Sept. 22, 1959 H. A. TOULMIN, JR 2,905,080

JET PRESS

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Fig. 1.

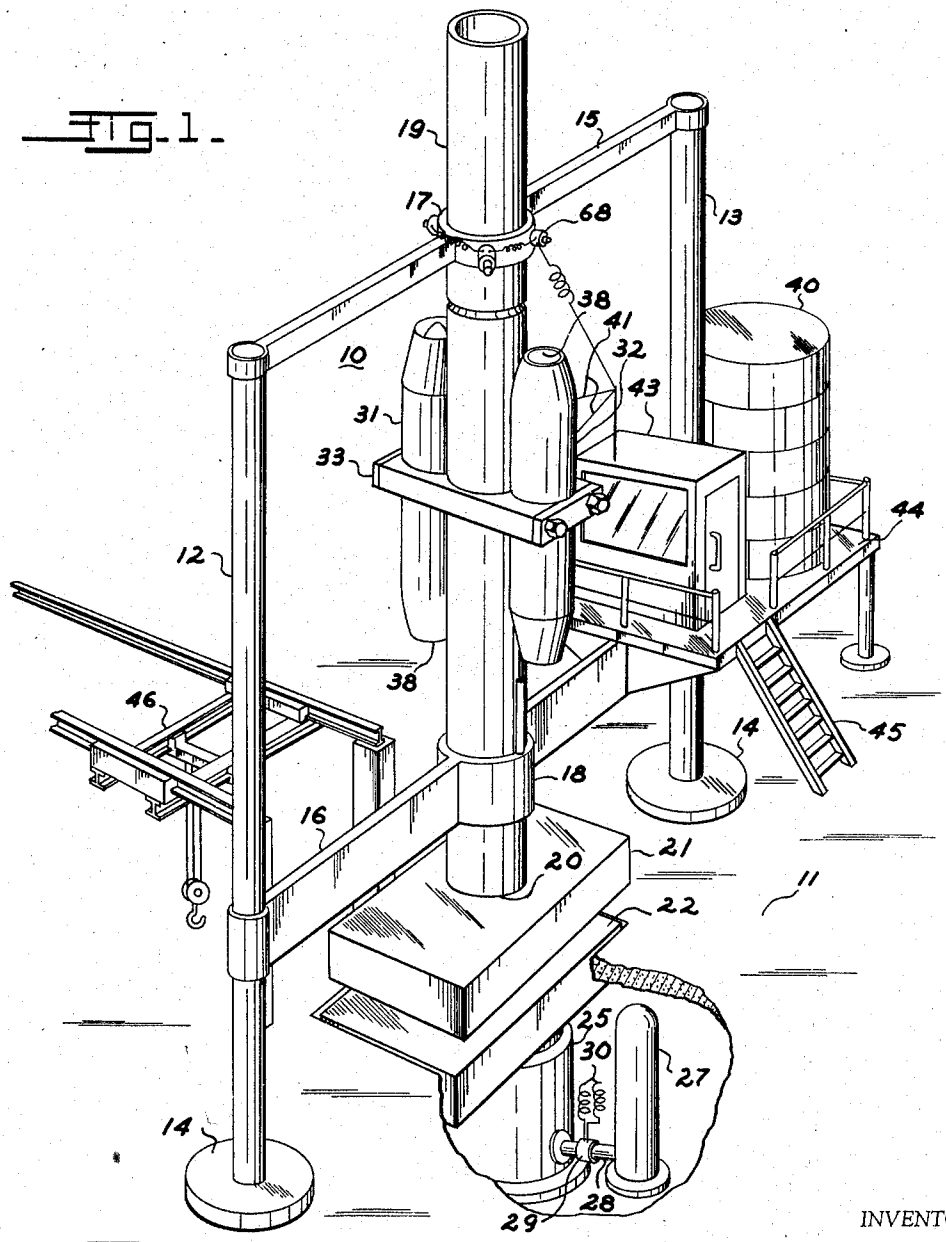

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Fig. 2.

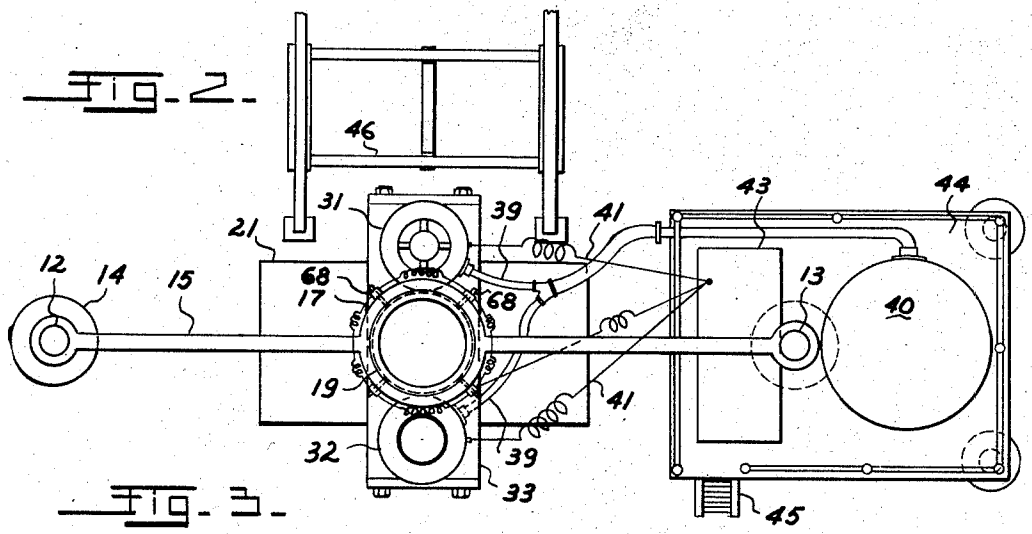


Fig. 3.

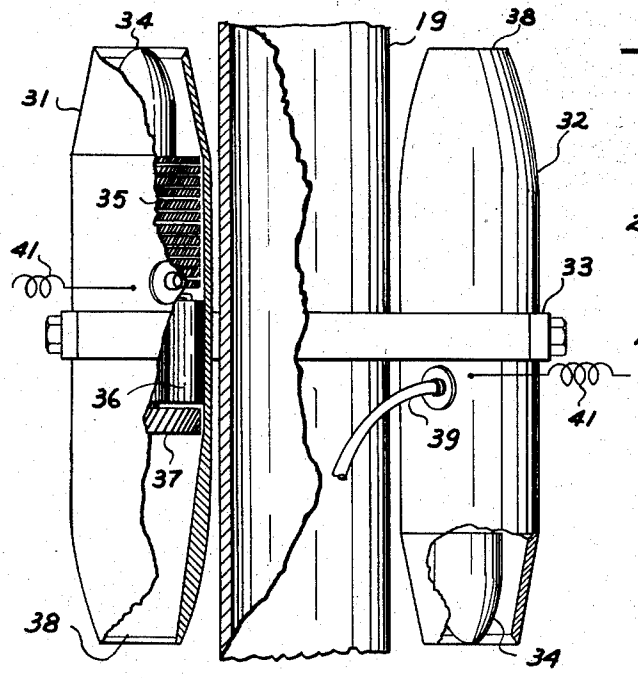
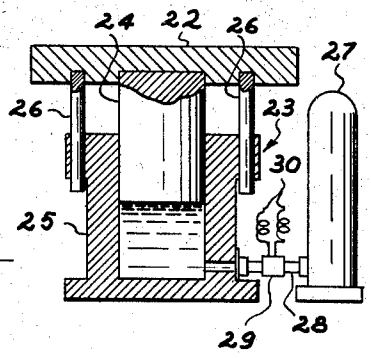


Fig. 4.



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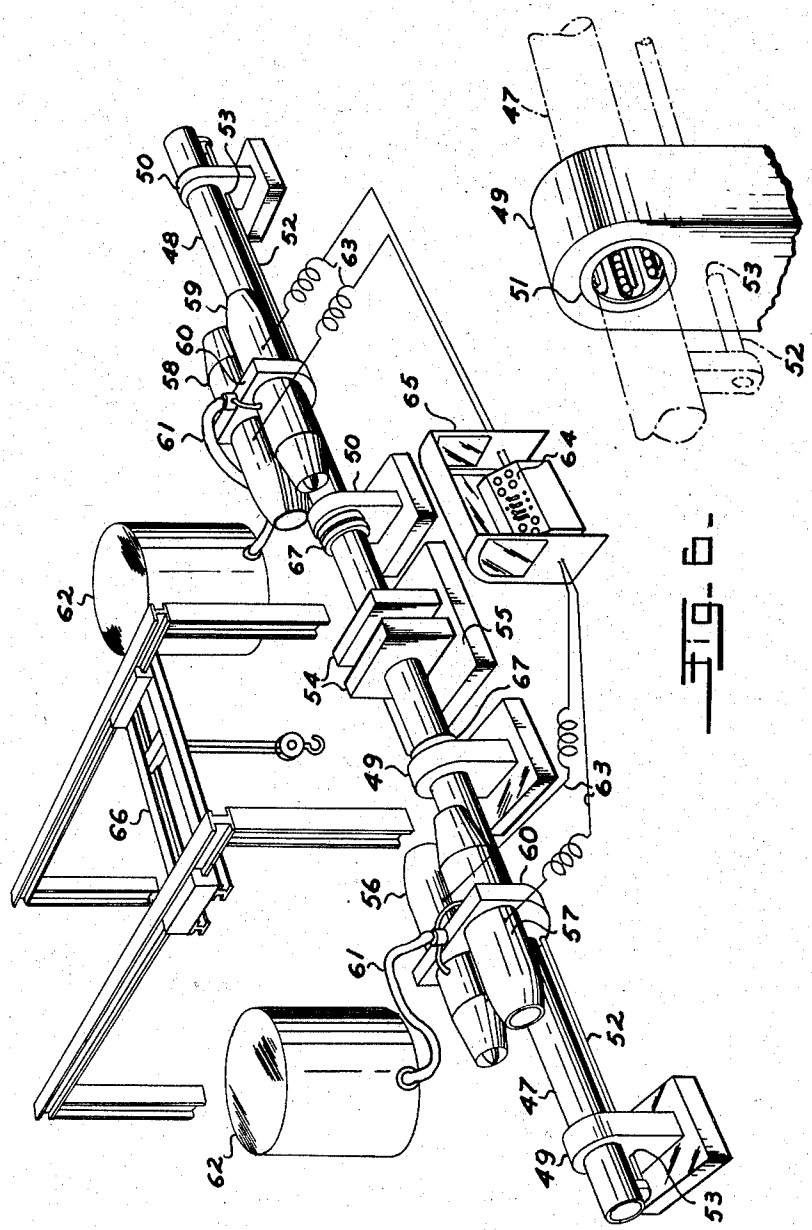

Fig. 6.

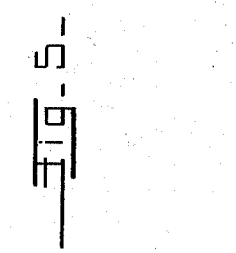

Fig. 5.

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United States Patent Office 2,905,080 Patented Sept. 22, 1959

2,905,080

JET PRESS

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Application October 7, 1954, Serial No. 460,907

4 Claims. (Cl. 100—264)

The present invention relates to an improved press, more particularly to a press or the like, operated by jet propulsion means.

The conventional press is operated by hydraulic power. This type of press comprises a structure which enables hydraulic fluid under pressure to act against a piston at whose end is a platen which is to be brought into engagement with the object to be worked. In order to satisfactorily operate and control the hydraulic press considerable complicated structure is involved. There first must be many hydraulic lines in order to convey fluid under pressure to the proper locations in the structure. In addition, various types of high pressure control valves must be employed. The frame of the hydraulic press must employ strain rods therein in order to maintain the operating components of the press in alignment and to maintain the various parts thereof in operating position against impacts in the press due to the piston reaching the end of its travel in either direction. Because of the many various guide members necessary in order to control the path of movement of both the piston and the platen, lubrication problems of a conventional hydraulic press are considerable.

While it is possible to obtain considerable working pressures with hydraulic presses, the amount of complicated equipment necessary in order to satisfactorily operate a high pressure press is considerable. Consequently, while the piston and the plate are the main components of the press, they actually form only a small portion of the entire mechanism which is necessary to operate the press. Therefore, a conventional hydraulic press repreents a complicated quantity of equipment, much of which is incidental but necessary to the main functional components of the press.

The present invention discloses a jet press which has fewer working parts and has a greatly simplified construction. The press disclosed herein employs jet propulsion means as a source of power. This jet press essentially comprises a ram which is reciprocally mounted in suitable guides. A platen is secured to one end of the ram and adapted for cooperation with a die cushion upon which may be mounted a die. Opposed jet means are then secured to the ram. Controls are provided in order to selectively operate either one of the jets in order to determine the direction of movement of the ram. The specific type of jet employed is immaterial. However, it is pointed out that the jets illustrated in this invention are of the turbo jet type.

This improved jet press may be constructed to operate in either a vertical or a horizontal position. When it is desired to construct a horizontal press employing the teachings of this invention, a pair of axially aligned horizontally disposed rams are reciprocally mounted on suitable guides. Platens are mounted on adjacent ends of the rams so as to cooperate with each other. A pair of opposed jets are then mounted upon each ram. Suitable controls are provided in order to operate the appropriate jets in order that the rams may move toward each other

and away from each other in order to work an object placed therebetween.

While this invention is directed to the use of a jet principle to a press, it is to be understood that this jet principle may be satisfactorily used in other forms of apparatus. The jet principle may be successfully applied to apparatus for metal forming, plastic injection, plastic compression molding, die casting, and the like.

Because of the simplicity of the structure involved and the easy manner in which the operation of the jets may be controlled, a jet press is considerably faster in operation than the conventional hydraulic press. One jet is operated to bring the platen down upon the object to be worked and at the end of the working stroke the oppositely directed jet is operated in order to return the platen into position in order to begin another working stroke. The operator of the press is carefully shielded in order to protect him from the blast from the jets. Fuel for the operation of the jets may be stored in separate tanks with lines leading to any jets or the other suitable or convenient location.

It is therefore the principal object of this invention to apply the jet principle to a press or the like.

It is another object of this invention to provide an improved and simplified press.

It is a further object of this invention to provide a high speed press or the like operated by opposed jets.

It is another object of this invention to apply the jet principle to apparatus for metal forming, plastic injection, plastic compressure molding, die casting, and the like.

It is still another object of this invention to provide a simplified but efficient press wherein many of the complicated mechanisms necessary for a conventional hydraulic press are eliminated.

It is a still further object of this invention to provide a principle of operation for a press which may be readily adapted to a horizontal or vertical press.

Other objects and advantages of this invention will become apparent upon reference to the following description when taken in conjunction with the accompanying drawings wherein;

Fig. 1 is an over-all perspective view of a vertical press operated by the jet principle in accordance with the teachings of this invention;

Fig. 2 is a top plan view of the jet press illustrated in Fig. 1;

Fig. 3 is an enlarged view of a portion of the press illustrated in Fig. 1 showing the mounting of the jets upon the ram with a portion of one jet removed to show the details of the construction therein;

Fig. 4 is a partial sectional view of the die cushion and accumulator employed in the press illustrated in Fig. 1;

Fig. 5 is an over-all perspective view of a horizontal press employing the jet principle; and

Fig. 6 is an enlarged view of one of the ram supports in Fig 5 showing the details of the linear bearing mounted therein.

Proceeding now to the drawings, more particularly to Fig 1 wherein like reference symbols indicate the same parts throughout the various views, **10** indicates generally a jet press constructed in accordance with this invention. The jet press **10** is illustrated as being mounted upon a concrete base **11**, which type of base has been demonstrated to be preferable for the mounting of presses. However, it is to be understood that any other type of base which is suitable for a particular application may be employed. Extending upwardly from the concrete base **11** is a pair of vertical frame members **12** and **13**. The vertical frame members **12** and **13** are suitably secured in the concrete base. Caps **14** may be placed about the

bottom of each vertical frame member 12 and 13 to rest upon the concrete base 11.

Interconnecting the vertically extending frame members 12 and 13 and vertically spaced from each other is an upper guide supporting member 15 and a lower guide supporting member 16. There is an upper guide 17 mounted in approximately the center portion of the upper guide member 15 and a lower guide 18 which is vertically aligned with the upper guide 17 is mounted in the lower guide supporting member 16. A cylindrical ram 19 is reciprocally mounted within the guides 17 and 18. The cylindrical ram 19 is of metal construction and, if desired, may be solid in order that additional force may be exerted by the press during its downward working stroke. However, the ram 19 illustrated in Fig. 1 is disclosed as being hollow in order to obtain a faster operating press.

The cylindrical ram 19 has a lower end 20 upon which is securely mounted a platen 21. The platen 21 is adapted to cooperate with a die cushion 22 which is reciprocally mounted upon die cushion mechanism 23 as shown in Fig. 4. The die cushion mechanism 23 is conventional in that it consists of a piston 24 which is slidably received within a cylinder 25. Guide rods 26 secured to the under surface of the die cushion 23 are also provided. The cylinder 25 is connected with an accumulator 27 by a line 28 wherein is mounted a 2-way reversible valve 29 which is electrically operated. The two-way valve 29 is operated by means of the lines 30 which lead to a control panel which is to be later described.

In order to power the press, jets 31 and 32 are mounted on diametrically opposite sides of the cylindrical ram 19 by means of a suitable mounting structure indicated at 33. The jets 31 and 32 are of the turbo jet type and are so mounted that jet 31 provides the upward movement of the ram 19 and the jet 32 provides the downward or working stroke of the ram.

Proceeding now to Fig. 3 it can be seen that the turbo jets 31 and 32 are of conventional construction in that each consists of a suitable starting engine 34, a compressor 35, a plurality of combustion chambers 36, a turbine 37, and an exhaust outlet 38. There is no need to provide any mechanism to vary the area of exhaust outlet 38 since the jets are operated at a constant altitude. A flexible fuel line 39 leads to each jet from a fuel storage tank 40. An electrical conductor 41 leads from the jet 31 to a suitable control panel. The manner in which the jet 31 is controlled will be presently described.

In order to control the operation of the turbo jets 31 and 32, a control panel 42 is located within a control cubicle 43. The control cubicle 43 is mounted upon a platform 44, which, in turn, may be mounted upon an extension of the lower guide supporting member 16. The control cubicle 43 is completely enclosed in order to protect the operator and since the cubicle is slightly elevated steps 45 are provided to permit ready access to the platform 44 and control cubicle 43.

A traveling crane 46 is employed to facilitate positioning objects to be worked upon the die cushion 22.

The operation of the jet press as described above is extremely simple in that it is only necessary to control the operation of each turbo jet. Beginning with the jet press in its normal position with the platen resting upon the die cushion, the turbo jet 31 is started by actuating the starting motor 34. By means of the electrical conductor 41, the operator may control the entrance of fuel into the combustion chambers so as to start the operation of the turbo jet 31. The downward thrust exerted by the turbo jet 31 will result in the cylindrical ram being moved to its raised position. Means as indicated at 68 may be provided in order to secure the cylindrical ram in its upward position while the object to be worked is being placed upon the die cushion. The downward stroke of the cylindrical ram is achieved by shutting off the flow of fuel to the turbo jet 31 and starting operation of the turbo jet 32. At the end of the working stroke the operation of the turbo jet 32 is stopped and the operator then begins operation of the turbo jet 31 to raise the cylindrical ram. As these turbo jets are conventional, it is not necessary at the beginning of the upward and downward strokes to completely start anew each turbo jet. A turbo jet when not being used to power the cylindrical ram may be caused to idle by admitting an amount of fuel to the combustion chambers sufficient only to maintain combustion in the chambers. Merely maintaining this combustion in the combustion chambers does not give any thrust to the turbo jet. Consequently, the turbo jet is idle. However, in order to obtain thrust from the jet the fuel valve is controlled in order to admit a greatly increased quantity of fuel into the combustion chambers. Introducing this quantity of fuel into the combustion chambers, will result in the turbo jet delivering sufficient thrust in order to move the cylindrical ram in the appropriate direction.

This alternate operation of the turbo jets 31 and 32 may be achieved by automatic control or each jet may be controlled individually by an operator.

The two-way valve 29 which is between the accumulator and the die cushion cylinder is connected to the control panel so that it operates to admit the flow of hydraulic fluid in the proper direction, depending upon the direction of movement of the cylindrical ram. Here also the control valve 29 may be controlled automatically or individually by the operator. It is preferable, however, that in order to achieve high speed operation with the jet press, the control of both turbo jets and the two-way valve should be synchronized in automatic control.

Proceeding now to Fig. 5 there is illustrated therein a modification of the jet press described above. This modified jet press is of the horizontal type. This horizontal press comprises a pair of horizontally disposed axially aligned rams 47 and 48. The ram 47 is reciprocally mounted in supporting members 49 and the ram 48 is similarly mounted in similar supporting members 50. In order to simplify the lubrication problem, all the supporting members 49 and 50 are provided with bearings 51 which are especially adapted for linear movement. The bearings 51 are illustrated in Fig. 6 and are conventional in structure. Hence, this linear bearing need not be explained in detail. Each ram 47 and 48 is provided with a guide rod 52 which reciprocates through an opening 53 in one of the supporting members 49 or 50 respectively. A platen 54 is mounted upon one end of each of the rams 47 and 48 in such a manner that the platens are adapted to engage each other when the rams 47 and 48 are moved toward each other. A working surface 55 is provided directly beneath the platens 54 in order to support the object being worked.

A pair of opposed turbo jets 56 and 57 are mounted upon the ram 47. A second pair of turbo jets 58 and 59 are similarly mounted upon the ram 48. The turbo jets 56 and 57 are secured to their respective rams by means of suitable mounting structure 60. A flexible fuel line 61 of sufficient length to extend to the extreme positions of each pair of jets, leads from the mounting structures 60 to a fuel tank 62. Electric control leads 63 lead from each of the turbo jets to a control panel 64. A shield 65 is interposed between the control panel and the press in order to protect the operator against the blasts from the jets. A traveling crane 66 is provided in order to facilitate the placting and removing of the object being worked from between the platens 54.

In operation, the action of the horizontal press is similar to that of the vertical press as described above. It is pointed out, however, that there is no need in the horizontal press for any sort of die cushion mechanism and accompanying accumulator. However, in some applications it may be desirable to provide buffer springs

67 on the ram interposed between the forward supports 49 and the respective platens 54.

In order to separate the platens so as to enable the object to be worked to be positioned therebetween, the jets 56 and 58 are operated. At the end of this stroke, the jets 56 and 58 are idled and the jets 57 and 59 are operated to give the thrust to accomplish the working stroke. As described previously, the operation of these jets is preferably automatic in order that the action of the appropriate jets on each ram may take place simultaneously.

While this invention has been described in connection with both vertical and horizontal presses, it is to be understood that it may be applied to other types of apparatus which function in a similar manner. Such apparatus would comprise metal forming machines and die casting machines. In addition, plastic injection, plastic compression molding and extrusion apparatus may be equipped to function by employing the jet principle. In all these cases it can be seen that a higher speed of operation is obtained because of the ease with which the turbo jets may be controlled. It is not necessary to wait for any accumulation of hydraulic fluids or the building up of pressures, but it is only necessary to start the appropriate jet to obtain the necessary thrust to move the apparatus in the desired direction.

It is to be understood that while the jet propulsion means described in this invention have been of the turbo jet type, other types of jets could also be utilized.

Thus it can be seen that this invention provides presses which are extremely simple in construction. In addition these presses are capable of operating at higher speeds than a conventional hydraulic press. This is a distinct advantage in decreasing production costs, while at the same time increasing the production. The apparatus of this invention need not be heavy and cumbersome since it is not necessary to employ any high pressure fluids in the apparatus. Consequently, these presses may be built to be much lighter in weight and to achieve a greater speed of operation.

It will be understood that this invention is susceptible to modification, in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed as this invention is:

1. A press comprising a base, a pair of spaced frame members extending parallel to each other, a pair of spaced guide members interconnecting said spaced frame members, a cylindrical ram reciprocably supported by said spaced guide members, a platen mounted on the end of said ram, a die cushion means arranged to receive said platen in pressing engagement therewith, a pair of jet means mounted on said ram, one of said jet means being operable to drive the ram in one direction, and the other of said jet means being adapted to drive said ram in the opposite direction, and means for supplying fuel to each of said jet means for operating the same.

2. A press comprising guide means, a ram reciprocally mounted therein, a platen on one end of said ram, die cushion means cooperating with said platen, opposed jet means mounted on diametrically opposite sides of said ram to provide the power for operating said ram in both directions, and means to operate said jet means so that thrust is alternatively delivered in opposite directions to reciprocate said ram.

3. A press comprising guide means, a ram reciprocally mounted therein, a platen on one end of said ram, die cushion means cooperating with said platen, opposed jet means mounted on said ram to provide the power for operating said ram in both directions, and means to operate said jet means so that thrust is alternately delivered in opposite directions to reciprocate said ram.

4. A press as claimed in claim 3 with said jet means comprising turbo jets.

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