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(54) Hydraulic lifting device for presses.

(57) The invention concerns a hydraulic lifting device particularly suited to displace dies placed on the die-supporting tables of presses; the device foresees one or more T-shaped bars (1), being horizontally inserted into the guiding slots (2) of the die-supporting table (3). Each bar presents at its lower contact surface a groove (5) lodging an elastic pipe system (8) into which the pressure fluid is made to flow.

When there is no pressure, the weight of the die resting on the rollers (4) arranged within the bars (1) deforms the underlying pipe system, so as to cause the rollers to disappear and allows the die to rest directly on the surface of the supporting table. On the other hand, when the fluid creates the presure, the pipe system (8) has a tendency to recover its original shape and it lifts the die, thereby removing it from the contact surface of the die-supporting table (3), thus allowing its displacement.

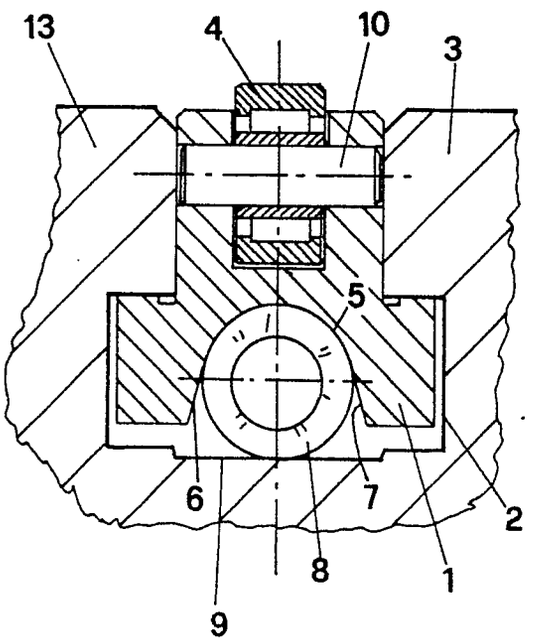

FIG. 2

EP 0 264 770 A2

HYDRAULIC LIFTING DEVICE FOR PRESSES

The invention concerns the construction of a hydraulic lifting device, which is particularly suited to lift the dies placed on the die supporting tables of presses, thus allowing their rapid and easy removal.

In the present technical situation, devices exist which lift off the die to be removed from the working area. They consist essentially of several hydraulic cylinders, placed close to each other and inserted into a T-shaped bar. The bars, in turn, are inserted into the guiding slots of the die supporting table. The number of said bars and, therefore, that of the lifting cylinders is proportional to the weight of the die to be lifted.

Inside the cylinders, which are vertically inserted into the T-shaped bars, there is a sliding piston. Each piston is provided, on the upper surface of its head, with a ball, which is lodged within a seat having a suitable shape, allowing it to freely rotate within its seat.

When the cylinders are put under pressure by activating the correspondig valve, which connects the tubes of said cylinders with the hydraulic power pack of the press, each of the pistons moves upward and the ball it is provided with at its upper end gets into contact with the die and lifts it, since the total strength exerted by the cylinders with the liquid being under pressure, overcomes the contrasting action of the weight of said die. Therefore, in order to remove the die, it suffices to make it slide along the die-supporting table, since the cylinders support its weight and the balls allow it to slide.

One of the main inconveniences presented by the just described devices is their considerable cost, due to the need for several hydraulically operated cylinders. The cylinders must necesserily be numerous, since their dimensions are rather limited, because they must fit into the grooves of the press surface together with the bar which contains them and which also acts as a distributor of the hydraulic liquid.

Another inconvenience presented by these devices appears when the die is removed from the die-supporting table. In fact, when the die rests on said table, its weight is equally distributed on the pistons supporting it, on the other hand, when the die is made to move and it gradually exits from the table, its weight rests only on the few pistons which still support it, thus causing dangerous unbalances and strong strains which might lead to the breaking down of the last lifting pistons.

The main purpose of the present invention is that of overcoming the just mentioned inconveniences, by building an extremely simple and, therefore, economical device, not requiring the use of costly hydraulic cylinders in order to obtain the same results of the traditional devices.

Yet another proposed goal is that of obtaining a hydraulic lifting device suited to equally support, under any condition, the strain caused by the weight of the die.

Another set goal is that of building a lifting device which does not force to perform any special operations on the guiding slots of the die-supporting table, so that said device can simply and adequately be housed even on the tables of presses already being in operation.

The just mentioned purposes are obtained by means of a lifting device for dies including one or more T-shaped bars being inserted into the grooves of the press table and presenting at their upper ends means allowing the sliding motion of the die, characterized by the fact that the lifting and lowering of the T-shaped bars and, therefore, of the die, are obtained by means of the variations caused by the elastic deformation of pipe systems which are put under pressure and which are arranged under the bars.

Advantageously, when the die is set on the die-supporting table, the pipe system appears to be flat, because of the action exerted by the weight of the die, while, when the hydraulic liquid flows into the pipe, the pressure increases and creates a force which is able to lift the die.

The main advantage presented by the device of the invention consists in the fact that the hydraulic cylinders are replaced by a single flexible pipe system performing an identical function, with considerable practicality and money saving. Besides, this device is even more economical, since it does not require any additional operation for its insertion into the table, thanks to the fact that the existing grooves can be used.

Other advantages and constructive and operational details will be better understood from the description of three preferred forms of execution of the invention, said descriptions being given by way of illustration only, but not being meant to limit the scope of the invention, such as it is illustrated in the enclosed tables of drawing, wherein:

-Fig. 1 is a perspective view of the device of the invention being inserted in the guiding slot of the die-supporting table;

-Fig. 2 is a cross-section view of the device when the liquid is under pressure within the flexible pipe system;

-Fig. 3 is a cross-section view of the device of Fig. 2, when the weight of the die causes the deformation of the flexible pipe being without pressure;

-Fig. 4 is a cross-section view of a variation of the device being the object of the invention, using a different method for the removal of the die;

-Fig. 5 is a cross-section view of the device of Fig. 4, when the weight of the die deforms the flexible pipe not being under pressure;

-Fig. 6 is yet another constructive variation of the device of Fig. 2, presenting a groove system, which has been performed on the die-supporting table and which is suited to house the flexible pipe.

-Fig. 7 is a front view of the device of Fig. 6 with the flexible pipe not being under pressure and being deformed by the weight of the die.

With reference to the mentioned drawings, the device of Fig. 1 consists of three T-shaped bars 1, being horizontally inserted into guide 2 of table 3 of the press; said bars present on their upper surface the rollers 4 which allow the sliding movement of the die on said table, when the rollers protrude from the surface of the table, as can be seen in Fig. 2.

The T-shaped bar is inserted axially into guiding slot 2 of the die-supporting table, with a sufficient lateral play to allow both the horizontal and the vertical sliding of the respective contact surfaces. In the lower surface of bar 1 there is an axial slot 5 having an almost semi-cylindrical shape with flares 6 and 7 at its ends. Within said slot an appropriate flexible pipe 8 , made of rubber or other materials which can stand medium-high pressures, is housed. Said pipe rests with its lower part on the horizontal surface 9 of the guiding slot 2 and with its upper part in the cylindrical part of slot 5.

Bar 1 presents a series of holes being arranged horizontally and transversally in relation to the length of the bar and being equally spaced from one another. Each of said holes contains a pivot 10 which supports roller 4 being housed within the seat which is obtained in bar 1 itself.

When the hydraulic fluid under pressure is present within the elastic pipe 8, as can be observed in Fig. 2, bar 1 is in its upward position, so that the series of rollers 4 protrudes from the surface 14 of the press, thus allowing the sliding of the die placed on top of it.

On the other hand, when the pressure is removed from pipe 8, the weight of the die exerts itself on the bars 1, by means of the rollers 4, so that pipe 8 is deformed and, as a consequence, it allows bar 1 and the rollers 4 to lower themselves until they are flush with the surface of the press, as can be observed in Fig. 3.

On this subject it is important to notice that the value of the maximum theoretical stroke imparted by pipe 8 to bar 1 must be approximately twice the actaul stroke required for the lifting. This is due to the fact that the pressure acting within the pipe exerts on the overlying bar and, therefore, on the die, a force which is proportional to the surface of contact between the pipe and the surface of contact on the guiding slot; as a consequence of this fact the highest lifting strength is impressed by the pipe on the bar, when the deformation of the pipe is at its utmost, since in that case the surface of contact is the largest. As the pressure within the pipe gradually increases, the contact surface decreases, so the reaction force impressed by the pipe on bar 1 decreases.

In actuality the force impressed decreases while the stroke increases and, therefore, when the pressure has caused the maximum theoretical stroke, which corresponds to the section of the pipe which has not been deformed, the pipe system can no longer push the overlying die. So, in order to obtain a sufficient lifting of the die, it is necessary to apply stroke values being intermediate in relation to the maximum theoretical stroke.

Various tests performed with dies of different weights have further proved the just expressed concept.

For instance, given a die weighing 3000 Kg, two 750 mm.-long pipes with an inner diameter of 13 mm., a theoretical stroke of bar 1 corresponding to 3 mm. and a pressure of 30 Atm., the actual stroke proved to be of 1,6 mm, while with 40 Atm. it was of 2 mm and with 60 Atm. it reached 2,2 mm.

On the other hand, given a die weighing 2000 Kg., with the same pipes at a 30 Atm. pressure, the actual stroke of bar 1 proved to be 1,7 mm, with a 40 Atm pressure 1,9 mm and with a 60 Atm pressure 2,2 mm.

Thus, on the basis of what has been expressed herefore, already by the value of 30 Atm. the stroke reaches the desired value of 1,6 mm, which practically corresponds to half of the maximum theoretical stroke of 3 mm.

Figs. 4 and 5 represent a construction variation of the device of the invention, which adopts the same functional principle which has just been described, but differs from it because of the different sliding element allowing the removal of the die. In fact, instead of roller 4, a cylindrical support 11 carrying a small ball 12, which is contained within an appropriate seat and surfaces upward, has been inserted into bar 1. The arrangement of the elastic pipe 8 and the shape of bar 1 remain identical to those of Fig. 1.

In Figs. 6 and 7 yet another constructive variation is represented, which is characterized by the fact that the elastic pipe system 8 is housed within groove 13, having a practically semi-cylindrical shape, obtained internally within guiding slot 2 of the die-supporting table, instead of being obtained directly within bar 1.

This solution can easily be built, mainly in presses that are being manufactured, while, if the system needs to be applied to already existing presses, the previously described solutions are preferable.

The just described device according to the invention, especially suited to move dies on the tables of presses, can actually prove to be very advantageous even when it is used on surfaces or within the sliding tracks for the displacement of very heavy materials or machinery, such as, for instance, tool machines while they are being manufactured. In order to obtain this, it suffices to equip a work bench or a sliding track with grooves housing the bars which are supported by elastic pipe systems under pressure, as described herefore.

During the construction phase of the invention, construction variations can be applied, concerning, for instance, the element allowing the displacement of the die, or the arrangement of the grooves housing the pipe system. Each variation will still be included within the scope of the just described inventive idea, such as it is defined in the following claims.

Claims

1) A hydraulic lifting device especially suited to lift dies from presses, including two or more bars (1), preferably shaped as a T, being inserted into the grooves of the press table and supporting at their upper end sliding means (4, 12), characterized by the fact that the lifting and lowering of the T-shaped bars and, as a consequence, of the die, is obtained by means of the shape variation due to the elastic deformation of pipe systems under pressure, arranged underneath the bars themselves.

2) A device according to claim 1), characterized by the fact that the elastic pipe system (8) which is put under pressure and moves the T-shaped bar (1) is lodged within a groove (5) obtained within the bar itself.

3) A device according to claim 1), characterized by the fact that the elastic pipe-system (8), which is put under pressure and moves the T-shaped bar (1) is lodged within a groove (13) being obtained within the guiding slot of the press table.

4) A device according to one of the preceding claims, characterized by the fact that the lifting bar (1) presents elements for the sliding motion on the table, consisting of rollers (4).

5) A device according to one of the claims from 1) to 3), characterized by the fact that the lifting bar (1) presents elements for the sliding motion on the table, consisting of balls (12) lodged within cylindrical supports (11).

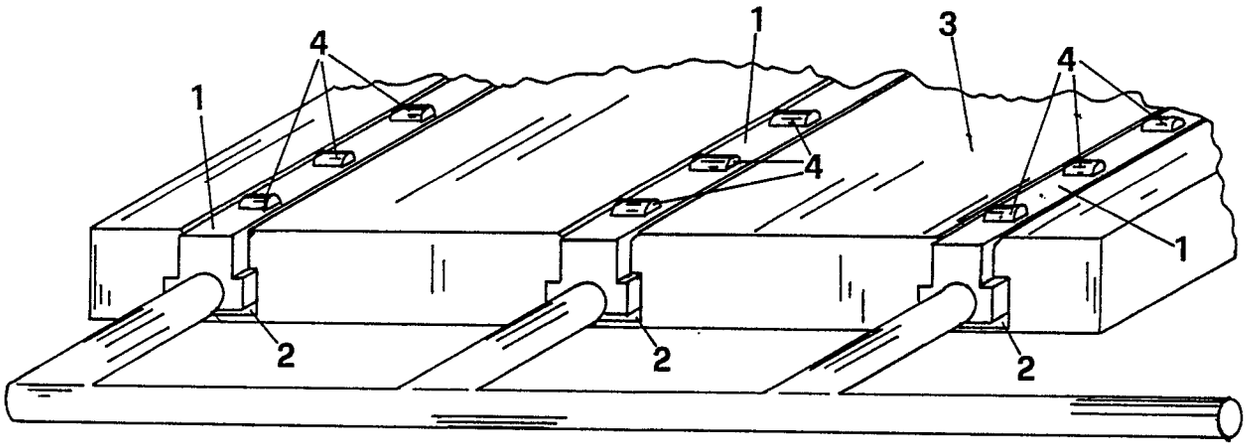

FIG. 1

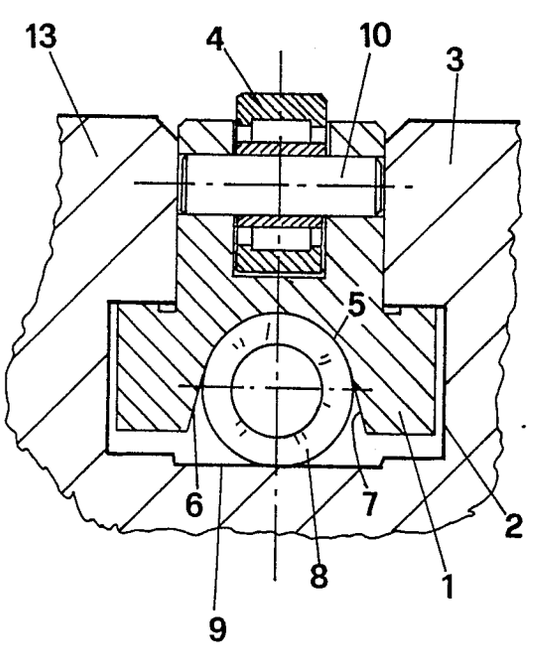

FIG. 2

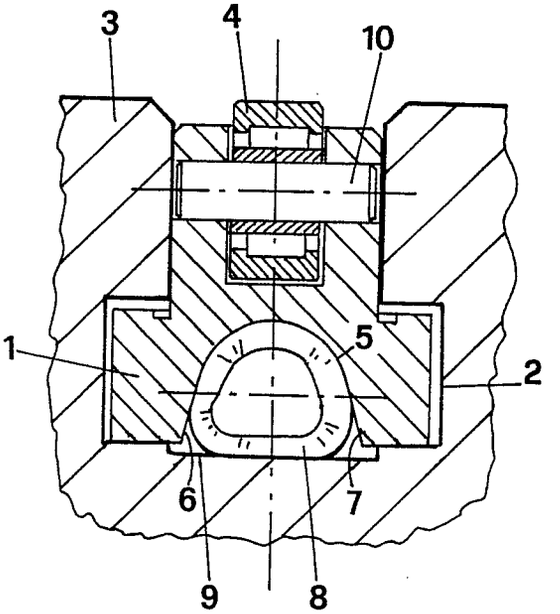

FIG. 3

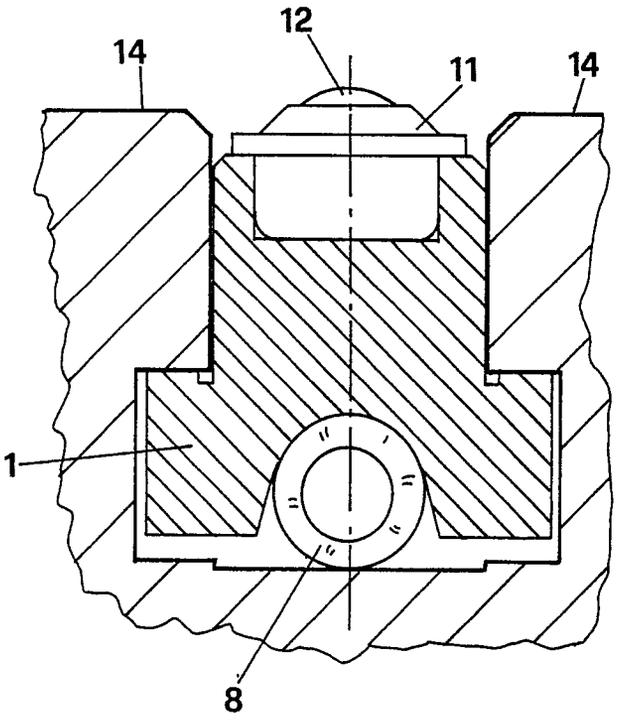

FIG.4

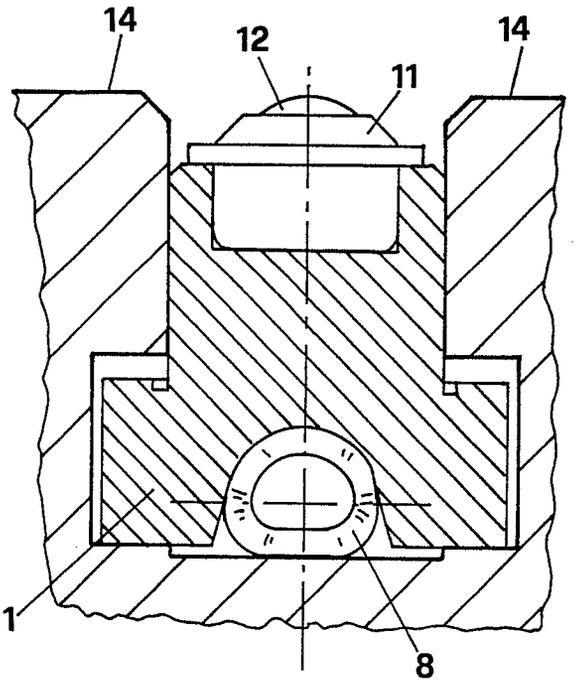

FIG.5

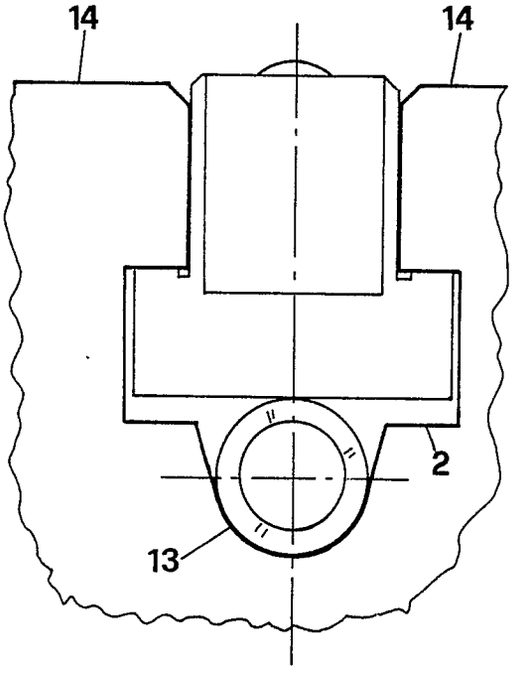

FIG.6

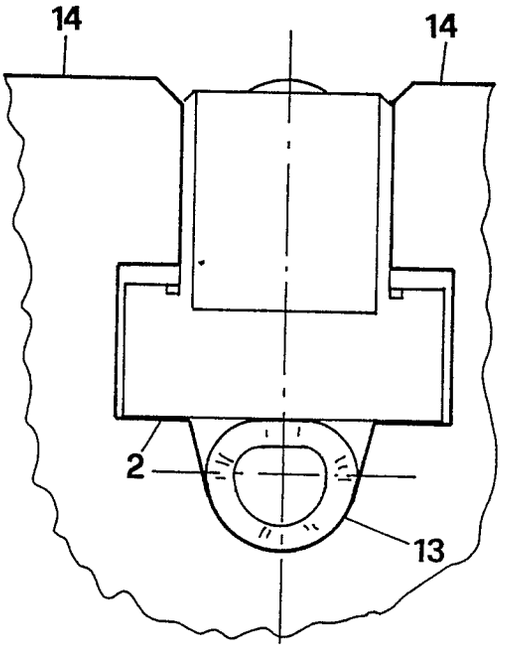

FIG. 7