United States Patent

[11] **3,608,478**

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[21] Appl. No. **29,196**
[22] Filed **Apr. 16, 1970**
[45] Patented **Sept. 28, 1971**
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[54] **HIGH-SPEED PRESS**
8 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **100/209,** 72/403, 100/244, 100/245, 100/282
[51] **Int. Cl.** **B30b 15/04,** B30b 15/14
[50] **Field of Search** ..... 100/186, 209, 244, 245, 264, 295, 208, 282; 72/405, 404, 403; 18/30 LM, 30 LC, 30 LD, 30 PM; 83/519

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ABSTRACT: Press mechanisms comprising a frame mounting at least two pairs of press shoes which are actuated by crankarms; and mechanical or electrical synchronizing means for operating the press shoes in alternate sequence.

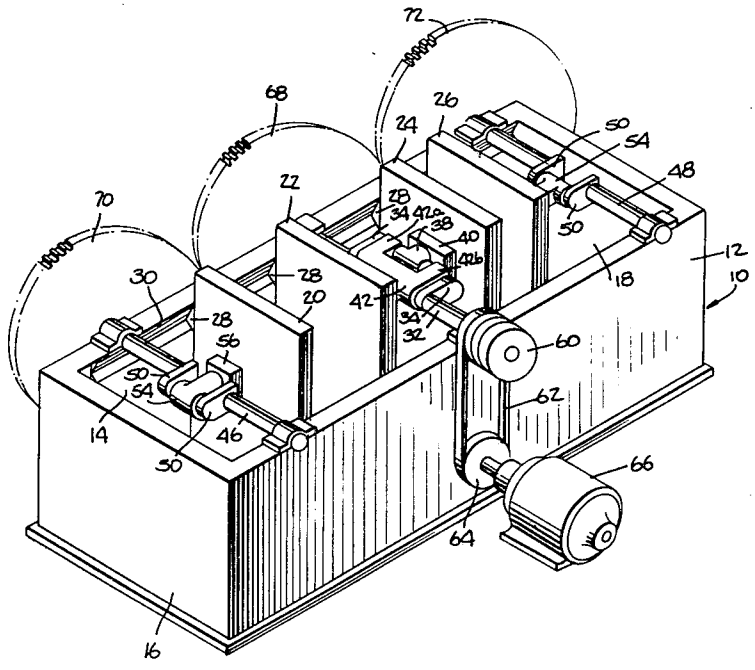
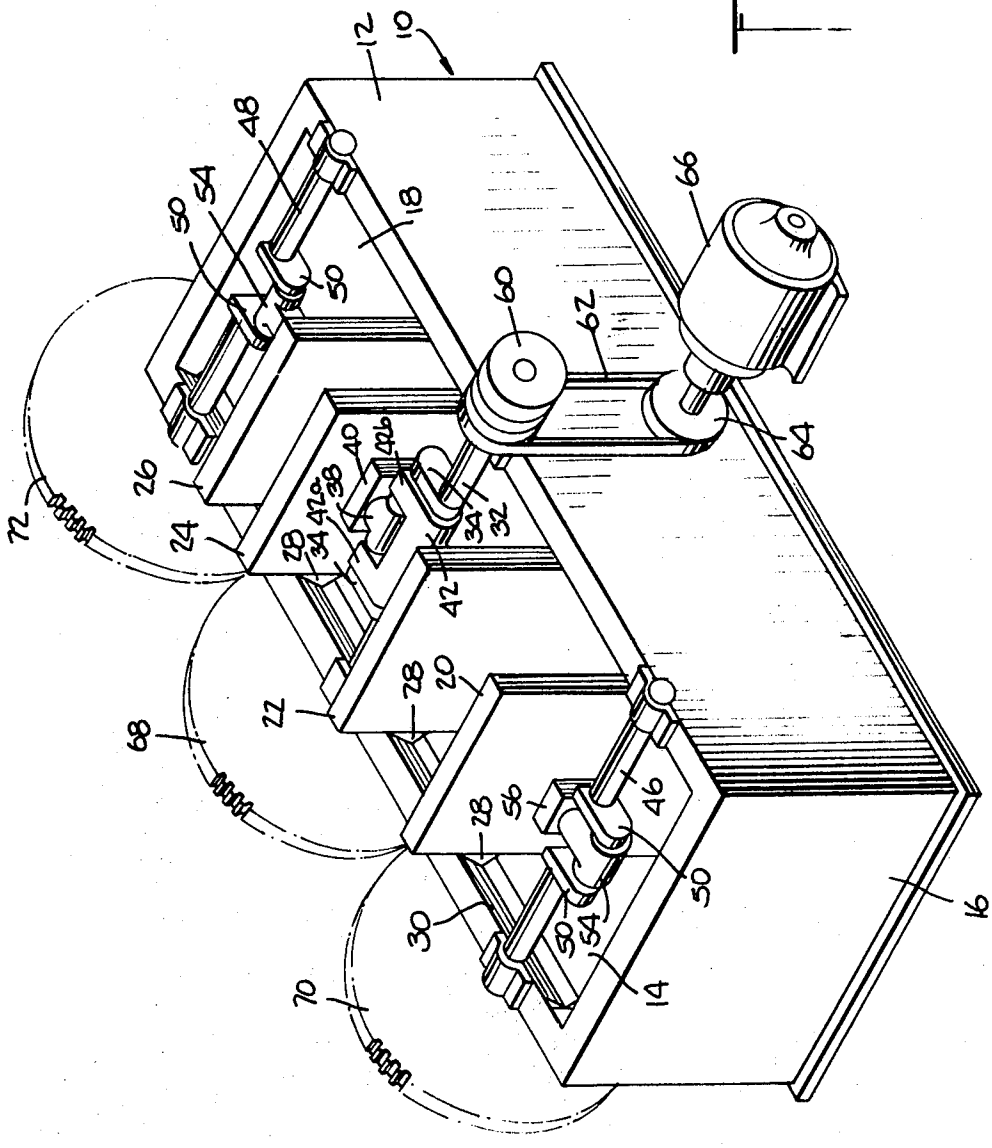


Fig. 1.



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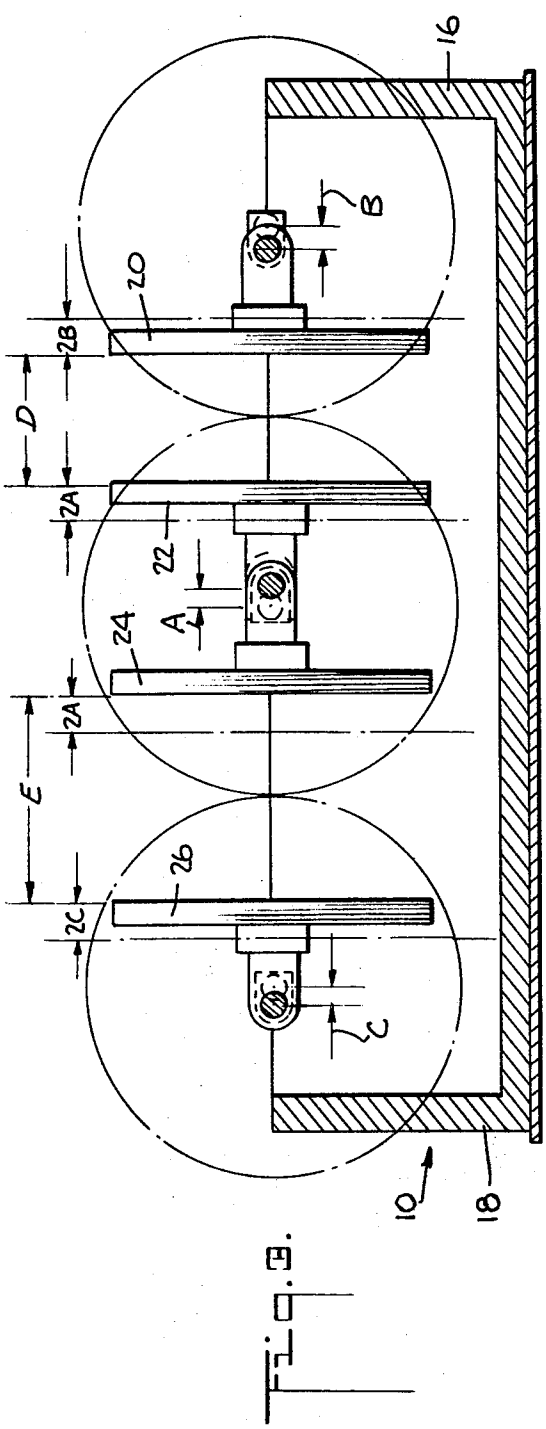


Fig. 3.

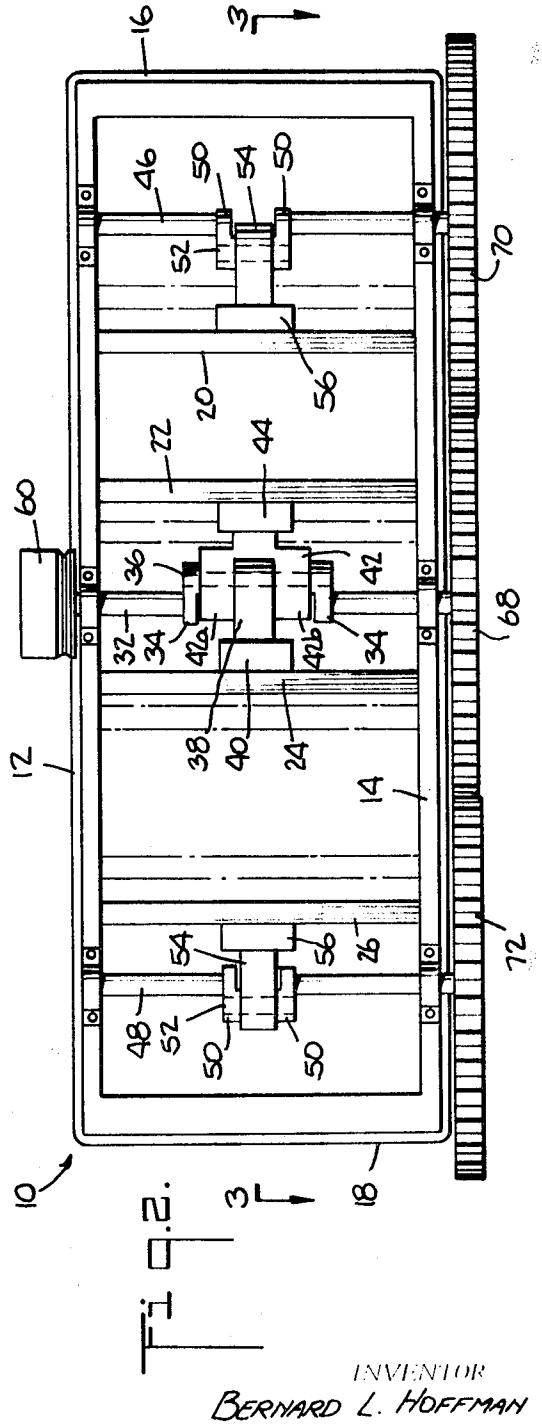


Fig. 2.

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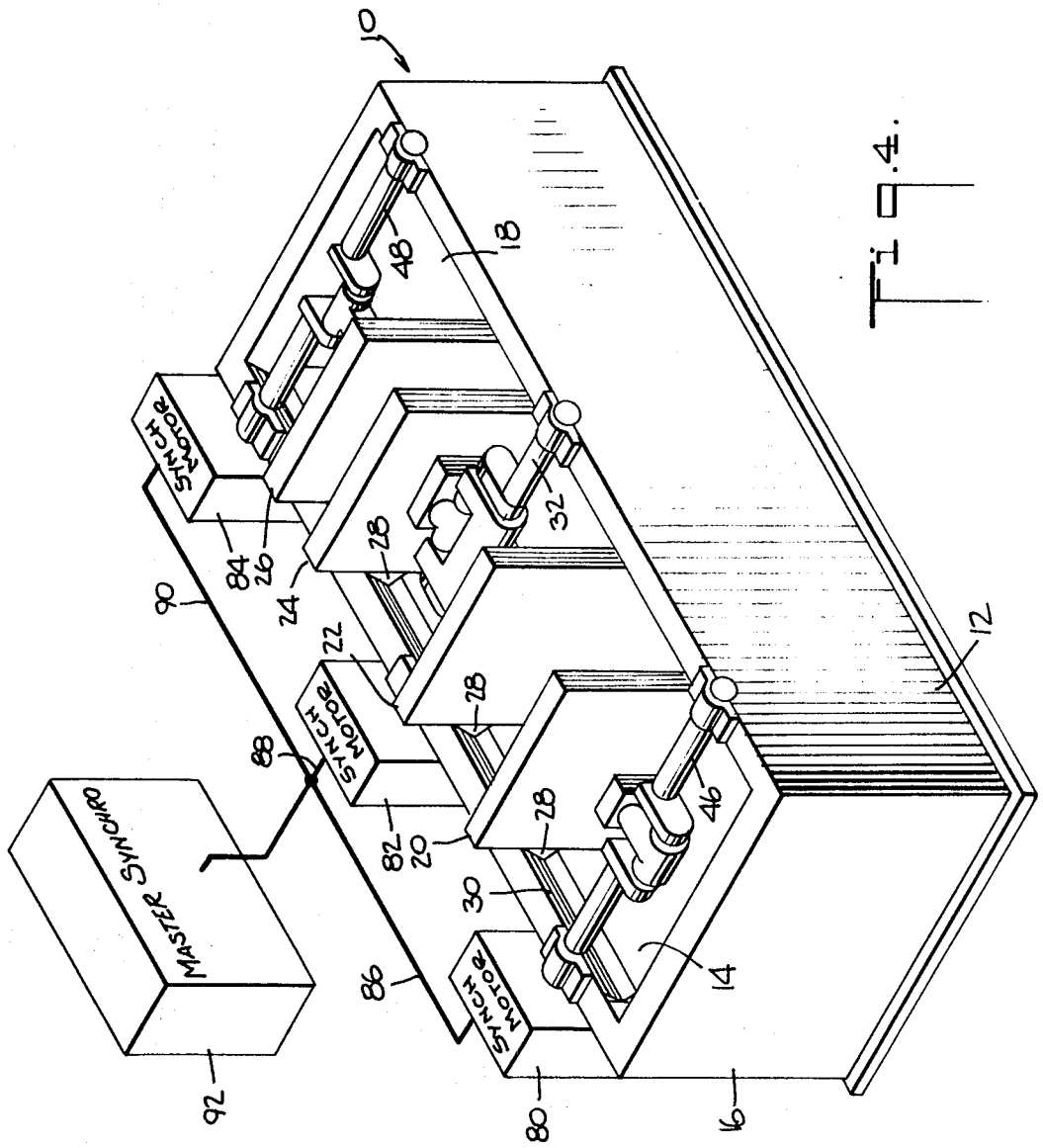


Fig. 4.

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HIGH-SPEED PRESS

This invention relates to presses and more particularly it concerns a novel press structure suitable for sustained high production output.

Conventional presses utilize a continuously rotating flywheel which turns a crankarm to move a die shoe in a reciprocal manner back and forth along a linear path. A cooperating stationary die shoe is also mounted along the path and workpiece material to be press worked is fed into the space between the die shoes. As the movable die shoe moves toward, or closes upon the stationary die shoe, the workpiece material between them is squeezed, drawn shaped or similarly worked. Thereafter, as the movable die shoe moves away from the stationary die shoe, the press worked workpiece is removed and a new workpiece is inserted.

The above-described conventional press arrangement is subject to a number of limitations which reduce its effectiveness. One of these limitations lies in the fact that only a very minor portion of each operating cycle is available for doing useful work. The remaining, major portion of each cycle is used in opening the die shoes, in removing the pressed workpiece and in inserting a new workpiece. As a result of this the crankarm length required for a given effective stroke must be quite large. Moreover, as crankarm lengths increase, the resultant local stresses in the system increase at an even greater rate at a given operating speed.

According to the present invention there is provided a novel press arrangement suitable for continuous operation which makes available a much larger portion of the operating cycle for doing useful work. This novel press arrangement moreover actually achieves a reduction in stresses throughout the system by reducing the length of crankarm required to produce a given effective stroke.

The present invention achieves these results through the provision of dual pairs of press shoes arranged to close and open in alternate sequence. These press shoes are guided in a rigid frame for movement toward and away from each other. One press shoe from each pair is connected to be actuated from a common crankarm, so that during one-half of the crankarm rotation one set of the press shoes closes while the other set opens; and during the remaining one-half of the crankarm rotation the first set of press shoes opens while the other set closes. The remaining press shoe in each pair is also arranged to be actuated by a crankarm so that only half the total stroke is undertaken by each individual press shoe. Means are provided for synchronizing the rotational movements of the various crankarms; and these synchronizing means serve to distribute power flow and to equalize stresses throughout the system. As a result higher production speeds may be employed for sustained periods of time without producing undue stresses on the system.

There has thus been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of the invention. It is important, therefore that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope the invention.

Specific embodiments of the invention have been chosen for purposes of illustration and description; and are shown in the accompanying drawings forming a part of the specification, wherein:

FIG. 1 is a perspective view illustrating one embodiment of the present invention;

FIG. 2 is a top plan view of the embodiment shown in FIG. 1;

FIG. 3 is a section view taken along lines 3—3 of FIG. 2; and

FIG. 4 is a perspective view illustrating a second embodiment of the present invention.

As shown in FIG. 1 there is a provided novel double action press which comprises an outer frame **10** of massive boxlike configuration having front and rear sidewalls **12** and **14** and a pair of end walls **16** and **18**. A plurality of press shoes **20**, **22**, **24** and **26** are arranged within the outer frame **10** to move reciprocally back and forth therein. The various press shoes are each provided with guide lugs **28** protruding from each side thereof into guide channels **30** formed along the inner surfaces of the front wall and sidewalls **12** and **14**.

The first and second press shoes **20** and **22** constitute a cooperating first pair; and these shoes are arranged with mutually facing work surfaces which move toward and away from each other to produce a desired pressing action therebetween. Similarly, the remaining press shoes **24** and **26** constitute a second cooperating pair; and these also have a mutually facing working surfaces which close and open with respect to each other to produce a desired press working action. Means (not shown) are provided in order to utilize the press working action of the various press shoes in any desired manner. For example, specially designed cooperating dies may be provided for drawing or stamping sheet metal objects.

A central crankshaft **32** is mounted in the outer frame **10** to extend from a location near the midpoint of the front sidewall **12** to a corresponding location near the midpoint of the rear sidewall **14**. Near the center of the central crankshaft **32** there are provided a pair of parallel crankarms **34**. As shown in FIG. **2**, the outer ends of these crankarms **34** are interconnected by means of a crankpin **36**. An inner connecting rod **38** is pivotally connected at one end to the crankpin **36** and is connected at its opposite end via a pivot block **40** to the press shoe **24**. Similarly, a bifurcated, outer connecting rod **42** is provided with forked arms **42*a*** and **42*b***, which are pinned to the crankpin **36** on opposite sides of the inner connecting rod **38**. The opposite end of the outer connecting rod **42** is similarly connected via a pivot block **44** to the press shoe **22**.

There are also provided outer crankshafts **46** and **48** which extend from the front sidewall to the rear sidewall **14** parallel to the center crankshaft **32** at a location closer to the respective end walls **16** and **18**. Each of the outer crankshafts **46** and **48** is provided near the center thereof with a pair of mutually parallel crankarms **50** which are interconnected at their outer ends by means of crankpins **52**. A further connecting rod **54** is pivotally connected at one end to each crankpin **52** and is connected at its opposite end via a pivot block **56** to a respective one of the outermost shoes **20** and **26**.

As shown in FIG. **1**, one end of the central crankshaft **32** is provided with a crank pulley **60**. This crank pulley receives rotative power via a drive belt **62** and a drive pulley **64** from a drive motor **66**. It will thus be seen that in operation of the device the central crankshaft **32** turns continuously.

As shown in FIG. **2** the end of the central crankshaft **32** opposite the crank pulley **60** is provided with a central gear **68** which is meshes with outer gears **70** and **72** keyed to the outer crankshaft **46** and **48** respectively. It will be noted that gears **68**, **70** and **72** are all of the same size and therefore the crankshafts **32**, **46** and **48** all turn synchronously and at the same speed; although the central crankshaft **32** turns in one direction while the outer crankshafts **46** and **48** turn in opposite direction.

As shown in FIG. **3**, the distance between the respective axes of the central crankpin **36** and the central crankshaft **32** is indicated as A. Thus, as the central crankshaft **32** rotates through a complete cycle, the two press shoes **22** and **24**, which are connected to the crankpin **36** via their respective inner and outer connecting rods **38** and **42**, each move laterally, as shown, through a total distance equal to 2A.

Similarly, the crankarms **50** produce displacements B and C between the axes of the outer crankshafts **46** and **48** and their respective crankpins **53**. As a result, when each of the outer shafts **46** and **48** undergo the complete cycle of rotation, the press shoes **20** and **26**, which are connected to the crankpins **52** by means of associated connecting rods **54**, are each caused to undergo a lateral displacement equal to twice the distance B and C respectively as shown.

It will be noted that the various crankarms **34** and **50** are arranged such that they each extend horizontally at the same time, with the outermost crankarms **50** extending in one direction form the respective crankshafts **46** and **48** while the crankarms **34** extend in opposite direction from the central crankshaft **32**. As a consequence, the first pair press shoes **20** and **22** are displaced by a minimum distance D as shown in Fig. **3** while the other pair of press shoes **24** and **26** are displaced by a maximum distance E. As the drive motor **66** turns the various crankshafts **32, 46** and **48** via the crank pulley **60** and the gears **68, 70** and **72**, the first pair of press shoes **20** and **22** will move apart from each other, each transversing its respective total displacement 2B and 2A so that the shoes move from a closed displacement D to an opened displacement D+2A+2B. At the same time the second pair of press shoes **24** and **26** move toward each other, each transversing its respective total displacement 2A and 2C so that the shoes move from an opened displacement E to a closed displacement E−2A−2C.

It will be appreciated that as the central crankshaft **32** undergoes one complete revolution, it causes a pressing action during two portions of this invention. That is, during each one-half revolution one or the other pairs of press shoes are closing upon each other. This contrasts with conventional presses which produce a pressing action only during one portion of shaft rotation. Thus, a grater portion of the movement of the press arrangement is utilized in producing useful work on workpieces.

The synchronizing gears **68, 70** and **72** serve to maintain the two pairs of press shoes **20, 22** and **24, 26** in alternate pressing sequence so that the first pair of press shoes **20** and **22** close while the second pair **24** and **26** open and vice versa. As a result of this finished workpiece may be taken out from between on pair of press shoes and new workpiece material may be inserted at the same time that the other pair of press shoes is producing a pressing operation on another workpiece.

In addition to performing the above-described synchronizing action, the synchronizing gears **68, 70** and **72** serve to distribute the stresses undergone by the various moving parts of the system so that a smooth and continuous flow of power may be maintained along with high speed of operation and without the introduction of highly concentrated localized stresses in the system. Thus, it will be appreciated that by virtue of the synchronizing gears the individual crankarms may have a total throw of only one-half of a total stroke of each pair of press shoes. Because of this minimization of crank throw, stresses are considerably reduced and higher speeds are obtainable.

Referring to FIG. **4**, a press system similar to that described above, but utilizing an alternate synchronizing will now be described. In the arrangement of FIG. **4**, as in the preceding arrangement, there is provided an outer frame **10** having press shoes **20, 22, 24** and **26** arranged to be driven by central and outer crankshafts **32, 46** and **48**. In the present embodiment, however, no synchronizing gears are provided. Further, no single drive motor and belt/pulley drive system is provided as in the preceding embodiment. Instead, in the embodiment of FIG. **4** each of the crankshafts **32, 46** and **48** is driven by an individual synchronous electrical motor **80, 82** and **84**. The motors **80, 82** and **84** are known as "followers" or "slaves." Each of these motors receives electrical energy in alternating in current form via lines **86, 88** and **90** from a common master-synchro **92**. The master-synchro **92** supplies electrical power for driving the synchronous motors **80, 82** and **84** and further it supplies power in the form of alternating current energy in such a manner that each of the motors is maintained in rotationally synchronized relationship to the master-synchro **92** in a manner similar to the manner in which electrical clock motors turn in synchronization with a master generator at a central power supply system.

It will be seen that the various pairs of press shoes are made to open and close in alternate sequence in the preceding embodiment. Further in the arrangement of FIG. **4** a stress distribution suitable for maintaining an even and continuous flow of power is also provided. However, the power distribution, instead of being effected through mechanical gears, is effected electrically through the synchrosystem.

Having thus described my invention with particular reference to the preferred forms thereof, it will be obvious to those skilled in the art to which the invention pertains, after understanding my invention that various changes and modifications may be made therein without departing from the spirit and scope of my invention, as defined by the claims appended thereto.

What is claimed as new and desired as to be secured by Letters Patent is:

1. A press mechanism comprising a rigid stationary frame, at least two pairs of mutually facing cooperating press shoes, means in said form for guiding the shoes in each pair for movement toward and away from each other, a plurality of crankshafts having crankarms mounted thereon, said crankshafts in turn being mounted to rotate in said frame; means connecting said press shoes to the crankarms of associated crankshafts so as to convert continuous rotational movement of the crankshafts to reciprocal linear movement of the press shoes, and means synchronizing the rotation of the various crankshafts in a manner to cause opening and closing of said press shoes in mutually opposite sequence.

2. A press mechanism as in claim **1** wherein the press shoes in each of said pairs are arranged in said frame to move toward and away from each other during rotational movements of their respective crankshafts.

3. A press mechanism as in claim **2** wherein said press shoes are arranges in a line along the direction of their reciprocal linear movement.

4. A press mechanism as in claim **3** wherein the adjacent press shoes of adjacent pairs are connected to a common crankshaft.

5. A press mechanism as in claim **4** wherein said adjacent press shoes are connected via common crankarms to said common crankshaft.

6. A press mechanism as in claim **5** wherein said crankshafts are gearably interconnected.

7. A press mechanism as in claim **6** wherein one of said crankshafts is coupled to a press drive motor.

8. A press mechanism as in claim **5** wherein said crankshafts are individually driven by synchronous electric motors.