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Sarkisov et al.

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[54] **AUTOMATIC TRANSFER PRESS WITH VERTICAL STAMPING SURFACES FOR STAMPING CONCENTRIC PARTS OF SHEET MATERIAL**

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[52] **U.S. Cl.** **83/132,** 83/129, 83/255, 83/268, 83/405, 83/519, 83/618, 83/628, 83/635

[51] **Int. Cl.** **B26f 1/02,** B26d 11/00

[58] **Field of Search** 83/132, 129, 255, 83/268, 405, 519, 618, 628, 635

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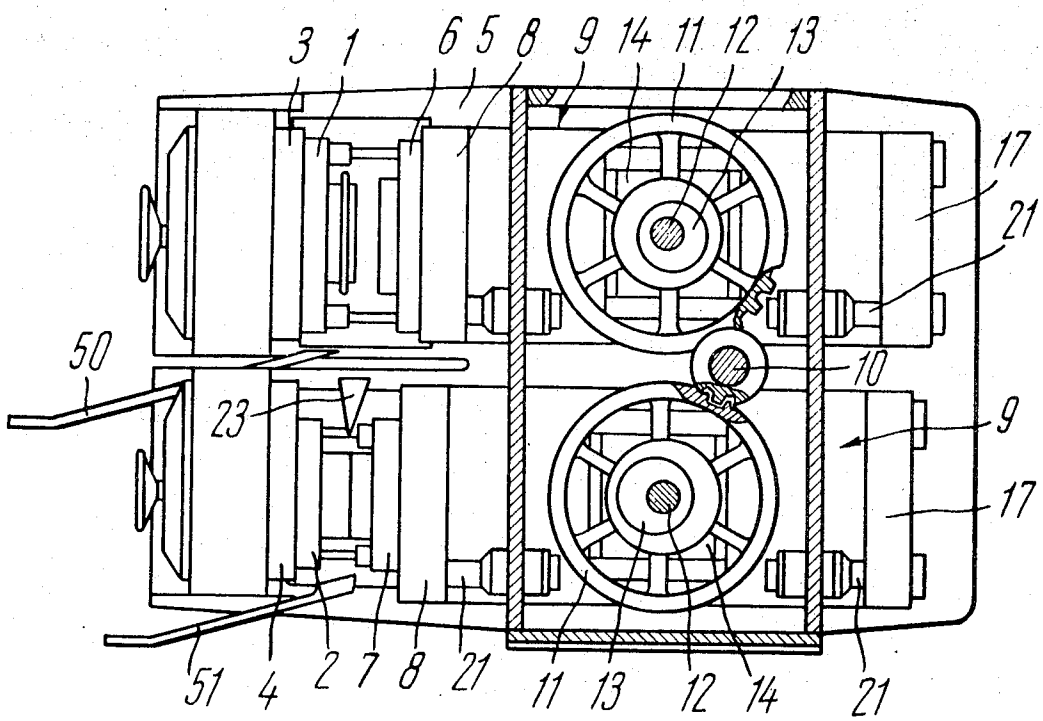
[57] **ABSTRACT**

An automatic transfer press with vertical stamping surfaces for stamping two concentric parts of sheet material. The press comprises two compound die sets arranged one above the other, with vertical stamping surfaces. The punches of the die sets are secured to slides moving horizontally in the opposite directions. Each slide is made in the form of a link mechanism consisting of a slide block and a link on which the cross-heads with punches are mounted. The link is made in the form of a vertical plate with a port accommodating the slide block secured on the eccentric of the press driven shaft.

5 Claims, 7 Drawing Figures



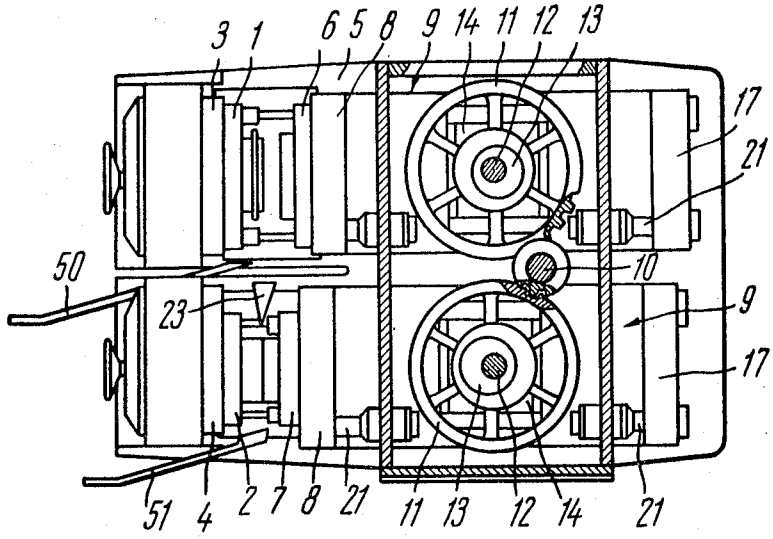

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FIG. 1

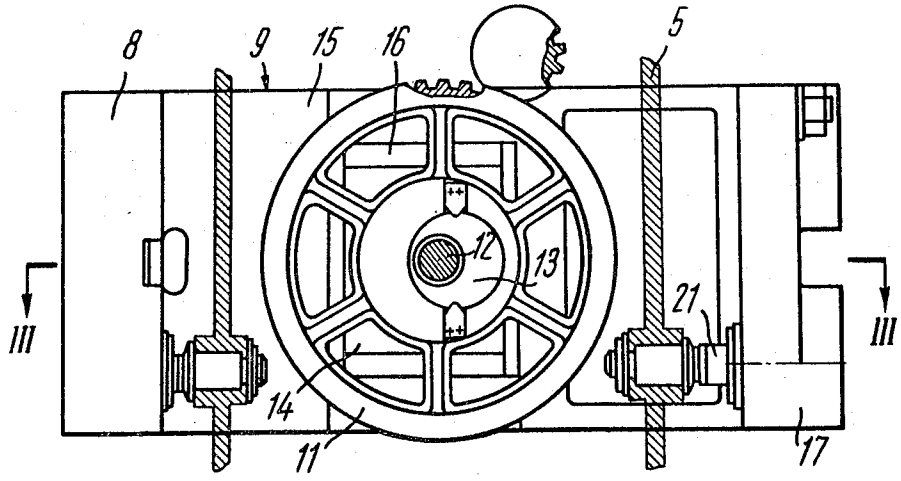
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FIG. 2

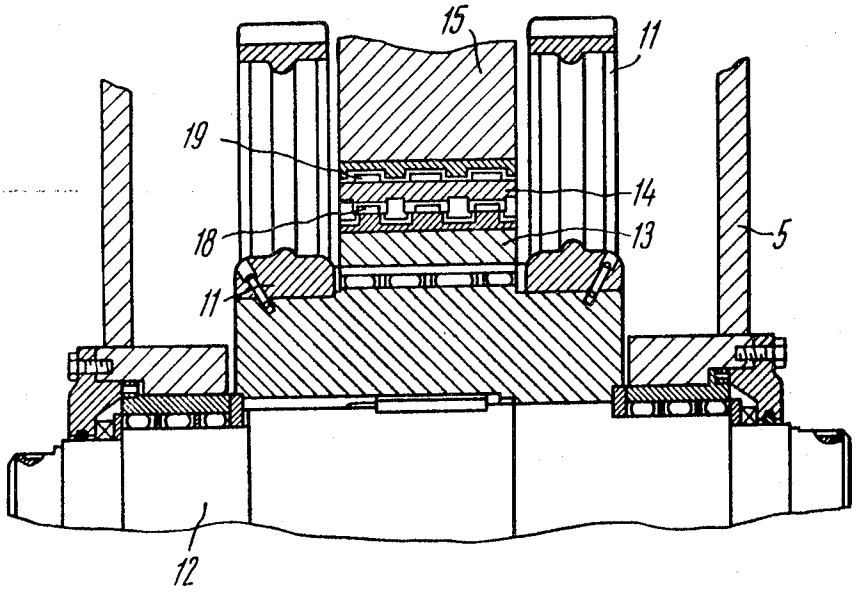

FIG. 3

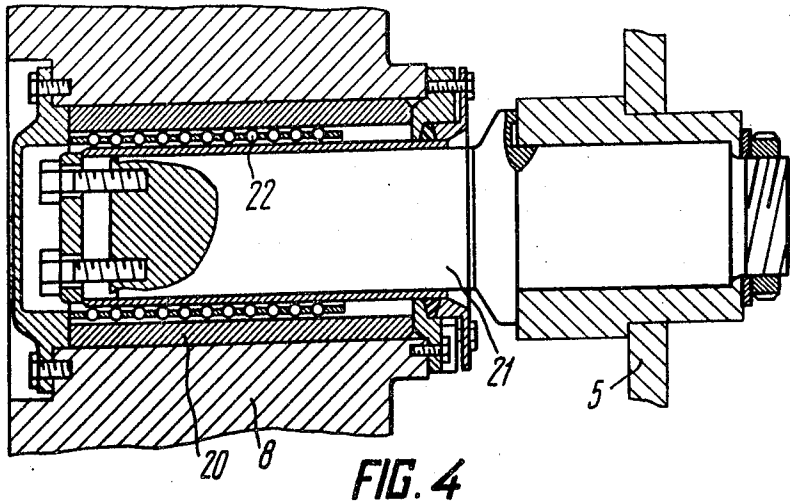

FIG. 4

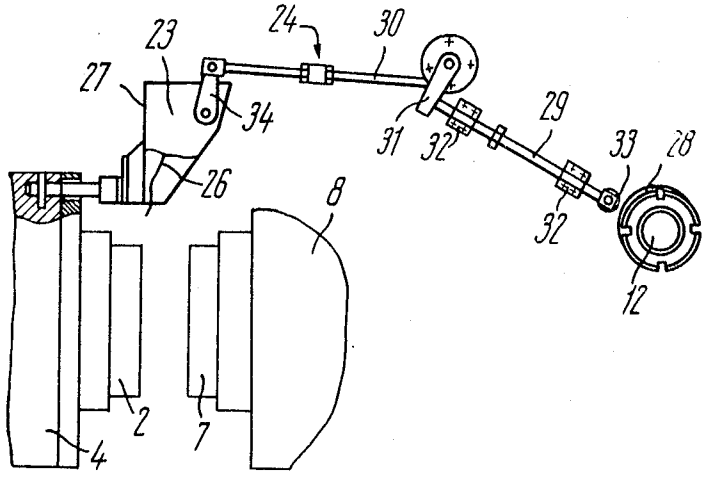
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FIG. 5

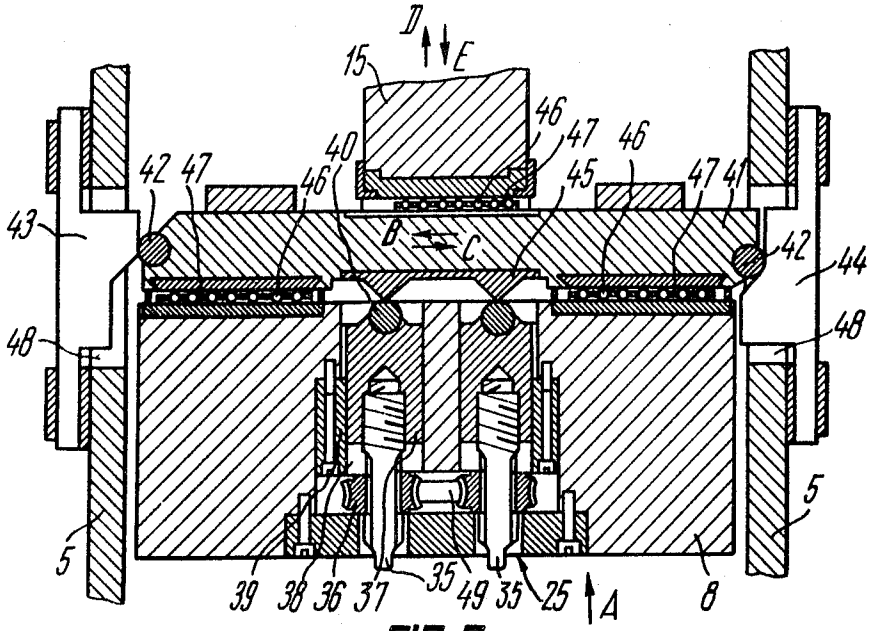
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FIG. 6

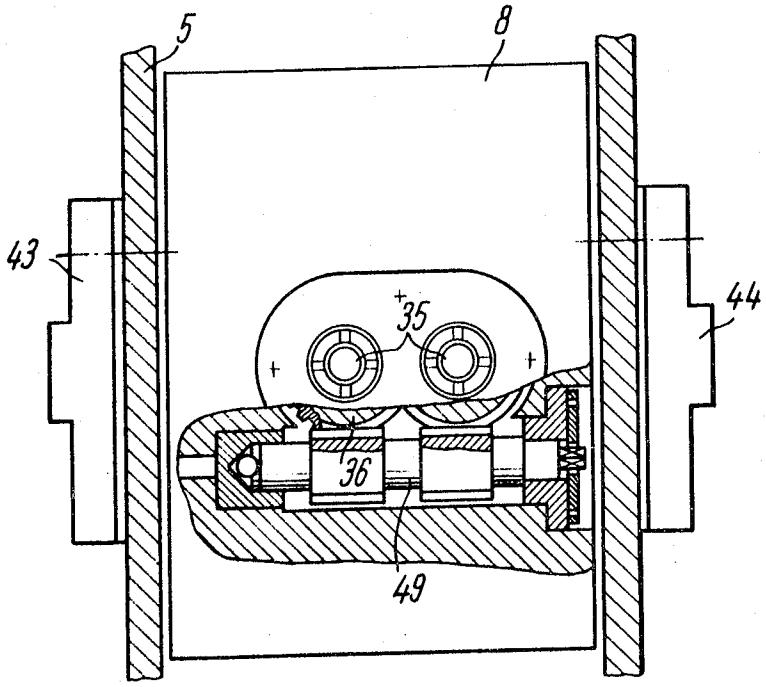

FIG. 7

AUTOMATIC TRANSFER PRESS WITH VERTICAL STAMPING SURFACES FOR STAMPING CONCENTRIC PARTS OF SHEET MATERIAL

The present invention relates to automatic transfer presses with vertical stamping surfaces for stamping two concentric parts of sheet material and can find wide application in electrical industry for manufacturing stator and rotor laminations of electrical machines.

Known in the art are automatic transfer presses with vertical stamping surfaces for stamping two concentric parts of sheet material wherein the punches of the compound die sets, arranged one above the other are secured on the cross-heads of the slides moved horizontally along the frame guides in the opposite directions by a drive shaft via gear wheels mounted on drive shafts which are provided with eccentrics. Besides, said press is provided with a device for periodical feeding of blanks into the die sets and appliances which synchronize the movement of the slides with the opening of said feeding device and the removal of the finished parts from the punches.

Each slide reciprocating in this press consists of cross-heads, front and rear ones, interconnected by four columns. The punches of the die sets are fastened to the front cross-heads of the slides. Such a slide has a heavy weight. Considerable inertia forces produced by the reciprocating motion of such a slide limit the increase in the number of press strokes and, therefore, hold back the rise of press output.

Motion is transmitted from the drive shaft to the driven shaft by a crank gear whose pitman is placed on the driven shaft eccentric by one end while its other end is connected to the rear cross-head of the slide.

In view of the fact that the drive is linked by the crank gear with the rear cross-head of the slide, the blanking force is transmitted to the front cross-head carrying the punches via four long columns which interconnect both cross-heads located on both sides of the press frame. During the blanking stroke the columns are somewhat stretched while after blanking they contract to their initial length. This causes an additional sinking of the punches into the holes of the die which affects adversely the strength of the die sets and leads to their premature wear.

Rapid wear of the die sets is also influenced by the allowable clearances in the articulated joint between the end of the pitman and the rear cross-head and by the clearances in the joint between the eccentric shaft and the crank gear.

Besides, the known presses are characterized by difficult access to the crank mechanisms located inside the box-shaped frame; the upper slide of these presses obstructs access to the crank gear of the lower slide to such an extent that repairs of the lower crank gear call for the removal of the upper slide complete with its crank gear.

An object of the present invention resides in eliminating the aforesaid disadvantages.

The main object of the present invention is to provide an automatic transfer press with vertical stamping surfaces wherein the motion would be transmitted from the drive shaft to the cross-heads by such mechanisms which would simplify the design of the slide, reduce the inertia forces occasioned by its reciprocating motion; eliminate clearances in the joints of the mechanisms which convert the rotary movement of the driven shaft into the reciprocating motion of the slides, allow the use of high-precision hard-alloy compound die sets which place more exacting demands on the design of the automatic transfer press.

This object is accomplished by providing an automatic transfer press with vertical stamping surfaces for stamping two concentric parts of sheet material in which the punches of the compound die sets arranged one above the other are secured on the cross-heads of the slides which are moved horizontally over the frame guides in the opposite directions by a drive shaft via gear wheels mounted on driven shafts provided with eccentrics and in which there are devices for periodical feeding of blanks into the die sets and appliances which synchronize the movement of the slides with the opening of said feeding device and with the removal of the finished parts from the punches wherein, according to the invention, each slide is made in the form of a link mechanism whose link is a vertical plate provided with a port and carrying said cross-heads on the ends while the slide block of said mechanism is located in the port of said plate and mounted on the eccentric.

Thus, making each slide in the form of a link mechanism allows direct transmission of force from the driven shaft to the front cross-head carrying the punch which has simplified the design of the slide an reduced its weight.

The reduction in the weight of the slides has diminished the inertia forces produced by their reciprocating motion and, correspondingly, has increased the number of slide working strokes, thus raising considerably the output of the press.

Besides, making the slides in the form of a link mechanism has simplified the design of the slide and facilitated considerably the access to all the press mechanisms.

It is practicable that rolling-contact supports should be installed between the interacting surfaces of the eccentric and slide block and between those of the slide block and the plate port. This eliminates play and clearances between the interacting parts which, in turn, increases the accuracy of stamping and allows the use of high-precision hard-alloy die sets.

In view of the changes in the slide design it is desirable that the appliance which synchronizes the removal of the finished parts from the punches with the movement of the slides would consist of pushers provided with worm wheels and screwed into sleeves which are built into the punch-carrying cross-heads with a provision for horizontal movement of a floating plate located between said cross-heads and the link and provided with projections for interacting with the sleeves, and of master forms mounted on the press frame on both sides of the floating plate and transmitting motion to the latter in the direction perpendicular to the plane of link mechanism movement.

Such a design of the appliances synchronizing the removal of the finished parts widens the range of adjustments and allows control of the moment of removal of the finished parts.

It is practicable that the floating plate should be provided with roller supports interacting with the master forms during the motion of the links and it is desirable that the master forms should be mounted on the frame with a provision for setting-up motions which makes it possible to eliminate play and reduce friction between the interacting parts.

It is desirable that the appliance which synchronizes the opening of the device periodically feeding the blanks into the die set with the movement of the slides would comprise two flat cams with identical profiles, secured on the driven shaft with a provision for changing and fixing their relative positions and connected with the device through an intermediate lever, a spring-loaded pusher and a rod, the latter being adjustable for length and articulated to the device while the pusher is provided with a roller contacting the cams.

Such a design of this device is also interrelated with the changes in the slide design; besides, it provides for the possibility of wider adjustments of the moment and duration of device opening.

Now the invention will be described in detail by way of example with reference to the accompanying drawings (in which:

FIG. **1** is a general view of the press according to the invention, without the side wall;

FIG. **2** illustrates a slide complete with the gear wheels of the press drive;

FIG. **3** is a section taken along line III—III in FIG. **2**;

FIG. **4** illustrates the guide column of a press slide;

FIG. **5** shows the appliance which synchronizes the movement of the slide with the opening of the device for periodical feeding of round blanks into the open die set;

FIG. **6** shows the appliance which synchronizes the movement of the slide with the removal of the finished article from the press punch;

FIG. **7** is a view along arrow A in FIG. **6.**)

The automatic transfer press with vertical stamping surfaces for stamping two concentric parts of sheet material, e.g. laminations of electrical machine magnet circuits, is provided with compound die sets located one above the other. The upper die set is intended to stamp stator laminations and round blanks while the lower die set is provided for stamping rotor laminations from round blanks fed from the upper die set.

The dies **1** and **2** (FIG. **1**) of these die sets are mounted, respectively, on bolsters **3** and **4** secured vertically on the frame **5**, one under the other.

The punches **6** and **7** are secured on the cross-heads **8** of the slides **9** which, like the bolsters **3** and **4** are arranged one under the other. The slides **9** are moved horizontally in the mutually opposite directions by a drive shaft **10** via gear wheels **11.** The gear wheels **11** are mounted on driven shafts **12,** each of said shafts being provided with an eccentric **13.**

Each slide **9** (FIG. **2**) is made in the form of a link mechanism comprising a link and a slide block **14.** The link is a vertical plate **15** with a port **16.** Mounted on the ends of the plate **15** are cross-heads **8** and **17,** the front cross-head **8** carrying the punch while the rear cross-head **17** is used only as a support of the link mechanism.

The slide block **14** is located in the port **16** of the plate **15,** being secured to the eccentric **13.**

To eliminate play and improve the structural rigidity of the press also to extend the life of the interacting surface of the link mechanisms, the press is provided with roller supports between these surfaces. The stamping force is transmitted from the eccentric **13** (FIG. **3**) via the roller support **18** to the slide block **14** wherefrom it is transmitted via roller **19** to the plate **15** and to the front cross-head **8** (not shown in the drawings) mounted on said plate **15** and carrying the punches.

To ensure directional movement of the slides **9** (FIG. **2**) with cross-heads **8** and **17,** the latter are provided with a pair of bushings **20** (FIG. **4**) which serve as sockets for the guide columns **21** fastened in the frame **5.**

Each pair of bushings **20** is located diagonally in the cross-heads **8** and **17** and provided with roller supports **22** which reduces considerably the forces of friction arising on the surfaces of the guide columns **21** moving constantly in the bushings **20,** eliminates the possible play and allows the use of high-precision hard-alloy die sets in the press.

The stator laminations can be blanked in the die set of the upper slide either from a sheet material or from round blanks punched in advance. This depends on the design of the die set installed on this slide. The rotor laminations are punched in the lower die set from round blanks fed from the upper die set.

Installed above the die set which punches the laminations from round blanks (in this example under the lower die **2**) is a device **23** (FIG. **1**) for periodical feeding of round blanks into the open die set. Besides, the press incorporates appliances **24** (FIG. **5**) and **25** (FIG. **6**) which synchronize the opening of the device **23** (FIG. **5**) and the removal of the finished articles from the punches, respectively, with the movement of the slides.

The device **23** for periodical feeding of the blanks into the die set is fastened to the frame **5** or to the bolster **4** and is made of two plates **26** and **27** one of which (**26**) is rotatable and installed at a certain angle to the other plate **27.**

The appliance **24** which synchronizes periodical opening of the device **23** and feeding of round blanks into the open die set with the movement of the slides comprises two flat cams **28,** a spring-loaded pusher **29** and a rod **30.**

The cams **28** of the same profile are mounted on the driven shaft with a provision for changing and fixing their relative positions. This ensures a high accuracy in setting the moment and duration of opening of the device **23** which is particularly important at high speeds of feeding the blank into the open die set.

The larger the diameter of the cam **28** the higher accuracy can be obtained in setting the moment and duration of opening the device **23.**

The rod **30** consists of two parts connected by a nut which allows its length to be changed, if necessary. Such a change of the length of the rod **30** is required for adjusting the turning angle of the rotatable plate **26.**

The rod **30** and pusher **29** are interconnected by an intermediate lever **31.**

The spring-loaded pusher **29** moves in the guides **32** secured in the frame **5** and is provided with a roller **33** which contacts the cams **28.** The rod **30** is articulated to the lever **34,** the later being connected to the rotatable plate **26** of the device **23.**

The appliances **25** (FIG. **6**) which synchronize the removal of the finished articles from the punches with the movement of the slides are installed in the cross-heads **8** of the upper and lower slides.

Each appliance **25** consists of a pair of pushers **35** provided with worm wheels **36.** One end of the pushers **35** protrudes beyond the cross-head **8** and bears against the plate of the die stripper (the plate is not shown in the drawing). The other end of these pushers **35** is threaded and screwed into sleeves **37.** The sleeves **37** can move freely in the channels **38** of the cross-head **8**

but are kept from rotating by means of knife edges 39 entering the slots in the sleeves 37. The sleeves 37 are provided with roller supports 40.

Located between the link plate 15 and the cross-head 8 is a floating plate 41 provided at the ends with roller supports 42 which bear against the shaped surfaces of the master forms 43 and 44 mounted movably on the frame 5. Besides, the plate 41 has projections 45 against which the roller supports 40 of the sleeves 37 bear. The master forms 43 and 44 transmit motion to the plate 41 in the direction perpendicular to the plane of slide movement (the direction of movement of the plate 41 is shown by arrows B and C while the movement of the slides is shown by arrows D and E).

To reduce friction arising when the plate 41 moves relatively to the cross-head 8 and link 15, there are roller supports 46 located between them and kept against falling out by cages 47.

The moment of removal of the finished articles from the punches 6 and 7 can be adjusted by moving the master forms 43 and 44 in the sockets 48 of the frame 5. The speed of removal is adjusted directly by the pushers 35 which can be screwed into the sleeves 37 to a different depth. For this purpose the pushers 35 are screwed in or out as required by means of a twin roller 49 (FIG. 7) interacting with the worm wheels 36.

The automatic transfer press functions as follows.

The shaft 10 (FIG. 1) is rotated by an electric motor via a V-belt drive (not shown in the drawing) and this rotation is transmitted by the gear wheels 11 to the driven shafts 12 provided with eccentrics 13. The eccentrics 13 transmit motion to the slide blocks 14 (FIG. 2). The rotary motion of the eccentrics 13 is resolved in the link mechanism into the vertical motions of the slide block 14 in the port 16 of the link 15 and the horizontal motions of the link 15, the guide columns 21 (FIG. 4) sliding in the bushings 20 of the cross-heads 8 and 17. Since the eccentricity of both eccentrics 13 (FIG. 1) is oriented in opposite directions, the movement of the links is shifted in phase by 180°.

Metal sheets or strips are fed in a vertical position (in a horizontal direction) into the upper die set which is secured on the upper cross-head 8 and bolster 3. This die set punches out the stator laminations and round blanks for the rotor laminations. After the stator laminations are removed from the punches 6 of the upper die set they fall on a tray 50 and are moved along it onto a mandrel (not shown in the drawing). The blanks of rotor laminations fall into the device 23 where they are held to the moment of opening of the lower die set. The opening moment of the device 23 (FIG. 5) is set by the cams 28 mounted on the shaft 12. During rotation of the shaft 12 the cams 28 actuate the device 23 via the rod 29, intermediate lever 30 and rod 31 and turn the plate 26. Falling out of the device 23 (FIG. 1), the blanks enter the lower die set where rotor laminations are punched from them. The finished rotor laminations fall out of the die set on the tray 51 and are moved along it onto a mandrel (not shown in the drawing).

The removal of the finished articles from the punches is synchronized with the movement of the slides by means of the appliance 25 (FIG. 6). As the link 15 and the front cross-head 8 move in the direction of arrows D and E, the floating plate 41 is moved by the projections and master forms 43 and 44 along arrows B and C. The projections 45 of the plate act on the roller supports 40 of the sleeves 37 so that the pushers 35 come periodically to bear against the plate of the die stripper (not shown in the drawing), thus removing the finished articles.

What is claimed is:

1. An automatic transfer press with vertical stamping surfaces for stamping two concentric parts of sheet material, comprising: a frame; horizontal frame guides; compound die sets arranged one under the other; slides moving horizontally opposite to each other in said guides and made in the form of link mechanisms; a drive shaft; driven shafts; gear wheels mounted on said driven shafts; another gear wheel mounted on the drive shaft and meshing with first-named gear wheels; eccentrics secured on said driven shafts; the link of each of said link mechanisms is a vertically arranged plate; cross-heads fastened on the end of said plates; a port made in each of said plates; a slide block of each of said mechanisms, moving in said port of the plate and secured on the eccentric of the driven shaft; punches of said die sets secured on said cross-heads; dies of said die sets secured on said frame; a device for periodical feeding of blanks into said die sets located above said die sets; an appliance which synchronizes the opening of said device with the movement of said slides; an appliance which synchronizes the movement of said slides with the removal of the finished articles from said punches.

2. An automatic transfer press according to claim 1 wherein there are roller supports located between the interacting surfaces of the eccentric and slide block and between those of the slide block and the port of the plate.

3. An automatic transfer press according to claim 1 wherein the appliance which synchronizes the movement of the slides with the removal of the finished articles from the punches comprises pushers provided with worm wheels and screwed into the sleeves which are built into cross-heads with a provision for horizontal movement, said cross-heads carrying punches, a floating plate located between said cross-head and link and provided with projections for interacting with the sleeves, and master forms mounted on the frame on both sides of the floating plate and transmitting motion to the latter in the direction perpendicular to the plane of motion of the link mechanism.

4. An automatic transfer press according to claim 3 wherein in the floating plate is provided with roller supports interacting with the master forms during the movement of the slides, said master forms being mounted on the frame with a provision for changing their position on said frame.

5. An automatic transfer press according to claim 1 wherein the appliance synchronizing the opening of said device with the movement of the slides comprises two flat cams of the same profile secured on the driven shaft with a possibility of changing and fixing their relative positions, said cams being connected with said device via an intermediate lever, a spring-loaded pusher and a rod, the latter being adjustable for length and articulated to the device whereas the pusher has a roller contacting the cams.

* * * * *