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(71) Applicant: **FIR Srl**
Via Pecori Giraldi 1
I-36016 Thiene (Vicenza)(IT)

(72) Inventor: **Ronda, Giovanni**
Via D'Annonzio 8
I-36016 Thiene Vicenza(IT)

(74) Representative: **Garrone, Fernando**
Internazionale Brevetti s.r.l. Via Brentano 2
I-20121 Milano(IT)

(54) Plate drawing apparatus.

(57) The present invention relates to a plate drawing apparatus comprising:

a) a supporting structure formed by a punch-holder part and by an opposite part, connected by at least two, preferably four, tension elements;

b) a punch supported by said punch-holder part and adapted to engage and disengage a corresponding die, the coupling between said punch and said die determining the shape of the drawing of said plate;

c) an abutment body supporting said die and slideable along said tension elements for a stroke at least corresponding to the depth of the drawing to be obtained on said plate.

The abutment body is formed by a first element supporting said die and by a second element; said first and said second element being mutually coupled by means of a plurality of short-stroke pistons supported by one of said elements; said second element being lockable in working position by virtue of mechanical locking means; the working pressure required for drawing being obtained by means of the action of said plurality of short-stroke pistons; the sliding of said abutment body required for the extraction of the drawn part being obtained by means of the release of said mechanical locking means.

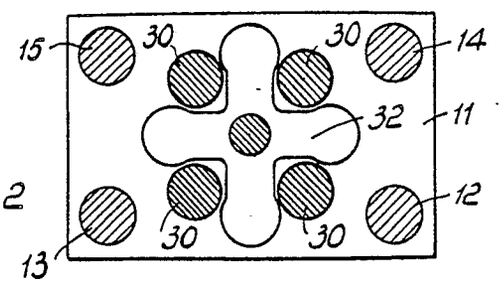

Fig. 2

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PLATE DRAWING APPARATUS

The present invention relates to an apparatus for drawing plate. In particular the field of the present invention is that of presses for drawing plate, which comprise a supporting structure formed by a punch-holder part, which is generally the base of the press, by an opposite part, generally arranged at the top of the press, and by a number of connecting tension elements, generally four, which also have the function of guides for the sliding of the moving parts of the press. The punch, generally actuated by a piston, is surrounded by a hollow blank holder body and couples, during actuation, with a die supported by an abutment body, generally called "ram", thus determining the shape of the drawn part. The plate is placed and pressed, for drawing, between the die and the hollow blank holder body. Naturally the operating pressures between the die and the hollow blank holder body must be high.

So that the drawn part may be extracted, the die must be raisable by an amount at least equal to the depth of the executed drawing.

The above briefly represents the main field of industrial application of the invention, which field does not however constitute a limitation of its scope, since the apparatus according to the invention, in particular as described and claimed hereinafter, can be advantageously used in any other equivalent field in which drawing processes are performed.

Devices of this type, wherein the lifting of the die (for the extraction of the drawn part after drawing) occurs by means of one or more pistons, are known. These pistons press, during drawing, the die against the hollow blank holder body until the pressure required for drawing is obtained.

According to another known embodiment, the pistons which press the die against the hollow blank holder body are merely pressers and have no return valves. In this case the lifting of the die for the extraction of the drawn part after drawing occurs by means of a special small-size piston, preset for this purpose alone.

Such known devices, however, entail some problems; in particular very bulky structures are required to achieve high pressures; in particular, to achieve a load of one thousand tons with four pistons it is generally necessary to use a ram having a transverse cross section with a surface of approximately 2,250,000 sq. mm. Smaller dimensions may be achieved by reducing the number of the pistons, but in this case one would have to renounce the possibility of adjusting and compensating the pressure among the various pistons according to the particular drawing requirements of the part involved. At least four pistons are in fact considered necessary to achieve a complete possibility of adjustment. To increase the load with equal dimensions and with an equal number of pistons it would be necessary to increase the operating pressure of each piston. However, above normal hydraulic operating pressures, around 250 atm, it is necessary to resort to extremely sophisticated and expensive special devices, which are thus in practice not usable in the field of plate drawing machines.

All the above mentioned devices are furthermore complicated and expensive to manufacture, since the long-stroke pistons which press the die against the blank holder require special quick-filling valves and special maintenance.

The aim of the present invention is to eliminate the above described disadvantages by providing an apparatus which allows to achieve a high load using a normal number of pistons and normal operating pressures.

An object of the invention is to allow a constructive simplification by eliminating the long-stroke pistons and the quick-filling valves.

A further object of the invention is to reduce dimensions by eliminating the need to provide pits in the floor for the insertion of the machine.

Not least object of the invention is to achieve a simplification of maintenance.

This aim, as well as these and other objects, are achieved by the apparatus according to the invention, which comprises:

a) a supporting structure formed by a punch-holder part and
by an opposite part, connected by at least two, preferably four, tension elements;

b) a punch supported by said punch-holder part and adapted to engage and disengage a corresponding die, the coupling between said punch and said die determining the shape of the drawing of said plate;

c) an abutment body supporting said die and slideable along said tension elements for a stroke at least corresponding to the depth of the drawing to be obtained on said plate; and is characterized in that said abutment body is formed by a first element supporting said die and by a second element; said first and said second element being mutually coupled by means of a plurality of short-stroke pistons supported by one of said elements; said second element being lockable in working position by means of mechanical locking means;
the working pressure required for drawing being obtained by means of the action of said plurality of short-stroke pistons; the sliding of said abutment

body, required for the extraction of the drawn part, being obtained by means of the release of said mechanical locking means.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a partially sectional lateral view of the apparatus according to the invention;

figure 2 is a sectional view taken along the line II-II of figure 1;

figure 3 is a sectional view taken along the line II-II of figure 1, in a different operating condition;

figure 4 is a sectional view taken along the line IV-IV of figure 1.

With reference to figures 1-4, the apparatus according to the invention comprises a supporting structure formed by a punch-holder part 10 and by an opposite part 11, connected by at least two, preferably four tension elements 12, 13, 14 and 15.

The punch 16 is supported by the punch-holder part 10 and is adapted to engage and disengage the corresponding die 17.

The coupling between the punch 16 and the die 17 determines the form of the drawing of the plate, so as to allow the forming of tubs, containers, shaped parts, as required, according to the configuration of the punch 16 and of the corresponding die 17.

An abutment body or ram 20 is provided, supporting the die 17, and is slideable along the tension elements 12, 13, 14, and 15, for a stroke x, which has a length at least corresponding to the depth y of the drawing to be obtained on the plate part.

The abutment body 20 is formed by a first element 21 which supports the die 17 and by a second element 22. The first element 21 and the second element 22 are mutually coupled by means of a plurality of pistons, for example by means of the four short-stroke pistons 23, 24, 25 and 26 which are supported either by the element 21 or by the element 22. In the embodiment illustrated in the figure, the four pistons 23, 24, 25 and 26 are supported by the second element 22. In particular the second element 22 has circular dead holes which constitute the seats for the accommodation of each of the four pistons 23, 24, 25 and 26. The oil sealing gaskets 27 allow continuous operation at a normal hydraulic pressure of 250 atm.

The second element 22 is preferably connected to said opposite part 11, in particular to the top of the press, by means of a piston 28 which has a stroke at least corresponding in length to the depth of the drawing to be obtained on the plate.

The second element 22 is lockable in working position by virtue of mechanical locking means. Said mechanical locking means preferably comprise a plurality of spacers 30, which engage the second element 22 and the opposite part 11. The spacers 30 are preferably fixable to the second element 22 and can slide through appropriate openings 31 provided on the opposite part 11. According to another embodiment, the spacers 30 are fixable to the opposite part 11 and can slide through appropriate openings provided on the second element 22. Naturally the execution of this second embodiment requires a much greater thickness of the second element 22 with respect to that indicated in the figures and in any case sufficient to accommodate the length of the spacers 30.

The spacers 30 are preferably lockable by means of a rotating plate 32 which opens or closes the openings 31 according to its angle of rotation. In particular figure 2 shows the rotating plate 32 in the position in which the openings 31 are open and can accommodate the spacers 30; figure 3 shows the rotating plate 32 in the position in which the openings 31 are closed and the spacers 30 can operate in compression.

According to another embodiment, the spacers 30 are lockable by means of a slideable plate, not illustrated in the figure, which opens or closes the openings 31 according to the sliding positions.

The operation is as follows: the plate part to be drawn is inserted between the die 17 and the blank holder 35, then the abutment body 20 is caused to descend, by means of the action of the piston 28, along the tension elements 12, 13, 14 and 15, until the die 17 rests on the plate to be drawn. In this step the pressure between the die 17 and the blank holder 35 is still very small since the piston 28 only has the function of moving the abutment body 20 and is not capable of transmitting compression forces useful for drawing. The action of the piston 28 has, in any case, allowed the exit of the spacers 30 out of the openings 31. Then the rotating plate 32 is caused to rotate until it reaches the position indicated in figure 3 to close the openings 31. At this point the four short-stroke pistons 23, 24, 25 and 26 start operating, and perform the actual compression effort, performing a slight spacing between the first element 21 and the second element 22 of the abutment body 20. Then the action of the punch 16 performs the actual drawing. To extract the drawn part it is necessary to return the rotating plate to the position indicated in figure 1 and actuate the piston 28 to cause the retraction of the spacers 30 inside the openings 31 for the entire length of the stroke x. The drawn part can thus be easily extracted. The sequence of operations is then repeated for the subsequent part.

The invention thus conceived is susceptible to

numerous modifications and variations, all of which are within the scope of the inventive concept; thus, for example, the locking means may differ from the spacers 30 and may intervene, for example, directly on the tension elements 12, 13, 14 and 15. The piston 28 may be mounted in reverse manner directly on the second element 22 or may be replaced with equivalent means, such as for example a rack. The pistons 23, 24, 25 and 26 may be accommodated in seats provided on the first element 21 and perform, in an equivalent manner, the spacing between the first element 21 and the second element 22.

The tension elements 12, 13, 14 and 15 may be, for example, replaced with only two lateral tension elements (generally termed shoulders) formed e.g. with a square profile and welded directly to the punch-holder part 10 and to the opposite part 11. In this case the sliding of the abutment body 20 occurs on appropriate guides provided on the two lateral tension elements or shoulders.

In practice it has been observed that the apparatus according to the invention allows to achieve all the intended aims, in particular it is possible to achieve a load of 1000 tons with an abutment body 20 having a transverse cross section with a surface of only 810,000 sq.mm., which is over two and a half times smaller than the corresponding cross section obtainable with known presses with an equal number of pistons and with the same oil feed pressure.

Claims

1. Sheet metal drawing apparatus comprising:
a) a supporting structure formed by a punch-holder part and
by an opposite part, connected by at least two, preferably four, tension elements;
b) a punch supported by said punch-holder part and adapted to engage and disengage a corresponding die, the coupling between said punch and said die determining the shape of the drawing of said plate
c) an abutment body supporting said die and slideable along said tension elements for a stroke at least corresponding to the depth of the drawing to be obtained on said plate;
characterized in that said abutment body is formed by a first element supporting said die and by a second element; said first and said second element being mutually coupled by means of a plurality of short-stroke pistons supported by one of said elements; said second element being lockable in working position by virtue of mechanical locking means;
the working pressure required for drawing being obtained by means of the action of said plurality of short-stroke pistons; the sliding of said abutment body, required for the extraction of the drawn part, being obtained by means of the release of said mechanical locking means.

2. Apparatus according to claim 1, characterized in that said second element is connected to said opposite part by means of a piston having a stroke at least corresponding to the depth of the drawing to be obtained on said plate.

3. Apparatus according to claim 1, characterized in that said plurality of pistons is supported by said second element.

4. Apparatus according to claim 3, characterized in that each piston of said plurality of pistons is accommodated in a seat provided directly in said second element.

5. Apparatus according to any one of the preceding claims, characterized in that said mechanical locking means comprise a plurality of spacers engaging said second element and said opposite part.

6. Apparatus according to claim 5, characterized in that said spacers are fixable to said second element and can slide through appropriate openings provided on said opposite part.

7. Apparatus according to claim 5, characterized in that said spacers are fixable to said opposite part and can slide through appropriate openings provided on said second element.

8. Apparatus according to claims 6 and 7, characterized in that said spacers are lockable by means of a rotating plate which opens or closes said openings according to the angle of rotation.

9. Apparatus according to claims 6 and 7, characterized in that said spacers are lockable by means of a slideable plate which opens or closes said openings according to the sliding positions.

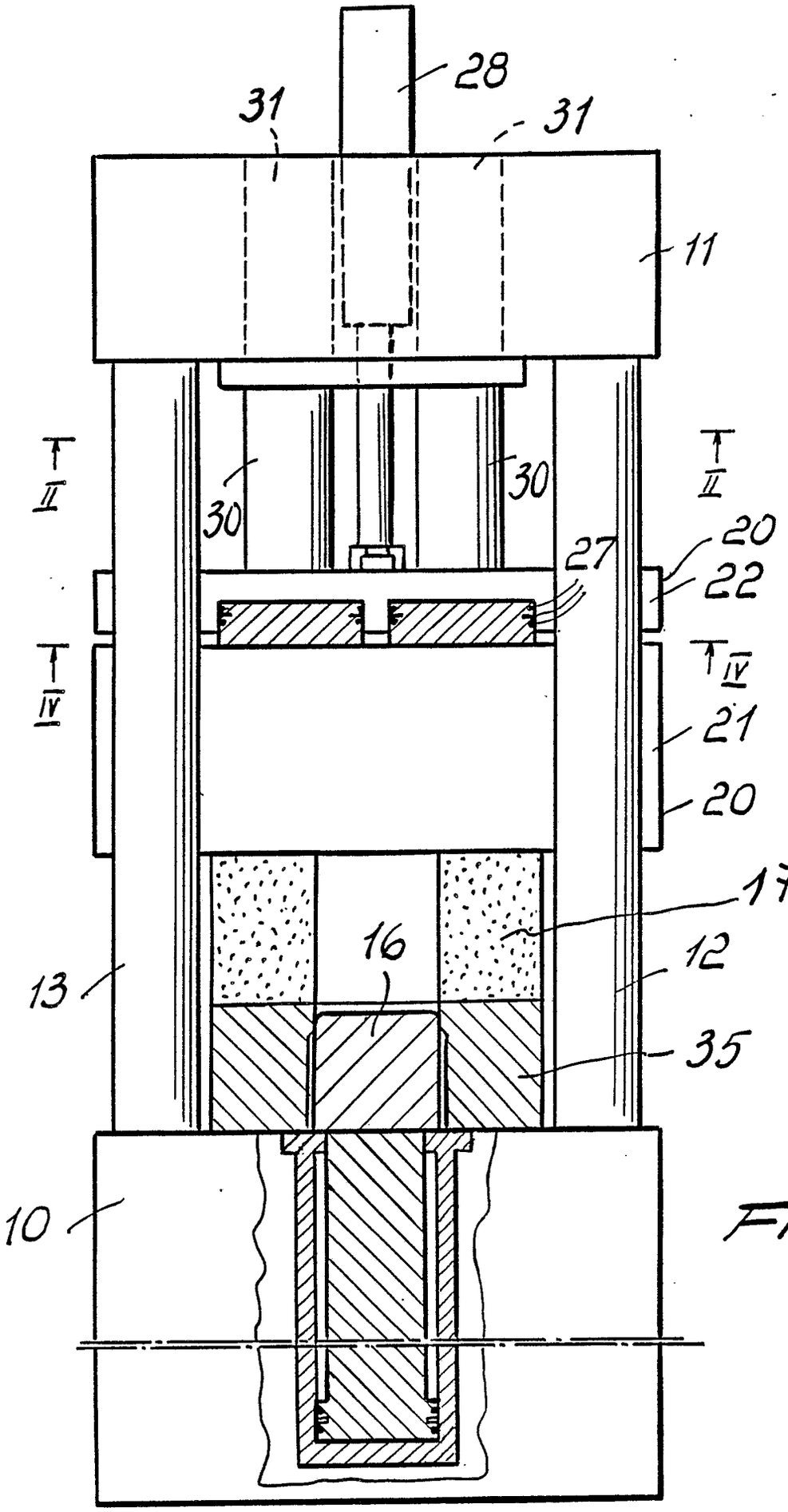

Fig. 1

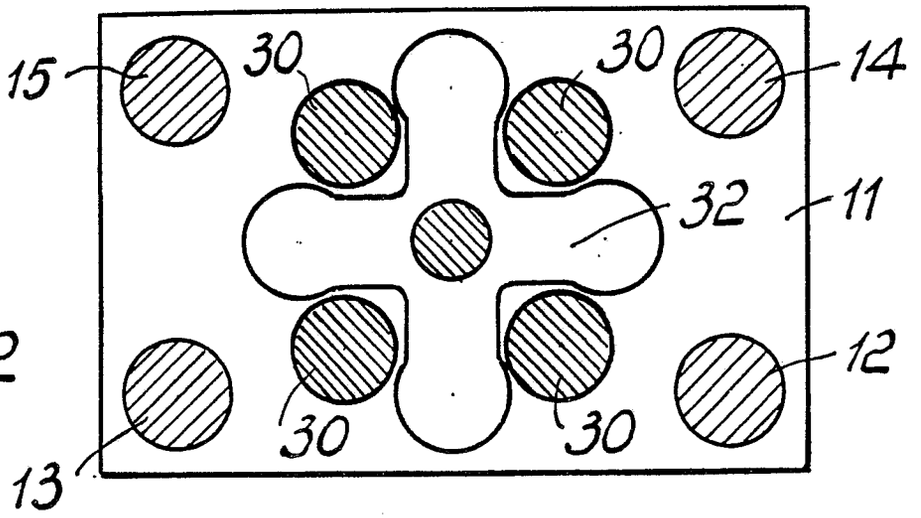

Fig. 2

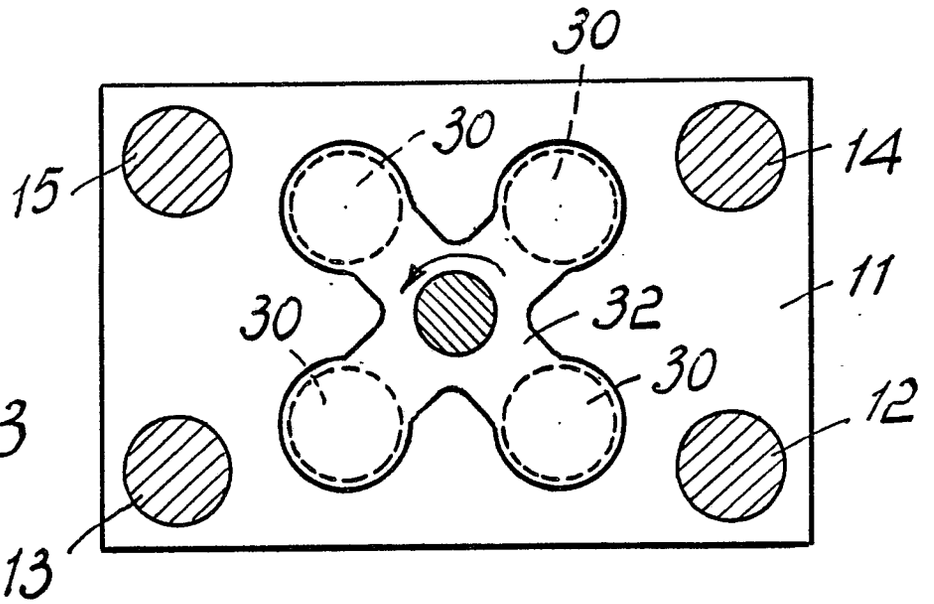

Fig. 3

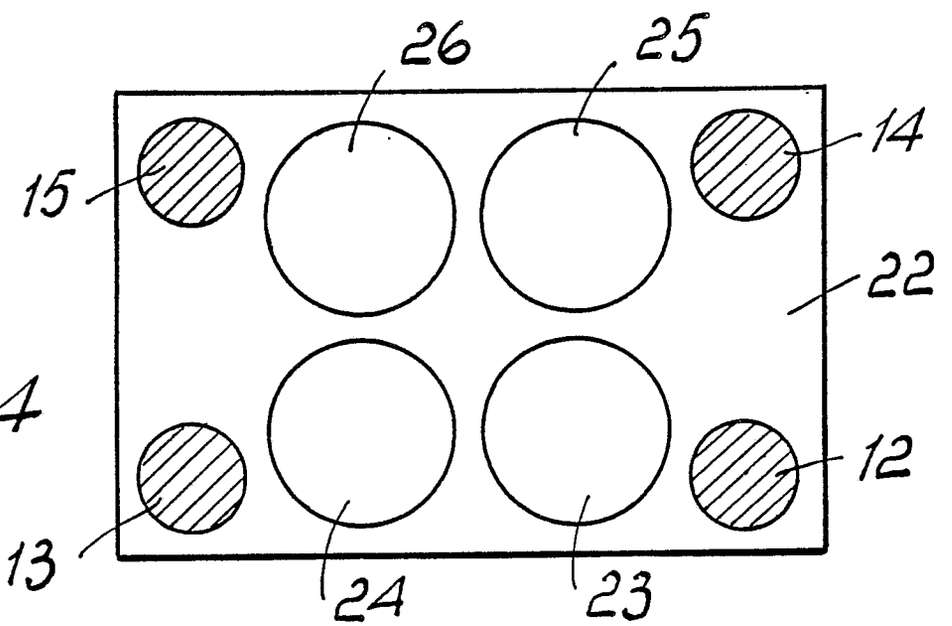

Fig. 4