

SPECIFICATION

Transfer press

- 5 The present invention relates to a transfer press having a plurality of press stages and a plurality of dies.

Recently, the configuration of parts made in transfer presses has often been varied and this has led to various problems such as the need to provide increased storage space and the need to protect stored parts against corrosion.

- According to the present invention, there is provided a transfer press having a plurality of press stages and a plurality of dies and including:
- 15 a blank-supply mechanism for supplying blanks; a blank-transport mechanism for carrying blanks from the blank supplying mechanism to the first of said stages; a transfer feed mechanism including exchangeable feed bars for feeding blanks through the press stages; a die exchange mechanism for automatically exchanging the dies; a feed bar exchange mechanism for exchanging the feed bars together with the dies in co-operation with the die exchange mechanism; a die cooling oil supply; a die cooling oil circuit connecting mechanism for disconnecting the cooling oil supply from die cooling oil circuits provided in dies to be removed at the time of exchanging dies and connecting it to die cooling oil circuits provided in the newly placed dies; a cushion pressure adjusting mechanism for each stage for supplying necessary pressure to a cushion cylinder associated with the stage; and a program control means for automatic press operation which controls the operations of the transfer feed mechanism, the die exchange mechanism, the feed bar exchange mechanism and the die cooling oil circuit connecting mechanism.

The present invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a front view of a transfer press embodying the present invention;

Figure 2 is a plan of the transfer press of *Figure 1*;

- 45 *Figure 3* is an elevational view in section of a blank-supply mechanism forming part of the transfer press of *Figure 1*;

Figure 4 is a sectional view of a cylinder forming part of the blank-supply mechanism which operates a magnet floater;

- 50 *Figure 5* is a plan view of a blank-transport mechanism forming part of the transfer press of *Figure 1* and in which above the centre line a feed bar is shown in a returned position and below the centre line a feed bar is shown in an advanced position;

Figure 6 is a front view of the blank-transport mechanism in a returned position;

- 60 *Figure 7* is a side sectional view along the line VII-VII of *Figure 5*;

Figure 8 is a side view cut along the line VIII-VIII of *Figure 6*;

- 65 *Figure 9* is a side view of a double blank detecting mechanism partly in section forming part of the transfer press of *Figure 1*;

Figure 10 is a plan view of the double blanks detecting mechanism;

Figure 11 is a side view in section along the line XI-XI of *Figure 9*;

- 70 *Figure 12a* is a side view showing an outline of a transfer operation;

Figure 12b is a side view of a switch-over mechanism partly in section forming part of the feed mechanism of the press;

- 75 *Figure 13* is a fragmentary front view of the switch-over mechanism;

Figure 14 is a sectional view of a cylinder forming part of the switch over mechanism;

- 80 *Figure 15* is a side view of the feed bars of the transfer press together with a mechanism for operating the feed bars and also controlling the separation of the feed bars during a clamping action;

- Figure 16A, B, C, D* are sectional views of part of the mechanism of *Figure 15*, each view showing a different separation of the feed bars;

- 85 *Figure 17* is a plan view of a die exchange mechanism forming part of the transfer press;

- Figure 18* is a side view in the direction of line XVII-XVII of *Figure 17*, one portion being shown in section;

- 90 *Figure 19* is a side view showing the connection of a truck and rails forming part of the die exchange mechanism partly in section;

- 95 *Figure 20* is a front view of a stopper plate provided at the wheel casing of a bolster;

Figure 21 is a plan view of feed bars forming part of the transfer press;

- Figure 22* is a front view of a mechanism for connecting a feed bar with an auxiliary feed bar;

- 100 *Figure 23* is a front view showing disengagement of the feed bar and the auxiliary feed bar of *Figure 22*;

- Figure 24* is a sectional view showing a feed bar engagement mechanism according to a different embodiment;

- 105 *Figure 25* is a plan view of the engagement of the mechanism of *Figure 24*;

Figure 26 is a side view of a die cooling oil connecting mechanism partly in section;

- 110 *Figure 27* is a sectional view in the direction of line XXVII-XXVII of *Figure 26*;

Figure 28 is a plan view showing the mounting position of a cushion pressure adjusting mechanism;

- 115 *Figure 29* is a side view of the cushion pressure adjusting mechanism;

Figure 30 is a block diagram of a program control means forming part of the transfer press; and

- 120 *Figures 31 and 32* are flow charts illustrating automatic operation of the press.

Referring now to *Figure 1*, there is shown a transfer press 1 embodying the present invention. The press 1 includes a blank-supplying mechanism 10 and a blank transport mechanism 20, located on the left hand side, and a transfer feed mechanism located beside a column 8 and driven by the drive mechanism of the press. The press further includes a bed 2, a crown 3, a slide 4, dies 6 mounted on bolster 5, feed bars 7, and a die cooling circuit connecting mechanism located along the longitudinal wall of



the bed 2. As shown in Figure 2, the press also includes a die exchange mechanism having trucks 270 running on rails 251 for carrying bolsters 5. The press 1 also includes a feed bar exchange mechanism associated with the die exchange mechanism and a program control means for automatic press operation. These various parts of the press will now be described in more detail.

Referring now to Figures 2 and 3, the blank-supply mechanism comprises vacuum-cup lifters 114 mounted on a piston rod 112 of a vacuum cylinder 110 secured to a frame body 111, and they suck up blanks 106 loaded in a magazine 103 one by one from the one on the top. The magazine 103 can move on rollers 102 mounted on rails 101, and it has blank holders 107. A hole 105 is provided in the bottom of the magazine 103 so that a piston rod 109 of a lift cylinder 108 which pushes up the blanks 106 can pass through.

The lift cylinder 108 is secured to rails 101, and it keeps the height of loaded blanks 106 within certain limits. The cylinder 108 is provided with a detector to measure the stroke of its piston rod 109.

A magnet floater 117 is located at the top of the loaded blanks 106 in a freely movable manner in order to separate blanks for one another.

Referring now to Figures 3 and 4, the magnet floater 117, blank support members 118 and plates 119 are secured to a rod 138. A piston 137 is also secured to the rod 138 and it is inserted into a piston rod 116. To the opening of the piston rod 116 is applied a plug 139. A clearance 143 is formed between the piston 137 and the tube 140. A piston 131 is secured to the piston rod 116 and inserted in a cylinder 115.

When pressurised fluid is supplied to a hole 132, the magnet floater advances to hit against a side surface of the blank 106, and the hitting is detected by a detector, and the supplying of pressurised fluid to holes 132, is stopped by a signal from the detector. Then, by the operation of the spring 141, the clearance 143 is formed between the tube 140 and the piston 137, and also a clearance corresponding to the clearance 143 is formed between blanks 106 and the magnet floater 117. The magnet floater is at its proper positions at this point.

The blank-supports 118 are mounted on the plates 119 so as to be rotatable in one direction by shafts 120 and they are structured to rotate when the blanks 106 are pushed up the lift cylinder 108 and pass these supports.

When the blanks 106 gradually decreases to a certain number, they are supported by the blank-supports 118 and the piston rod 109 goes down. The emptied magazine then runs on the rails 101 to go out from the mechanism, while a newly loaded magazine 103 is supplied. In the meantime, supplying of the blanks 106 to the press machine continues.

The blank 106 sucked up to the vacuum-cup lifters 114 is lifted by the vacuum cylinder 110, and in this lifted position it is sucked at different places by vacuum-cup lifters 164 of the blank transport mechanism as will now be described.

Referring now to Figures 5 and 6, the blank-

transport mechanism is arranged to supply the blank 106 sucked by the vacuum-cup lifters 164 from the blank-supplying mechanism to the first stage of the transfer press by transmitting advance-return movements of cylinders 162 to the vacuum-cup lifters 164.

In Figure 5 clamp units 150, 151 which operate clamp-and-unclamp movements of feed bars 7 are secured to columns 8 and connected to feed bar guides 152. In the guiding grooves of the feed bar guides 152, auxiliary feed bars 153 are supported.

The feed bars 7 are connected on their left to the auxiliary feed bars 153 and on their right to auxiliary feed bars 304, as shown in Figure 21 by connecting pins 307, 307. These connections will be explained later in the specification.

Referring to Figure 5 to 8, a drive pin 157 provided on each of the auxiliary feed bar 153 is supported in a hole of a sliding member 156 guided by guide rods 155 secured to a transport frame 154. The transport frames 154 have arms 158, and rollers 161 mounted on the arms are engaged in the guide groove provided in rails 159. The rails, in turn, are secured to bridges 160 which are mounted through the cylinders 162, 162 to a frame body 111 of the blank-supply mechanism and to the columns 8 of the transfer press.

Vacuum-cup lifters 164 are mounted on connecting rods 163 at the same spaced intervals as the dies of the press. The connecting rods, in turn, are secured to transport frames 154.

In Figures 5 and 6, a base 165 is provided parallel to the feed bars above clamp units 150, 151. Upward facing vacuum-cup lifters 166 are secured at positions that correspond to so-called "idle stages" between die mounting positions of the press machine.

Figures 9 to 11 show a mechanism which detects lifting of two or more blanks at a time and which, in such case, ejects them all. In Figure 9, a blank on a blank receiving rod 170 which extends in a direction that perpendicularly intersects the blank transport direction, is checked up by a contact arm 176 of a rotative lever 174, operated by a cylinder 177 and a proximity switch 185. When more than two blanks are detected, they are pushed off.

The contact arm 176 is positioned at one end of the lever 174, the lever 174 being mounted rotatable on the machine frame 171, and a piston rod 178 of the cylinder 177 is mounted rotatably at its other end. An operation member 184 is also provided at this end of the lever. The cylinder 177 is mounted rotatable on the machine frame 171.

The proximity switch 185 is provided at a position where it is possible to operate it by the operation member 184. An adjusting screw 186 and a cushion shaft 181 are provided at positions that come in contact with the lever 174.

A slider 187, which ejects blanks when two or more of them are detected, is guided by the shaft 175 fixed to the machine frame 171. The bottom of the slider 187 is engaged with the forked end 190 of a swing rod 189 through a connecting pin 188.

The other end of the swing rod 189 is mounted rotatably to the machine frame 171 by a pin, and at its center it is connected rotatably to a piston rod 192

of a cylinder 191.

A blank 106, sucked up by vacuum-cup lifters 114 and lifted by the vacuum cylinder 110 in Figure 3, is transferred to the vacuum-cup lifters 164 (vacuum-cup lifters 114 and 164 suck the blank at different positions) and is advanced by a distance corresponding to the feed strokes of the transfer process according to the advancing movement of the transfer frame in Figure 6. By the action of the cylinder 162, the blank 106 then is lowered and received on the vacuum-cup lifters 166 secured to the bed 165. After releasing the blank 106, the vacuum-cup lifters 164 ascend and return to their original positions by the return movement of the transfer frame 154. Then, the vacuum-cup lifters 164 descend by the action of the cylinder 162 so as to receive the blank 106 being sucked to the vacuum-cup lifters 114 and 166, and ascend by the action of the cylinder 162 and advance. Then the vacuum-cup lifters 164 again descend to transfer the blank 106 to the vacuum-cup lifters 166, and ascend again. In this manner, the vacuum-cup lifters repeat the same action.

The blank 106 on the bed 165 is detected by the proximity switch 185 in Figure 9, and in case more than two of them are found, they are ejected by the slider 187.

According to this series of action, the blanks are transferred one by one to the first stage of the press.

In Figures 12 to 14 is shown a mechanism for operating the clamp-and-unclamp movements of the feed bars 7.

A cam holder 206 is provided on a plate 205 mounted above a slide adjusting screw 202 of the press. This cam holder is arranged to slide in the longitudinal direction, guided by the longitudinal wall of the slide 4, and in the lateral grooves 207 of the holder a cam 208 is inserted and is slidable in the lateral direction. The cam 208 consists of a first control surface 210 and a second control surface 209. Cylinders 216, 216 are fixed on the inner surface of the cams 208, 208, and piston rods 219, 219 of the cylinders 216, 216 are connected to each other by connecting rod 220.

On both sides of the cam 208 limit switches 223, which detect switching of the cam, are provided.

A lever 212 is mounted rotatably on a bracket 214 which is fixed on the crown 3. The lever has a roller 213 which engages the cam at its one end, and its other end is connected to clamp-and-unclamp units casing 231 through a longitudinal rod and a rack-and-pinion mechanism.

Since the cam 208 moves in accordance with adjusting screw 202, relative positions of the cam and the roller do not change even when the die height of the press machine is adjusted. The selection between the cam 210 and the cam 209 depends on the action of the cylinder 216.

In Figures 12a, 15 and 16 is shown a structure which adjusts the smaller separation of a pair of feed bars 7, 7 during a clamping movement so that this separation is in accordance with the size of the blank to be transfer-processed.

Figure 12a shows the mechanism by which up-and-down movements of the slide 4 of the press operate the clamp-and-unclamp movements of the feed bars

through the cam mechanism, the longitudinal rod, clamp-and-unclamp units casing and clamp-and-unclamp units.

In Figure 15 the clamp-and-unclamp units casing 231 has two duplex cylinders 233, 233. Each duplex cylinder 233 comprises a pair of cylinders on both sides of a partition 238 as shown in Figure 16, and their stroke is indicated as S1, S2 ($S1 \neq S2$). One piston rod 235 of the duplex cylinder is fixed to a column 8 while the other piston rod 234 is fixed to a wall 236 of clamp-and-unclamp casing 231.

In the same figure a drive shaft 232 which is driven by the up-and-down movements of the slide 4 of the press is connected to the feed bars 7 through the rack-and-pinion mechanism.

As shown in Figure 16, the clamp-and-unclamp units casing has four separate positions according to the combination of the strokes S1, S2 of the two cylinders. Twice the length of strokes is the inner width adjusting length of a pair of the feed bars 7, 7.

In Figures 17-20, the die exchange mechanism for replacing a die on the press 1 by another is shown. A bolster 5 on which is placed a die runs back and forth in Figure 17, while a truck 270 on which is placed the bolster 5 runs from side to side. There are two of these trucks and they are connected to each other by a connecting rod 272.

Rails 250 of the same level as that of the bed 2 extend rearwardly from it and to the rear of these rails floor rails 251 which perpendicularly intersects the first rails are provided. The rails 250 are for the bolsters 5, while the floor rails are for the trucks 270.

In Figure 18 the bolster 5 is arranged to run on wheels 52, and to the bed 2 is provided an elevator at a position that corresponds to wheels 52 when the bolster 5 is in place. When the bolster 5 is running the elevator is lowered.

A connecting plate 265 is secured to the bolster 5 and at its bottom a U-shaped depression is formed for the free-engagement of a roller 264 of a slider 254 therein. At the bottom of the slider 254 rollers 256, which abut on both sides of a rail 255, and a roller 257 which is in contact with the inner wall of a guide groove 253 of a bed 252, are provided.

The slider 254 has a longitudinal groove 258 in which is fitted a roller 259. This roller is connected to a motor 263 by chain sprockets 260, 261 and a chain 262 which reciprocates in the guide groove 253.

In Figure 17 the truck 270 is connected to a motor 292 by a chain 288 which reciprocates parallel to the floor rails 251, and runs on the floor rails. The truck has at its upper portion cross rails 271 which are parallel, and of the same height and same spacing as the rails 250, 250. The cross rails 271 are provided with through holes 275 inside of which is positioned a stopper device for securing the bolsters. A stopper plate 276 having engagement groove 285 of the stopper device are arranged to contact the bolster 5 so that the movement of the bolster 5 is restricted in the running direction of the bolster and in the direction that perpendicularly intersects the former direction. The stopper plate 276 is operated by a cylinder 281 and a spring 280.

In Figure 17 connecting rails 273 are provided at notches formed at the intersections of the floor rails

251 and the running track of the slider 254. The connecting rails are rotatable and arranged to connect and disconnect parts of the floor rails.

Also, the die exchange mechanism is provided with several detectors which control the running of the bolsters 5 and the trucks 270.

In this die exchange mechanism, the bolster 5 which carries an already used set of dies in the press 1, runs on the rails 250 and the cross rails 271 to be placed on the truck 270. Then another truck 270 which carries another bolster 5 with a new set of dies to be used, runs until it comes to the rear of the press 1 where the bolster is led into the press machine through the rails 250 to undergo die exchange. This operation is automatic.

Mounting of the dies on the press is done by conventional clamping devices.

Figures 21-25 show the feed bar exchange mechanism which detach the feed bars 7 positioned between the right and left hand columns and exchanges them together with dies 6 at the time of die exchange.

In Figure 21 a transfer unit 300 for advancing and returning the feed bars 7 and clamp-and-unclamp units 301, 302 for clamping and unclamping them are provided at a right hand column 82. At a left-hand column 81 the clamp unit 151 is provided. Feed bar guides 303, 152 are connected respectively to clamp-and-unclamp units 301, 302 and 151, and auxiliary feed bars 304, 153 (not shown in this figure) are also respectively fitted in the grooves of the feed bar guides 303 and 152. Mating ends of the auxiliary feed bars and those of feed bars 7 are joined and connected by connecting pins 307, 307.

The feed bar guides are provided with cut-outs in their bottom and by utilizing these cut-outs a slider 306 for transfer-operating and the auxiliary feed bar 304 are connected to each other. With regard to other components of the feed bar exchange mechanism, conventional transfer-operating mechanism and clamp mechanism are employed.

In Figure 22 a lift cylinder 65 secured in the bolster 5 supports a common plate 63 for the lower dies 62 and a bed 66 secured to this plate supports the feed bars.

In Figure 23, when the dies are to be exchanged the feed bars 7 are raised by the common plate 63 for the lower dies 62 and are thus detached from the connecting pin 307.

In Figure 24 and 25 is shown an arrangement which prevents disconnection of the feed bars 7 and the auxiliary feed bar 304 at the time of high speed transfer operation. An oil pressure cylinder 310 and a piston 313 are provided on the auxiliary feed bar 304, and an elastic body 315 is inserted between an upper surface of the auxiliary feed bar 304 and the bottom of a head plate 316 secured to the piston rod. In order to provide oil pressure to the oil pressure cylinder 310 and to expand the elastic member 315 in its circumferential direction, the elastic body 315 is pressured in its axial direction.

In Figure 26 a connecting mechanism for the cooling oil circuits which are provided in the dies is shown. It is a mechanism for automatic connection of cooling oil circuits by utilizing up-and-down

movements of the slide 4 at the time of die exchange.

A check valve 321 is secured to the slide 4 through a rubber sheet 329. The check valve 321 has a plug body 323 and spring 324 positioned in a hole in its interior, and the end of the plug body and the bottom of the hole of the check valves form a seal. Springs 324 push the plug body 323 into the sealing position. The plug body 323 has a longitudinal hole 325 and lateral holes 326, and when the seal is opened, a passage for cooling oil is formed. The check valve 321 has a cap-connected to an oil pipe 320 leading to the chamber in which are housed the plug body 323 and the springs 324. The oil pipe 320 is connected to a cooling oil supply.

A hole 671 is provided in the common plate 67 for the upper dies at a position which corresponds to the check valve 321 so as to form a cooling oil passage from the hole 671 to the cooling oil supply circuits in the upper dies 61 through the common plate 67 for the upper dies.

A flow rate adjusting bolt 68 is screwed from the bottom of the common plate 67 for the upper dies to penetrate the hole 671 so that its end is in contact with the plug body 323.

When a die is to be removed, the end of the plug body 323 is separated from the end of the adjusting bolt 68 with the ascent of the slide 4 and the surface 322 is sealed by the action of the springs 324. Supply of cooling oil to the die is thus stopped. On the other hand, when a new die is to be placed, the plug body 323 is pushed up by the adjusting bolt 68 by the descending action of the slide 4 to open the sealed surface 322, and the passage of cooling oil is thus opened to enable supplying of oil.

In Figures 28 and 29 is shown a pressure-adjusting mechanism for cushion cylinders 346 within the bed 2, which is employed in the transfer-processing in connection with the die exchange operation. Since each stage of transfer-processing has its own cushion cylinder, a pressure-adjusting mechanism is necessary for each cushion cylinder. This mechanism is aimed to obtain necessary pressure from pressure fluid by utilizing running movement of the bolster and operating a regulator 345.

In each mechanism levers 341 are mounted rotatably on the front surface of the bed. At one end of the levers are provided projections 343 which engage adjusting bolts 340 provided on common plate 63 for the lower dies, while on the other end are provided screw rods 344 which are in contact with a regulator valve 345 secured to the longitudinal wall of the bed 2. A limit switch 351 which is secured to the longitudinal wall of the bed 2 is in contact with the lever 341.

When a die is to be removed, the bolster 5 goes up with the common plate 63 for the lower die and the projections 343 become separated from the adjusting bolt 340. Then the lever 341 rotates counterclockwise, detaching the limit switch 351 from the lever 341. The screw rod 344 is then detached from the regulator, and by a signal from the limit switch 351, a magnetic crossover valve 348 is operated to discharge fluid in the cushion cylinder 346, enabling in the bolster 5 to run. The bolster, thus, runs out of the

press 1. The magnetic crossover valve 348 may be operated before the running of the bolster instead by the limit switch 351.

When the bolster runs into the press, the lever 341 rotates clockwise and the pressure fluid circuit is opened by the operation of the magnetic crossover valve.

By rotating the adjusting bolt 340 to adjust its projecting length, necessary pressure is obtained by the operation of the regulator 345 through the lever 341.

Figures 30-32 show a program-control means for automatic operation of the press. A memory unit 90 which stores necessary programs for automatic operation of the press has a 1 kilo/word core memory.

An arithmetic unit 91 continuously reads out and decodes the data stored in the memory unit 90.

Using the decoded information, the arithmetic unit puts out control signals to control elements 921-92N of the press so as to operate it. At the same time this unit receives output signals from sensors 931-93N provided at each check-up point of the press and compares them with the decoded information obtained from the memory unit to judge whether the press is operating according to the instructions of the programs. When it is found that the press is not operating in the proper manner, the arithmetic unit puts out error signals to an indication output unit explained below.

The control elements 921-92N are, for example, magnetic switches or magnetic valves which form the output unit 92 together with transistors which drives the control elements according to control signals sent from the arithmetic unit 91.

An input unit 93 connected to the sensors 931-93N supplies a signal at 5 volts DC which are used in the arithmetic unit 91 to prevent noise by setting the output signals of the sensors and an automatic operation button at "on". The sensors 931-93N are respectively located at positions which correspond to the control elements 921-92N.

An indication output unit 95 comprises transistors which amplify indication signals of the arithmetic unit 91. BCD codes (Binary Coded Decimal) transistor-driven by the unit 95 are put into decoders 961, 962 to drive indication panels 963, 964. When two-digit numbers are used, indication output units 95 has eight outputs.

Now the operation of the press arranged composed as described above will be explained with reference to flow charts shown in Figures 31 and 32.

When the power is put on, it is ascertained whether the operator has properly set the automatic operation button 94 at "on" according to the programs in the memory unit 91, and then the automatic operation of the press starts.

"1" signifying "operator's button operation waiting" is indicated on the indication panel 963 after the power is on until the automatic operation button 94 is set at "on".

When the button 94 is set at "on", it is ascertained whether the slide 4 of the press is located at top dead center. Simultaneously, an automatic operation indication light 97 is lit to indicate that automatic

operation is now under way.

In the case where the press slide 4 is not at the top dead centre as shown in Figure 31, this condition is indicated by "2" on panel 963 and the automatic operation indication light 97 is put out, and thus the operator is informed that the automatic operation has not started due to the improper location of the press slide. This procedure is shown in order in Figure 32.

When the operator manually corrects the position of the press slide to the top dead center and the automatic operation button is set once again at "on", the operation proceeds to E2, receiving automatic operation button signals shown in Figure 32. Then the automatic operation indication signal 97 is once again lit it is ascertained whether the press slide is at the top dead center. When the location of the press slide is confirmed, the operation proceeds to the next stage in which it is checked up whether the die is being clamped and also in which other initial conditions of the press machine are equally checked.

With the initial condition check-ups mentioned above, the operator can discover deficient parts in the press in a very short time and start the automatic operation speedily.

After the initial conditions for the automatic operation are properly set up, each stage of the automatic operation follows in sequence, thus establishing a whole automatic operation by program control.

For example, when the arithmetic unit 91 reads an instruction, "die unclamp" from the memory unit 90, the control elements 92N of the output unit 92 is operated according to the instructions and the magnetic valve 98 connected to a contact point 92N of the control element 92N is also operated.

Then a sensor 93N is operated in order to ascertain whether the "die unclamp" has really been performed, and it is checked whether the necessary signals have been put in from the input unit 93. Since it takes some time to operate the control element 92N, to switch over the valve 98, to remove oil pressure from the die, to unclamp it, and finally to ascertain "die unclamp" has really taken place, "26" is indicated on the indication panel 963, 964, showing that "die unclamp" now going on". After confirming that "die unclamp" is properly finished, the operation goes on to next stage and a series of the automatic operation is completed.

115 CLAIMS

1. A transfer press having a plurality of press stages and a plurality of dies and including:-
 - 220 a blank-supply mechanism for supplying blanks;
 - a blank-transport mechanism for carrying blanks from the blank supply mechanisms to the first of said stages;
 - a transfer feed mechanism including exchangeable feed bars for feeding blanks through the press stages;
 - a die exchange mechanism for automatically exchanging the dies;
 - a feed bar exchange mechanism for exchanging the feed bars together with the dies in co-operation



press 1. The magnetic crossover valve 348 may be operated before the running of the bolster instead by the limit switch 351.

When the bolster runs into the press, the lever 341 rotates clockwise and the pressure fluid circuit is opened by the operation of the magnetic crossover valve.

By rotating the adjusting bolt 340 to adjust its projecting length, necessary pressure is obtained by the operation of the regulator 345 through the lever 341.

Figures 30-32 show a program-control means for automatic operation of the press. A memory unit 90 which stores necessary programs for automatic operation of the press has a 1 kilo/word core memory.

An arithmetic unit 91 continuously reads out and decodes the data stored in the memory unit 90.

Using the decoded information, the arithmetic unit puts out control signals to control elements 921-92N of the press so as to operate it. At the same time this unit receives output signals from sensors 931-93N provided at each check-up point of the press and compares them with the decoded information obtained from the memory unit to judge whether the press is operating according to the instructions of the programs. When it is found that the press is not operating in the proper manner, the arithmetic unit puts out error signals to an indication output unit explained below.

The control elements 921-92N are, for example, magnetic switches or magnetic valves which form the output unit 92 together with transistors which drives the control elements according to control signals send from the arithmetic unit 91.

An input unit 93 connected to the sensors 931-93N supplies a signal at 5 volts DC which are used in the arithmetic unit 91 to prevent noise by setting the output signals of the sensors and an automatic operation button at "on". The sensors 931-93N are respectively located at positions which correspond to the control elements 921-92N.

An indication output unit 95 comprises transistors which amplify indication signals of the arithmetic unit 91. BCD codes (Binary Coded Decimal) transistor-driven by the unit 95 are put into decoders 961, 962 to drive indication panels 963, 964. When two-digital numbers are used, indication output units 95 has eight outputs.

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When the button 94 is set at "on", it is ascertained whether the slide 4 of the press is located at top dead center. Simultaneously, an automatic operation indication light 97 is lit to indicate that automatic

operation is now under way.

In the case where the press slide 4 is not at the top dead centre as shown in Figure 31, this condition is indicated by "2" on panel 963 and the automatic operation indication light 97 is put out, and thus the operator is informed that the automatic operation has not started due to the improper location of the press slide. This procedure is shown in order in Figure 32.

When the operator manually corrects the position of the press slide to the top dead center and the automatic operation button is set once again at "on", the operation proceeds to E2, receiving automatic operation button signals shown in Figure 32. Then the automatic operation indication signal 97 is once again lit it is ascertained whether the press slide is at the top dead center. When the location of the press slide is confirmed, the operation proceeds to the next stage in which it is checked up whether the die is being clamped and also in which other initial conditions of the press machine are equally checked.

With the initial condition check-ups mentioned above, the operator can discover deficient parts in the press in a very short time and start the automatic operation speedily.

After the initial conditions for the automatic operation are properly set up, each stage of the automatic operation follows in sequence, thus establishing a whole automatic operation by program control.

For example, when the arithmetic unit 91 reads an instruction, "die unclamp" from the memory unit 90, the control elements 92N of the output unit 92 is operated according to the instructions and the magnetic valve 98 connected to a contact point 92n of the control element 92N is also operated.

Then a sensor 93N is operated in order to ascertain whether the "die unclamp" has really been performed, and it is checked whether the necessary signals have been put in from the input unit 93. Since it takes some time to operate the control element 92N, to switch over the valve 98, to remove oil pressure from the die, to unclamp it, and finally to ascertain "die unclamp" has really taken place, "26" is indicated on the indication panel 963, 964, showing that "die unclamp" now going on". After confirming that "die unclamp" is properly finished, the operation goes on to next stage and a series of the automatic operation is completed.

CLAIMS

1. A transfer press having a plurality of press stages and a plurality of dies and including:-
 - a blank-supply mechanism for supplying blanks;
 - a blank-transport mechanism for carrying blanks from the blank supply mechanisms to the first of said stages;
 - a transfer feed mechanism including exchangeable feed bars for feeding blanks through the press stages;
 - a die exchange mechanism for automatically exchanging the dies;
 - a feed bar exchange mechanism for exchanging the feed bars together with the dies in co-operation



with the die exchange mechanism;

a die cooling oil supply;

a die cooling oil circuit connecting mechanism for disconnecting the cooling oil supply from die cooling oil circuits provided in dies to be removed at the time of exchanging dies and connecting it to die cooling oil circuits provided in the newly placed dies;

a cushion pressure adjusting mechanism for each stage for supplying necessary pressure to a cushion cylinder associated with the stage; and

a programme-control means for automatic press operation which controls the operations of the transfer feed mechanism, the die exchange mechanism, the feed bar exchange mechanism and the die cooling oil circuit connecting mechanism.

2. A transfer press as claimed in Claim 1 in which the blank-transport mechanism transfer blanks from the blank-supply mechanism one by one to the first of said stages of the press by means of vacuum-cup lifters mounted on a transport frame at intervals which correspond to those of the stages of the press, the said transport frame being movable in parallel with the feed bars, and vertically relative to the feed bars.

3. A transfer press as claimed in Claim 2 in which the transport frame is connected to the feed bars by sliding members, the sliding members being mounted on drive pins provided on the feed bars and being loosely inserted on guide rods provided on the transport frame.

4. A transfer press as claimed in Claim 2 in which the transport frame is connected movably to rails extending parallel to the feed bars, and in which a vertically movable cylinder is provided on the press, the cylinder being connected to the rails.

5. A transfer press as claimed in Claim 1 in which the programme-control means includes a control circuit responsive to a memory unit and to a sensor provided at each of said stages for monitoring the supply of blanks even when a blank is not supplied to one of said stages.

6. A transfer press as claimed in Claim 1 in which the transfer feed mechanism includes a switch-over mechanism for switching the feeding action between a first feeding action and a second feeding action.

7. A transfer press as claimed in Claim 6 including a slide and in which the switch-over mechanism includes a cam mounted on a side wall of the slide for movement in a direction perpendicular to the direction of movement of the slide and having a first control surface and a second control surface, a lever pivotally mounted on the press and having one end rotatably connected to a rod which forms part of a clamp-and-unclamp mechanism connected to the feed bars in order to operate them and having a roller engageable with the cam provided at its other end, and means for moving the cam in a direction perpendicular to the directions of movement of the slide for selectively switching the positions of the cam between a position in which the roller engages the first control surface and a position in which the roller engages the second control surface.

8. A transfer press as claimed in Claim 1, in

which the transfer feed mechanism includes a clamp-and-unclamp mechanism for operating the clamp and unclamp action of the feed bars, the clamp-and-unclamp unit having a casing, a duplex cylinder having the free end of one piston rod secured to a column of the press and the free end of the other piston rod connected to a side wall of the casing, the cylinders of the duplex cylinder having strokes of differing lengths and each cylinder having two openings, and a tube for selectively supplying pressurised fluid to one of the two openings of each cylinder.

9. A transfer press as claimed in Claim 1 including a bed and in which the die exchange mechanism includes bolsters for carrying the dies and having connecting plate means engageable freely with a slider connected to a chain driven by a motor and sprocket, the bolsters running on bolster rails which extend rearwardly from the bed and have the same height as the upper surface of the bed, and trucks for carrying the bolsters, the trucks having wheels which run on truck rails which extend in a direction perpendicular to the bolster rails, the trucks being moved by a chain driven by a motor and sprocket and the truck rails having notches where the slider passes, the notches being bridged by connecting rails when the trucks are running.

10. A transfer press as claimed in Claim 9 in which there are provided two trucks connected to each other by a connecting rod.

11. A transfer press as claimed in Claim 1 in which in the feed bar exchange mechanism the feed bars are shorter than the inner width of the press and in which both ends of the feed bars are connected to auxiliary feed bars driven by clamp-and-unclamp units.

12. A transfer press as claimed in Claim 1 in which the dies comprise a lower set of dies and an upper set of dies, the lower set of dies being supported by a common plate and the common plate being supported by a bolster, and in which the transfer feed mechanism further includes a bed mounted on the common plate for supporting the feed bars, feed bar guides mounted at each end of the feed bars, clamp-and-unclamp units connected to the feed bar guides, and a transfer unit, and in which the feed bar exchange mechanism includes auxiliary feed bars mounted in the feed bar guides, the auxiliary feed bars being connected to the transfer units and the auxiliary feed bars and the feed bars having mating ends, and a lift cylinder mounted on the bolster for supporting and raising the common plate, the arrangement being such that raising the common plate disengages the feed bars from the auxiliary feed bars.

13. A transfer press as claimed in Claim 12 in which the transfer unit includes a slider for operating the advance-and-return movement of the feed bars, the auxiliary feed bars and the slider being connected together through cut-outs formed in the feed bar guides.

14. A transfer press as claimed in Claim 12 or Claim 13 in which the ends of the feed bar and auxiliary feed bars are connected by connecting pin mechanisms each connecting pin comprising a



piston mounted on the associated auxiliary feed bar, a head plate secured to the piston, an elastic body located between the head plate and a surface of the auxiliary feed bar, and a tube for supplying pressurised fluid for operating the piston.

15. A transfer press as claimed in Claim 1 in which the dies include a set of upper dies mounted on an upper common plate and a set of lower dies mounted on a lower common plate, a slide, the upper common plate being mountable on the slide and the upper common plate having an oil passage connectable with oil circuits formed in the upper dies, and in which the die cooling oil circuit connecting mechanism includes a check valve fixed to the slide for connecting the oil supply circuit to the oil passage formed in the upper plate and an adjusting bolt fixed to the upper common plate for operating the check valve.

16. A transfer press as claimed in Claim 1 in which the programme-control means includes a memory unit programmed with instructions for operating the press, an arithmetic unit responsive to the memory unit for operating the control elements of the press, an indication unit for indicating errors occurring during operation of the press.

17. A transfer press substantially as hereinbefore described with reference to and as shown in the accompanying drawings.