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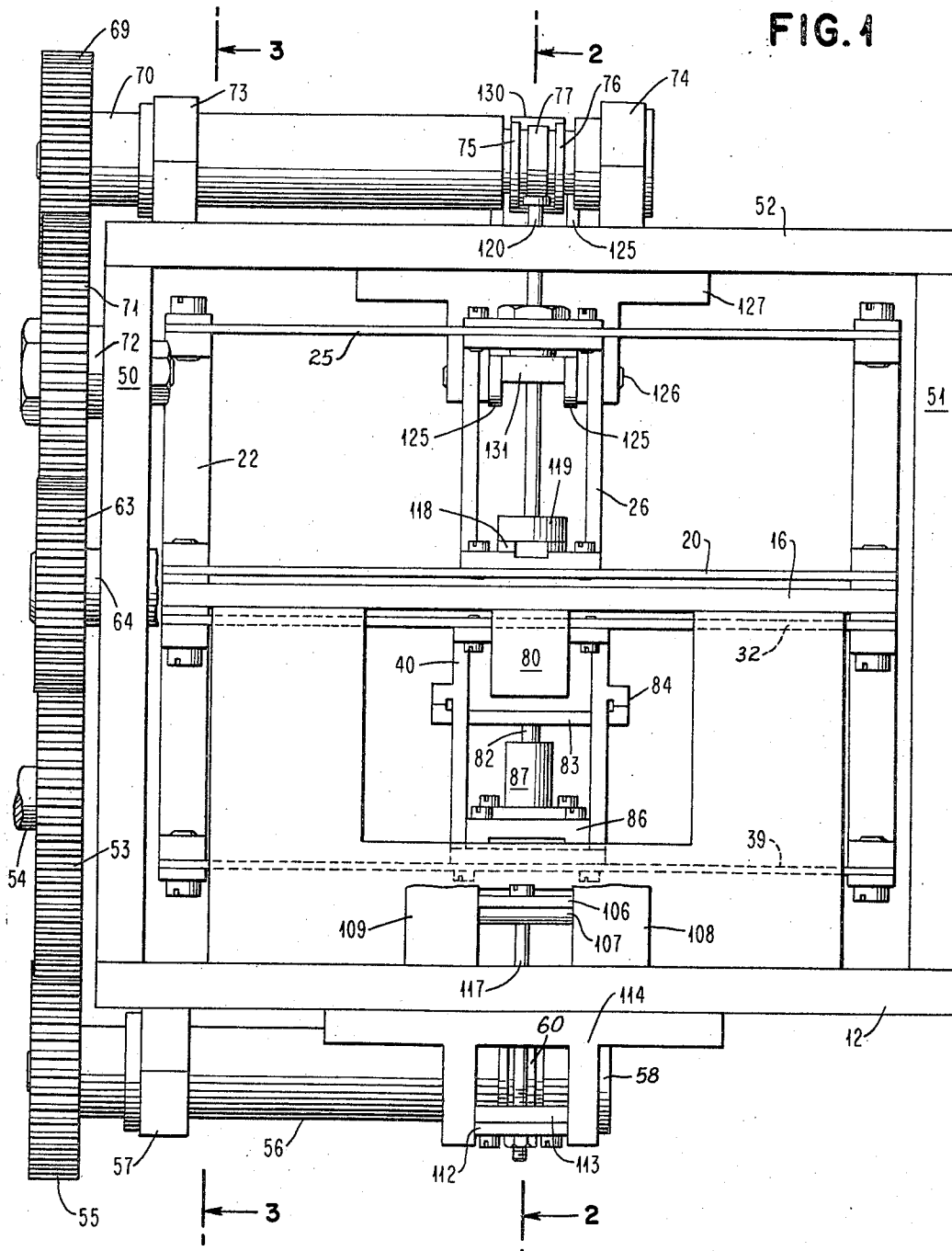
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3,491,407

PRESS FOR FERRITE CORES

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FIG. 2

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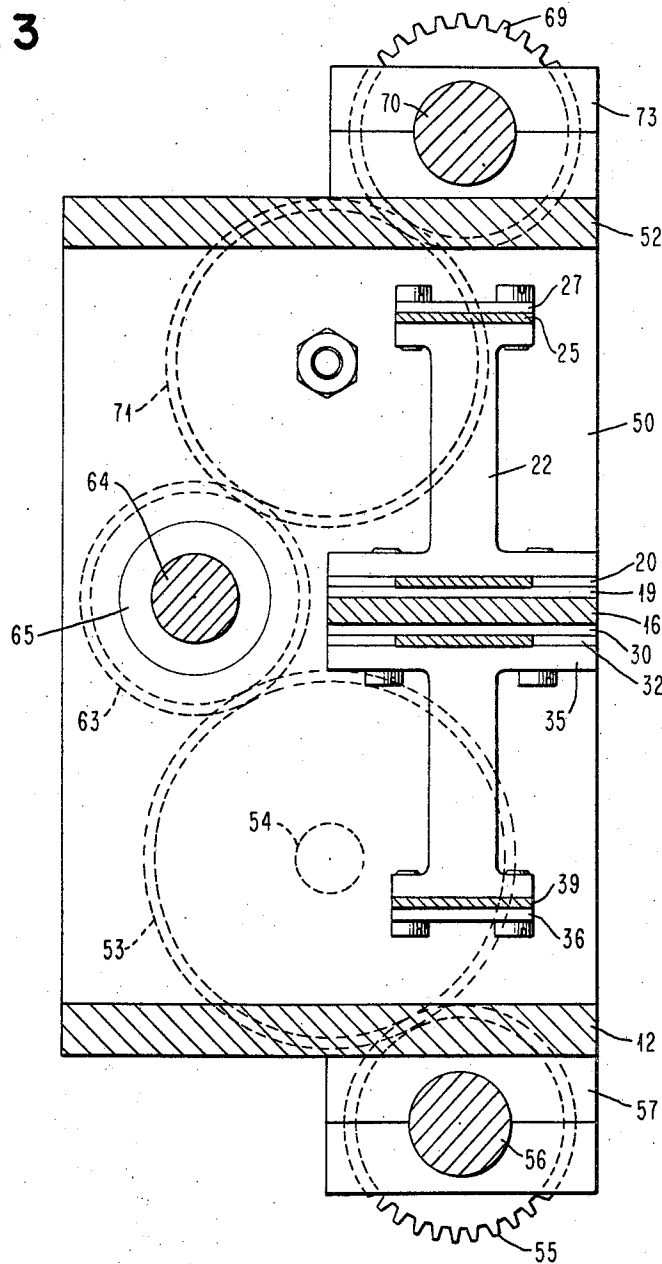
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FIG. 3



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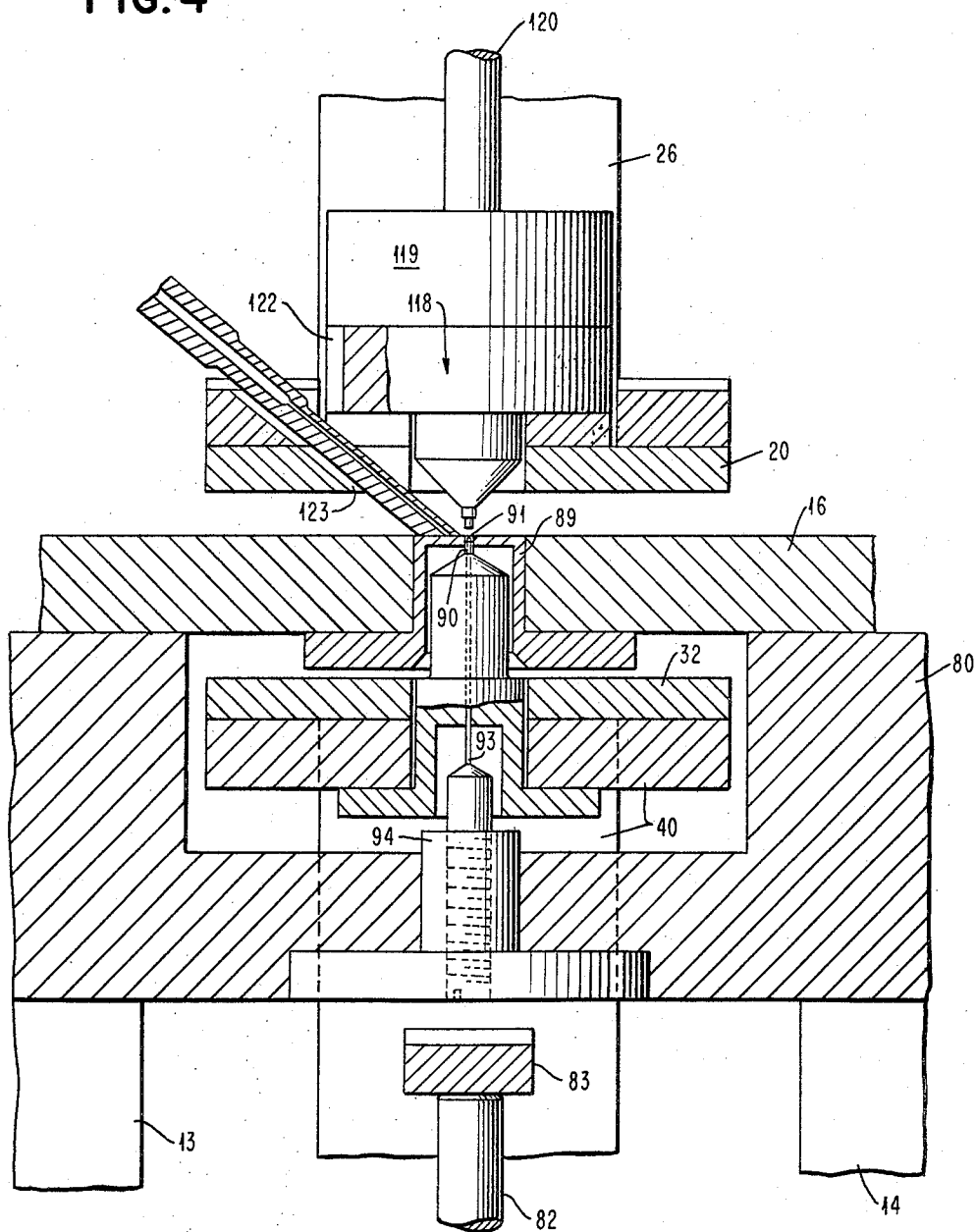
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FIG. 4



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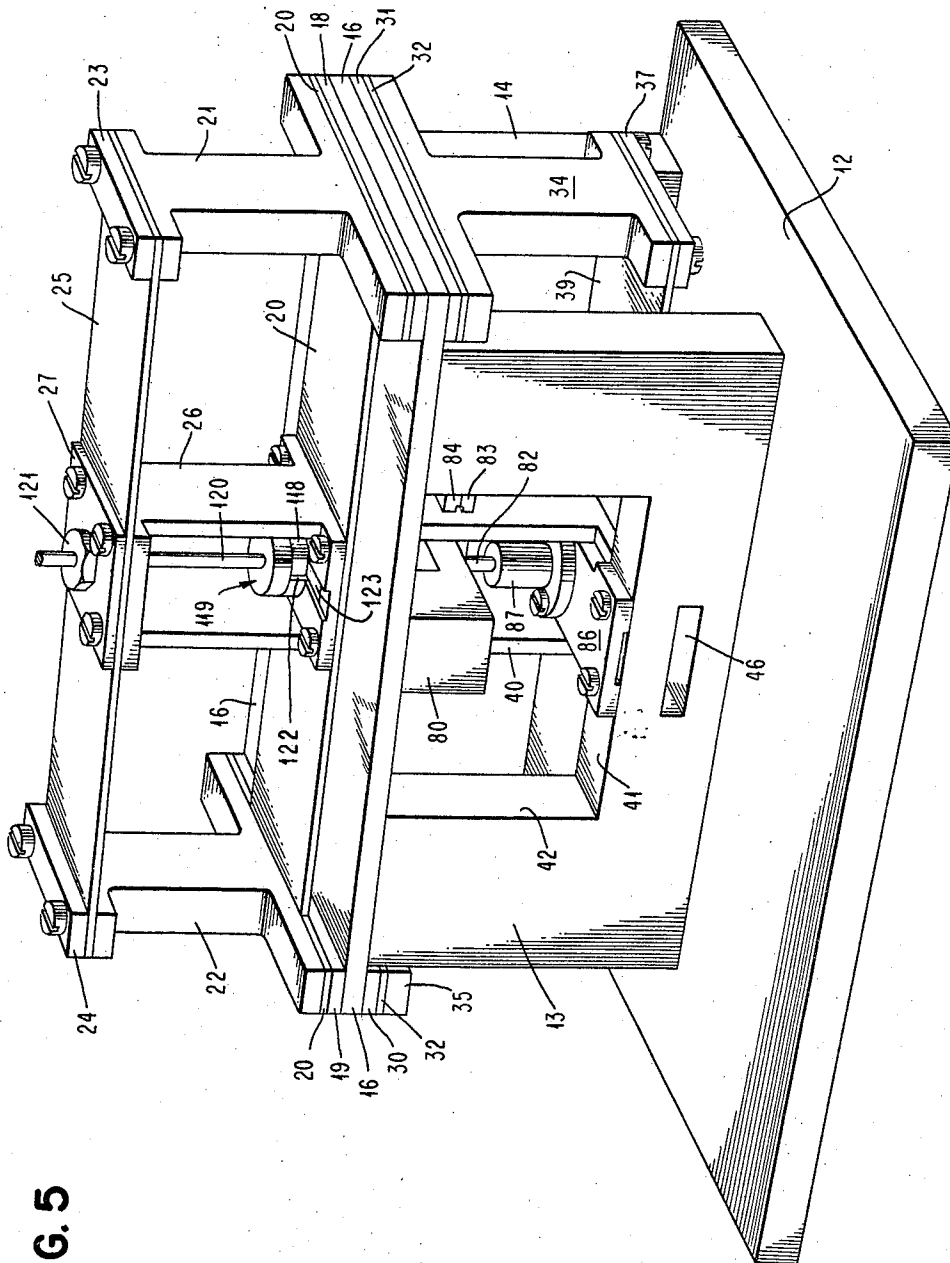


FIG. 5

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PRESS FOR FERRITE CORES
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7 Claims

ABSTRACT OF THE DISCLOSURE

This invention provides an improved support for the upper and lower punches of a press for making toroidal cores from powdered ferrite material. Each punch is mounted on a pair of flexible beams. The beams are constructed to flex slightly in the direction of intended motion of the punch but to be rigid in every other direction. This flexing provides the only motion of the upper and lower punches. The new support structure provides improved alignment of the upper and lower punches and the stationary die cavity and thereby reduces tool wear and permits pressing smaller cores.

THE PRIOR ART

Ferrite cores are small toroidal elements that are used in magnetic storage devices for data processing apparatus. Cores usually have an outside diameter of about a few tens of thousandths of an inch. Smaller cores can be driven harder and thereby switched faster than larger cores, and improvements in the speed of ferrite core memories have been closely related to advances in manufacturing smaller cores.

A core press usually includes a stationary element that has a cylindrical aperture that forms the outer cylindrical walls of a die cavity, a second stationary cylindrical element that is located coaxial with the die cavity and forms the inner walls of the die and the aperture of the pressed core, a movable lower punch that is coaxial with the inner stationary cylindrical element, and a movable upper punch. The upper punch is movable to press the ferrite powder into shape, and the lower punch is movable to raise the pressed core out of the die after it has been pressed.

In the prior art, core presses have been developed from presses originally designed for pressing pills. The pills are of course much larger than ferrite cores, and the tolerances between the moving punches and the supports for a pill making press are of course much wider than the tolerances for a core making press. In these prior art core presses, the punches are mounted on cylindrical supports that reciprocate axially within cylindrical openings in a support. These elements are made very accurately to produce a close sliding fit between the movable parts and their supports. Nevertheless, the alignment of these presses has been difficult and as a result, tool wear has been a recognized problem. Furthermore it is doubtful that core presses of this type can be further adapted to permit pressing cores that are much smaller than the cores now being pressed. One of the objects of this invention is to provide a new and improved core press (or similar device) in which the reciprocating parts maintain very accurate alignment.

In these prior art core presses, the punches have been operated through a fixed distance and the cores being made on a press at about the same time all have the same height. When cores are pressed in this way to a fixed height, the density of the cores tends to vary and magnetic characteristics that depend on density can be degraded. Core press operators routinely test weight the cores and adjust the press to vary the core height as is appropriate to maintain the desired core density.

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The prior art has suggested core presses which operate to give the cores a uniform density rather than a fixed height. However, these presses have used hydraulic drives which have been undesirably complex. A more specific object of this invention is to provide a new and improved core press that presses cores to a preset density rather than to a preset height.

THE INVENTION

The core press of this invention uses dies and punches that are generally similar to the prior art core presses already described. According to this invention, the upper and lower punches are each carried by a pair of flexible beams. The beams have their outer ends fixed to the stationary supporting parts of the press. A punch is mounted between the pair of beams at the midpoint between the fixed ends. The beams are constructed to be sufficiently flexible to be movable vertically a few thousandths of an inch. In other directions the beams are constructed to be essentially rigid. Suitable means is provided for reciprocating the upper and lower punches to operate the press through a core pressing cycle.

In the preferred press, the upper punch is driven by a direct mechanical linkage and thereby is operated over a fixed path. The lower punch is operated directly by the drive mechanism only during the operation of ejecting a core from the die cavity. During the pressing operation, the lower punch is supported by the lower pair of flexible beams and, preferably, by auxiliary spring means. The beams and the springs are constructed to provide essentially constant force on the core material in the die cavity over the range in variation of core height that might be experienced. Thus, this press produces cores having preset density and slight variations in height.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

The drawing:

FIG. 1 is a front elevation of the preferred press.

FIG. 2 is a section 2—2 of FIG. 1.

FIG. 3 is a section 3—3 of FIG. 1.

FIG. 4 is an enlarged section of the punches and die as shown in FIG. 2.

FIG. 5 is a perspective with parts removed.

THE PREFERRED PRESS

Introduction

The simplified perspective of FIG. 5 is a helpful introduction to the more detailed showings of the other figures. The press includes a base 12 that supports the other elements, and a support 16 that supports the die and the punch carrying elements. A front support 13 and a back support 14 are arranged to position support 16 at about the vertical midpoint of the press structure. As will be explained later, cores are punched within a die held by support 16, and the pressed cores are ejected onto the upper surface of support 16. An upper punch and its associated components are mounted above the support 16 and a lower punch and its associated components are mounted below support 16.

A pair of elements 18 and 19 are mounted on support 16 to position a flexible beam 20 slightly above support 16. Beam 20 is somewhat H-shaped to be as wide as elements 18 and 19 at its ends and to be somewhat narrower between its ends. Elements 21 and 22 cooperate with elements 23 and 24 to position a second flexible beam 25 above and parallel to beam 20. A rigid spacer 26 is mounted between beams 20 and 25 at the midpoint between their ends to support the movable elements of

the upper punch. A plate 27 is mounted over beam 25 and spacer 26.

Similarly, elements 30 and 31 support a flexible beam 32 closely below support 16; elements 34, 35, 36 (hidden in FIG. 5) and 37 support a flexible beam 39, and a spacer 40 is mounted between the beams. The inner beams 20 and 32 carry the punches, and the outer beams 27 and 39 function primarily to laterally stabilize the outer parts of the punch.

FIG. 5 also shows that wall 13 has a cut out portion that forms a surface 41 that supports stationary parts of the lower punch assembly that will be described later. A surface 42 is numbered to show the relationship of FIG. 5 to FIG. 2. Wall 14 has a similar cut out portion and surfaces 43 and 44 not shown in FIG. 5. FIG. 5 also shows a small opening 46 formed in wall 13 which receives an element (106) of the lower punch assembly which will be explained later in the description of FIG. 2.

Mechanical drive

FIGS. 1 and 3 show the mechanical drive and its supporting structure. Side elements 50 and 51 and a top element 52 are mounted on the base 12 to form an open, box-like, structure that surrounds the components already introduced in the description of FIG. 5. A gear 53 is mounted on a shaft 54 to be supported and driven from a suitable source that is not shown. A gear 55, shown also in FIG. 2, is mounted on a cam shaft 56 and is arranged to be driven from gear 53. Cam shaft 56 is rotatably mounted below base 12 by means of bearings 57 and 58. Cam shaft 56 carries a cam 60 which drives the lower punch.

A gear 63 is mounted on a cam shaft 64 and is arranged to be driven from gear 53. Cam shaft 64 is rotatably mounted in bearings 65 mounted on side elements 50 and 51. (Bearings 65 are shown only in FIG. 3 and are to be distinguished from the space 66 shown in FIG. 2.) Cam shaft 64 carries a cam 68 that operates a powder feed mechanism that is shown only in FIG. 2 and will be described later.

A gear 69 is mounted on a cam shaft 70 and is coupled through a gear 71 to be driven by gear 63. Gear 71 is mounted on a shaft 72 that is mounted on the side element 50. Shaft 70 is rotatably mounted on bearings 73 and 74 which are mounted on top element 52. Shaft 70 carries a first cam formed of elements 75 and 76 and a second cam 77. These cams raise and lower the upper punch.

The die and the lower punch

FIG. 5 shows the general relationship of the die and the lower punch to other components that have been described already. The die (89 described later) is mounted in the support 16. A support 80 is mounted below support 16 to hold a stationary die rod (93 described later). Support 80 is shaped to be spaced away from support 16 in the region of the die to provide space for the upper portion of the spacer 40, which carries the lower punch (90, described later). The spacer 40 is driven from the lower cam 60 (not shown in FIG. 5) through a rod 82. Rod 82 engages a flexible element 83 that extends through openings in the sides of spacer 40 and bears against elements 84 formed on the sides of spacer 40. Rod 82 is removable from element 83 to facilitate assembling these elements.

FIG. 5 also shows a stationary stop element 86 that is mounted on surface 41 of front support 13 and a similar surface of back support 14. A guide 87 is mounted on stop 86 to guide the rod 82. Stop element 86 extends through the spacer 40 to bear against a movable stop (95, described later) carried by spacer 40. When the lower punch (90, described later) is driven to its uppermost position by cam 60 and rod 82, the lower punch assembly stops against stop element 86. Further motion of the

rod 82 then slightly flexes the flexible member 83 but does not further raise the lower punch.

FIG. 4 shows the details of the die 89 and the lower punch 90. Support 16 is provided with an aperture for receiving the die. The die is provided with a flange that fits against the lower surface of support 16, and screws that are not shown fasten the die to the support. Die 89 has a cylindrical aperture 91 that has a diameter of about .006". This aperture forms the outer walls of the die cavity and shapes the outer circumferential walls of a core.

The lower punch 90 is shaped to extend into the aperture 91 and to form the lower wall of the die cavity. Lower punch 90 is also shaped to be mounted on the lower surface of the upper portion of spacer 40 by means of screws, not shown. The lower punch has an axial bore for receiving a stationary core rod 93. Core rod 93 forms the inner walls of the die cavity and shapes the aperture of a core. Core rod 93 is tightly threaded in an element 94 which is mounted on support 80, and the core rod is adjustable to set up the press.

FIG. 2 shows in a reduced side view the elements that have been introduced in the description of the front view of FIG. 4. FIG. 2 also shows the movable stop element 95 which was introduced but not shown in the description on FIG. 5. Stop element 95 is fixed to the lower portion of the spacer 40 and the lower flexible beam 39. When the lower punch is in its uppermost position, element 95 stops against the stationary stop 86.

In FIG. 2, unshaded portion of the stationary stop element 86 corresponds to the vertical surface of the slot that FIG. 5 shows formed in the lower surface of stationary stop 86. The slot is constructed to receive a thickness gauge for adjusting the clearance between elements 86 and 95 when the lower punch is in its lower position.

The movable stop 95 is also constructed to bear against a preloaded spring assembly 96 when the lower punch is in its lowermost position. The preloaded spring assembly includes a spring 98, housing elements 102 and 103, and an element 104 that slides within the housing to transmit the force of spring 98 to the stop 95. Stop 95 is adjusted to engage the spring assembly near the lowermost point of the travel of the lower punch and to thereby provide a predetermined spring force opposing the force of the upper punch. The spring assembly 96 is easily replaceable as a unit to change the force that the press applies to a core.

As the press has been described so far, the cam 60 drives the lower punch upward to eject a core at the end of a pressing operation and the flexible beams 32 and 39 lower the punch for the forthcoming operation of filling the die cavity with powder. A circumferential groove is formed on the movable stop 95, and an element 106 is shaped at one end to engage the groove of element 95 and at its other end is mounted on a rod 107 that is pivotally mounted between supports 108 and 109. (See FIGS. 1 and 2.) A lower element 112 is mounted at one end on a rod 113 that is pivotally mounted on a support 114 that is mounted on the lower surface of base 12. Element 112 is adapted to ride on the lower surface of cam 60, and a rod 117 connects elements 106 and 112 to transmit the downward force of cam 60 to the lower punch. Rod 117 is made adjustable to establish the desired relationship between the position of the cam and the position of the lower punch.

The upper punch

The simplified drawing of FIG. 5 shows an upper portion of the upper punch 118, an element 119 that is mounted above the die, and a rod 120 that is arranged to engage punch 118 and to extend above the upper portion of the spacer 26 to ride on the upper cam element 77 (not shown in FIG. 5). A screw 121 shown in FIG. 5 cooperates with other elements to raise the upper punch at the end of a core pressing operation. The upper punch has

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a slot 122 that cooperates with an opening 123 formed in spacer 26 to receive the powder shute.

FIG. 4 shows the upper punch 118 as it is mounted with element 119 on the lower portion of spacer 26. The upper punch is provided with an axial bore (not shown) that communicates with an air supply fitting mounted on element 119. After the punch has been raised, air pressure is applied to clear the punch of loose powder. The air tends to be deflected from the powder shute and to help move the core to the right in FIG. 4.

As FIGS. 1 and 2 show, the rod 120 rides against the cam 77 that is carried by the cam shaft 70. Cam 77 operates the rod and the upper punch through a fixed downward path for pressing a core. Cams 75 and 76 operate through a rocker mechanism to lift the punch to its upper position. The rocker mechanism includes an arm 125 that is pivotally mounted on shaft 126 that is held by a support 127 mounted on top element 52. Rocker arm 125 carries a roller 130 that rides on the cams 75 and 76. The screw 121, introduced in the description of FIG. 5, has a lower rounded portion that engages a complementary shaped element 131 mounted at the lower end of arm 125.

The powder feed mechanism

FIG. 2 shows the general features of the power feed mechanism. Powder is held in a reservoir 136. A powder shute 137 is attached to the reservoir to deliver powder to the die cavity. The powder shute is arranged to extend through the opening 123 in spacer 26 and to ride flush on the surface of support 16. The reservoir and powder shute assembly is mounted on a plate 138 that is pivotally mounted by means of a shaft 139 on a support 140 that is slidably mounted on the supports 108 (FIG. 1 only) and 109 that were introduced in the description of the lower punch. The shaft 139 carries a roller 141 that rides on the cam 68. For a pressing operation, the cam 68 drives the powder feed components to the frontmost position illustrated by FIG. 2. After the lower punch has been raised to eject a core, the powder feed mechanism is pulled rearward by a spring 143 to a point where the powder shute covers the die cavity and powder fills the die cavity. A space 66 is provided to separate the shaft 64 from the supports 108 and 109 and from the slidable support 140.

OPERATION

To fill the die cavity, the upper punch is raised to its uppermost position and the lower punch is kept in its upper position from a previous core ejecting operation. The powder feed mechanism is then driven rearward to cover the die and air pressure is applied momentarily to the reservoir to fill the die cavity with powder as the lower punch is lowered. As the powder feed mechanism moves over the die cavity, it pushes to the rear the core that was formed in the preceding operation. Air pressure is applied to the upper punch to clear the press of loose powder, and the air is deflected to the rear and helps to move the core away from the area of the die. The powder shute is moved frontward, and the upper punch is lowered to compress the powder to form a core. As the upper punch compresses the powder, it increases the force on the lower punch and on the spring assembly 96. The lower punch moves a rather small distance under a substantially uniform force established by assembly 96. (A strain gauge may be mounted on the lower flexible beam 39 for monitoring the position of the lower punch.) Thus the density of the cores is quite uniform and they may vary slightly in height. The upper punch is then raised by the operation of the rocker assembly, and the lower punch is raised to lift the pressed core out of the die cavity and into position to be moved rearward when the powder shute moves into the filling position. The lower punch is then lowered by the cam 60 and the flexible beams 32 and 39 or the elements that couple the cam to the adjustable stop 95.

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While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A device for pressing a subject under a punch, comprising,
 - (a) a base,
 - (b) means mounted on said base to support said subject to be pressed,
 - (c) a beam constructed to flex slightly in one direction and to be rigid in other directions,
 - (d) means fixed to the beam only at the ends of the beam for mounting said beam on said base for said beam to be flexed toward and away from said support means and in close proximity to said support means,
 - (e) a punch,
 - (f) means fixedly mounting said punch to be carried at about the midpoint of said beam and to extend beyond the beam in a direction to press said subject, and
 - (g) means for operating said punch for a pressing operation on the subject in which said beam flexes to guide said punch in alignment with said subject.
2. A device according to claim 1 further including,
 - (h) a second flexible beam, and means fixed to the beam only at the ends of the beam and mounting said second beam on said base parallel to the other beam and spaced from said other beam in a direction away from said means to support the material to be pressed, and,
 - (i) a spacer connecting said first and second beams at their midregions.
3. A device for pressing material in a die, comprising,
 - (a) a base, a die, and means mounted on said base to support said die,
 - (b) a first flexible beam, an upper punch, means fixedly mounting said upper punch to be carried at about the midpoint of said beam, and means fixed to said first beam only at its two ends and mounting said beam above said die support in close proximity to said support with said upper punch aligned with said die,
 - (c) a second flexible beam, a lower punch, means fixedly mounting said lower punch to be carried at about the midpoint of said second beam, and means fixed to said second beam only at its two ends and mounting said beam below said die support in close proximity to said support with said lower punch aligned with said die, and
 - (d) means to operate said upper and lower punches through an operation of pressing material in the cavity of said die in which said beams flex to guide said punches in alignment with said die.
4. A press, comprising,
 - a base, a die, and means mounted on said base to support said die,
 - a first pair of flexible beams, a spacer fixedly connecting said beams at their midpoints, an upper punch fixedly mounted on said spacer, and means connected to said beams only at their ends and mounted on and above said die support for aligning said upper punch above said die,
 - a second pair of flexible beams, a spacer fixedly connecting said beams at their midpoints, a lower punch fixedly mounted on said spacer, and means connected to said beams only at their ends and mounted on and below said die support for aligning said lower punch with said die, and
 - means for operating said upper and lower punches through a pressing operation in which said beams flex to guide said punches in alignment with said die.

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5. A press according to claim 4 in which said operating means comprises cam means for lowering said upper punch through a predetermined path for a pressing operation and raising said upper punch to permit ejecting a subject pressed in said die after a pressing operation and said press further includes auxiliary spring means positioned to engage said lower punch near the end of its downward travel in response to said cam means to apply a substantially uniform force on each subject being pressed.

6. A press for cores, comprising,

a base, a die, means mounted on said base to support said die, a core rod, and means mounted below said die support and spaced from said support in the region of said die and supporting said core rod extending into the aperture of said die,

a first pair of flexible beams constructed to flex in one direction and to be rigid in other directions, a spacer fixedly connecting said beams at their midpoints and spacing apart said beams in their direction of flexing, an upper punch fixedly mounted on said spacer, and means fixed to said beams only at their outer ends and mounted above said die support for aligning said upper punch with said die,

a second pair of flexible beams constructed to flex in one direction and to be rigid in other directions, means fixed to one of said beams only at its ends and positioning said one beam to extend through the space between said core rod support and said die support in close proximity at its midpoint to said die in a direction toward and away from said die, means fixed to the other of said beams only at its ends for positioning said other beam below and generally parallel to said one beam for said beam to be fixed in the same direction as said one beam, a spacer fixedly connecting said beams at their midpoints, and a lower punch having an axial bore for receiving said core rod fixedly mounted on said spacer and aligned with said die, and

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means for operating said upper and lower punches through a core pressing operation in which said beams flex to guide said punches in alignment with said die.

7. A core press according to claim 6 in which said operating means comprises cam means for lowering said upper punch through a predetermined path for a core pressing operation and raising said upper punch to permit ejecting a core after a pressing operation and said press further includes auxiliary spring means positioned to engage said lower punch near the end of its downward travel in response to said cam means to apply a substantially uniform force on the cores.

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