United States Patent [19]

Maurer

[11] **3,802,310**

[45] **Apr. 9, 1974**

[54] **PRECISION PUNCH PRESS**

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[22] Filed: **Mar. 5, 1973**

[21] Appl. No.: **338,298**

[30] **Foreign Application Priority Data**

Mar. 3, 1972 Switzerland 3187/73

[52] **U.S. Cl.** **83/527,** 83/248

[51] **Int. Cl.** **B26d 7/26**

[58] **Field of Search** 83/240, 248, 527, 529, 83/530

[56] **References Cited**

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Primary Examiner—J. M. Meister

Attorney, Agent, or Firm—McGlew and Tuttle

[57] **ABSTRACT**

The punch press has two rigidly interconnected frame parts on which are arranged respective table bodies displaceable axially relative to each other by hydraulic pressure, and which serve to clamp on two tool parts. A first frame part is formed with a chamber receiving two pistons coaxially movable relative to each other, a first piston being connected to a piston rod and the second piston embracing the piston rod and forming part of the first table body mounted for displacement on the first frame part. The piston rod and first table body are selectively lockable on the first frame part, so that there can be used selectively, in the press, either tools which work with a cutting die movable relative to the first table body and a fixed pronged ring or tools which work with a fixed cutting die and a movable pronged ring. A reversing device has two complementary and relatively movable spacers whose relative adjustment determines whether or not the first table body can be locked in the first frame part. One spacer has a series of spaced apertures therein and the other has a series of correspondingly spaced pins thereon engageable in the apertures in one adjusted position of the spacers but not in the other adjusted position of the spacers. First and second pressure fluid supply passages in the first frame part supply pressure fluid to respective opposite sides of the first piston and the first piston, when charged through the first passage, is locked to the first frame part along with the piston rod, with such locking not being effected when pressure fluid is supplied to the first piston through the second passage. An operating lever is provided to effect relative adjustment of the spacers, and cooperates, in respective end positions, with two limit switches controlling the exciter circuits of respective electromagnets operating a reversing valve in respective opposite directions. The reversing valve, in a first end position of the operating element, supplies pressure fluid to the first passage and, in a second end position of the operating element, supplies pressure fluid to the second passage. The first table body is locked to the first frame part by the spacers in the second end position but not in the first end position.

10 Claims, 5 Drawing Figures

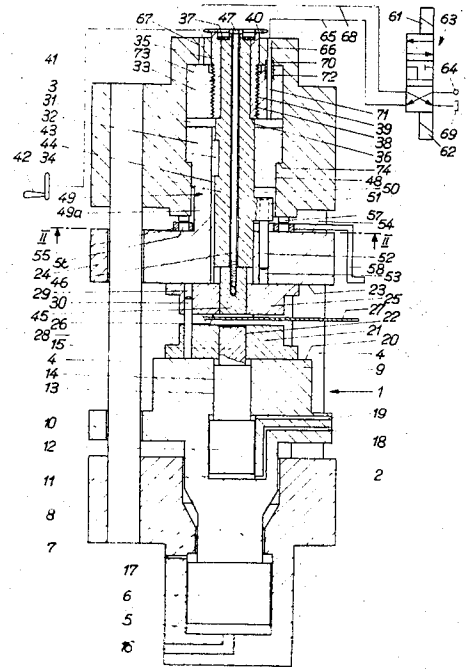

Fig.1

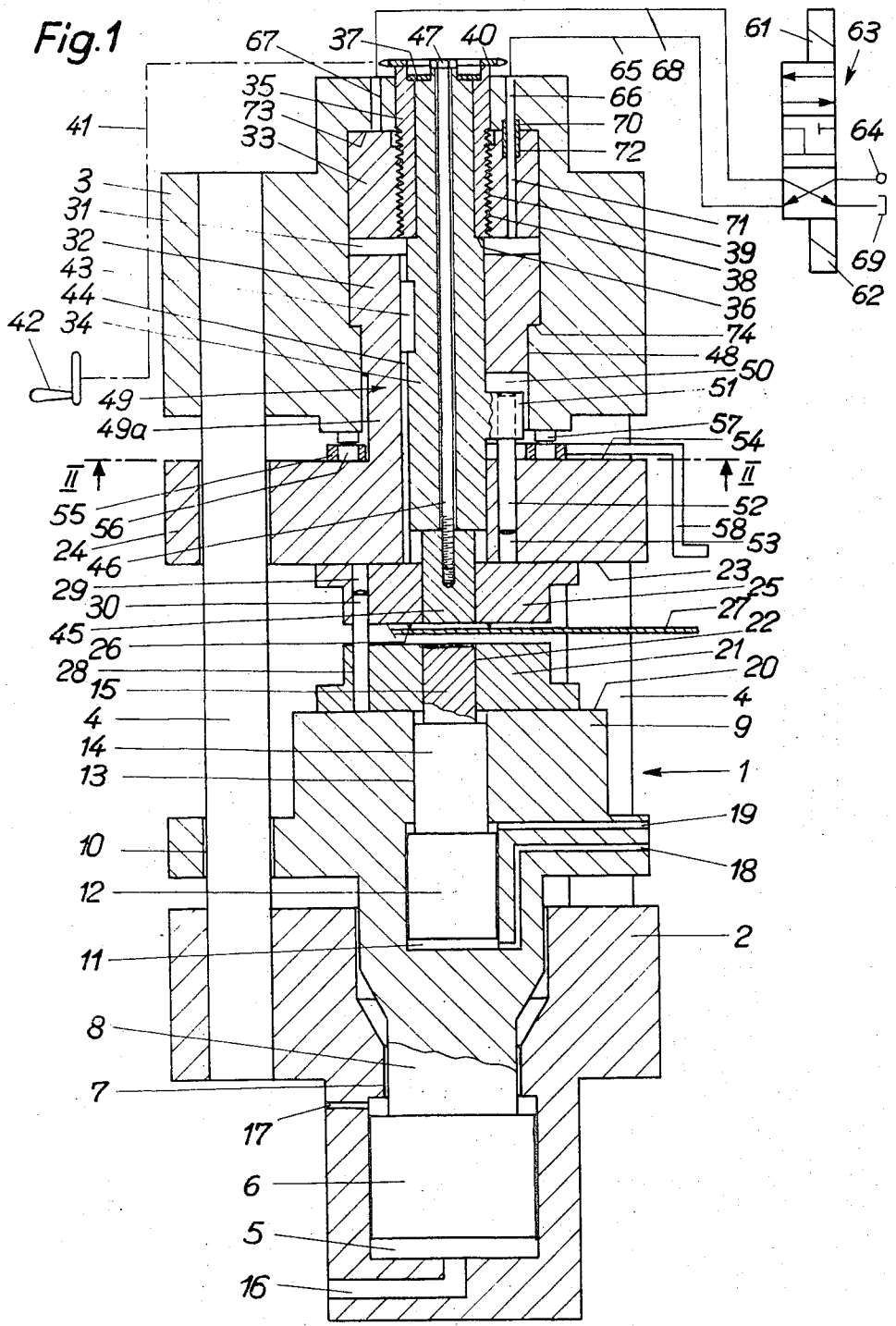
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Fig.3

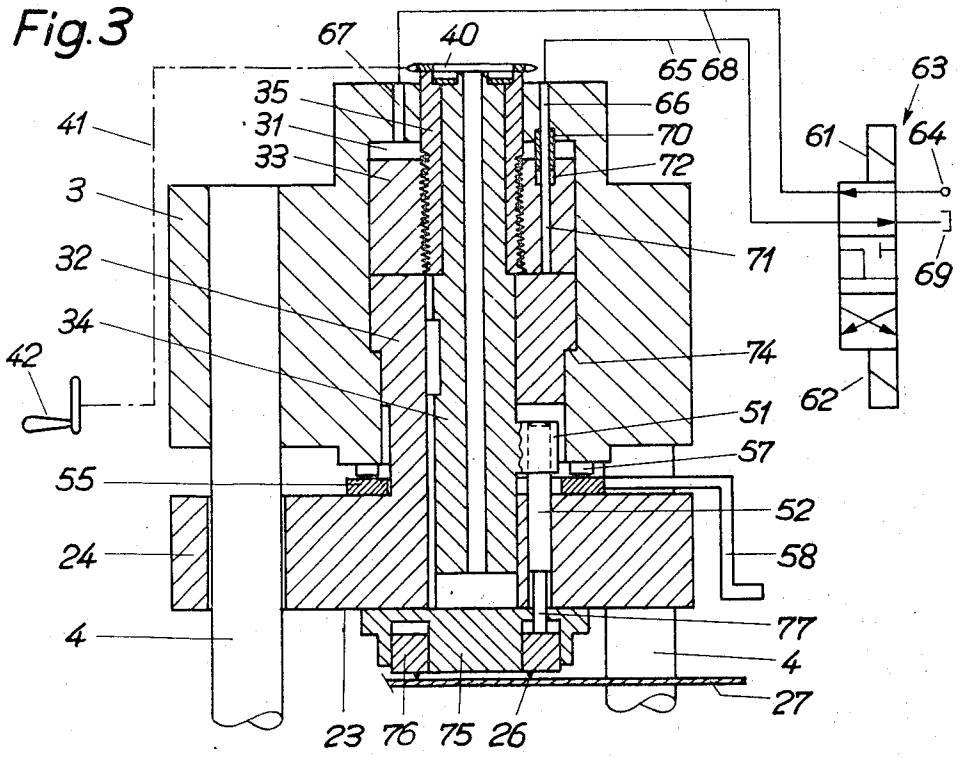


Fig.2

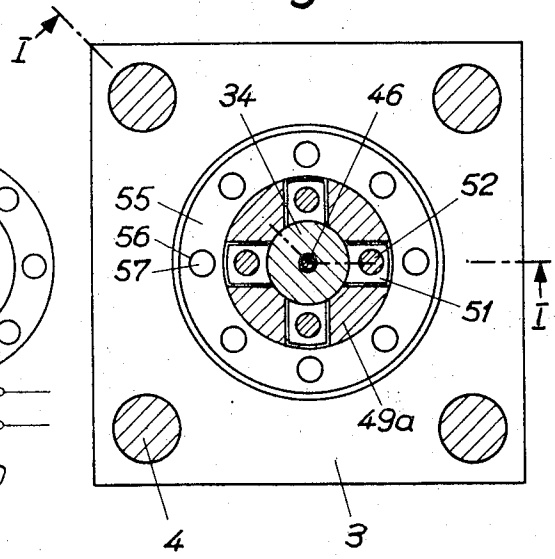


Fig.4

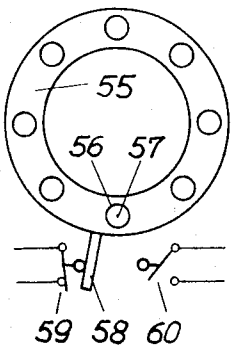
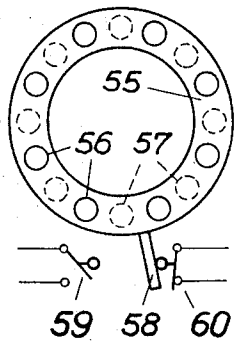


Fig.5



PRECISION PUNCH PRESS

FIELD AND BACKGROUND OF THE INVENTION

The invention is directed to a precision punch press with two rigidly connected frame parts on which are arranged two table bodies which can be displaced by hydraulic means axially toward and away from each other and which serve to clamp on two tool parts. A cylindrical chamber is formed in the first frame part, and receives therein two pistons movable coaxially relative to each other, with the first piston being connected to a piston rod and the second surrounding or embracing the piston rod and forming part of a displaceable first table body arranged on the first frame part. The piston rod and first table body are lockable selectively on the first frame part so as to be able to use, in the press and selectively, tools which work with a cutting die movable relative to the table body and a fixed pronged ring or tools which work with a fixed cutting die and a movable pronged ring.

In a press of this type, which is known, either the piston rod or the table body must be fixed by screws or the like on the frame part in order to change the type of tool, and this is inconvenient and time-consuming. In addition, a hydraulic system which serves to charge the press with pressure fluid, and valves, must be provided to take into account the new type of tool, and wrong connections are not impossible.

SUMMARY OF THE INVENTION

The invention avoids these disadvantages by providing a reversing device which has two complementary spacers that can be adjusted relative to each other, and whose relative displacement determines whether the table body can be locked on the frame part or not. Furthermore, first and second passages are provided in the frame part and communicate with the cylindrical chamber, and through which pressure fluid can be supplied to one or the other side of the first piston so that, when the cylinder is charged through the first passage, the first piston, and thus the piston rod, are locked on the frame part and, when the charge is effected through the second passage, the piston and the piston rod are not locked. An operating element for the relative displacement of the complementary spacers is provided, and cooperates, in each of its end positions, with a respective one of two limit switches controlling the exciter circuits of respective electromagnets of a reversing valve. The reversing valve, in a first end position of the operating element, supplies pressure fluid to the first passage and, in a second end position of the operating element, to the second passage. The table body is fixed by the spacers on the frame part in the second end position and is not fixed in the first end position. Merely by actuating a single operating element, for example, by turning a lever, the press is thus switched in hydraulically and mechanically completely from one type of tool to another.

In a preferred embodiment of the precision press according to the invention, it is possible to compensate the shortening of the cutting die, both in operation with a movable cutting die and in operation with a fixed cutting die, and which shortening occurs during regrinding. Hitherto, this has required an extremely difficult and time-consuming adjustability, with the insertion of

distance or spacer washers. With the invention, such adjustment is effected in a very simple manner, for example, by turning a crank.

An object of the invention is to provide an improved precision punch press.

Another object of the invention is to provide such a precision punch press which can be simply and easily switched between a first condition for operating with one type of cutting die and second condition for operating with another type of cutting die.

A further object of the invention is to provide such a precision punch press whereby shortening of a cutting die can be compensated in a very simple manner and in a very short time.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a vertical sectional view through a precision punch press, embodying the invention, taken along the line I—I of FIG. 2, and illustrating operation with a tool including a movable cutting die;

FIG. 2 is a cross-sectional view of the press along the line II—II of FIG. 1;

FIG. 3 is a partial sectional view, similar to FIG. 1, but illustrating only the upper part of the press as in operation with a tool with a fixed cutting die;

FIG. 4 is a somewhat schematic representation of a part of a reversing device in the position for operation with a movable cutting die; and

FIG. 5 is a somewhat schematic representation similar to FIG. 4 but illustrating the operation with a fixed cutting die.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, the illustrated precision punch press has a frame 1 consisting of a lower frame part 2, an upper frame part 3 and four columns 4 which connect parts 2 and 3 with each other. In lower part 2, there is formed a cylindrical cavity 5 in which there is arranged a piston 6 connected, by a piston neck 8 passing through a bore 7 of part 2, to a lower table body 9. Table body 9 has four bores 10 by which it is guided on columns 4. The table body 9 likewise is formed with a cylindrical cavity 11 in which there is arranged a piston 12 disengageably connected, by a piston neck 14 guided in a bore 13 of body 9, to an ejector die 15, which is part of the tool. Lower frame part 2 and lower table body 9 actually consist of at least two or three parts connected with each other by suitable fastening means such as screws, and which is necessary for assembly reasons, but which is not necessary for understanding the method of operation of the press and which is therefore not represented. The same holds true for other parts of the press to be described hereinafter, and it will not be mentioned specifically again.

Frame part 2 is formed with two passages 16 and 17 serving to supply pressure fluid to the lower and upper working surfaces, respectively, of piston 6. Furthermore, a passage 18 is formed in table body 9 to supply pressure fluid to the lower working system of piston 12, and a passage 19 in table body 9 serves to vent the upper part of cylindrical cavity 11. A lower tool part 21

is clamped on the top surface 20 of table body 9 by means of screws, which have not been shown. Lower tool part 21 has a bore 22 for passage of ejector die 15.

An annular upper tool part 25 is clamped on the bottom surface 23 of an upper table body 24, and its underside is formed with an annular series of prongs 26 with which a metal strip 27, to be treated, is pressed against lower tool part 21 before the punching out. In the two tool parts 21 and 25, there are provided, laterally of metal strip 27, two or more pairs of corresponding holes 28 and 29 which receive guide bolts 30 to assure exact guidance of parts 21 and 25 during the closing movement of the press.

Upper frame part 3 is formed with a cylindrical cavity 31 in which are arranged two pistons 32 and 33 through which extends a hollow axle 34 corresponding to a piston rod, piston 32 being axially displaceable along axle 34. However, piston 33 is connected to axle 34 for joint axial movement therewith, but its axial position on axle or piston rod 34 is adjustable. For this purpose, there is provided a bush 35 whose lower end bears on a shoulder 36 of hollow axle of piston rod 34, and whose upper end is retained by a ring 37 secured thereon. Bush 35 has a male thread 38 engaging a female thread 39 of piston 33. A chain wheel 30 is secured to the upper end of bush 35 and is engaged by a chain, which has not been shown, forming part of a schematically indicated kinetic connection 41 to an adjusting crank 42.

In order to avoid turning of hollow axle or piston rod 34 relative to lower piston 32 when bush 35 is screwed up or down in piston 33, a key 43, extending in a longitudinal direction and secured on axle or piston rod 34, engages a longitudinal groove 44 of piston 32. At the bottom end of axle or piston rod 34, there is secured a cutting die 45, belonging to the tool, securement being effected by means of a screw 46 passing through hollow axle 34 and having its head 47 bearing on the upper end of axle or piston rod 34. As a rule, cutting die 45 is not round, and this is the reason why a rotation of hollow axle 34 is not admissible. It will be clear that the cutting edge of lower tool part 21 must have a fit with the opposite cutting edge of the cutting die 45.

Lower piston 32, and a piston neck 49 arranged in a bore 48 of upper frame part 3, form part of upper table body 24. Piston neck 49 consists, as can be seen from FIG. 2, of four sectors 49a, separated from each other by wide slots 50 in which are engaged four radial arms 51 projecting from axle or piston rod 34, a downwardly extending bolt 52 being secured on each arm 51. The four bolts 52 engage a corresponding number of bores 53 which extend in table body 24 from the bottom end of slots 50 to the bottom surface 23 of table body 24. The bolts 52 themselves do not prevent rotation of axle of piston rod 34, so that key 43 is provided only for safety, in case of a small elastic deformation of parts 51 and 52 or in case of play in the bores.

On a wide annular shoulder 54 of table body 24, provided under piston neck 49, there is arranged a distance or spacer washer 55 embracing piston neck 49, and washer 55 has an annular series of eight equidistant holes 56. In FIGS. 1 and 4, washer 55 is so positioned that its eight holes 56 are aligned with a corresponding number of complementary pins 57 which project from a lower annular surface of frame part 3. Pins 57 do not prevent an upward movement of table body 24 corresponding to the height of distance or spacer washer 55, because they can enter into holes 56. However, if washer 55 is angularly displaced into the position of FIGS. 3 and 5, its holes 56 are no longer aligned with pins 57, so that pins 57 prevent an upward movement of table body 24 by engaging distance washer 55, so that the latter is locked on frame part 3.

Washer 55 can be turned by means of a lever 58 which serves, at the same time, to actuate two limit switches 59 and 60 arranged on upper table body 24, and which are not visible in FIGS. 1 and 2. Switch 59 is closed in the end position of lever 58 as shown in FIG. 4, and switch 60 is open, while, in the end position of lever 58 shown in FIG. 5, the opposite is true. Switches 59 and 60 are arranged in the exciter circuits of respective electromagnets 61 and 62 of a schematically represented known reversing valve 63 having three switching positions.

In a first position of reversing valves 63 shown in FIG. 1, and corresponding to closing of switch 59 and opening of switch 60, valve 63 connects a source 64 of pressure fluid through a line 65 to a first passage 66 formed in upper frame part 3. At the same time, valve 63 connects a second passage 67, formed in the upper frame part 3, through a line 68 to oil sump 69.

In the second position of valve 63, shown in FIG. 3, and which corresponds to closing of switch 60 and opening of switch 59, valve 63 connects source 64 through line 68 to passage 67 and oil sump 69 through line 65 to passage 66.

In the central position of valve 63, which has not been shown and which corresponds to the case where lever 58 has not been turned into one of its end positions, both passages 66 and 67 are connected with oil sump 69, while source 64 is completely shut off so that admission of pistons 32 and 33 is impossible, if holes 56 and complementary pins 57 are in overlapping position.

Passage 67 opens directly into the upper end of cylindrical chamber 31. However, passage 66 is connected, through a packing sleeve 70, to a passage 71 extending paraxially through piston 33. The upper end of sleeve 70 is secured in frame part 3 and the lower end of sleeve 70 engages in an annular enlarged recess 72 of passage 71, so that sleeve 70 prevents escape of pressure fluid above piston 33 and permits, at the same time, axial displacement of piston 33 in cylindrical chamber 31 between the end positions shown, respectively, in FIGS. 1 and 3.

The press, as so far described, and provided with tools 21, 15, 25 and 45 as shown in FIG. 1, and whose cutting die 45 is movable relative to table body 24 serving to clamp pronged ring 25, works in the following manner. From source 64, pressure fluid flows through control valve 63, line 65 and passages 66 and 71 connected by packing sleeve 70 to the underside of piston 33. Piston 33 is pressed against the upper end wall 73 of cylindrical chamber 31, and piston 32 is pressed against a bottom shoulder 74 of the latter. When pressure oil is supplied now in the lower frame part 2 to cylindrical chamber 5, through passage 16, and lower table body 9 is thus moved upwardly by its piston 6, the press closes, at first, the lower tool part 21 bearing, through plate 27, against pronged ring 25, and the annular prongs 26 penetrate into plate 27. During further upward movement of piston 6 which, as a working piston, does the work necessary for the cutting movement,

upper table body 24 is moved upward through pronged ring 25 against the pressure prevailing above piston 32, and spacer pins 57 enter into holes 56. Cutting die 45, which bears through axle or piston rod 34, bush 35 and piston 33 on wall 73, and thus on upper frame part 3, does not participate in the movement of upper table body 24 and therefore cuts plate 27.

Pressure fluid is now fed to passage 17 so that lower table body 9 is lowered. By supplying piston 12 with pressure fluid through passage 18, ejector 15 is actuated and, after a corresponding feed of metal strip 27, the cycle is repeated.

Referring now to FIG. 3, a cutting die 75 is clamped firmly on the lower surface of upper table body 24, while prongs 26 are arranged on a ring 76 moving relative to body 24 and from which four bolts 77 extend upwardly and connect ring 76 with bolts 52 projecting downwardly from arms 51 of axle or piston rod 34. As mentioned above, spacer pins 57 now rest between holes 56 on washer 55, so that an upward movement of table body 24 is prevented. Pressure fluid flows through passage 67 above piston 33 into cylindrical chamber 31, and piston 33 therefore presses piston 32 against shoulder 74.

The lower part of the press, which is omitted in FIG. 3, is the same as in FIG. 1, except that the lower parts 15 and 21 of the tool must naturally match the upper parts 75 and 76. During the working stroke of working piston 6, the press is first closed again and the prongs 26 are pressed into plate 27. Pronged ring 76, which bears through parts 77, 52, 51, 34 and 35 on upper piston 33, thus yields upwardly, the force of working piston 6 overcoming the force exerted by the pressure fluid on piston 33, so that cutting die 75, fixed on table body 9, cuts metal plate 27.

It should be explained, at this point, why an adjustability of the axial position of axle 34 with respect to piston 33 is provided. This adjustability has the purpose of compensating the shortening of the cutting die caused by the regrinding of the cutting end face of the cutting die 45 or 75. Heretofore, it was necessary to place spacer washers between the die and axle 34 or table body 24. This was a very time-consuming operation which had to be done, as a rule, once or twice a day. In the precision punch press embodying the invention, however, it is necessary only to turn crank 42 so far that the end face of the die comes in contact with the corresponding calibrating templet.

In a tool with a movable cutting die 45, a hollow axle that cannot be readjusted by grinding would be too short. Bush 35 therefore must be screwed down in piston 33, carrying along hollow axle 34 correspondingly. In a tool with a fixed cutting die 75, bolts 53 would be too long after grinding. Consequently, bust 35 must be screwed up in piston 33, taking along hollow axle 34 and thus also arms 51 and bolts 52.

The foregoing decription should make clear that the design of the upper part of the press is of paramount importance in the invention. However, since a horizontal base could be used instead of vertical columns 4 for rigidly connecting the two frame parts 2 and 3, the claims will mention not an upper and lower frame part but more generally a first and second frame part, table body and the like.

Complementary spacers 55 and 57 need not necessarily consist of a perforated rotatable spacer washer 55 and an annular row of pins 57 fitting into the holes 56. In a square frame, for example, suitable marginal recesses could be provided instead of holes for receiving pins, and such a frame could be displaced by means of any operating element from one end position into the other.

While a specific embodiment of the invention has been shown and described to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a precision punch press of the type having two rigidly interconnected frame parts on which are arranged respective table bodies which can be displaced axially relative to each other by hydraulic pressure and which serve to clamp on two tool parts, a first frame part being formed with a cylindrical chamber receiving two pistons coaxially movable relative to each other, with a first piston connected to a piston rod and the second piston embracing the piston rod and forming part of the first table body mounted for displacement on the first frame part, the piston rod and the first table body being selectively lockable on the first frame part, whereby there can be used selectively, in the press, either tools which work with a cutting die movable relative to the first table body and a fixed pronged ring or tools which work with a fixed cutting die and a movable pronged ring: the improvement comprising, in combination, a reversing device having two complementary and relatively movable spacers whose relative adjustment determines whether or not said first table body can be locked in said first frame part; first and second pressure fluid supply passages in said first frame part connected to said cylindrical chamber on respective opposite sides of said first piston in a manner such that, when pressure fluid is supplied through said first passage to charge said first piston, said first piston and said piston rod connected thereto are locked to said first frame part, with such locking not being effected when pressure fluid is supplied through said second passage to charge said first piston; an operating element for effecting relative adjustment of said complementary spacers; and two limit switches cooperable with said operating element in respective end positions of the latter, and controlling the exciter circuits of respective electromagnets operating a reversing valve in respective opposite directions; said reversing valve, in a first end position of said operating element, supplying pressure fluid to said first passage and, in a second end position of said operating element, supplying pressure fluid to said second passage; said first table body being locked to said first frame part by said spacers in said second end position but not in said first end position.

2. In a precision punch press, the improvement claimed in claim 1, in which said movable spacers comprise a first plate shiftable by a lever constituting said operating element and formed with a plurality of uniformly spaced apertures therein, said first plate being arranged on said table body; the other spacer comprising a series of pins having a uniform spacing corresponding to the uniform spacing of said apertures and engageable into the apertures, said pins projecting from said first frame part; said pins being aligned with said apertures in said first end position and being out of alignment with said apertures in said second end position.

3. In a precision punch press, the improvement claimed in claim 2, in which said first spacer is a ring rotatable by said lever and resting on a shoulder of said first table body, said ring being formed with a series of equidistant apertures therethrough; said other spacer comprising a ring of pins having an equidistant spacing equal to the equidistant spacing of said apertures.

4. In a precision punch press, the improvement claimed in claim 1, in which said piston rod is a tubular member; the movable cutting die, during press operation with a movable cutting die, being secured by a screw extending through said tubular member and having its inner end threadedly engaged with the movable cutting die and a head on its outer end bearing against the outer end of said tubular member.

5. In a precision punch press, the improvement claimed in claim 4, in which said tubular member has radial arms projecting laterally therefrom; axially directed bolts on said radial arms extending into aligned bores through said first table part; the movable pronged ring, during press operation with a fixed cutting die, being formed with axially directed second bolts extending through said bores and bearing on said first-mentioned bolts.

6. In a precision punch press, the improvement claimed in claim 1, including means restraining rotation of said piston rod relative to said first table body; and an externally threaded bush embracing said piston rod and threadedly engaged in said first piston whereby, upon rotation of said bush, said piston rod is adjusted axially relative to said first piston.

7. In a precision punch press, the improvement claimed in claim 6, including means restraining axial movement of said bush relative to said piston rod.

8. In a precision punch press, the improvement claimed in claim 7, including a driving element secured at an outer end of said bush projecting from said first frame part; an externally accessible adjusting element; and a kinematic connection between said driving element and said adjusting element; whereby said piston rod can be adjusted axially relative to said first piston to compensate a shortening of the cutting die caused by regrinding a movable or fixed cutting die.

9. In a precision punch press, the improvement claimed in claim 1, in which said first pressure fluid supply passage includes a packing sleeve fixedly secured in said first frame part and extending into a passage extending paraxially through said first piston.

10. In a precision punch press, the improvement claimed in claim 5, in which said first table body is formed with radial slots receiving said radial arms.

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