June 20, 1961 P. CHAZE ET AL 2,988,778

POWER-MULTIPLYING LOCKING SYSTEM FOR INJECTION PRESSES

Filed Jan. 7, 1959 2 Sheets-Sheet 1

FIG. 1.

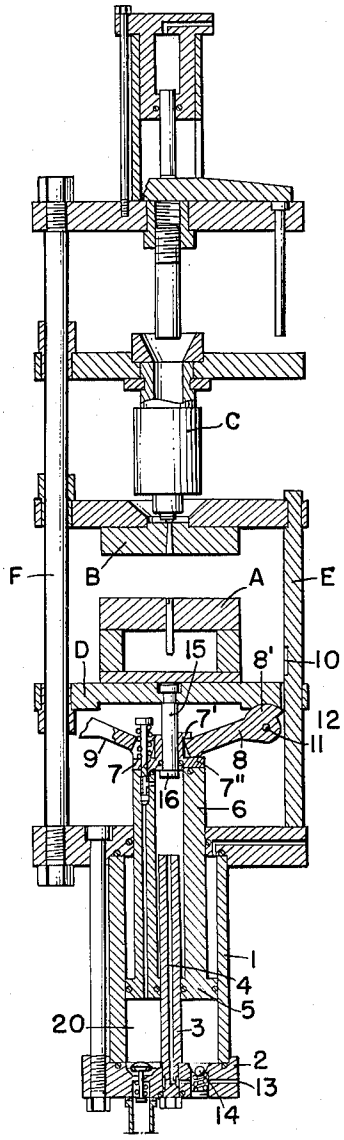
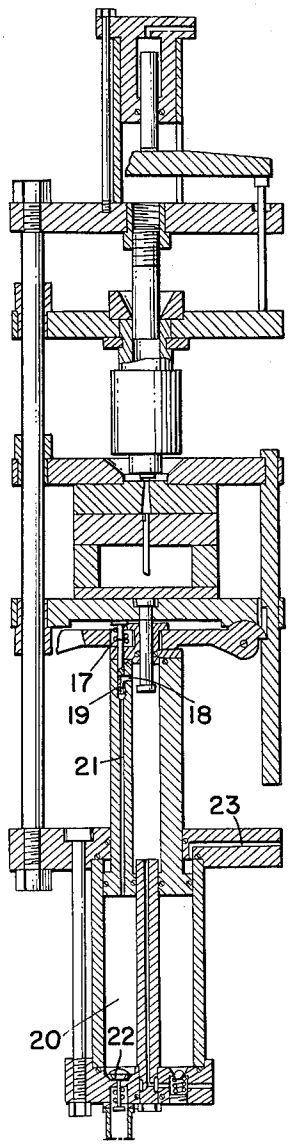


FIG. 2.



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FIG. 3.

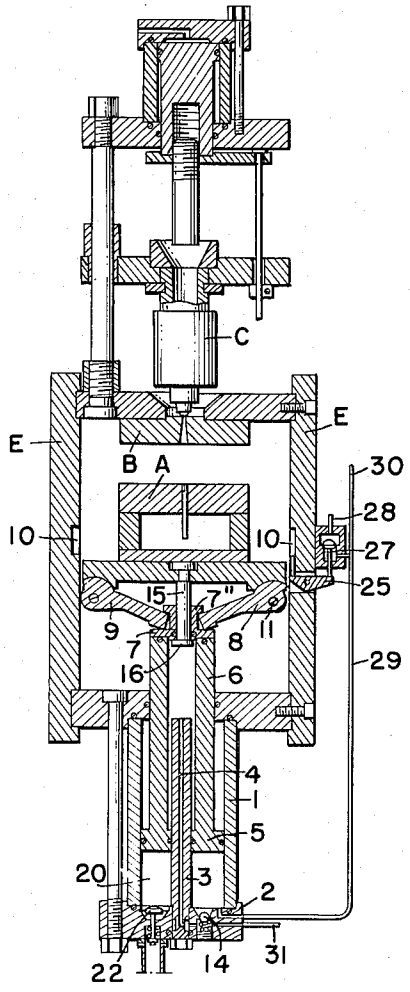
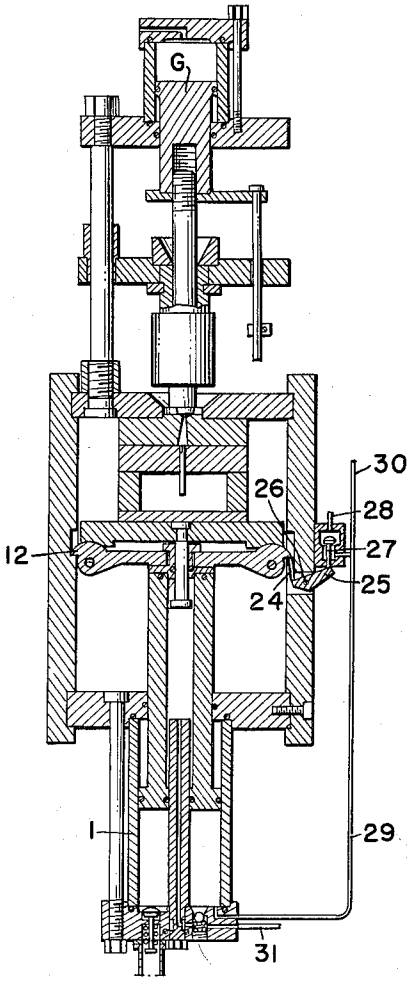


FIG. 4.



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POWER-MULTIPLYING LOCKING SYSTEM FOR INJECTION PRESSES

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Our invention has for its object an arrangement for locking the two sections of a mold incorporated with an injection press, said arrangement allowing in particular increasing the locking power developed to a considerable extent, for instance by six to ten times, with reference to the conventional injection presses.

Said arrangement is characterized chiefly by the combination of at least two levers inclined radially with reference to the axis of the press, mounted freely through one end on the end of a sliding control member and including each at its other end a pivotally secured head which engages the carrier plate of one of the sections of the molds and ends with a hook adapted to engage a lateral notch formed in one of the lateral connecting plates of the press so as to allow the pivotally secured head on each of these levers to exert a mold locking pressure on said carrier plate when said levers are rocked into alignment, said locking pressure increasing when the pivotally secured heads of said levers are spaced to a greater extent from each other.

According to a further feature of our invention, the sliding control member is subjected to the action of a first fluid pressure which urges the levers into a rocking movement towards their final engaged position after which a second fluid pressure, which is much larger, produces the final locking of said levers.

According to a still further feature of our invention, said fluid pressures which are exerted in succession are obtained through a jack inside which is fitted a sliding cylinder which moves first under the action of the first fluid pressure prevailing in the inner recess of said cylinder and then under the action of the second higher fluid pressure exerted on the larger diameter bottom of said cylinder.

According to yet another feature of the invention, at least one of the above-mentioned levers produces in its rocking movement and through the agency of a valve, the change over from the first lever-shifting fluid pressure exerted on the sliding control member to the second higher fluid pressure producing the actual locking and exerted on said same member controlling the rocking of the levers.

We have illustrated by way of example in the accompanying drawings two embodiments of our invention as applied to a vertical press. In said drawings:

FIGS. 1 and 2 are sectional elevational views of an injection press of the associated closing and injecting type respectively in its open and closed position.

FIGS. 3 and 4 are similar views of a press of the independent injection type.

Said two types of presses are well-known in the art and do not form part of our invention so that it is not necessary to disclose them with much detail hereinafter.

In the drawings, A and B indicate simply the upper and the lower sections of the mold respectively, while C designates the injection pot.

In FIGS. 1 to 4, 1 designates the cylinder of a jack which is carried by a pedestal 2 and carries an inner axial rod 3, provided with an axial channel 4 opening at the upper end of the rod.

Inside said cylinder 1, the cover 5 of an inner cylinder 6 slides over the hollow rod 3, said second cylinder 6 having its upper end closed by a cap 7.

Between the two peripheral flanges 7' and 7'' formed on said cap 7 are freely fitted the inner ends of two levers 8 and 9 arranged radially with reference to the injection press and ending each at its outer opposite end with a rounded head such as 8', fitting inside a corresponding housing formed in the lower surface of the carrier plate D supporting the lower section A of the mold.

The carrier plate D may slide vertically along the connecting plates E provided, inwardly and in vertical alignment with the outer end of each lever 8 and 9, with a transverse notch 10.

In FIGS. 1 and 2, the head of the lever 9 is concealed by a rod F intended for guiding vertically the mold carrier plates.

Each of the lever heads on the levers 8 and 9 is pivotally secured at a point such as 11 to the lower part of the plate D and is provided with a nose or hook 12 adapted to engage the corresponding notch 10 throughout its depth, whenever the two levers 8 and 9 have been shifted or rocked into their upper position into alignment with each other, through a sort of toggle link movement, as illustrated in FIGS. 2 and 4.

Said shifting of the levers 8 and 9 is obtained as follows:

In the case of the injection press of the associated closing and injection type illustrated in FIGS. 1 and 2, fluid under pressure is fed through the channel 13 and through the non-return valve 14 into the axial channel 4 of the rod 3 and thence inside the cylinder 6.

A small piston 15 rigid with the carrier plate D extends through the cap 7 of the cylinder 6 and carries at its lower end a flange 16, under the cap.

Under the action of the fluid pressure exerted through the channel 4, inside the cylinder 6, the latter slides inside the jack cylinder 1 and over the rod 3 whereby it raises frictionally the small piston 15 and consequently the carrier plate 5 and the lower section A of the mold. At a predetermined moment, said lower section A of the mold engages the upper section B of the mold. The pressure continuing its action inside the cylinder 6, the latter continues rising; the small piston 15 sinks with reference to the cylinder 6 and the levers 8 and 9 driven by the cap 7 of the cylinder 6 rock round the pivotal connections 11 of their heads until said levers reach a position in alignment with each other and urge the hooks 12 on their heads inside the transverse notches 10.

However, at the same moment the spring urged stem 17 of a valve carried by the inner cylinder 6 urges the valve head against the lower surface of the carrier plate D, which leads to a connection between a channel 18 extending transversely through the wall of the cylinder 6 with a right angled passage 19 formed in said valve stem. This allows thus the passage of compressed fluid out of the cylinder 6 into the chamber 20 of the jack cylinder 1 through said channels 18 and 19 and a further channel 21 extending longitudinally inside the wall of the cylinder 6. The pressure of the controlling fluid is exerted now inside said chamber 20 on the lower surface of the large diameter cover 5 for the cylinder 6.

A fluid pressure which is much higher than the first pressure exerted solely inside the cylinder 6 for moving the parts towards each other produces, at this moment, a very energetic locking of the two sections A and B of the mold together through the agency of the terminal heads of the levers 8 and 9, the hooks 12 terminating which have precedingly engaged the lateral notches 10.

This locking pressure is all the larger when the heads terminating the levers 8 and 9 are spaced further apart.

Said very energetic locking is obtained between the sections of the molds A and B with a great power-increasing ratio, as provided by the rounded heads of the levers engaging the corresponding housings in the lower surface of the carrier plate D. During the first portion of the movement of the cylinder **6** towards the end of its stroke, fluid is sucked out of its supply container into the chamber **20** through the valve **22** which closes as soon as the fluid under pressure passes out of the cylinder **6** into said chamber **20**.

A pipe **23** provides an admission of fluid under pressure, urging the cylinder **6** downwardly so as to open the sections A and B of the mold, as soon as the molding operation is at an end.

In the case of a press subjected to a separate injection procedure as in the case of FIGS. 3 and 4, the operation is exactly the same with the sole difference that the admission of oil under pressure into the chamber **20** of the jack cylinder **1** is obtained through the lowering of a short rod **24** at the moment of the engagement of the hooks **12** on the head of the lever **8** inside the notches **10**, said rod **24** being rigid with a double lever **25** pivotally secured at **26** and the outer arm of which raises the stem of a valve **27**. Said valve **27** provides then a connection between the admission **28** of the fluid under pressure, on the one hand through the pipe **29** with the chamber **20** in the cylinder **1** of the jack and, on the other hand, through a starting pipe **30** with the automatic control means for the injection piston G of the press.

When the fluid pressure starting the parts into movement is applied inside the cylinder **6**, the valve **27** closes and a suction of fluid is produced inside the chamber **20** through the pipe **29** and the open valve **22**.

In the case of FIGS. 3 and 4, the admission of the fluid under pressure inside the channel **4** for starting the closing movement is obtained through an auxiliary pipe **31** provided with a non-return valve **14**.

The downward returning movement of the cylinder **6** after molding may be obtained in the same manner as that disclosed with reference to FIGS. 1 and 2.

The arrangement according to our invention provides, inter alia, a highly reliable operation of the press and a high speed cycle of working therefor.

What we claim is:

1. In an injection press including two superimposed mold sections adapted to be brought into engagement to form a mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, at least two locking levers pivotally connected to said carrier plate and extending in radial planes with reference to the vertical axis of the mold, said levers being capable of being shifted between inoperative positions oblique to said plate and in line operative positions, a pair of heads each fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite said mold, a control member engaging the inner ends of said locking levers, means for driving said control member along the vertical axis of the mold for exerting an upwardly directed thrust on said lever inner ends pivoting said levers from their inoperative oblique positions into their in line operative positions moving said carrier plate and the mold section thereon towards the other mold section, a projection provided on each of said lever heads, at least one connecting plate connected to the injecting means extending laterally of and having said carrier plate slidably engaging the same for being guided thereby, said connecting plate being provided with an inner transverse notch adapted to engage and lock said head projection of the corresponding locking lever when in its in line operative position and registering transversely with said notch.

2. In an injection press including two superimposed mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, at least two locking levers pivotally connected to said carrier plate and extending in radial planes with reference to the vertical axis of the mold, said levers being capable of being shifted between inoperative positions oblique to said carrier plate and in line operative positions, a pair of heads each fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite said mold, a stationary jack cylinder coaxial with said mold sections, a member fixedly mounted within and extending coaxially of said jack cylinder, a second cylinder positioned inside said jack cylinder, the bottom of said second cylinder being slidably mounted over said coaxial member and having its periphery extending in coaxial sliding relationship with the inner surface of said jack cylinder, a cap mounted over the end of said second cylinder facing away from said bottom of the latter and to which the inner ends of the locking levers are pivotally engaged, means for feeding a compressed fluid first into said second cylinder through said coaxial member to shift said second cylinder and cap forwardly in a direction urging the levers towards their operative positions and then into said jack cylinder to apply a larger force to the sliding system including said second cylinder and its cap, a projection fixedly mounted on each lever head, at least one connecting plate connected to the injecting means, and having said carrier plate in slidable engagement therewith along its outer periphery, said plate being provided with an inner transverse notch adapted to engage and lock the projection on the head of the corresponding locking lever when in its operative position and registering transversely with said notch.

3. In an injection press including two superimposed mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, at least two locking levers pivotally connected to said carrier plate and extending in radial planes with reference to the vertical axis of the mold, said levers being capable of being shifted between inoperative positions oblique to said carrier plate and in line operative positions, a pair of heads each fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite said molds, a stationary jack cylinder coaxial with said mold sections, a member fixedly mounted within and extending coaxially of said jack cylinder, a second cylinder positioned inside said jack cylinder, the bottom of said second cylinder being slidably mounted over said coaxial member and having its periphery extending in coaxial sliding relationship with the inner surface of said jack cylinder, a cap mounted over the end of said second cylinder facing away from said bottom of the latter and to which the inner ends of the locking levers are pivotally engaged, means for feeding a compressed fluid first into said second cylinder through said coaxial member to shift said second cylinder and cap forwardly in a direction urging said levers towards their operative positions and then into said jack cylinder to the outside of the bottom of said second cylinder to apply a larger force to the sliding system including said second cylinder and its cap, and means for locking said levers in their operative position upon closing of the mold.

4. In an injection press including two superimposed

mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, at least two locking levers pivotally connected to said carrier plate and extending in radial planes with reference to the vertical axis of the mold, said levers capable of being shifted between inoperative positions oblique to said carrier plate and operative positions in line with one another, a pair of heads each fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite said molds, a stationary jack cylinder coaxial with said mold sections, a member fixedly mounted within and extending coaxially with said jack cylinder, a second cylinder positioned inside said jack cylinder, the bottom of said second cylinder being slidably mounted over said coaxial member and having its periphery extending in coaxial sliding relationship with the inner surface of said jack cylinder, a cap mounted over the end of said second cylinder facing away from said bottom of the latter and to which the inner ends of the locking levers are pivotally engaged, a small piston fixedly connected to said carrier plate and extending with a frictional fit through said cap of said second cylinder, means for applying pressure inside said second cylinder for making the latter raise said levers into their operative positions and thereby provide a lowering of said small piston into said second cylinder, means for applying pressure into said jack cylinder on the outside of said bottom of said second cylinder to raise with a greater force the system constituted by said second cylinder, cap, levers and carrier plate, and means for locking said levers in their operative position upon closing of the mold.

5. In an injection press including two superposed mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, two locking levers extending in diametrically opposed radial planes with reference to the vertical axis of the mold and pivotally connected to said carrier plate for being shifted between inoperative positions oblique to said carrier plate and in aligned operative positions, a pair of heads each fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite said mold, a stationary jack cylinder coaxial with said mold sections, a hollow rod fixedly connected to and extending coaxially with said jack cylinder extending inside the latter, a second cylinder positioned inside said jack cylinder, the bottom of said second cylinder being slidably mounted over said coaxial member and having its periphery extending in coaxial sliding relationship with the inner surface of said jack cylinder, a cap mounted over the end of said second cylinder facing away from said bottom of the latter and to which the inner ends of the locking levers are pivotally engaged, means for feeding a compressed fluid first into said second cylinder through said hollow rod to shift said second cylinder and cap forwardly in a direction urging said levers towards their operative positions and then into said jack cylinder to the outside of said bottom of said second cylinder to apply a larger force to the sliding system including said second cylinder and its cap, a projection fixedly connected to each of said lever heads, at least one vertical connecting plate fixedly connected to the injecting means, slidingly engaging said carrier plate along its outer periphery and provided with an inner transverse notch adapted to engage and lock the projection on said head of the corresponding locking lever when in its operative position and registering transversely with said notch.

6. In an injection press including two superposed mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, comprising a movable carrier plate for supporting one of said mold sections, at least two locking levers extending in radial planes with reference to the vertical axis of the mold and pivotally connected to said carrier plate for being shifted between inoperative positions oblique to said carrier plate and in aligned operative positions, a pair of heads each fixedly connected to the outer end of each locking lever and pivotally engaging the lower surface of said carrier plate opposite said molds, a stationary jack cylinder coaxial with said mold sections, a member fixedly mounted within and coaxially extending with said jack cylinder, a second cylinder positioned inside said jack cylinder, the bottom of said second cylinder being slidably mounted over said coaxial member and having its periphery extending in coaxial sliding relationship with the inner surface of said jack cylinder, a cap mounted over the end of said second cylinder facing away from said bottom of the latter and to which the inner ends of said locking levers are pivotally engaged, means for feeding a compressed fluid into said second cylinder and cap forwardly in a direction urging said levers towards their operative positions, a projection fixedly connected to each of said lever heads, at least one vertical connecting plate fixedly connected to the injecting means, slidingly engaging said carrier plate along its outer periphery and provided with an inner transverse notch adapted to engage and lock said projection on the head of the corresponding locking lever when in its operative positions and registering transversely with said notch, a bell crank pivotally secured to one of said connecting plates and in the path of said cooperating lever head to be rocked by the latter upon engagement between said projection and said cooperating notch, a valve controlled by the rocking of said bell crank and means for feeding a further fluid pressure into the jack cylinder to the outside of the bottom of the second cylinder to apply a larger force to the sliding system including said second cylinder and its cap upon the opening of said valve.

7. In an injection press including two superposed mold sections adapted to be brought into engagement to form a complete mold and means for injecting material into the closed mold, a control system adapted to shift one mold section into engagement with the other mold section and to lock said sections in their operative mold-forming position, said system comprising a carrier plate movable axially of said molds and for supporting one mold section, at least two locking levers extending in radial planes with reference to the vertical axis of the mold and pivotally connected at one end portion to said carrier plate for being shifted betwen inoperative positions oblique to said carrier plate and operative positions in line with one another, a pair of heads fixedly connected to the outer end of one of said locking levers and pivotally engaging the surface of said carrier plate opposite to said mold, a control member engaging the other ends of said locking levers and capable of sliding vertically along the vertical axis of the mold and to exert an upwardly directed thrust on said lever other ends to shift, said levers from their inoperative positions into their operative positions and to urge same with said carrier plate and mold section thereon towards the other mold section, fluid operated means controlling the upward movement of said sliding member in succession under lower pressure and under higher pressure conditions, means for changing the lower pressure conditions over into higher pressure conditions upon said levers reaching a predetermined position, a pair of projections fixedly connected to each of said lever heads, at least one vertical connecting plate fixedly connected to the injecting

means, slidingly engaging said carrier plate along its outer periphery and provided with an inner transverse notch adapted to engage and lock said projection on the head of the corresponding locking lever when the latter is in its horizontal operative position and registers transversely with said notch.

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