Feb. 2, 1971 R. HERMES 3,559,243

APPARATUS FOR CONTROLLING THE MOVEMENT OF THE MATRIX OF METAL-POWDER PRESSES

Filed May 28, 1968 3 Sheets-Sheet 1

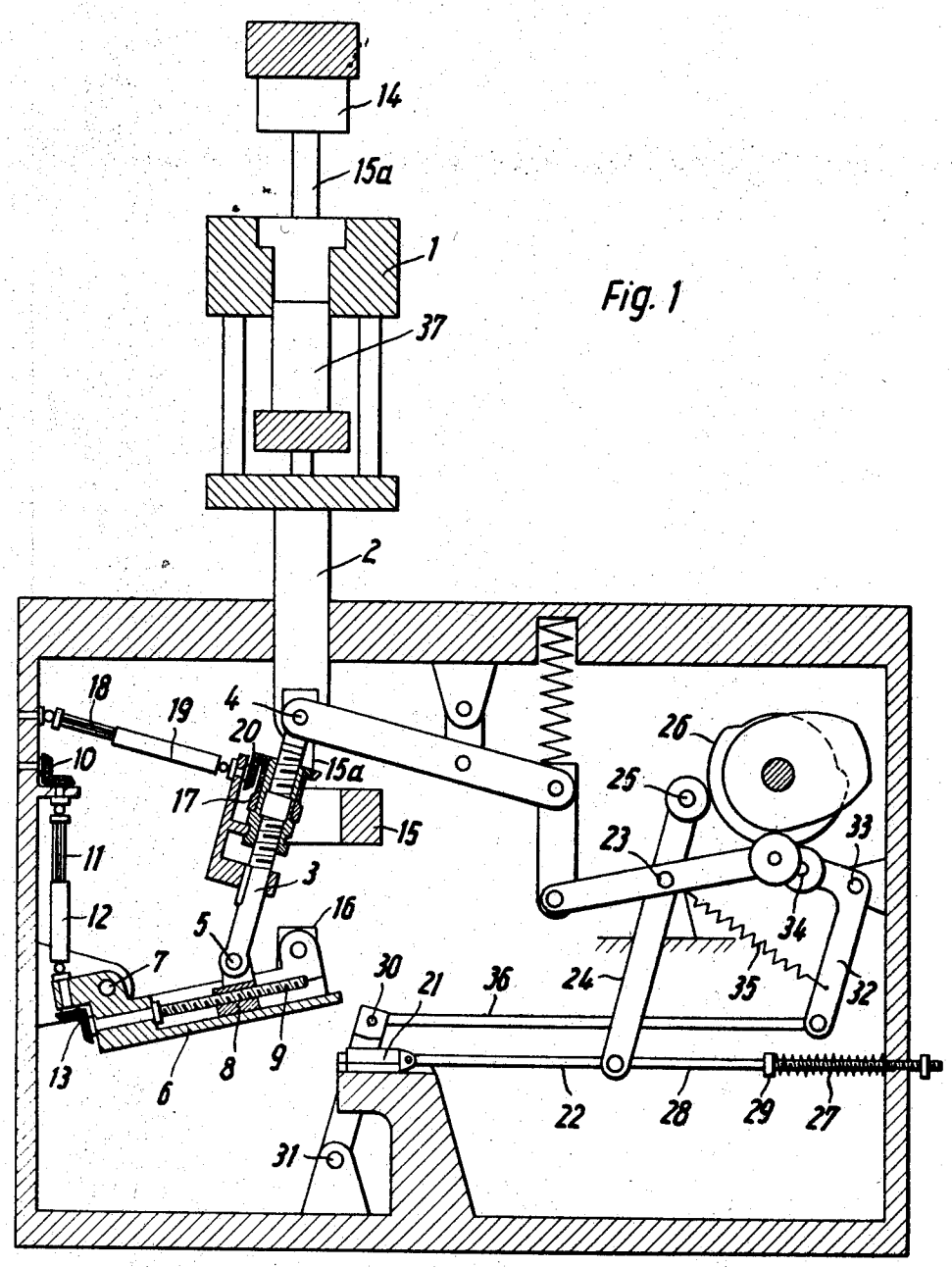


Fig. 1

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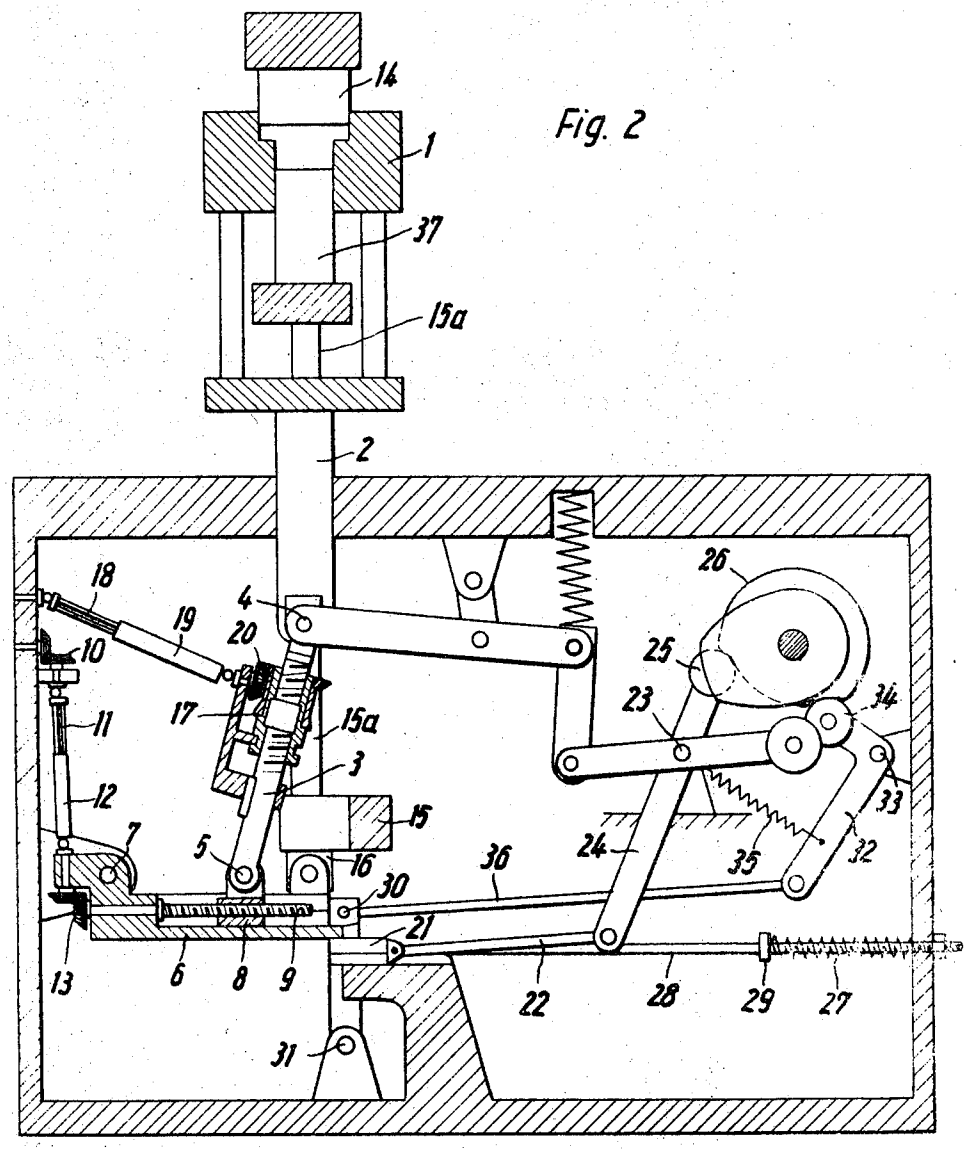
Fig. 2

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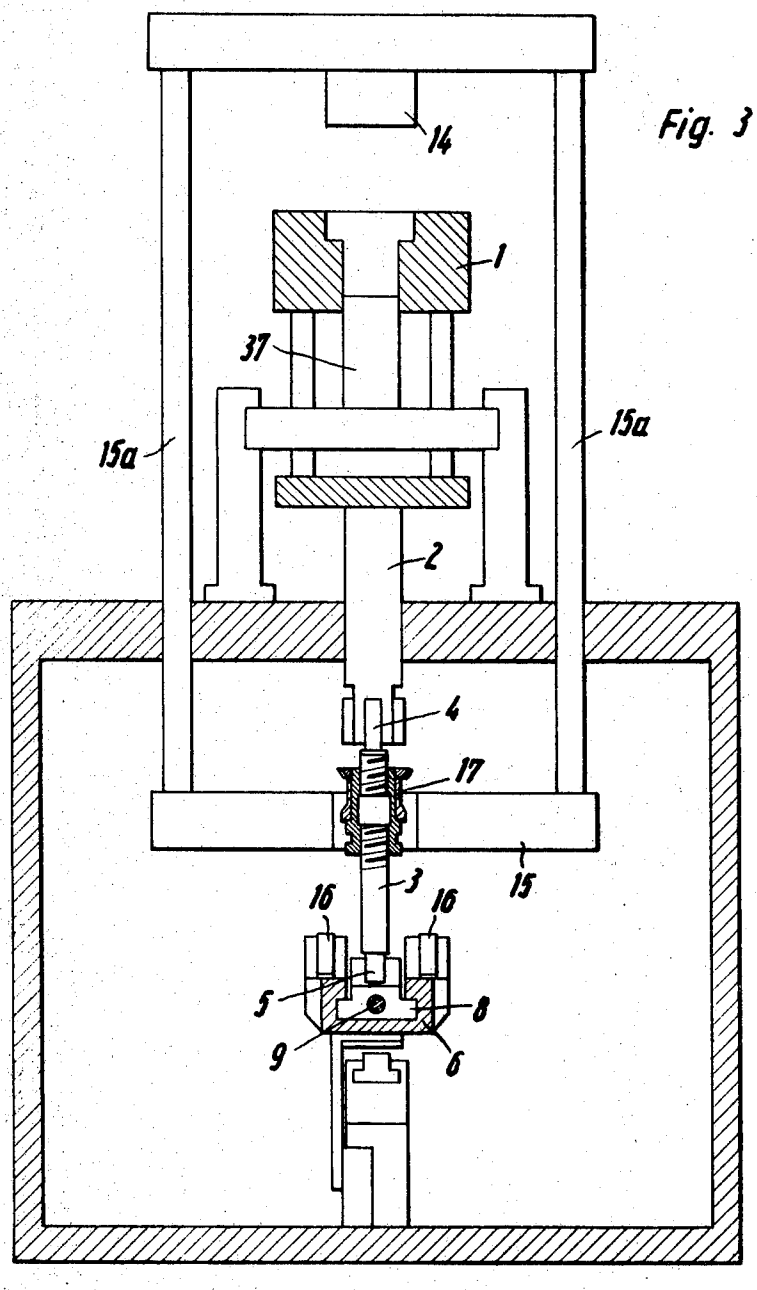


Fig. 3

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# APPARATUS FOR CONTROLLING THE MOVEMENT OF THE MATRIX OF METAL-POWDER PRESSES

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U.S. Cl. 18—16.5 3 Claims

## ABSTRACT OF THE DISCLOSURE

A mechanism controls, for instance steplessly adjustably, the movement of the matrix of a press during the compression stroke, in dependence on the movement of the upper punch. An element is connected to the upper punch which moves synchronously therewith and engages a mechanism that is connected to the matrix for effecting movement of the latter after a predetermined movement of the upper punch.

The present invention relates to a control of the movement of a matrix, particularly of metal-powder presses, in dependence on the movement of the punch during the compression stroke.

When pressing metal powder, it is desired to obtain a homogeneous texture of the stamping by making it equally dense throughout.

Since, during the pressing operation, besides the friction between the wall of the matrix and the powder granules there occurs also internal friction between the granules and there takes place elastic, plastic deformation, one endeavors to effect the pressure so that the internal resistances are taken care of by controlling the movement of the matrix during the compression stroke in dependence on the movement of the punch.

Recognizing the internal actions and their influence on the quality of the stamping, it has been attempted to operate with so-called floating matrixes whereby the matrix is taken along by the wall friction of the powder when the punch enters the matrix, so that the stationary lower punch also enters the matrix (see "Industrieblatt, 1962").

The disadvantage of not being able to control the pressing operation is thereby accepted.

The German Pat. No. 543,671 discloses control of the pressing operation by moving the matrix by cams whereby transmission of the great pressure forces through the cam rollers causes considerable difficulties.

Whereas the German Pat. No. 1,019,599 additionally operates with a bevel gear and a tooth segment, causing considerable expense, the German Gebrauchsmuster No. 1,909,962 proposes to take along the matrix over the upper punch by a wedge, whereby the take-along velocity of the matrix is equal to that of the upper punch and cannot be changed.

The problem of controlling the movement of the matrix according to size and configuration of the stamping so that a uniformly dense structure of the stamping is obtained, is solved by the present invention. Generally, the solution is accomplished by connecting an element to the upper punch which, at its movement which is synchronous with that of the upper punch, abuts against a mechanism which is connected to the matrix and infinitely variably adjustable.

In a preferred device according to the invention, a traverse is connected to the upper punch by means of the punch supporting structure, which traverse abuts, after



a predetermined stroke, against a slide element connected to a rocking lever and takes said lever along to an abutment, a slide element displaceably connected to the rocking lever being pivotally connected to one end of a connecting rod whose length is adjustable and the second end of which is pivotably connected to a bolt connected to the matrix.

With the aforedescribed lever system the following results are obtained:

(1) The length adjustment of the connecting rod defines the moment at which the rocking lever is taken along and thereby the beginning of the movement of the matrix.

(2) The displacement of the slide element in the rocking lever makes possible a velocity modulation of the matrix relative to the velocity of the upper punch whereby both, the slide element and the rocking lever, afford infinitely variable adjustment by conventional devices, such as threaded spindles and gears.

The apparatus according to the invention affords, in a simple manner, infinitely variable control of the movement of the matrix according to the size and form of the stamping so that production of a structure, which is homogeneous throughout and correspondingly dense, is assured and the quality of stampings of any kind can be guaranteed.

The accompanying drawing illustrates, by way of example, the operation of a device according to the invention.

FIG. 1 is a diagrammatic longitudinal sectional illustration of a matrix drive according to the invention in filling position;

FIG. 2 is a diagrammatic longitudinal sectional view shown in FIG. 1 with the mechanism shown in position after the pressing operation; and

FIG. 3 is a diagrammatic transverse sectional view of the matrix drive according to the invention in filling position.

Referring more particularly to FIGS. 1, 2, and 3 of the drawing wherein like parts are designated by like numerals in all three figures, numeral **1** designates a matrix which is connected by longitudinal rods and a traverse to a bolt **2** to the free end of which one end of a connecting rod **3** is pivotally connected by a pin **4**.

The opposite end of the connecting rod **3** is pivotally connected by a pin **5** to a slide **8** which is slidably supported in a rocking lever **6** which is rockable on a fulcrum **7**. The slide **8** can be displaced by rotating a threaded spindle **9** by means of a pair of bevel gears **10**, a splined shaft **11** with sleeve **12**, and bevel gears **13**.

An upper punch **14** is connected by a supporting structure **15***a* to a traverse **15** adapted to abut against slide surfaces provided on slide elements **16** which are rockably supported by the rocking lever **6**.

For changing the length of the connecting rod **3** a turnbuckle **17** is provided which can be rotated by revolving a splined shaft **18** with sleeve **19**. The latter is operatively connected to the turnbuckle **17** by bevel gears **20**.

An abutment **21** limits movement of the rocking lever **6** and defines its lowermost position; the abutment **21** is connected by means of a rod **22** to one end of a two-arm lever **24** rotatable on a pin **23**. The second end of the lever **24** supports a roller **25** which rolls on a cam **26** and is pressed against the cam **26** by the action of a spring **27** pressing against a collar **29** on a rod **28** which is connected to the abutment **21**. A locking means or latch **30** holds the rocking lever **6** in its lowermost position. The latch **30** is rockable on a fulcrum **31** and is connected by a rod **36** to one arm of an angle lever **32** which is rotatable on a pin **33**; the second arm of the angle lever is provided with a roll **34** which is pressed against the cam **26** by the action of a tension spring **35**.

A lower punch **37** is rigidly connected to the housing of the control apparatus (FIG. 3). The mechanism for actuating the upper punch **14** is not shown in the drawing because it is not part of the present invention.

Pressing operation:

After entry of the upper punch **14** in the matrix **1** the traverse **15** abuts against the elements **16** of the rocking lever **6** and takes along the matrix **1** whereto the lever **6** is connected by the slide **8**, the connecting rod **3** and the bolt **2**. The velocity of the movement of the matrix relative to the movement of the upper punch can be infinitely variably changed by displacing the slide **8** in the lever **6**. In the extreme right position of the slide **8**, as shown in FIG. 2, the speed of movement of the matrix is approximately equal to that of the upper punch **14**, since the pin **5** at the lower end of the connecting rod **3** is farthest away from the fulcrum **7**. If the slide **8** is moved to the left the deviation of the pin **5** becomes smaller, causing a reduction of the velocity of movement of the matrix **1**.

Changing of the length of the connecting rod **3** changes the moment when the rocking lever **6** is engaged with the traverse **15** and the matrix **1** is moved.

The aforedescribed system **22**, **31** with the levers **24**, **32** and springs **27**, **35**, as well as the rolls **25**, **34** and the latch **30** effect fixing of the lever **6** and its release at the return stroke of the upper punch **14** whereby the latch **30** arrests the lever **6** until the matrix **1** is withdrawn.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent is as follows:

**1.** A control system for presses, particularly for metal-powder presses, comprising a movable matrix, a movable upper punch, first means connected to said upper punch for movement therewith, second means connected to said matrix and engageable with said first means during the compression stroke of said upper punch for moving said matrix when said upper punch is moved and said first means is engaged with said second means, and said second means comprising infinitely variable means for controlling the time of engagement of said first means with said second means for controlling the movement of said matrix during the compression stroke in dependence on the movement of said upper punch.

**2.** A control system as defined in claim **1** wherein said first means comprises a supporting structure for said upper punch, said seconds means comprising a rocking lever having slide elements mounted thereon for engagement with said support structure and movement of said rocking lever after a predetermined compression stroke of said upper punch, an abutment adapted to be abutted by said rocking lever for stopping movement of the latter after a predetermined movement of said rocking lever, infinitely variable means in the form of a slide longitudinally movable on said rocking lever, a bolt connected to said matrix, and a connecting rod having a first end connected to said slide and having a second end connected to said bolt.

**3.** A control system according to claim **2** comprising means for infinitely variably displacing said slide longitudinally of said rocking lever, locking means for arresting said rocking lever after movement of said rocking lever has been stopped by said abutment, and cam means for actuating said locking means and said abutment for releasing said rocking lever.


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