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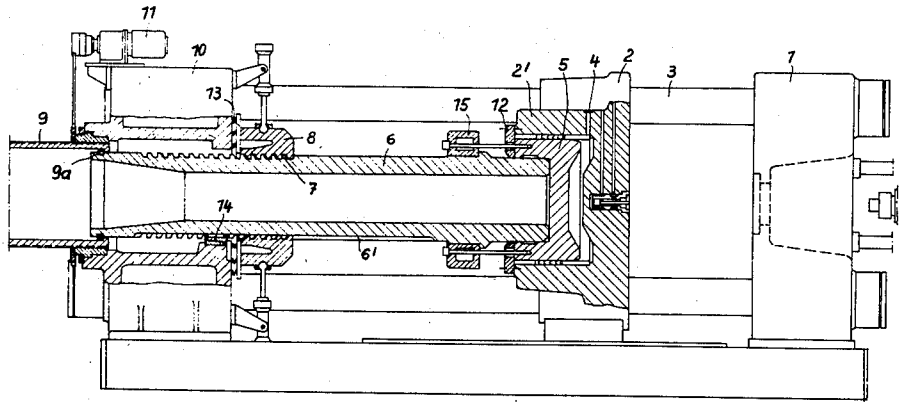
[54] **MOULD-CLOSING DEVICE**
2 Claims, 1 Drawing Fig.

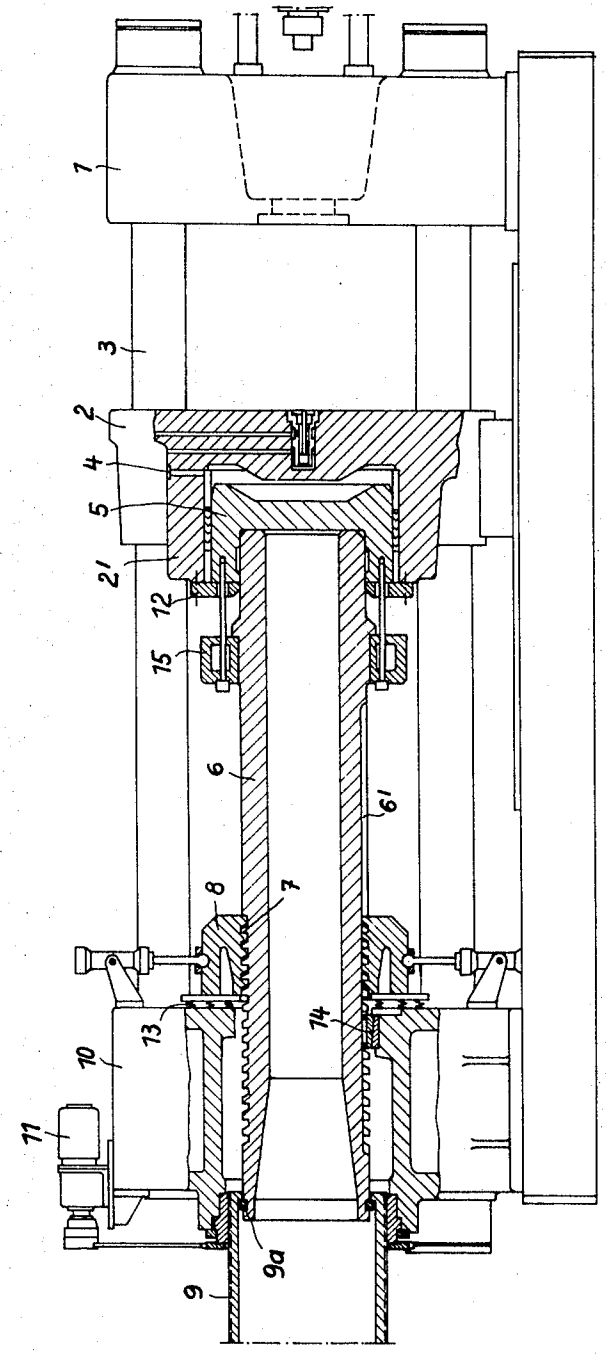
[52] **U.S. Cl.** **18/30**
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[50] **Field of Search** ..... 18/5 (BO), 30 (LA), 30 (LM), 30 (LV)

[56] **References Cited**
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ABSTRACT: A mould-closing device in the form of a four-column hydraulic press, for injection moulding machines for moulding synthetic substances, having a stationary mould-carrying plate, and a movable mould-carrying plate capable of sliding along the column of the press and of being locked in position thereon, the movable mould-carrying plate being in the form of a cylinder slidable upon a press plunger, which is connected with a supporting column, this supporting column being provided, at the end remote from the mould-carrying plates, with annular grooves, in which there engage locking jaws, which abut on a stationary crosshead.





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MOULD-CLOSING DEVICE

The invention relates to a mould-closing device in the form of a four-column hydraulic press for injection moulding machines for use with plastics materials, having a fixed mould-supporting plate and also one which is movable on the columns and may be locked in position, the latter taking the form of the cylinder of a press plunger.

In a conventional mould-closure device of this type the plunger, which extends into the mould-supporting cylinder, is also the working cylinder of a fixed piston, which is mounted in the base of a housing which is provided with external threading, by means of which it is able to move within a rotatably mounted, driven threaded bushing with internal threading located in the machine frame. The purpose of this arrangement is to achieve a reduced overall machine length in combination with maximum aperture of the mould. In this arrangement, the press plunger abuts in the threading during the pressing operation, which involves considerable pressure, the result being that when extremely high pressures are used, damage and shifting is easily caused.

The aim of the invention is to provide a mould closing device of the type described above, which allows the use of maximum pressures and yet ensures that the movable portion of the mould is able to move with the press plunger without risk of shifting. This is achieved by the invention substantially in that the plunger is provided with a supporting column provided at the end with annular grooves in which there engage two or more locking jaws which abut on the crosshead. With this arrangement, it is not only possible rapidly to shift the supporting column, which carries the press plunger, from locked to released position and vice versa, but the relatively large groove flanks and the corresponding surfaces on the jaws mean that the pressures are acceptable even when maximum force is applied. The locking jaws, which are advantageously able to move axially a few millimeters, may easily be actuated by means of working cylinders or the like.

According to a further feature of the invention, the crosshead contains a stop sleeve which takes the form of an open-ended threaded sleeve able to slide axially and acting upon the supporting column. This stop member serves to limit the mould-closure movement so as to ensure that during the working cycle, when the mould closes, the position of the supporting column is always so adjusted to the position of the locking jaw as to correspond to the height of the mould, thus ensuring that the locking jaw, which moves on the crosshead, may be properly inserted in the annular grooves on the supporting column and does not rest on the teeth or ridges formed by the grooves.

The invention will now be described with reference to the accompanying drawing, which illustrates the invention, but in no restrictive sense.

The fixed mould-supporting plate **1** is secured to the fixed crosshead **10** by columns **3**. The movable mould-supporting plate **2** slides on the columns **3** against the crosshead, and in particular is adjustable in opened and closed or moulding position by means of sliding cylinders not shown in the drawing. Internally, the movable mould-supporting plate **2** is designed to constitute the cylinder **2'** of the press plunger **5**. The pressure chamber located between the front face of the plunger **5** and the cylinder **2'** may be supplied with hydraulic fluid through the line **4** in a conventional manner. The press plunger **5** is in addition connected to the supporting column **6** by means of a clamp **15**. The column **6** extends in an axial direction and is provided towards the end remote from the mould members with milled annular grooves **7**. The grooves **7** have a sawtooth profile, the inclined flanks facing the mould while the opposite flanks extend vertically.

These vertical faces, which are more effective in transmitting force, abut during locking against the jaws **8**, which are provided with corresponding internal teeth.

A stop sleeve **9** which acts on the supporting column **6** is screwed into the rear end of the crosshead **10** so as to be axially adjustable. Depending upon the position of the sleeve **9**, the mould-closure movement is limited in the manner already described so as to adjust with great precision to the locking position corresponding to the height of the mould. The varying heights of mould are taken into consideration with the provision of the milled annular grooves which extend over a length which is in general equal to the maximum mould height relatively to the width of the locking jaw, or is at least equal to the difference between the maximum and minimum heights of the moulds with which the mould-closing device is to be used.

In order to adjust the machine, when the two halves of the mould are secured to the supporting plates **1** and **2**, the stop sleeve **9** is moved as far as possible towards the mould by means of the drive **11**, thus ensuring that as the mould-supporting plate **2** moves into closure position, the supporting column stop **9a** cannot hinder its movement. The mould is then advanced into closure position, leaving only a few millimeters clearance, the supporting column being brought into a position in which the locking jaws can be inserted in the annular grooves without interference. In this locked position the stop sleeve **9** is retracted until it hits the supporting column **6**, thus achieving an adjustment which is correct for the whole series of objects to be produced from the one mould, and which ensures that when the mould closes, lateral cylinders not shown in the drawing slide into a locking position which corresponds to the locking jaw **8**.

From this locking position the actual moulding process commences, as a result of actuation of the plunger **5** built into the movable mould-supporting plate, the mould first being completely closed, and the desired pressure then being built up to hold the mould together. Once the injection process is complete the plunger **5** is relieved of pressure, and is slightly retracted by means of pressure elements **13**, which cooperate with the locking jaw **8**, thus ensuring that the locking jaw **8** is disengaged without friction from the grooves **7**. Once the unlocking process is achieved, the movable mould-supporting plate **2** may be retracted by means of the sliding cylinders, and the mould emptied. The cycle then recommences.

The pressure elements **13** may be the springs shown, or hydraulic or pneumatic means which return the press plunger.

In order to ensure that the mould-supporting plate **2** is retracted with the supporting column **6**, an inwardly projecting flange **12** is provided on the edge of the cylinder **2'** formed by the mould-supporting plate **2**, and the plunger **5** moves into abutment against this flange. The flange is provided with holes for the threaded bolts which connect the plunger **5** to the clamp **15**.

The support and guiding of the supporting column **6** is further ensured by a longitudinal groove **6'**, which is provided in the adjustment area, and in which there engages a guide-piece **14**, which may be adjusted on the crosshead **10**.

We claim:

1. A mould-closing device for injection moulding machines for moulding synthetic materials, in the form of a hydraulic press, comprising: a stationary crosshead, a stationary mould-supporting plate, four columns connecting the stationary mould-supporting plate with the stationary crosshead, a movable mould-supporting plate slidable along the said columns, a press plunger, a supporting column formed with annular grooves towards the end remote from the mould members, the said grooves extending over a length at least equal to the difference between the maximum and minimum heights of the moulds with which the mould-closing device is to be used, a clamp connecting the press plunger with the supporting column, a hydraulic cylinder, integral with the movable mould-supporting plate and slidable upon the press plunger, and locking jaws, abutting on the crosshead, and formed with internal teeth engaging in the annular grooves of the supporting column.

2. A mould-closing device as claimed in claim **1**, further comprising an axially slidable open-ended externally screw-threaded stop sleeve acting upon the supporting column.