

Jan. 20, 1953

H. H. POORT ET AL
HYDRAULIC EDUCTOR VALVE

2,625,797

Filed March 15, 1952

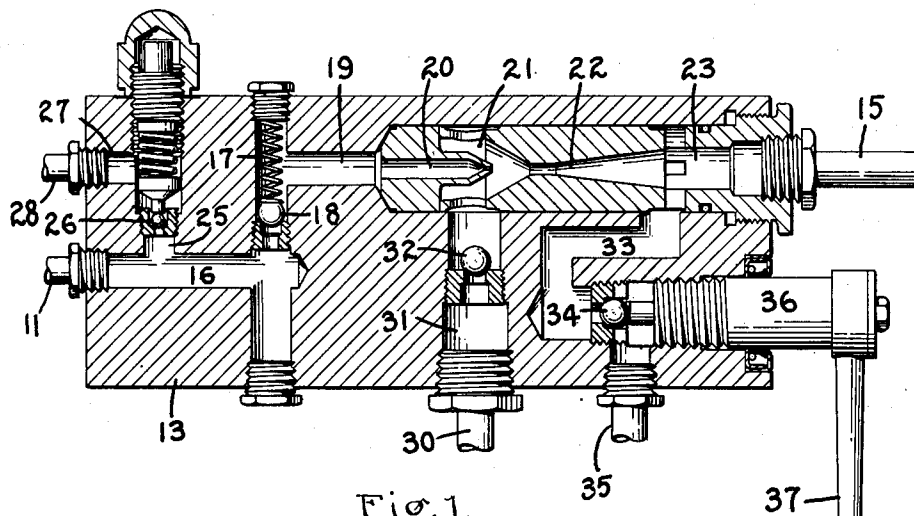


Fig. 1.

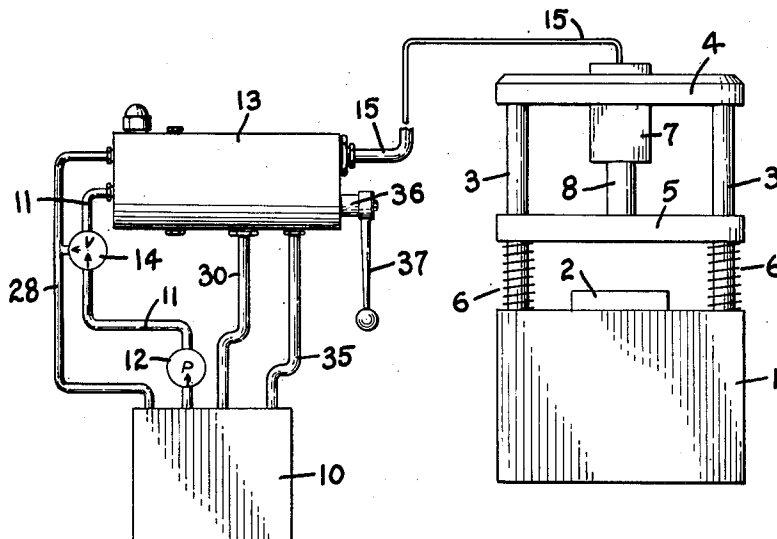


Fig. 2.

Inventors
Henry Harold Poort
James H. Shaver
By Harold A. Van Antwerp
Attorney.

UNITED STATES PATENT OFFICE

2,625,797

HYDRAULIC EDUCTOR VALVE

Henry Harold Poort and James H. Shaver, Grand
Haven, Mich., assignors to Dake Engine Com-
pany, a corporation of Michigan

Application March 15, 1952, Serial No. 276,762

5 Claims. (Cl. 60—52)

1

This invention relates to a hydraulic eductor valve especially adapted to be used with a hydraulic press to increase the speed of movement of the ram of the press as it approaches the work on the bed. In the use of a hydraulic press it is customary to raise the ram a considerable distance above the work on the bed so that there is sufficient clearance to remove and replace and adjust the work for a subsequent operation. For the working stroke of the ram it must move down to the work and then considerable pressure is applied to accomplish the pressing operation.

It is desirable that movement of the ram from its raised position above the work downward into engagement therewith shall be as rapid as possible to speed the operation and this movement of the ram prior to engagement with the work requires relatively little power.

The hydraulic pressure to move the ram of the press is produced by a pump which has great pressure capacity but relatively small volume of flow resulting in a very slow movement of the ram from its raised position to the work causing considerable lost time in the pressing operation.

With the use of the eductor valve of this invention the same high pressure, low volume pump is caused to flow a greatly increased volume of liquid at relatively low pressure but sufficient to move the ram at greatly increased speed until it reaches the work whereupon the eduction automatically ceases and high pressure created by the pump is exerted to perform the pressing operation. It has been found that educed flow of liquid in the pipe leading to the press will be at least five times as great as the normal delivery of the pump.

The invention is hereafter more fully described and particularly pointed out in the claims, reference being had to the accompanying drawing in which:

Fig. 1 is a longitudinal section of the eductor valve embodying this invention and,

Fig. 2 is a diagrammatic illustration of the valve with the environing mechanisms.

Like numbers refer to like parts in all of the figures.

The hydraulic press, which is of conventional structure, has a base 1 on which the work 2 is located, upright posts 3, and a head 4. The ram 5 is slidably mounted on the posts 3 and normally lifted by springs 6. A hydraulic cylinder 7 is mounted on the head 4, within which is a conventional piston having a piston rod 8 connected to the ram 5.

The liquid used in the hydraulic operation may

2

be of suitable nature, usually oil, has a supply reservoir or tank 10. A supply pipe 11 extends from the tank to the pump 12 and thence to the eductor valve 13 with a manual control valve 14 interposed by means of which operation of the press may be controlled. The pipe 15 leads from the valve 13 to the cylinder 7 above the piston therein.

The eductor valve 13 has various passages, valves, inlets, outlets and a nozzle hereafter described. The supply pipe 11 communicates with a passage 16 leading to a passage 17 in which is located a check valve 18. The passage 17 branches into the passage 19 which leads to the nozzle 20 and the nozzle has its outlet in an induction chamber 21. From the chamber 21 a reduced passage 22 in the form of a venturi leads to the chamber 23 which communicates with the pipe 15 leading to the hydraulic cylinder 7.

A branch passage 25 emerges laterally from the passage 16 and a conventional spring loaded safety valve 26 is located in and normally closes the passage 25. The safety valve 26 has an outlet through the passage 27 which communicates with the return pipe 28 leading to the tank 10. An eductor pipe 30 leads from the tank 10 and communicates with the passage 31 in which is a check valve 32 and the passage 31 opens into the chamber 21. A passage 33 leads from the chamber 23 to a shut-off valve 34 which communicates with a return pipe 35 leading to the tank 10. A hand operated screw 36 having a lever 37 has a tipped end which engages the shut-off valve 34 and holds it closed or may be turned to release the valve.

Operation

The shut-off valve 34 is closed by turning the screw 36 and assuming that the pump 12 is operating, the valve 14 is opened admitting oil into the passage 16. The oil is under sufficient pressure to open and pass by the check valve 18, flowing through the passages 17 and 19 into the nozzle 20. The pump 12 is capable of creating high oil pressure which may be assumed to be 5,000 lb. per sq. in. and this may be considered as the working pressure of the hydraulic press. Therefore the spring tension of the safety valve 26 is set to hold that valve closed at pressure less than 5,000 lbs.

The volume capacity of the pump 12 is relatively small and the outlet orifice of the nozzle 20 is small enough to retard the flow of oil there-through and to create a back pressure of about half the capacity of the pump or approximately

2,500 lbs. With this amount of pressure in the line the safety valve 26 will remain closed.

The oil under 2,500 lbs. pressure escapes through the nozzle 20 in a small jet at high speed and in passing through the Venturi passage 20 it creates a semivacuum in the induction chamber 21 which sucks or siphons oil from the tank 10 through the pipe 30, past the check valve 32, which is freely movable, through the chamber 21 and out through the passage 22 with the oil emerging from the nozzle 20 and the combined volumes of oil pass on through the chamber 23 and the pipe 15 into the upper end of the hydraulic cylinder 7.

The volume of oil educed by suction from the tank 10 by virtue of the high speed jet passing through the venturi 22 is relatively great, being at least five times that of the jet from the nozzle and the force of the jet is sufficient to carry the combined volumes through the pipe 15 and into the cylinder 7 with enough pressure to lower the ram 5 against the relatively small resistance of the springs 6 and to move the ram downward until it engages the work 2 and this preliminary movement of the ram is about six times as fast as it would move if only the volume of the pump 12 were utilized for that purpose.

For example, if the low volume pump could, with its own capacity, lower the ram six inches per minute the same pump with this eductor valve would lower the ram thirty-six inches per minute. If the ram were elevated eighteen inches above the work it would take three minutes for the pump to lower the ram in its preliminary movement while with the eduction valve this movement is accomplished in thirty seconds.

When the ram 5 engages the work 2 resistance to its movement immediately builds up pressure in the whole system, whereupon the siphon eduction of oil through the pipe 30 ceases and the check valve 32 is closed by such back pressure. After the check valve 32 closes the oil flow in the whole system is in accordance with the volume and pressure capacity of the pump 12 which continues to force oil through the nozzle 20 until the compressing operation of the press is completed and ram 5 can move no further. Then when the oil attains its maximum pressure it will open the safety valve 26 and the continued flow from the pump will escape therethrough and return to the tank 10 through the pipe 23.

When movement of the ram ceases and the pressing operation is completed the valve 14 may be closed and/or the operation of the pump stopped and then the oil in the cylinder 7 and pipe 15 is held under pressure by the check valves 18 and 32 which close and prevent escape of oil. When it is desired to release the ram and permit it to rise by action of the springs 6, the screw 35 is turned to release the shut-off valve 34 which opens and permits oil to flow from the cylinder 7 through the pipe 15, the chamber 23, the passage 33 and out through the pipe 35 to be returned to the tank 10.

Thus it will be seen that by use of this eductor valve the low volume, high pressure pump con-

ventionally used with a hydraulic press is automatically temporarily converted into a high volume low pressure pump for the purpose of fast movement of the press ram in its preliminary movement to the work and thereafter the pump automatically resumes its high pressure low volume character for exerting the necessary high pressure for the actual pressing operation. This is accomplished without any alteration whatever of the pump itself. The eductor valve is entirely automatic in its operation and is relatively simpler in construction and having no moving parts excepting the check valves it is durable and long-lasting, and furthermore it is very simply installed in the hydraulic system of the hydraulic press.

The invention is specifically defined in the appended claims and is to be considered comprehensive of all forms coming within their scope.

We claim:

1. The combination with a hydraulic pump having a fluid reservoir and a hydraulic ram having a cylinder and piston therein of an eduction valve comprising, a body having an inlet passage in communication with said pump and an outlet passage in communication with said cylinder, an induction chamber interposed between said inlet and outlet passages, an eduction conduit communicating between said reservoir and said induction chamber, a check valve in said eduction conduit opening in the direction of flow toward said induction chamber, a Venturi passage communicating between said induction chamber and said outlet passage, and a nozzle in communication with said inlet passage and having its outlet in said induction chamber directed toward said Venturi passage.

2. The elements of claim 1 in which the outlet of said nozzle has a flow capacity considerably less than that of said pump.

3. The elements of claim 1 combined with a return conduit communicating between said outlet passage and said reservoir, and a manual shut-off valve in said return conduit.

4. The elements of claim 1 combined with a check valve in the passage between said inlet and said nozzle opening in the direction of flow toward said nozzle.

5. The elements of claim 1 combined with a spring pressed safety relief valve opening from the passage between said inlet and said outlet and a return conduit leading from the outlet of said safety relief valve to said reservoir.

HENRY HAROLD POORT.
JAMES H. SHAVER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,982,711	Vickers	Dec. 4, 1934
2,093,403	Batterson et al.	Sept. 21, 1937
2,533,028	McConaghy	Dec. 5, 1950