a point in the retraction of the reciprocable head and before said means reaches its lowermost position to swing the tiltable head outwardly and downwardly and to cause the said arm to swing over and rest upon the arm-swinging means, the arm-swinging means thereafter supporting the tiltable head and lowering it through the remaining portion of the downward movement of the arm-swinging means and imposing the weight of said head on the said hydraulic ram to assist retraction of the lower head, the ram serving as a means to regulate the downward movement of the upper head.

9. In a hydraulic press apparatus including a press frame, a lower die-carrying pressure head mounted for vertical reciprocation, a cooperating tiltable die-carrying upper pressure head, hydraulic power means comprising a cylinder and ram therein for reciprocating the lower head, a supporting arm for said tiltable head, a pivotal mounting for said arm supporting it for swinging the tiltable head upwardly into opposition to the reciprocable head about a single axis and downwardly and outwardly away from the reciprocable head, and means connected to the said ram and operable upon said arm to swing the tiltable head upwardly into pressing position on the working stroke of the ram, and operating upon the retraction of the ram to swing the tiltable head outwardly and downwardly and impose the weight of the tiltable head upon the ram during downward movement thereof, whereby the ram regulates the downward movement of the tiltable head and the weight of the tiltable head assists in the retraction of the ram.

10. In a press apparatus including a lower pressure head mounted for reciprocation and a cooperating upper pressure head tiltable into and out of opposed relation to said lower head, a supporting arm for the upper head depending therefrom, the upper head being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it for swinging the upper head into and out of opposition to the lower head about a single horizontal axis spaced below the upper head and located directly beneath the center of gravity of the upper head when the latter is in opposed relation to the lower head, and means operable upon said arm by shift of the lower head on its working stroke to swing the upper head about said axis from a position out of opposition to the reciprocable head to a position in opposition thereto.

11. In a press apparatus including a press frame, a lower pressure head mounted for reciprocation and a cooperating upper pressure head tiltable into and out of opposed relation to said reciprocable head, a supporting arm for said upper head depending therefrom, the upper head being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it on the press frame for swinging the upper head into and out of opposition to the lower head about a single axis, a thrust device mounted on the press frame for vertical reciprocation above the level of the lower head and operable upon said arm by upward shift to swing the upper head about said axis from a position out of opposition to the lower head to a position in

opposition thereto, and an operative connection between the lower head and said thrust device to shift the latter upward by rise of the lower head on its working stroke and retract the device by retraction of the lower head.

12. In a press apparatus including a pressure head mounted for reciprocation and a cooperating pressure head tiltable into and out of opposed relation to said reciprocable head, a supporting arm of said tiltable head, the latter being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it for swinging the tiltable head into and out of opposition to the reciprocable head about a single axis, and means operable upon said arm by shift of the reciprocable head upon a portion of its working stroke to swing the tiltable head from a position out of opposition to a position in opposition to the reciprocable head and operable upon the arm during a following portion of said stroke to hold the tiltable head in opposition to the reciprocable head.

13. In a press apparatus including a pressure head mounted for reciprocation and a cooperating pressure head tiltable into and out of opposed relation to said reciprocable head, a supporting arm for said tiltable head, the latter being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it for swinging the tiltable head into and out of opposition to the reciprocable head about a single axis, and means operable upon said arm by shift of the reciprocable head on its working stroke to swing the tiltable head about said axis from a position out of opposition to the reciprocable head to a position in opposition thereto, said means being also operable upon said arm by retraction of the reciprocable head to initiate swinging of the tiltable head to a position out of opposition to the reciprocable head.

14. In a press apparatus including a vertically reciprocable lower pressure head and a cooperating upper pressure head tiltable into and out of opposed relation to said lower head, a supporting arm for said upper head depending therefrom, the upper head being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it for swinging the upper head into and out of opposition to the lower head about a single axis spaced along the arm from the upper head, and means operable upon said arm by shift of the lower head upward to swing the upper head about said axis from a position out of opposition to the lower head to a position in opposition thereto.

15. In a press apparatus including a vertically reciprocable lower pressure head and a cooperating upper pressure head tiltable into and out of opposed relation to said lower head, a supporting arm for said upper head rigid therewith and depending therefrom, a pivotal mounting for said arm supporting it for swinging the upper head into and out of opposition to the lower head about a single axis spaced along the arm from the upper pressure head, means operable upon said arm by shift of the lower head upward to swing the upper head about said axis from a position out of opposition to the lower head to a position in opposition thereto, abutment means engageable by the upper head to resist the pressing force, and means at the said pivotal mounting to permit the upper head to yield upwardly under the pressing force to bear against said abutment means.

16. In a press apparatus including a vertically reciprocable lower pressure head and a cooperating upper pressure head tiltable into and out of opposed relation to said lower head, a supporting arm for said upper head depending therefrom, the upper head being held at all times against tilting relatively to said arm, a pivotal mounting for said arm supporting it for swinging the upper head into and out of opposition to the lower head about a single axis spaced along the arm from the upper head and directly beneath the center of gravity of the latter, and means operable upon said arm by shift of the lower head upward upon a portion of its working stroke to swing the upper head from a position out of opposition to a position in opposition to the lower head and operable upon the arm by shift of the lower head upon a following portion of said stroke to hold the upper head in said opposition, and operable upon the arm by retraction of the lower head to initiate swinging of the upper head to a position out of said opposition.

17. In a press apparatus including a pressure head mounted for reciprocation and a cooperating pressure head tiltable into and out of opposed relation to said reciprocable head, a supporting arm bearing said tiltable head, a pivotal mounting for said arm supporting it for swinging the tiltable head into and out of opposition to the reciprocable head about a single axis, a connection between said arm and the tiltable head supporting the latter against tilting relatively to the arm in said swinging movement of the tiltable head, and means operable upon said arm by shift of the reciprocable head on its working stroke to swing the tiltable head about said axis from a position out of opposition to the reciprocable head to a position in opposition thereto.

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