April 27, 1965 W. H. J. D. DAALDEROP 3,180,294

ECCENTRIC PRESS WITH FEEDING MECHANISM

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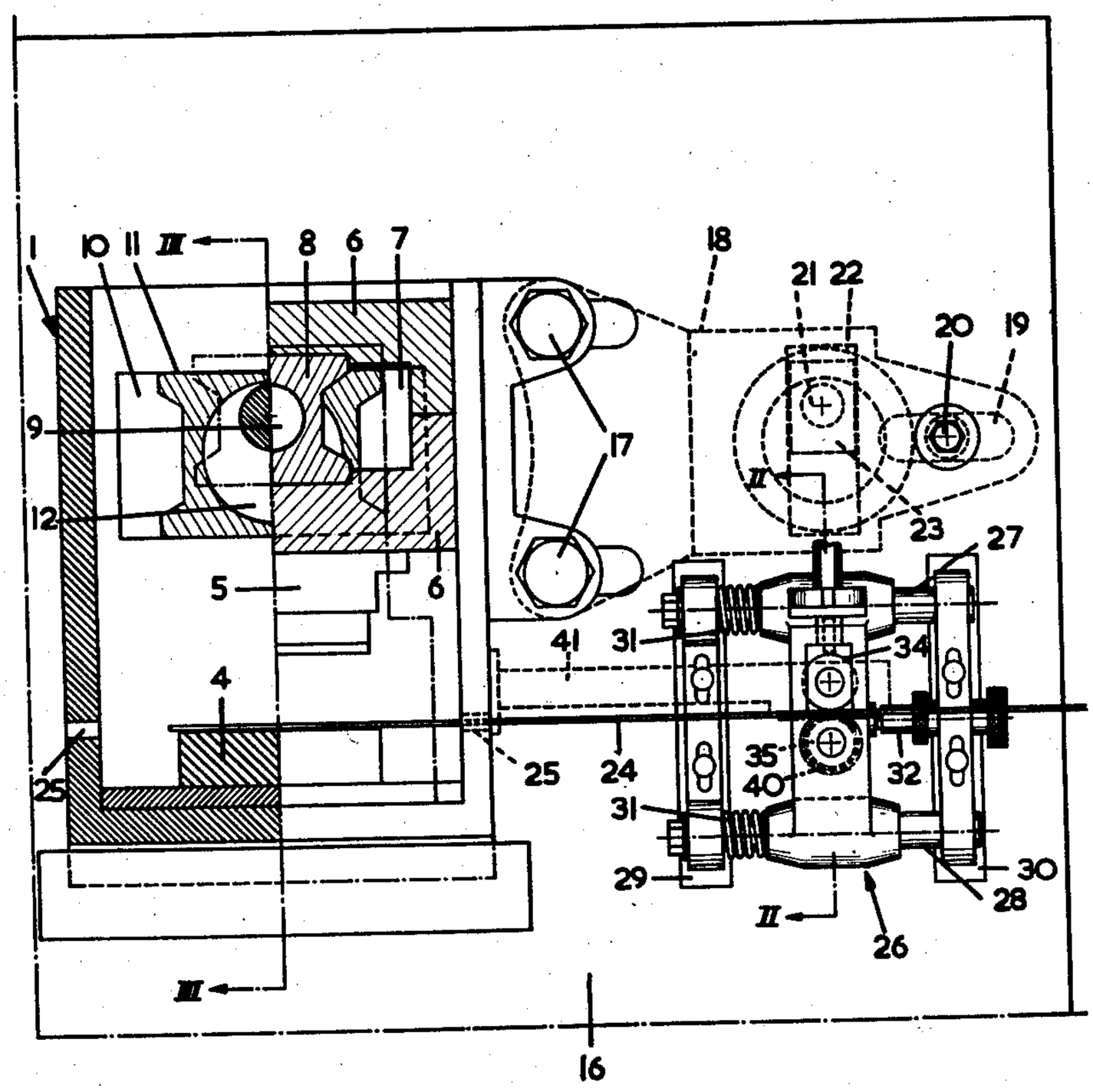

FIG. 1

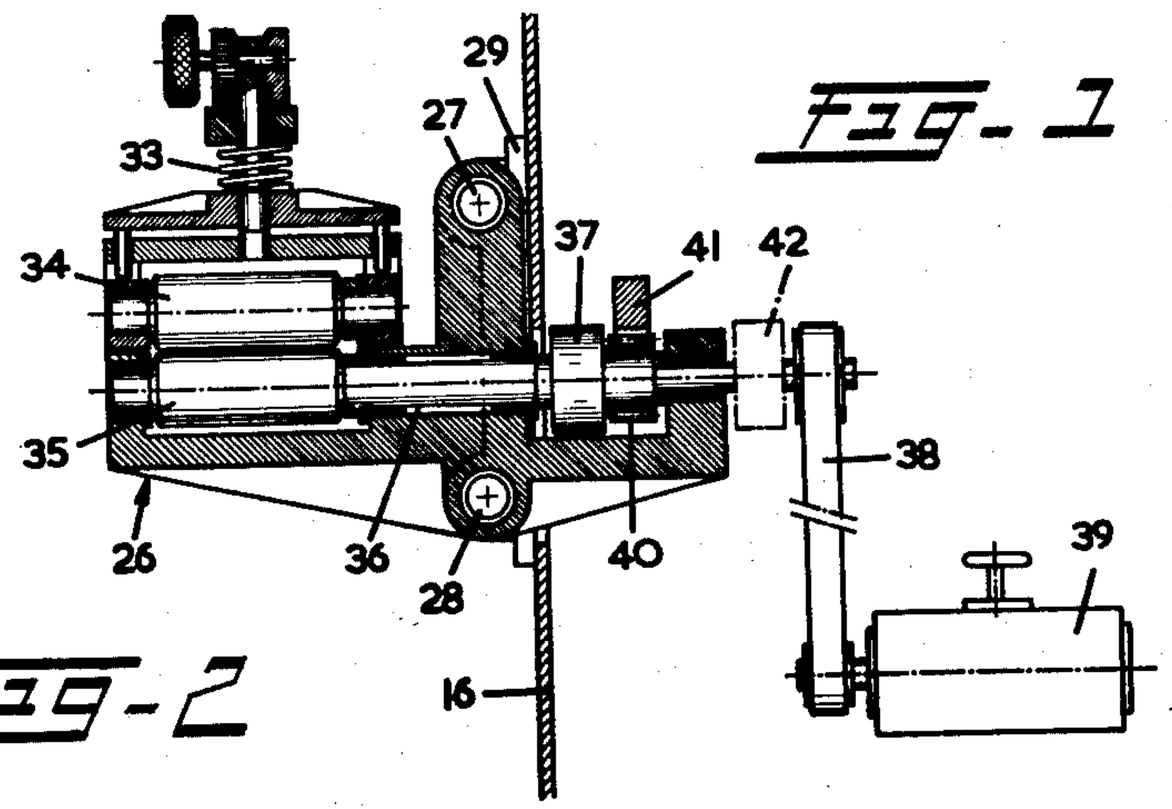

FIG. 2

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Fig. 3

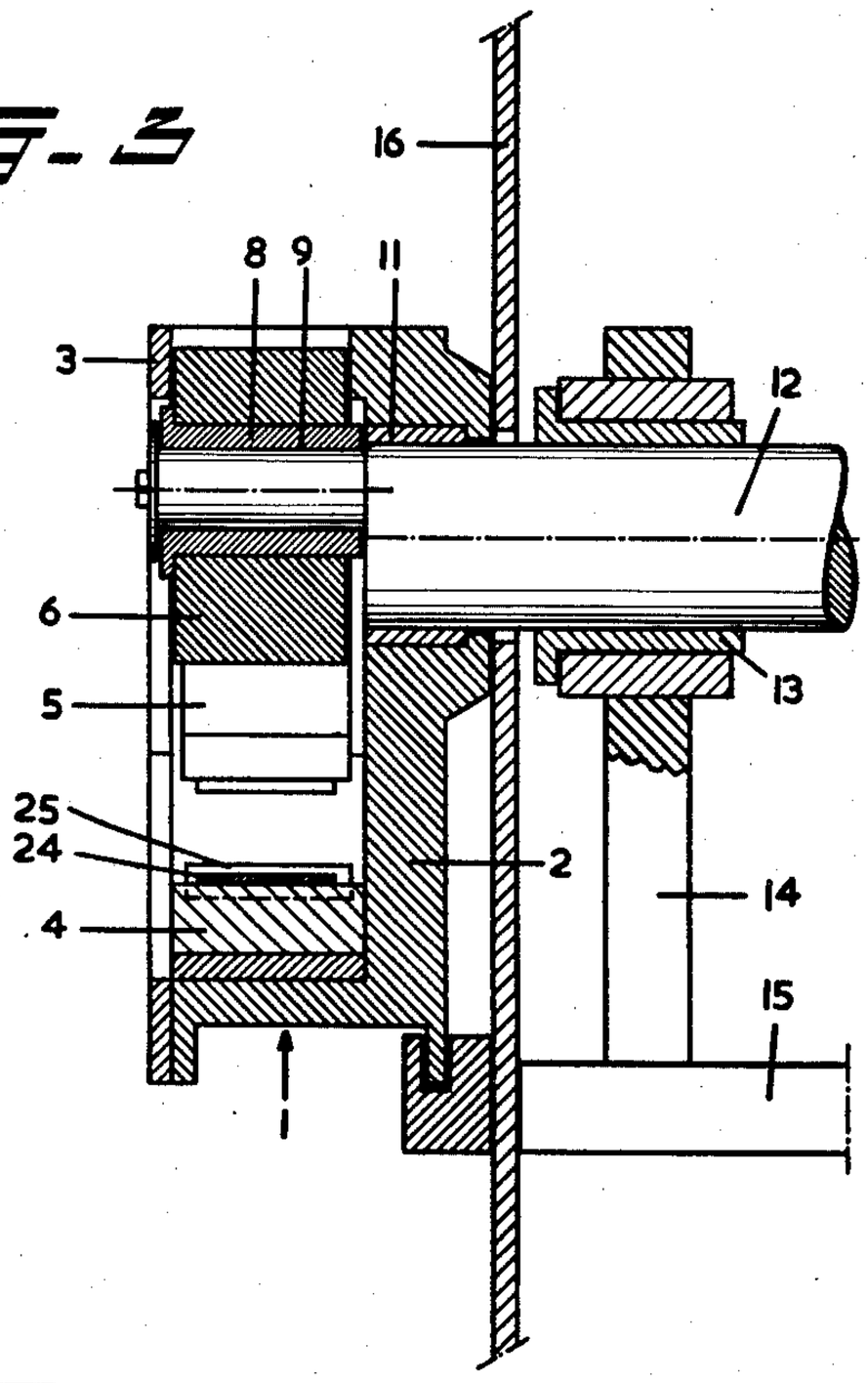

Fig. 4

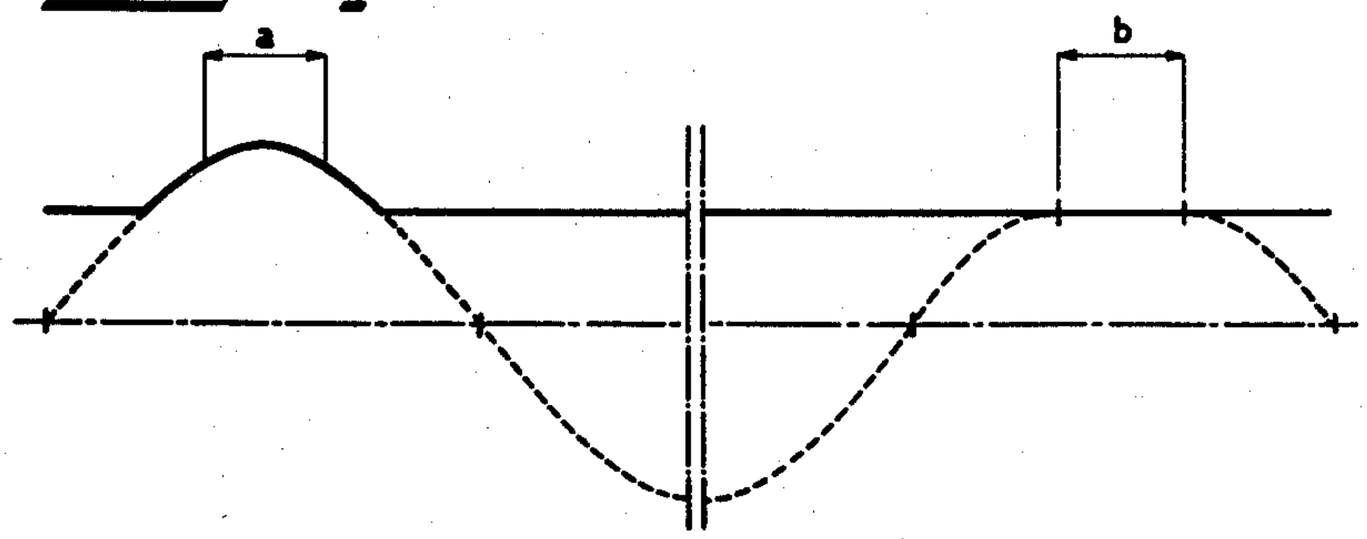

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Fig. 5

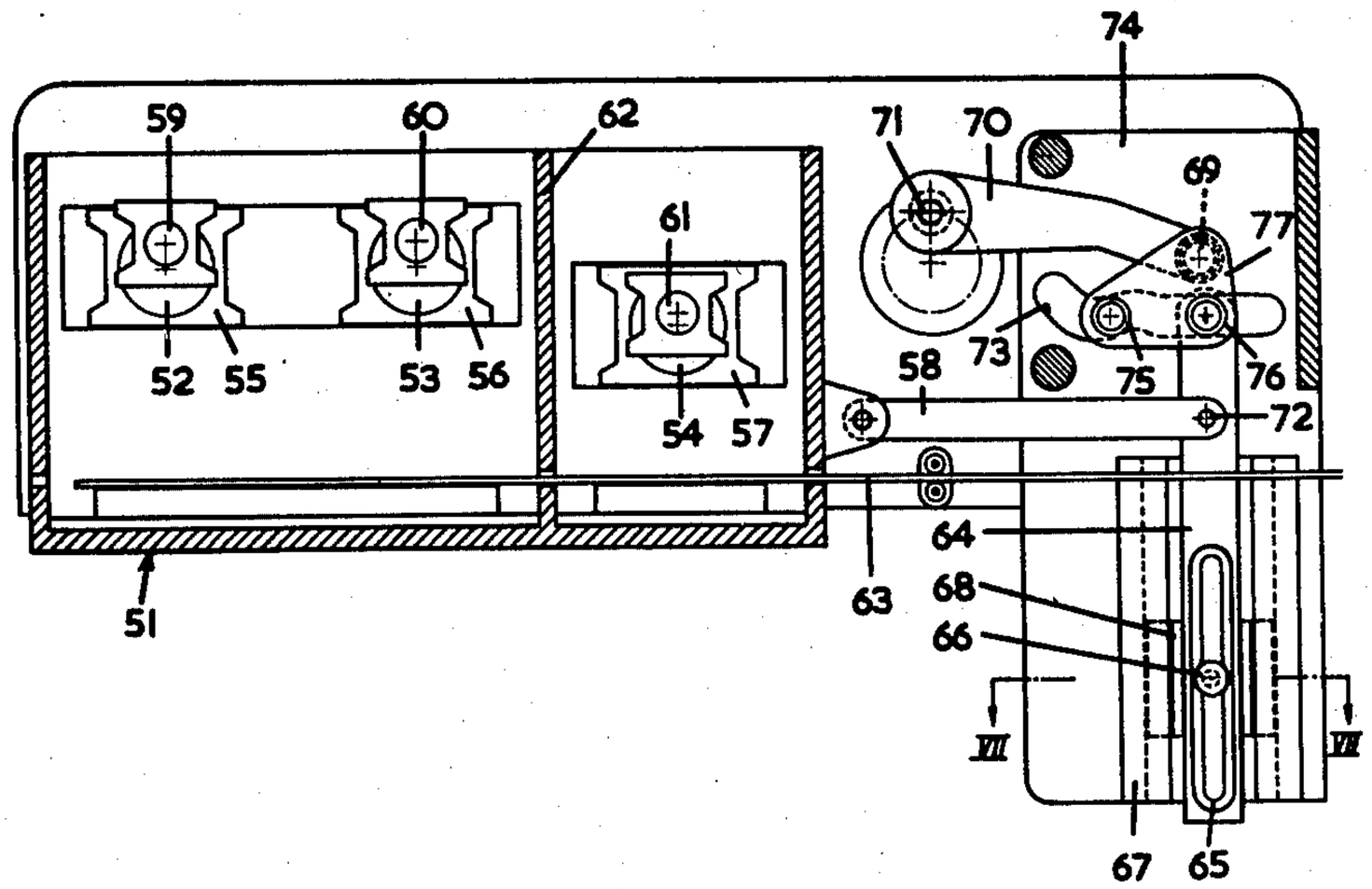


Fig. 6

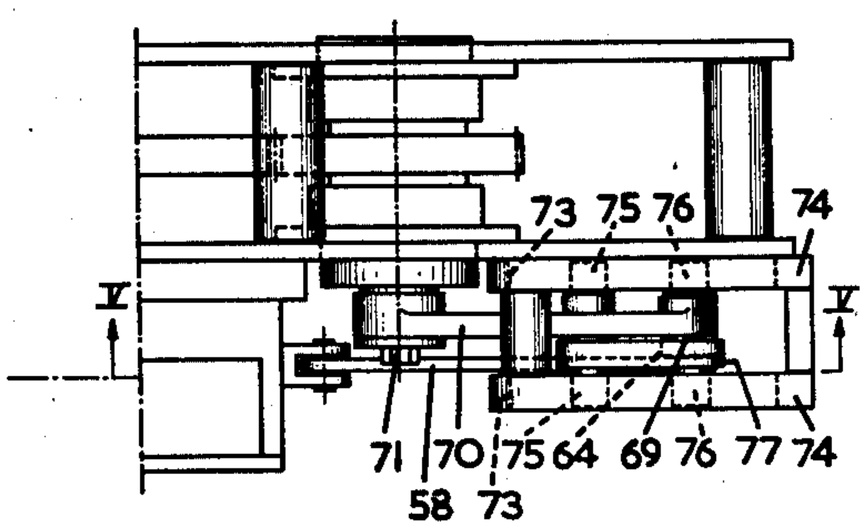
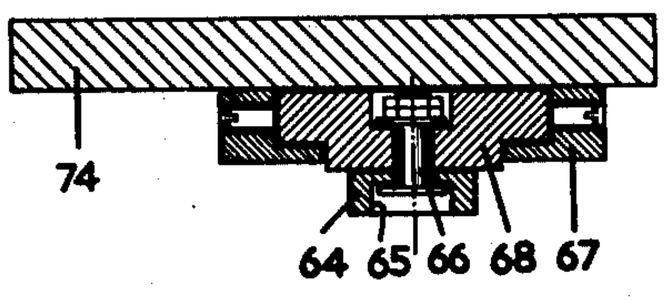


Fig. 7



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ECCENTRIC PRESS WITH FEEDING MECHANISM

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11 Claims. (Cl. 113—113)

The present invention relates to a press in which two main sections of a tool assembly are guided relatively to and from each other in the direction of working for working on a strip of material fed by a feeding mechanism in a direction of travel transverse to said direction of working, a movement in the direction of travel of the strip of material being imparted to a carrier supporting said tool assembly during the effective part of a working stroke. Such presses are known in which the tools can be activated by hydraulic means separately from the means imparting a movement to the tool carrier synchronizing the carrier movement with the strip movement.

It is an object of the invention to provide such a press with eccentric tool actuating means and to eliminate the drawbacks normally experienced with eccentric presses, which drawbacks are especially felt with high rates of production, in that as a result of the occurring delaying and accelerating forces the precision of the feed of the strip of material is lost.

A further object of the invention is to provide an effective and rational construction of a press which is improved with respect to the drawbacks mentioned.

In a press according to the invention the drive means for actuating the tool assembly in the direction of working consists of at least one eccentric coupled to one of said main sections of the tool assembly by way of means allowing for relative movement between the eccentric and this main section in said direction of travel.

The invention will be explained with reference to the accompanying drawings, in the course of which description a number of particulars of the invention will become apparent.

In the drawings:

FIG. 1 is a front view of a portion of the press having mounted on it the tool carrier with moving mechanism and the strip feeding mechanism, some parts being shown in cross-section;

FIG. 2 is a cross-sectional view of the feeding mechanism on the line II—II in FIG. 1;

FIG. 3 is a cross-sectional view of the tool carrier on the line III—III in FIG. 1;

FIG. 4 is a motion diagram;

FIG. 5 illustrates a tool carrier for a press having a-multiple eccentric mechanism, and provided with a different moving mechanism for the tool carrier from the press according to FIG. 1, in cross-section on the line V—V in FIG. 6;

FIG. 6 is a top view of the moving mechanism according to FIG. 5;

FIG. 7 is a cross-sectional view on the line VII—VII in FIG. 5.

The tool carrier 1 according to FIGS. 1 and 3 is of substantially rectangular peripheral shape and has a back wall 2 and a frame-like plate 3 on the front. Of a tool assembly, the lower main section 4 is mounted to the bottom of the carrier 1, the upper main section 5 being mounted against a guide block 6, which is guided along the vertical sidewalls of the carrier 1. The guide block 6 is provided with a horizontal guide slot 7 with parallel, plane, top and bottom edges. A block 8 is

mounted in the slot 7 for horizontal movement but locked from vertical movement, and is keyed to the eccentric tap 9. In the back plate 2 of the carrier 1 is provided a slot 10 with parallel top and bottom edges, fitting a main shaft block 11 for movement in horizontal direction but locked from movement in vertical direction, which shaft block 11 is keyed to the main shaft 12, which at this end is itself journalled in a bearing 13, fixedly secured to the frame plate 16 by way of supports 14, 15. The carrier 1 and the tool guide block 6 are permitted to move to and fro horizontally by reason of the slots 10 and 7, respectively, while the eccentric tap 9 can move the guide block 6 vertically, independently of the horizontal position of the guide block. This renders it possible for the tool assembly to be given a movement in the direction of travel of the strip of material during the effective part of the working stroke, synchronous with and equal to the movement of the strip of material, by means of a separate moving mechanism, so that the strip can be supplied at a constant rate, or with comparatively small variations in the velocity.

The moving mechanism for the carrier 1, shown in dash lines in FIG. 1, comprises a control plate 18 situated behind the frame plate 16, rigidly connected with the carrier 1 by means of bolts 17, and at its end, by means of a slot 19, guided along a fixed pin 20 on the frame plate 16, so that the carrier 1 is locked from rotation about the shaft 12. The control plate 18 is driven by an eccentric 21 on a shaft (not shown) geared to the main shaft 12 somewhere behind the frame plate 16. The eccentric 21 engages the plate 18 by way of a sliding block 23 freely movable up and down in a vertical slot 22 of the plate 18 and fitting the same horizontally. The eccentricity of the eccentric 21 can be made adjustable in a known manner, so that the carrier 1 performs a harmonic movement to and fro with an adjustable amplitude.

In order for the movements in the direction of travel of the carrier 1 and the strip 24, passed through the carrier by way of slots 25 in the sidewalls thereof, to be fully adapted to each other during the effective part of the working stroke, an additional movement is imparted to the strip, which for the rest is, for example, supplied at a constant velocity, the said movement corresponding to the velocity top of the sinusoid of the movement diagram of the carrier 1, as indicated in the left hand portion of the diagram in FIG. 4, or the movement of the carrier 1 is flattened over the top portion of the sinusoid to the constant velocity of the strip, as shown in the right hand portion of FIG. 4.

If only care is taken that the period of the movement modification exceeds that of the effective working stroke, *a* and *b*, respectively, in FIG. 4, the adjustment does not require great precision.

The first method has been applied to the embodiment according to FIGS. 1 and 2, the second to that according to FIGS. 5 and 6.

In FIGS. 1 and 2 the feed mechanism 26 is slidably mounted on rods 27, 28 secured to the frame plate 16 by means of supports 29, 30. Springs 31 tend to push the mechanism away oppositely to the direction of travel against the adjustable stop member 32 secured to the support 30.

The feeding mechanism 26 comprises two rollers 34, 35 biased towards each other by a spring 33, and firmly gripping the strip 24, the latter of which rollers is driven by way of the shaft 36, a one-way coupling 37, and a belt or chain transmission 38, by a speed variator 39. The one-way coupling 37 cooperates with a pinion 40, which is engaged by a rack 41 connected to the carrier 1. The pitch circle diameter of the pinion 40 is equal to the diameter of the roller 35, which diameter, in conjunction with the number of revolutions, determines the rate of feed of

the strip 24. When during a certain period the velocity of the carrier 1 exceeds such rate of feed, the rack 41 overtakes the strip 24 and hence the pitch circle of the pinion 40, imagined to rotate along with the shaft 36, and tends to cause it to rotate faster than the shaft 36, so that the shaft 36 and the pinion 40 are coupled to each other by the one-way coupling 37. Inasmuch as the shaft 36 and hence the pinion 40 cannot rotate faster than is admitted by the variator 39, the rack 41 will pull along the entire feeding mechanism, so that the strip 24 will then have the same velocity as the carrier 1. If a second one-way coupling is applied between the variator 39 and the coupling 37, as indicated in dot-dash lines at 42, the shaft 36 is permitted to rotate faster relative to the speed determined by the variator 39, and during its overtaking period the rack 41 will cause the roller 35 to rotate faster while the feeding mechanism remains in its place.

In the embodiment according to FIGS. 5–7, more than one main shaft with eccentric is used, cooperating in a manner similar to that described with reference to FIG. 1 with the tool carrier 1. The main shafts 52–54 are interconnected, for example, by means of gear wheels, and carry by way of shaft blocks 55–57 the carrier 51 for horizontal movement. By using two shaft blocks, for example, 55 and 57, the carrier 51 is locked from rotation, so that it can be driven by a rod 58 pivoted to it.

As appears from FIG. 5, the shafts 52–54 can be positioned relative to each rather at random. Also, the working cycles of the eccentric pins 59–61 may be shifted in phase relative to each other, if, for example, in a long, successive-step die the operations must not take place simultaneously. So long as the effective part of the working stroke falls within the synchronisation period of the feed rate of the strip and the movement of the carrier, any phase shifting is possible.

In the carrier 51 an intermediate wall 62 is indicated, which can be used if the upper main section of the tool assembly is not integral, and the separate parts of it are to be guided separately.

In this embodiment the strip of material 63 is supplied by a feeding mechanism (not shown) at a constant rate. The tool carrier 51 is reciprocated by way of the rod 58 by a moving mechanism which flattens the top of the sinusoid and makes it coincide with the constant speed line of the strip in the manner as indicated in the right hand portion of FIG. 4. This moving mechanism is provided with a swinging arm 64, whose hinge pin 66, which engages a straight slot 65, is adjustable relative to the drive tap 69 by displacement of the hinge pin bearing 68 in the track formed by guide ribs 67, the drive tap being coupled to a crank pin 71 by means of a connecting rod 70. The point of attachment 72 of the rod 58 with the arm 64 may also be adjustable along this arm, and so may the eccentricity of the crank pin 71.

In general the adjustment of the hinge pin 66 will be sufficient for the adaptation to the length of the strip advanced. By reason of the fact that the adjustment of the hinge pin 66 is effected along a straight path of adjustment, the motion pattern remains substantially unchanged.

This motion pattern, as indicated in FIG. 4, is partly determined by a specially formed slot 73 in each of the frame plates 74, in which slot are guided two follower rollers 75, 76 rotatable about shafts mounted in a control plate 77, which is also hinged to the arm 64 by means of the shaft for the follower roller 76, as a consequence of which the follower rollers impart an additional swinging motion to the arm 64 in following the track defined by the slot 73. The shape of the slot 73 is such that it causes a swinging motion to be superposed on the rocking motion of the arm 64 imparted by the crank pin 71, so that the top of the sinusoid of the motion of the carrier 51 is flattened in the manner illustrated in FIG. 4.

It should be noted that the direct suspension of the tool carriers 1 and 51 from the main shaft or shafts has the advantage that the tool reaction forces do not compensate each other by way of the frame of the press, so that the frame permits of a light construction.

In the embodiments described the tool carriers are themselves carried by one or more sliding blocks. These sliding blocks may be replaced by or provided with rolling members. It is also possible to support a tool carrier by means of a rocking rod, preferably directed substantially vertically, or by means of a plurality of such rods completing, for example, a hinging parallelogram construction. These rods may then be supported from the main shaft or main shafts direct or by way of a yoke, their hinge connections to the tool carrier being situated either above or below said shaft or shafts.

It may also be advantageous so to drive the tool carrier that a different velocity trend is obtained from that selected in the embodiments described as the starting point for the mutual adaptation of the velocities of the strip of material and of the carrier. It is possible so to drive the tool carrier that the mutual adaptation of the velocities may be effected over a larger portion of a working cycle, and/or that only minor differences in velocity have to be compensated for, and possibly that in special cases the additional measures for the adaptation of the velocities are superfluous.

The use of cam and follower elements allows of a wide variety of drive possibilities. In that case it is also advantageous to interpose a swinging arm with a substantially rectilinear adjustment path for the point of application of a hinge transmitting the motion.

It may be most advantageous to drive the tool carrier by means of a swinging arm swung by a crank pin or other drive member moving in a closed path and having a varying distance from the point of articulation of the swinging arm during its cycle, since this offers the possibility of using a larger portion of a cycle for the movement of the carrier in the direction of travel of the strip of material, and/or for keeping the velocity of the tool carrier closer to a constant value during such a period. In such drives the driving element is slidable along the swinging arm or the swinging arm is slidable in its hinge points. The driving element may be connected with a crank arm and move along a circular path. It may also be connected with a point of, for example, a chain or the like passed over two pulleys rotating at a constant speed, so that in the sections between the pulleys moves rectilinearly at a constant speed, which movement can be transmitted to the tool carrier as a similar movement.

I claim:

1. A press comprising a frame with driving gear means, a tool carrier, two main sections of a tool assembly guided for relatively rectilinear movement in a direction to and from each other defining a direction of working supported by said carrier, a feeding mechanism drivingly connected with said gear means to feed a strip of material in a direction to said tool assembly defining a direction of travel, said directions of working and travel being transverse to each other, means supporting said tool carrier movably in said direction of travel, carrier drive means drivingly connected to said gear means to reciprocate said tool carrier in said direction of travel, tool drive means to actuate said tool assembly in said direction of working independently of the position of said tool carrier in said direction of travel, means connecting said carrier drive means with said feeding mechanism to synchronize the movement in the direction of travel of the strip material and of said tool carrier during the effective part of a cycle of press operation, said tool drive means comprising at least one eccentric to be coupled to one of said main sections of the tool assembly by means allowing for relative movement between said eccentric and said main section in said direction of travel.

2. A press according to claim 1, in which said tool carrier comprises a guide block guided by said tool carrier for movement in the direction of working and provided with a guide slot extending in the direction of travel, said

eccentric being pent-up in said guide slot immovably in the direction of working and movably in the direction of travel relative to the tool carrier.

3. A press according to claim 2, in which said tool carrier is supported in the direction of working by a shaft carrying said eccentric.

4. A press according to claim 1, in which said carrier drive means comprises a swinging arm pivoted in a fulcrum to said frame, a coupling member for connecting said arm to the tool carrier being adjustable along a substantially straight portion of the swinging arm extending substantially radially relative to the fulcrum.

5. A press according to claim 1, in which said carrier drive means comprises a swinging arm pivoted in a fulcrum to said frame and coupled to said carrier, said arm being provided with a substantially straight portion along which said fulcrum is adjustable relative to said arm.

6. A press according to claim 1, in which said carrier drive means comprises a swinging arm pivoted in a fulcrum to the frame of the press and coupled to said carrier, a coupling member hingeably connected to said pivoting arm and to said gear means to swing said swinging arm, and cam and follower means between said frame and said coupling member to modify the swinging movement imparted to said swinging arm.

7. A press according to claim 1, in which there is provided between said tool carrier and said feeding mechanism overtake coupling means comprising one-way coupling elements adapted to become effective on movement of said tool carrier in the direction of travel with a speed higher than the speed of delivering the strip of material by said feeding mechanism.

8. A press according to claim 7, in which said overtake coupling means comprises a connecting element engaging drivingly a disc element mounted on the shaft of a feed roller of the feeding mechanism, the effective engaging pitch of said disc element having a diameter equal to the

effective diameter of said feed roller, said disc element being drivingly connected to said feed roller shaft through one-way coupling elements, and said feeding mechanism being slidably supported in the direction of travel by said frame.

9. A press according to claim 7, in which said overtake coupling means comprises a connecting element engaging drivingly a disc element mounted on the shaft of a feed roller of the feeding mechanism, the effective engaging pitch of said disc element having a diameter equal to the effective diameter of said feed roller, said disc element being drivingly connected to said feed roller shaft through a first set of one-way coupling elements and said feed roller shaft being drivingly connected through a second set of one-way coupling elements to said driving gear means, said first and second sets of coupling elements being reversely effective.

10. A press according to claim 1, in which said carrier drive means comprises a swinging arm pivoted in a fulcrum to said frame, a driving element moving in a closed track engaging drivingly said swinging arm at a distance to said fulcrum varying during the passage of said driving element through said closed track.

11. A press according to claim 10, in which the driving element is moved and carried by a chain passed over two pulleys.

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