

[54] **PRESS EQUIPPED WITH A TRANSFER DEVICE**

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[58] Field of Search **100/207; 72/421; 214/1 BB; 83/277**

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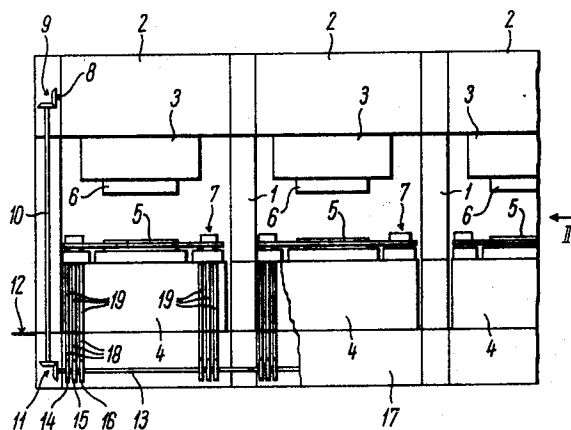
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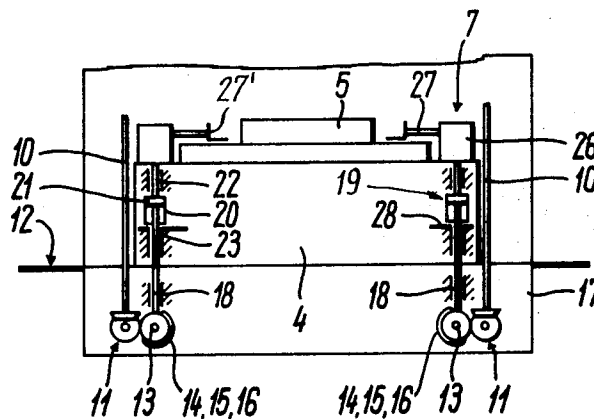
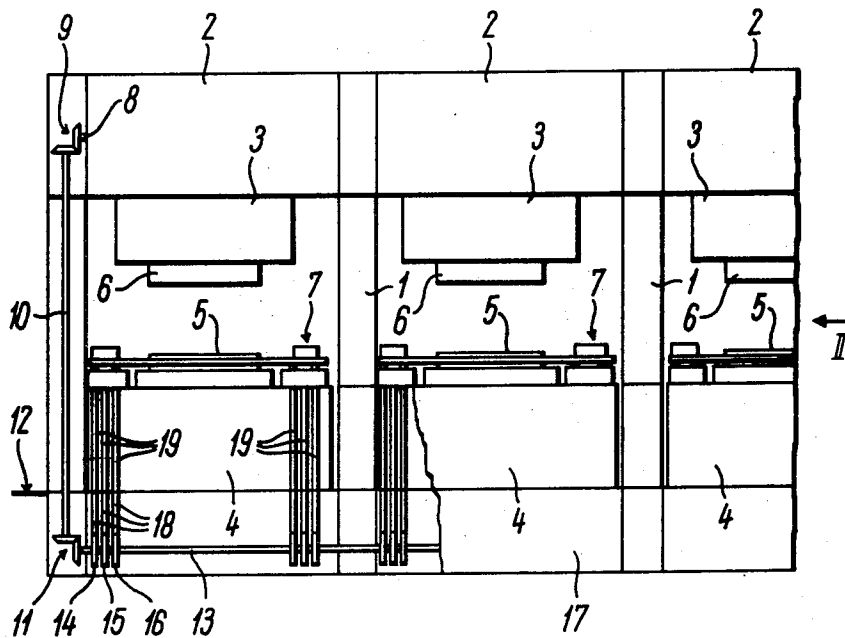
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[57] **ABSTRACT**

A transfer press having a series of rams each provided with a transfer mechanism which are independently driven, the transfer mechanism being supported on means such as a table or base plate moveable from an operative position within the press frame to a withdrawn position to enable the transfer mechanism and the tool parts of any selected ram or rams to be withdrawn as when changing or replacing tools.

20 Claims, 4 Drawing Figures





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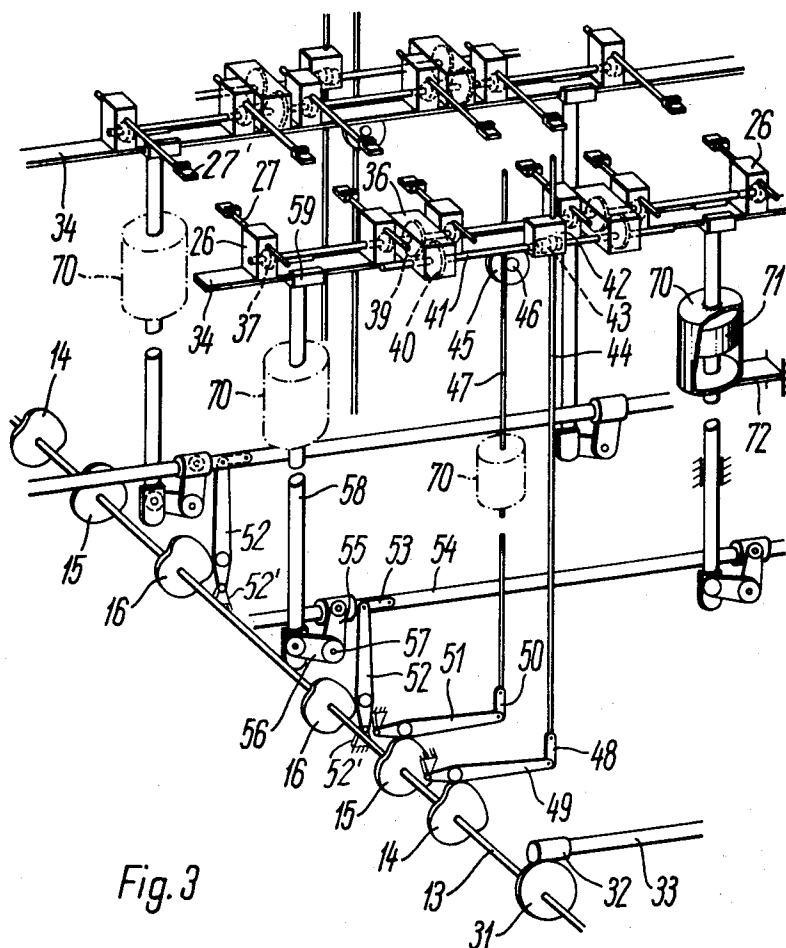


Fig. 3

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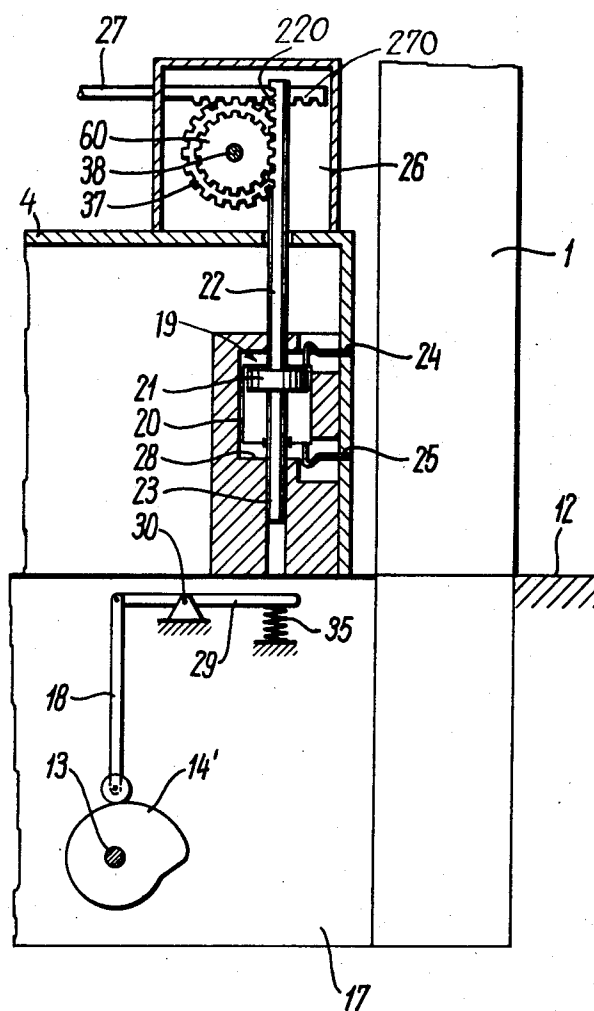


Fig. 4

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PRESS EQUIPPED WITH A TRANSFER DEVICE

The invention relates to a transfer press equipped with a transfer device, the drive of which is coordinated with the movement of the associated press ram and more particularly when derived from the drive shaft of the latter and wherein the transfer device conveys the workpiece after each working stroke to the tool performing the next processing operation.

In transfer presses of the type disclosed, e.g. in German No. 1,802,630, in which a workpiece is subjected to a series of operations carried out by a succession of different tools, the workpiece is passed from one tool to the next by means of a transfer device. In this transfer device, which is provided with gripper bars, the latter extend in the longitudinal direction of the workpiece feed and are approximately of the same length as the transfer press, so that they extend from the first to the last tool. In addition to being movable longitudinally, these gripper bars are usually movable both vertically and laterally and carry gripper arms provided with gripping tongs.

Following one operation in the press, and the rams together with the upper tools are performing their upwardly directed return stroke, the gripper bars, one of which is usually provided on each side of the machine, are moved inwardly towards one another, and having gripped the workpiece by means of the gripping tongs, they are then advanced by one tool space in the longitudinal direction, and then lowered again. The gripping tongs deposit the workpieces in the tools, whereupon the gripper bars are moved outwardly and/or upwardly and returned to their starting position, whereupon the next working stroke of the press commences.

These transfer systems have the disadvantage that the transfer device performs the same movements and travels over the same paths in all the stages of the transfer press with the result that it may be difficult to adapt the gripping devices to any change in shape of the workpiece which may vary considerably from one tool to another. Moreover, in this arrangement the transfer steps must coincide in phase in all the stages. Another disadvantage is that when a tool change is made, adjustment of the transfer device, frequently taking considerable time, is required to bring the grippers into correct position in relation to the path of movement of the new tool. Any such adjustment is time-consuming and leads to undesirably long machine standstill times. Moreover, when a tool is taken out the gripper bars cause an obstruction and must be raised or at least partly dismantled and then refitted.

The problem of this invention is to provide a transfer system for a press wherein relatively short tool change times are possible.

According to the present invention, in a transfer press having a series of rams provided with tools for subjecting a workpiece to successive pressing operations at least one of the tools is provided with its own transfer device, which is adapted to be moved out of and into an operative position in the transfer press together with the tool.

This arrangement has the advantage that it enables the designer or operator to secure optimum use or adaptation of the transfer device, and the most effective path of movement in which it travels, to the special

conditions presented by the tool and to the shape of the workpiece itself, without any limitations imposed by the conditions presented by other tools, which are often completely different, having to be taken into account. Furthermore, the adjustment and adaptation of the transfer device and of its grippers to the various tools can be effected outside the press. Accordingly, a new tool together with the transfer device associated with it can be made ready and any adjustments that may be necessary effected outside the transfer press without production having to be stopped.

In the case of a tool change-over and particularly when re-setting the press to manufacture a different product, it is sufficient to remove the tools previously in use and the transfer device from the press, insert the new tools together with the previously adapted and adjusted transfer devices, and align the tool. The transfer press is then immediately ready for production.

The press of this invention eliminates any lengthy standstill times and consequent loss in production which is liable to occur with existing presses due to the fact that even after the tools have been inserted and aligned, the transfer device must itself be modified, adapted and adjusted. This entailed the further disadvantage that it was necessary to start adjustment at the start end of the press and to adjust successive stages one after the other, so that re-setting times were relatively long. The invention results in a further economy in that it makes it possible for even smaller series to be produced economically whereas hitherto the ratio of re-setting time to production time was so unfavorable that economic manufacture could not be achieved. The minimum number of pieces required to maintain a calculated machine cost rate can thus be considerably reduced by the invention, so that transfer presses can now also be used for the manufacture of a comparatively small number of pieces.

As applied to transfer presses equipped with sliding tables, it is possible for the transfer device associated with a particular tool or tools to be mounted on the sliding table which carries the tool. This results in the advantage that changing of the tools by running out the sliding table together with the previously used tool and insertion of a replacement sliding table together with the new tool can be effected very rapidly. In these presses a large proportion of change-over time is taken up by the removal and refitting of the transfer device and the re-adjustment of the latter. It is precisely this relatively long part of the change-over time which is decisively shortened by the invention. It is possible for a plurality of tools served by one transfer device to be mounted on a sliding table.

In one embodiment of the invention each transfer device is provided with its own drive. This drive is in turn operated by the drive shaft of the press ram, the necessary transmission being housed in the main pillars or uprights of the press. Because of the mechanical connection between the respective drives of the ram and the transfer device, there is exact synchronization of the movement phase of the transfer device to the instantaneous position of the ram at any given moment.

In some cases, however, the space available is so restricted that it may be difficult or even prohibit accommodation of the drive for the transfer device in the pillar. In such cases provision may be made to

synchronize the drive of each transfer device electrically with the associated ram. This synchronization may be based on the principle of feedback control or by use of a synchro for this purpose.

By providing each transport device with its own drive, particularly when each ram or at least some of the rams is or are provided with its own drive, it has the advantage that in making a tool adjustment each ram can be operated individually so that tool adjustment can be effected simultaneously on a plurality of rams, since the rams can be operated independently of one another. During normal production operation on the other hand the rams are synchronized and have predetermined phase positions in relation to one another.

In transfer presses having a common drive for all the rams, the rams can only operate simultaneously. In presses of this type, as well as in presses having individual drives for each ram, a common drive shaft may be provided for all the transfer devices of the transfer press, which has the advantage that disconnection of the ram drive from the drive shaft of the transfer device requires only a single operation.

In transfer presses in which a common drive shaft is provided, this shaft extends over the length of the transfer device approximately at the height of the sliding table or of the tools, and the individual transfer movements are taken off this shaft. This has the disadvantage that when a tool is changed or when the sliding table is run out and in, this shaft must be at least partly dismantled. The shaft is therefore adapted to be disconnected at each sliding table, the shaft sections being detachably connected by flanges and screw connections.

In a preferred embodiment of the invention the drive shaft for the transfer device is situated below the separating plane on which the tool, possibly with the sliding table, is adapted to be run out, and the elements transmitting the movement from the drive shaft to the transfer device are adapted to be disconnected in this plane. The advantage of this arrangement resides in the drive shaft being disposed in a position in which it cannot cause an obstruction when changing tools or when the sliding tables are run out and in. Accordingly, tool changes are shortened in time, since the dismantling and assembly work previously necessary are eliminated. Since the transmission elements are disconnected in this separating plane it is a simple matter to construct them so as not to form an obstruction when the sliding tables are moved out.

The conversion of the rotary movement of the drive shaft into the necessary movement cycles of the transfer device may be effected in any desired manner. Thus, racks may be driven by pinions, the movement of which is reversible, or crank drives and linkages may be provided.

In a preferred embodiment the drive shaft rotates cam discs from which the stroke movements of the transmission elements that separated at the separating plane, are derived, so that it becomes a simple matter to obtain the most diverse stroke lengths and speed patterns for the transfer movements. Moreover, since such cam discs are readily interchangeable a rapid change in the movement programme of the transfer device is possible at any time.

Preferably three cam discs are provided in each case, one of which is associated with the movement of the transfer device in the direction of the feed of the work-piece, a second being associated with the movement transversely to the direction of the feed and/or with the operation of the gripping tongs, while the third is associated with the movement in the vertical direction. Through the separation of the different movements, the designing of the shape of the cam discs is greatly simplified and it is possible to use ordinary flat discs over the periphery of which a movement component is stored. While it is also possible either to store the different movement components on one cam disc, distributed over its periphery, or to combine a plurality of discs, each with a movement component stored over its periphery, to form a one-piece disc, this entails the disadvantage that when a cam disc is replaced because of a modification of the movement programme of one movement component, the other cam discs must likewise necessarily be replaced.

The transmission components for the drives may extend through the separating plane in any desired spacial position. Preferably, however, these transmission components are arranged perpendicularly or substantially perpendicularly to the separating plane. It is thus possible to keep the cross-section dimensions of the transmission components relatively small at this point.

The length of the transmission components and the shape of the cam discs are so selected and adjusted to one another that at least once during a work cycle all the dividing surfaces of these components are situated in or below the separating plane, which has the advantage that there is always a ram position in which, when the transmission elements are separated, the sliding table can be run out and in without difficulty.

Above the separating plane the transmission elements may be in the form of rods and levers mounted or guided on the tool.

In a preferred embodiment of the invention the transmission elements are in the form of plungers which are longitudinally displaceable in the sliding table above the separating plane and, when the sliding table is in its operative position, are operatively connected to rods in the press table. This arrangement has the advantage that whatever forms of transfer device be used, the plungers in the sliding table are always re-used, as well as the rods in the press table and with which they are operatively connected, so that only the grippers and the gripper bars have to be modified in accordance with the shape of the tool whenever the machine is re-tooled.

The mutually associated rods in the press table and the plungers in the sliding table are substantially aligned with one another, that is to say their axes coincide, when the sliding table is inserted. With the sliding table in position the plungers and rods are thus situated one above the other, so that on a vertically movement of the rods the plungers in the sliding table participate in the movement of the rods. This has the advantage that coupling means between the rods and the plungers are unnecessary since the plungers, which are secured in the sliding table so that they cannot fall out when the sliding table is removed by running it out due to their weight on the rods in the press table when the sliding table is inserted, and on displacement of the rods in the

press table, transmit it to the gripping devices effecting the transfer.

Alternatively a lever transmitting the movement of the rod may be transmitted to the plunger by a lever between the plunger and the rod, the axes of the rod and the plunger being offset laterally in relation to one another. This lever may be provided either in the sliding table or in the press table. The provision of a lever enables the movement of the rod to be transmitted to the plunger with a stepped-up or stepped-down transmission ratio. Movement of the rod is usually stepped-up, since the diameter given to the cam disc from which the rod derives its movement cannot be made indefinitely great and the variation in diameter along the periphery of the cam disc cannot be increased indefinitely in steepness. This can be done in a simple manner with the aid of a lever of this kind. Instead of being disposed in the separating plane the lever may, however, be provided on the cam disc; in this case the lever may bear directly on the cam disc.

When the sliding table has been run in the plunger or the lever disposed between the plunger and the rod will bear on the rod in the press table due to gravity and thus provide the driving connection between the rod and the plunger. The force produced by the weight of these parts is, however, generally not sufficient to obtain a movement pattern for the transfer device which exactly follows the movement of the rod.

To overcome this difficulty the plungers and/or the rods may comprise means which permits variation under external control of the effective length of the plunger and/or rod.

Such means may consist of a working piston adapted to be loaded on each side and which is operated with compressed air or pressure liquid.

In another arrangement the effective length of the rod may be adjusted by a spring, the initial stress of which is adjustable by means of cams. These arrangements have the advantage that a force-constrained connection can be provided between all the elements in the transmission system between the cam disc and the transfer device so that they are maintained in contact without play. Another advantage consists in that this force-constrained connection can be disengaged from outside in a simple manner so that the sliding table can be run out and in without difficulty.

The increase in stroke which can be achieved by a lever disposed adjacent to the separating plane in the sliding table or in the press table is generally sufficient. In those cases in which the rod and the plunger are disposed in line with one another, so that no lever is provided, or in which a relatively greater increase in stroke is necessary, it is, however, possible, as provided for in one embodiment of the invention, for the sliding table to be provided with stroke increasing means which increase to the desired extent the movement of the transfer device which is derived from the rods.

The invention is diagrammatically illustrated in the accompanying drawings, in which:

FIG. 1 is a schematic representational view of a transfer press as seen from the longer side;

FIG. 2 is a schematic end-on view of the transfer press as seen in the direction of arrow II in FIG. 1 with the plungers of FIG. 1 being illustrated in greater detail;

FIG. 3 is a diagrammatic perspective view of an embodiment a transfer device according to the invention, and

FIG. 4 is a sectional view on an enlarged scale of a press in accordance with another embodiment of the invention.

Referring to FIGS. 1-3 of the drawings, there is shown a transfer press mounted partly above ground and partly below ground and made up of three press units, each unit including pillars 1 and a press head 2. The press head 2 contains the drive for rams 3, of which three are provided in the embodiment illustrated. The transfer press has a series of sliding tables 4 which are adapted to be run out and in, one table being associated with each ram 3. Bottom tools 5, which co-operate with upper tools 6 carried by the ram 3, are fast on their respective sliding tables 4. Each of the sliding tables 4 is, in addition, provided with a transfer device 7 which after each stroke of the ram removes the processed workpiece from the tool and inserts it into the tool at the next station or press unit.

A plurality of sub-tools 5 may be mounted on a sliding table and a plurality of upper tools 6 on the associated ram 3. The tools on the sliding table are served by a transfer device which performs the same transfer movements for each of the tools on the table. The transfer movements of other sliding tables, on the other hand, have different paths of movement and the distances moved differ. The paths on which the transfer device travel are adapted to the conditions of the respective tools and shape of the workpiece.

Each transfer device 7 is driven from a shaft 8 mounted in the press head 2 and itself driven by the ram drive, from which drive is transmitted through a bevel gear drive 9 to a downwardly extending shaft 10 enclosed within the pillar 1 and by which drive is transmitted through a second set of bevel gearing 11 to a horizontal shaft 13 disposed under the floor 12 in the sub-structure of the press and extending the entire length of the press. The shafts 10 may be duplicated so that there are shafts on both sides.

Where the rams 3 incorporate a separate drive a similar transmission shaft may be provided for each ram for imparting drive to the associated shaft 13, which in this case does not extend the entire length of the machine. On the shaft 13 are three cam discs, 14, 15 and 16 which are preferably duplicated. The cam discs 14, 15 and 16 drive rods 18, which are mounted in guides in the press table 17, the surface of which is flush with ground level as indicated at 12, the rods performing an upward and downward movement following the contour of the cam discs, either directly or indirectly through interposed rollers or levers.

In guides on the sliding table 4, which rolls on the surface of the press table 17 when being run out of and into the press, are mounted plungers 19, which are shown schematically as rods in FIG. 1, and which are in line with the rods 18 and which receive the movement from the latter and transmit it to the transfer device 7. The transfer device 7 is adapted to be run out of the press together with the table 4. For this purpose the shaft 13 is driven into a position in which the top ends of the rods 18 are situated approximately at ground level 12, whereupon the table 4 can be run out after the plungers 19 and rods 18 have been uncoupled, i.e., not in contact with one another.

In order to raise the plungers 19 to a position in which their lower ends will not bear on the ground 12 when the tables 4 are run out, and at the same time ensure a good force-constrained connection between the rods 18 and the plunger 19, an axially adjustable member, which is externally controlled, is provided in the table 4 for each plunger 19. This adjustable member consists of a cylinder 20 (see FIGS. 2 and 4) having a bar 22 fastened to the upper end face thereof. The bar 23 extends through table 4 and into a transmission casing 26 in which its reciprocating movement is converted into a forward and backward movement of a gripper rod 27 in known manner. The piston rod 23 of piston 21, which is in alignment with the bar 22, abuts the rod 18 as shown in FIG. 2. The plunger 19, as shown in FIG. 2, is formed by members 20-23. At each end of cylinder 20 are inlets 24 and 25 for a pressure medium, by means of which the piston 21 can be moved into its lower or upper position. The cylinder 20 is likewise guided in the sliding table 4, its downward movement being limited by a shoulder 28. When pressure is applied to the inlet 24, which has its outlet at the end face of the cylinder 20 facing the transfer device 7, the piston 21 is in the position in which the piston rod 23 is at the greatest distance from the rod 22 and its bottom end bears against the rod 18 in the press table 17. When pressure is applied to the inlet 25 which leads to the opposite end face, the piston 21 is situated in the end position lying next to the transfer device 7 and accordingly the piston rod 23 is lifted off the bar 18. A simple but readily operated separation of the elements transmitting the reciprocating movement is obtained in this manner at the dividing plane. On raising the piston 21 the sliding table 4 together with the transfer device 7 can be run out and in without any obstruction.

It is not necessary for rod 18 to be disposed in line with the plunger 19 or the piston rod 23. As shown in FIG. 4, the rod 18 may be articulated to a lever 29, which is mounted in a position beneath the dividing plane in the press table 17, for rocking about a fixed pivot 30. In operation the plunger 19 or the piston rod 23 bears against the free end of the lever 29, which permits the stepping-up or stepping-down of the stroke of the rod 18, a spring 35 urging lever 29 in a direction to hold the rod 18 in operative engagement with cam disc 14.

In FIG. 3 there is shown the arrangement according to the invention for a sliding table equipped with three tools. For clarity all parts not serving the transfer device or its drive are omitted from the drawing. In addition to the cam discs 14, 15 and 16, of each of which two are provided, the shaft 13 has fast thereon a worm wheel 31 in mesh with a worm 32 fast on a drive shaft 33, the shaft being driven synchronously with the movement of the rams.

The transfer device 7 comprises gripper bars 34 which extend longitudinally of the press, the workpieces being passed from one processing station to another. The gripper bars 34, and all other parts of the transfer device 7, are usually provided in pairs and disposed symmetrically on each side of the central plane of the press, two such bars 34 being shown in FIG. 3, each gripper bar 34 being movable in two directions. It performs a reciprocating movement in its longitudinal direction and also an upward and downward movement, in which it is moved parallel to its longitudinal axis.

On the gripper bars 34 are gear casings 36 and 26. The gripper rods 27 associated with their respective bars 34 are guided in the gear casings 26 and project inwardly, substantially perpendicularly to the center plane of the press: at their inner ends they are provided with gripper tongs indicated generally at 27'. It will be seen that each gripper bar 34 is provided with two gripper rods 27 at each processing station, each of which is displaceable in a gear casing 26 and by means of which a forwards and rearwards movement is imparted to the rods, i.e. in the axial direction of the rods 27. This movement is imparted to each gripper rod 27 by a toothed portion of the rod which meshes with a gear 37 on the shaft 38, parallel to the gripper bar 34 and extending through each of the gear casings 26 and 36. In the gear casing 36 there is keyed on the shaft 38 a gear 39 in mesh with a gear 40 fast on shaft 41 which also extends parallel to the gripper bar 34. The shaft 41 extends through a gear casing 42, on which shaft 41 is a gear 43, the gear 43 meshing with teeth on a vertical rod 44 (i.e. perpendicular to the gripper bars 34 and gripper rods 27).

On their underside the gripper bars 34 have a further set of teeth engaging a gear 45 coupled to a second gear 46 which is in driving engagement with teeth on a second vertical rod 47 parallel to the rod 44. At its bottom end, remote from the gripper bars 34, the rod 44 is articulated by means of a link 48 to a one-armed lever 49, the other end of which is mounted to rock about a pivot 49' on the frame and having a roller that bears on the cam disc 14.

On rotation of the shaft 13 the lever 49 is caused to rock about its pivot in accordance with the shape of the cam disc 14, which movement imparts a reciprocating movement to the rod 44. A reciprocating movement of the rod 44 gives rise to a rotational movement of the shaft 41, which in turn, by way of the intermeshing gears 40 and 39, produces rotation of the shaft 38, which in turn gives rise to a forward and backward movement of the gripper rods 27. Similarly, the rod 47 is connected by a link 50 to a lever 51 which is rocked by the cam disc 15. A reciprocating movement of rod 47 produces a rotation of the gears 46 and 45, whereby the gripper bars 34 are moved longitudinally since the gear 45 meshes with the teeth on the underside of the gripper bar 34.

A vertical lever 52 mounted to rock about a pivot 52' on the machine frame bears against the cam disc 16, its other end being articulated by means of a link 53 to a push-rod 54 to which one arm 55 of a two-armed lever 55,56 is pivotally connected, its other arm being pivoted to a lift rod 58 and the lever 55,56 having a pivot 57 on the machine frame. At its upper end, remote from the angle lever 55,56, the lift rod 58 carries a bracket in which is a dovetail section guide slot 59 in which the gripper bars 34 are slidable. A second lift rod 58 also actuated by a two-armed lever 55,56 from rod 54 and provided with a slotted bracket 59 supports the other end of gripper bar 34. Likewise the other gripper bar 34 is slidably carried in brackets 59 on the upper ends of lift rods 58 actuated through two armed levers from a push-rod 54.

A to-and-fro movement is imparted to the push-rod 54 through the cam disc 16 and transmitted by lever 55,56 to produce an upwards movement of the lift rod 58, which in turn raises the gripper bars 34. In opera-

tion each lift rod 58 produces a lifting movement of the transfer device, each rod 47 imparts a longitudinal movement to the associated gripper bar 34, that is to say in the direction of the workflow, and the rod 44 moves the gripper rods 27 forwards and backwards.

The extent of the stroke is stepped up so that the lifting movement of the plunger 19 or of the rod 22 is converted into an increased movement of the gripper rod 27. At its end remote from the cylinder 20 the bar 22 is provided with teeth 220 for engagement with a gear 60 (FIG. 4) fast on the shaft 38. It will be seen that gear 37 also fast on shaft 38 has a larger diameter than the gear 60 and that it meshes with the toothed end 270 of the gripper rod 27. In accordance with the gear ratio of the gears 60 and 37, the lifting movement of bar 22 is converted into an increased length of stroke of the gripper rod 27. The increased stroke can also be obtained by gears mounted on different shafts. In the arrangement of FIG. 3 this increase of stepping-up of the stroke length is effected first by the gear 43 in mesh with teeth on the rod 44 and thence via gear 40 fast on shaft 41. Gear 40 drives gear 39 which is identical in size, whereby shaft 38 to which gear 39 is keyed rotates at the same speed as shaft 41. Gear 37 driving the gripper rod 27 has a larger diameter than gear 43, so that here again an increase in stroke is obtained corresponding to the diameters of the gears 37 and 43.

A linear stroke increaser may comprise a gear rolling on a fixed rack moved by a rod carrying the bearing of said gear, the latter engaging in a movable rack disposed parallel to the fixed rack. The movement of the movable rack then becomes exactly twice as great as the movement of the rod carrying the bearing of the gear. If on the other hand the movable rack engages with a gear which rotates with the first-mentioned gear, but has a different diameter, practically any desired transmission ratio can be selected for such movements. In another embodiment the gear is in that the rod 58 corresponds to the rod 18 and the cylinder 70 and piston 71 correspond to cylinder 20 and piston 21 of FIG. 4.

In the arrangement of FIG. 3 the pair of gears 45, 46 must participate in the lifting movement of the gripper bars 34, since otherwise the teeth of the gear 45 would disengage from the teeth on the underside of the gripper bar 34. A lifting movement of gear 45, however, means a simultaneous rotation where the rod 47, with whose teeth the gear 46 engages, is stationary. This rotation of the pair of gears 45, 46 would result in a longitudinal displacement of the gripper bar 34, which is frequently undesirable.

To overcome this either the contour of the cam disc 15 may be so selected that when the cam disc 16 produces a lift of the gripper bar a corresponding lift of the rod 47 is produced, which results in the gripper bar 34 not performing a longitudinal movement.

If a longitudinal movement of the gripper bar 34 is also desired on lifting of the gripper bar 34, the cam disc 15 may be shaped accordingly. The longitudinal movement of the gripper bar 34 is then obtained due to the relative movement of the rod 47 and the gripper bar 34. Should a longitudinal movement of the gripper bar not be necessary when the gripper bar 34 is raised, it is possible to disconnect the rod 47, in which case the upper part of the rod 47 participating in the lifting

movement is located, i.e. becomes ineffective, in relation to the gripper bar 34.

As already stated, provision is in any case made for disconnecting the rod 47 in order to permit outwards movement of the sliding table so that it is withdrawn without difficulty. For this purpose the rods 47, as well as the rods 44 and 58, can be constructed in two parts to permit separation in the dividing plane, as likewise diagrammatically illustrated in FIGS. 2 and 4.

Each of the rods extending through the dividing plane is provided above the latter in the sliding table with a device including a cylinder 70 and piston 71, the cylinder 70 being connected to that part of the rod connecting with the gripper system, the other part of the rod beneath the dividing plane being attached to the piston 71. Movement of cylinder 70 in the direction of the dividing plane is limited by a stop 72. This arrangement corresponds in this respect to that illustrated in FIG. 4 rotatably mounted on a fixed nondisplaceable axle and the two racks, engaged with the gear, are movable. The two movable racks may in this case be not in parallel, as shown in FIG. 4. It is obvious that a device according to the invention may also be used without the disconnecting cylinders 70, or that other expedients, for example working mechanically, may be used to disconnect the rods when running out the table.

It is obvious that the invention is not restricted to the examples of embodiment illustrated, but that variations therefrom are possible without departing from the scope of the invention.

What is claimed is:

1. A transfer press comprising a press frame, a series of rams arranged at successive stations throughout the length of the press frame for subjecting a workpiece in succession to a number of pressing operations by tool parts operated by their respective rams, a transfer device associated with at least one of the press rams by which the workpiece following a pressing operation is transferred to the ram in adjacent station where it is subjected to a further pressing operation, and support means for the transfer device moveable from and into an operative position within the press frame whereby the transfer device and the tool parts can be withdrawn.

2. A transfer press comprising a press frame, a series of rams arranged at successive stations throughout the length of the press frame for subjecting a workpiece to a number of pressing operations by tool parts operated by their associated rams, a transfer mechanism associated with each ram by which the workpiece, following a pressing operation, is transferred to the ram in the next station where it is subject to a further pressing operation, and a support means for cooperation with each ram and on which the ram transfer mechanism is carried, each of said support means being moveable from and into an operative position on the press frame to enable the transfer device and the tool parts to be withdrawn when required.

3. A press according to claim 2 wherein the support means comprises a table slidably mounted on the press frame.

4. A press according to claim 2 wherein each transfer mechanism is provided with an independent drive.

5. A press according to claim 4 wherein the drive of each transfer mechanism is electrically synchronized with its associated ram.

6. A press according to claim 2 comprising a common drive shaft from which drive is transmitted to each transfer mechanism.

7. A transfer press comprising a press frame, a series of rams arranged at successive stations extending lengthwise of the press wherein the workpiece is successively subjected to a pressing operation by tool parts operatively connected with each ram, support means for said tool parts mounted on the press frame for movements relative to a common separating plane whereby individual tools can be moved from and into an operative position, a transfer mechanism in each ram station by means of which the workpiece following a pressing operation by the tool parts of one ram can be transferred to the next ram of the series, drive means for said transfer mechanisms including a drive shaft located below said separating plane and upper and lower drive elements for transmitting drive from the drive shaft to their respective transfer mechanisms and positioned respectively above and below said separating plane and having releasable connections located in the separating plane.

8. A press according to claim 7 and comprising cam elements driven by the drive shaft for imparting lifting movements to said transmission drive elements.

9. A press according to claim 8 and comprising a transfer mechanism having components capable of movements longitudinally of the press frame in the direction of feed of the workpiece and transversely thereto including movement in a vertical direction, in which the drive means for each transfer mechanism comprises three cam members, one of said members effecting movement in the direction of feed of the workpiece, the second member effecting movement transversely to the direction of feed and the third member effecting movement in the vertical direction.

10. A press according to claim 8 and comprising a transfer mechanism including a gripper bar mounted for movement in the direction of feed of the workpiece and gripper tongs operatively connected thereto, in which the drive means for each transfer mechanism comprises three cam members, one of said cam members effecting movement of the gripper bar in the direction of feed of the workpiece, the second member effecting operation of the gripper tongs and the third member effecting movement of the gripper bar in the vertical direction.

11. A press according to claim 8 and comprising a

transfer mechanism having components capable of movements longitudinally of the press frame in the direction of feed of the workpiece and transversely thereto including movement in a vertical direction, in which the drive means for each transfer mechanism comprises three cam members, one of said cam members effecting movement of the transfer mechanism in the direction of said workpiece, the second member effecting movement transversely to the direction of feed and also operating the gripper tongs, and the third member effecting movement in the vertical direction.

12. A press according to claim 7 in which the drive transmitting elements are mounted on guides which are substantially perpendicular to the separating plane.

13. A press according to claim 12 comprising means for adjusting the length of the transmission elements and varying the contour of the cam members in relation to one another so that at least once during a work cycle the parting ends of the transmission elements are situated in or below the separating plane.

14. A press according to claim 12 in which each transmission element comprises a plunger capable of axial displacement in the support means above the separating plane and, when the support means is in its operative position, are in operative engagement with a rod mounted in a guide in that part of the press frame beneath the said plane.

15. A press according to claim 14 in which the transmission element comprises a rod and plunger having their axes off-set laterally in relation to one another in which movement of the rod is transmitted to the plunger by means of a lever.

16. A press according to claim 14 and comprising means for adjusting the effective length of the plungers.

17. A press according to claim 14 and comprising means for adjusting the effective length of the rods.

18. A press according to claim 14 in which the means for adjusting the length of the transmission elements comprises a cylinder having a double acting piston.

19. A press according to claim 14 in which the means for adjusting the length of the transmission elements comprises a spring and means, such as a cam, for varying the tension of the spring.

20. A press according to claim 7 wherein the transmission elements mounted in the support means operate through a cylinder having a double acting piston for increasing or decreasing their stroke.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3, 707, 908 Dated Jan. 2, 1973

Inventor(s) Lothar Merk and Wolfgang Michael

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title Page: --- add the following:

-- Foreign Application Priority Data

Dec. 23, 1969 Germany P 1964 326.6 --

Signed and sealed this 6th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents