United States Patent [19]

Borrini

[11] **3,773,446**

[45] **Nov. 20, 1973**

[54] **DEVICE FOR MOULDING PARTS TO BE SINTERED**

[75] Inventor: **Bartolomeo Borrini,** Ivrea, Italy

[73] Assignee: **Ing. C. Olivetti & Co., S.p.A.,** Ivrea (Torino) Italy

[22] Filed: **Aug. 24, 1971**

[21] Appl. No.: **174,325**

[30] **Foreign Application Priority Data**

Sept. 10, 1970 Italy 70042 A/70

[52] **U.S. Cl.** **425/78,** 425/450, 425/354, 425/149

[51] **Int. Cl.** **B30b 11/02**

[58] **Field of Search** 425/78, 242, 249, 425/251, 450, 149

[56] **References Cited**

UNITED STATES PATENTS

3,020,589	2/1962	Maritano	425/78
2,570,989	10/1951	Seelig	425/78
1,607,389	11/1926	Claus	425/78 X
2,389,169	11/1945	Stacy	425/149
2,916,768	12/1959	Quere et al.	425/450
3,382,540	5/1968	Van DeModeu et al.	425/78
2,823,419	2/1958	Winters et al.	425/78
2,592,296	4/1952	Kutik	425/249 X
2,653,377	9/1953	Seelig	425/78 X
2,791,804	5/1957	Talmage	425/78 X
2,883,704	4/1959	Jurgeleit	425/251
3,270,372	9/1966	Hesse	425/450

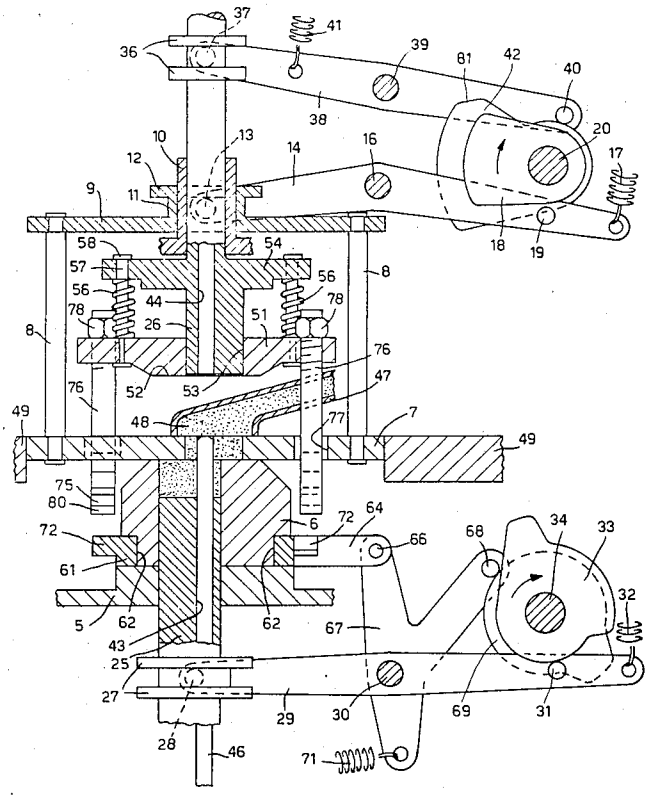
Primary Examiner—J. Howard Flint, Jr.

Attorney—Harold J. Birch et al.

[57] **ABSTRACT**

A device for moulding parts to be sintered by compressing powdered materials held between a fixed die and a movable die. A pair of punches extending through the dies compresses the powdered material. A pressure plate operated by the punch extending through the movable die engages the movable die and is also locked to the fixed die during the compression stroke of the punches to insure that the dies do not separate during the compression stroke.

10 Claims, 4 Drawing Figures



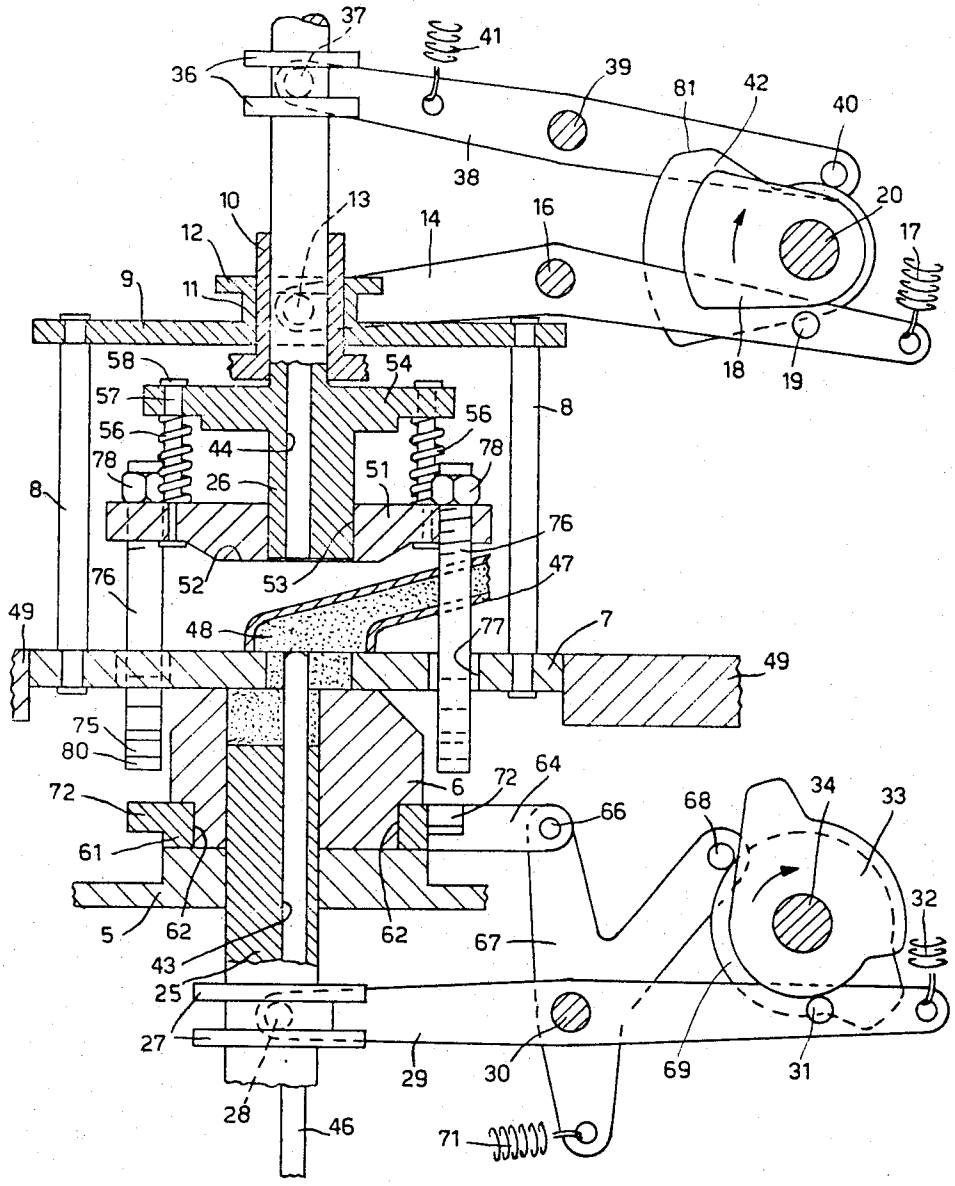


Fig. 1

INVENTOR.
BARTOLOMEO BORRINI

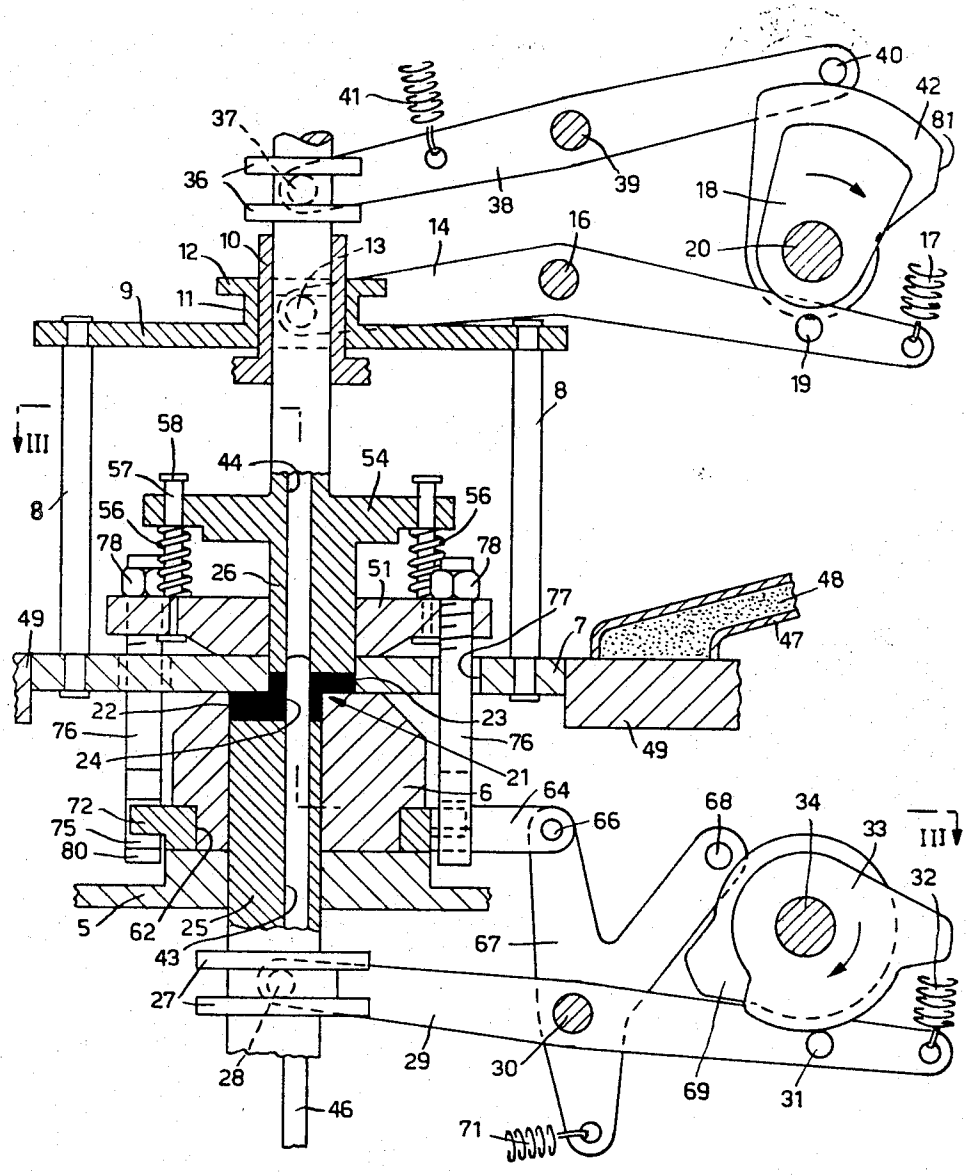


Fig. 2

INVENTOR.
BARTOLOMEO BORRINI

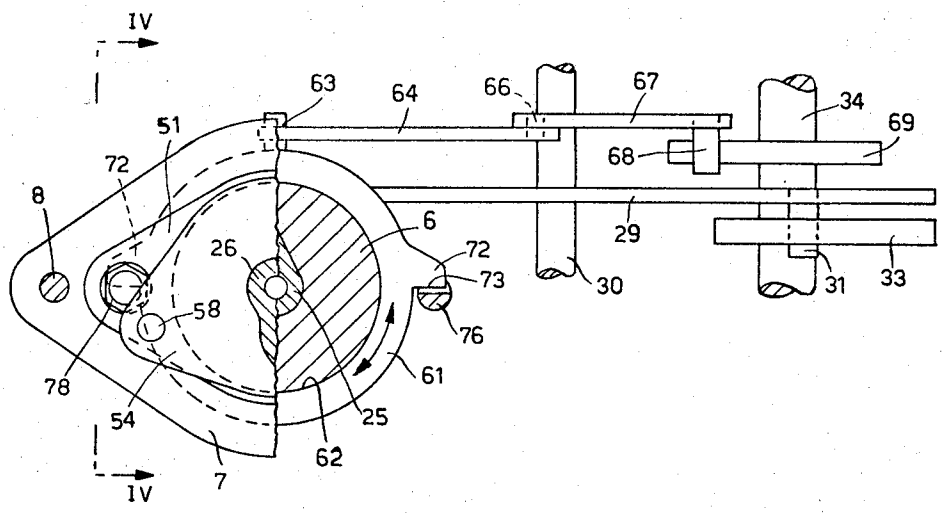


Fig. 3

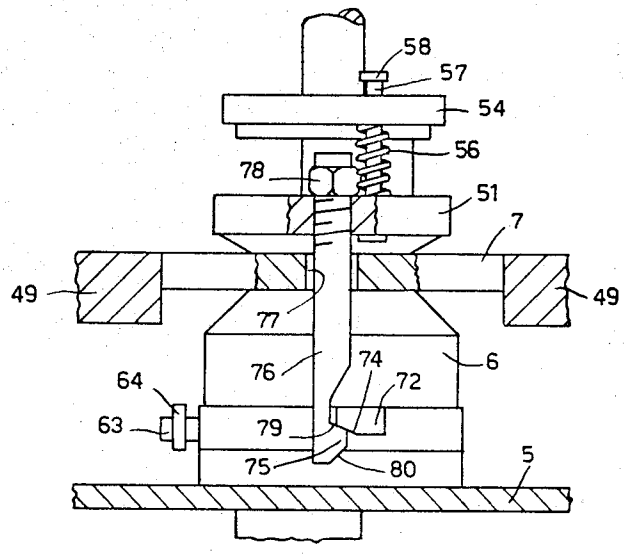


Fig. 4

INVENTOR.
BARTOLOMEO BORRINI

DEVICE FOR MOULDING PARTS TO BE SINTERED

BACKGROUND OF THE INVENTION

The present invention relates to a device for moulding parts to be sintered, by compressing powdered materials. Various such devices are known for moulding parts which generally have cylindrical or prismatic shapes and can be constructed of two or more integral parts of different section. These parts are normally compressed by means of a group of punches, each of which has a section equal to one of the portions of the part, whilst other punches each have a section equal to that of a portion not covered by another portion of the part, i.e., of a partion which projects relative to another portion.

In a known moulding device, for the purposes of allowing the extraction of parts having portions projecting with regard to others, it has already been proposed to use two dies, one of which is movable away from the other in the direction of movement of the punches. The two dies mate at the plane of variation of section of the part during the compression. This device, has nevertheless, the disadvantage of the difficulty of keeping the two dies fitting perfectly together during the compression. Therefore, particularly in the case where the projections of one portion of the part with regard to the other are very pronounced, the action of the opposing punch tends to detach the movable die from the fixed one, whereby flashes form on the surface of the compressed part.

SUMMARY OF THE INVENTION

The object of the present invention is to ensure perfect contact between the dies during the compression of the powdered material, preventing the formation of flashes on the side surface of the molded part.

According to the present invention, there is provided a device for moulding parts to be sintered by compressing powdered materials, comprising at least one pair of punches shiftable axially towards each other in order to compress the powder, the punches co-operating with a pair of dies capable of being separated parallel to the punch axes so as to allow the extraction of the moulded part, and means for positive locking the dies in contact during the compression.

The locking means can comprise a pressure plate resiliently coupled to the punch which co-operates with the movable die so as to be urged against the die by the punch. The locking means can also be arranged to couple the pressure plate positively to the fixed die during the compression. The thrust of the punch co-operating with the fixed die against the movable die is counterbalanced by the pressure plate.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in more detail, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a cross-section of a moulding device embodying the invention in one working position;

FIG. 2 is the section of FIG. 1 in another working position;

FIG. 3 is a partial section along the line III — III of FIG. 2; and

FIG. 4 is a partial section along the line IV — IV of FIG. 3.

DESCRIPTION OF A PREFERRED EMBODIMENT

The moulding device is incorporated in a press having a fixed frame, of which a portion 5 is shown in FIG. 1. The moulding device comprises a pair of dies 6 and 7, of which the die 6 is fixed on the portion 5 of the frame, whilst the die 7 is connected through two columns 8 to a plate 9 sliding on another portion 10 of the frame of the press. The plate 9 is integral with a sleeve 11 and a flange 12. A peg 13 of a lever 14 is engaged between the plate 9 and the flange 12. The lever 14 fulcrumed on a fixed pivot 16 and is thrust in an anticlockwise direction by a spring 17 which normally keeps the die 7 against the fixed die 6. The spring 17 thus avoids breakage which could be caused by entry of foreign bodies, for example bits of previously moulded parts, which could get between the open dies 6 and 7. The lever 14 is provided with a peg 19 capable of cooperating with a cam 18. This latter is fixed on an actuating shaft 20 of the press, which shaft is capable of being rotated cylindrically in a clockwise direction.

The two dies 6 and 7 are provided for the moulding of a part 21, visible in section in FIG. 2, which consists of a pair of integral cams 22 and 23 provided with a central hole 24 for mounting the cams on a shaft. The part 21 is therefore formed from two generally cylindrical or prismatic portions, having a different cross-section and joined at the plane of variation of the section, which plane is perpendicular to the axes of the two dies 6 and 7. The part 21 has furthermore, in each of the two portions 22 and 23, part which project relative to the other portion, which require, for the extraction, the opening of the two dies 6 and 7. The extraction is effected upwardly from the fixed die 6.

Associated with the two dies 6 and 7 are two punches 25 and 26, each having the section equal to that of the corresponding portion 22 and 23 respectively of the part 21 to be moulded. The lower punch 25 is provided with two flanges 27, between which there is engaged a peg 28 of a lever 29. This latter is fulcrumed on a fixed pivot 30 and is provided with another peg 31 which normally rests, through the action of a spring 32, against a cam 33 (FIG. 1) which is fixed on a second shaft 34 capable of rotating in a clockwise direction in synchronism with the shaft 20. The punch 26, in its turn, is provided with a pair of flanges 36, between which there is engaged a peg 37 of a lever 38 fulcrumed on a fixed pivot 39. The lever 38 is provided with another peg 40 which normally rests through the action of a spring 41 against a cam 42 fixed on the shaft 20.

The two punches 25 and 26 have, internally, an axial hole 43 and 44 respectively, into which there can pass a rod 46 in order to allow the moulding of the hole 24 of the part 21. The press further comprises a duct 47 for feeding the metal powder 48 into the dies 6 and 7. The duct 47 is displaceable cyclically in known manner on the die 7 and on to a plate 49 coplanar with the die 7, from the position of FIG. 1 to that of FIG. 2.

In accordance with the invention, the moulding device comprises means for positve locking capable of keeping the dies 6 and 7 in contact during the compression. In particular, these locking means comprise a pressure plate 51, which is provided at the bottom with a projection 52 capable of resting against the die 7, but normally removed from it as in FIG. 1. The plate 51 is provided with a central hole 53, by means of which it is guided by the punch 26. This latter is provided, in its

turn, with a flange 54, which is connected to the plate 51 through two resilient couplings. Each resilient coupling is formed by a compression spring 56 and by a small pillar 57 fixed at the bottom on the plate 51 and sliding in the flange 54. Each pillar 57 is provided with a flange 58 normally resting against the flange 54.

The locking means of the matrix comprise, furthermore, a member which can be actuated for positively coupling the pressure plate 51 with the fixed die 6. This member is constituted by a ring 61, which is rotary in a groove 62 of the fixed die 6. The ring 61 (FIG. 3) is provided with a peg 63 connected with a lot of play to a hole of a slider 64. This is fulcrumed on a pin 66 (FIG. 1) carried by a lever 67 fulcrummed on the pin 30. The lever 67 is provided with a peg 68 normally resting against a cam 69 on the shaft 34 under the action of a spring 71 which tends to cause the lever 67 to rotate in a clockwise direction.

The ring 61 is furthermore provided with two diametrically opposed teeth 72, of which only one is visible in FIG. 3. Each tooth 72 has a radial edge 73 and the lower surface 74 slightly inclined (FIG. 4). Each tooth 72 is capable of cooperating with a shoulder of a hooked appendage 75 of a corresponding column 76 (FIG. 1) passing through a corresponding hole 77 of the movable die 7.

The two columns 76 are threaded at the top and are fixed in two threaded holes of the pressure plate 51 so as to be able to be adjusted in height. The columns 76 are then fixed in the desired position by lock nuts 78.

The appendage 75 of each column 76 is provided with an upper surface or shoulder 79 (FIG. 4) inclined substantially like that of the corresponding tooth 72 and with a lower surface 80 inclined in the opposite direction and capable of cooperating with the radial edge 73 of the corresponding tooth 72.

In operation of the moulding device, at the start of the cycle of the shafts 20 and 34, the punch 26 is in the high position whilst the movable die 7 rests against the fixed die 6, as indicated in FIG. 1. Furthermore, the ring 61 is in the position of FIG. 3, so that the peg 68 rests against the cam 69. The duct 47 is above the central portion of the movable die 7, so as to effect the charging of the two dies 6 and 7 with the metal powder 48 in a manner known per se. Subsequently the duct 47 is slid on to the plate 49 outside the path of the plate 51.

Afterwards the cam 42 through the lever 38 commences to displace the punch 26 downwards. The punch 26 through the flange 54 and the springs 56 resiliently urges the pressure plate 51 downwards together with the columns 76. When the lower surfaces 80 (FIG. 4) of the appendages 75 encounter the respective teeth 72 of the ring 61, the action of the springs 56 prevails over that of the spring 71 (FIG. 1). The ring 61 is then rotated slightly in an anticlockwise direction until the teeth 72 snap back above the appendages 75.

The plate 51 reaches the movable die 7 before the punch 26. The spring 71 then urges the lever 67 to rotate in a clockwise direction and through the slider 64 forces the ring 61 in the clockwise direction, so that the teeth 72 through the inclined surfaces 74 and 79 force the columns 76 downwards. The peg 68, however, does not succeed in going back into contact with the cam 69 (FIG. 2), whereby it is the action of the spring 71 which keeps the teeth 72 wedged above the appendages 75, thus locking the die 7 positively with the die 6.

The downward travel of the punch 26 continuing, the compression of the springs 56 starts, which thus press the plate 51 with increasing force against the movable die 7. The cam 33 now causes the punch 25 to shift upwards, whilst the cam 42 through a portion 81 subsequently thrusts the punch 26 inside the die 7, thus effecting together with the punch 25 the compression of the part 21 simultaneously from the two sides, until the position of FIGS. 2, 3 and 4 is reached.

It thus becomes clear that the action of the punch 25 on the portion 22 (FIG. 2) of the part 21, projecting with respect to the portion 23, which would tend to bend the die 7, not being counterbalanced by the upper punch 26, is now counterbalanced by the plate 51 rigidly connected to the die 6. One thus prevents the bending of the die 7, which would cause a gap between the two dies and hence the emergence of powder from the side surface of the part 21, with consequent formation of a flash, is thus prevented.

After the compression, the cam 69 through the lever 67 and the slider 64 unlocks the ring 61 from the columns 76. Then the cam 18 through the lever 14 causes the upper die 7 to move upwards, which die pulls up the pressure plate 51 by compressing the springs 58. The die 7 thus moves clear of the compressed part 21.

Immediately afterwards the cam 42 allows the spring 41 to move the punch 26 upwards, whilst the cam 33 causes the punch 25 to shift subsequently upwards and thus expel the part 21 from the die 6. The part 21 is then removed, in a manner known per se. The cam 69 then allows the spring 71 to bring back the lever 67 and hence the ring 61 into the position of rest indicated in FIG. 1. Then the cam 18 allows the spring 17 to bring the die 6 back into contact with the die 7. Finally, the duct 47 moves over the matrix 7, effecting once more the filling of the powder 48.

Various modifications can be made to the moulding device described. For example, the actuation of the punches 25 and 26, of the die 7 and of the plate 51, can be effected by hydraulic means, instead of through the action of cams.

I claim:

1. A device for moulding parts to be sintered by compressing powdered materials, comprising

a pair of dies movable with respect to one another between a moulding position in aligned cooperating relationship and an open position separated from one another so that the moulded part can be removed,

at least one pair of punches shiftable axially toward each other in a compression stroke along axes parallel to the direction of movement of said dies, said punches cooperating with said dies to compress said powdered material, and

locking means engaging and forcibly urging said dies together when said dies are in said moulding position to prevent separation of said dies during the compressing of said powdered material.

2. A device according to claim 1 wherein one of said dies is movable and the other of said dies is fixed, and wherein said locking means comprises a pressure plate operated by one of said punches and engaging said movable die when said die is in said moulding position and said punches are operated in said compression stroke.

3. A device according to claim 2 wherein said locking means further comprises means for positively engaging

and coupling said pressure plate to said fixed die and for transmitting a force urging said pressure plate and said fixed die together while said pressure plate engages said movable die.

4. A device according to claim **3** wherein said means for positively engaging and coupling comprises at least one locking shaft attached to said pressure plate and extending outwardly therefrom toward said fixed die, and a locking member carried by said fixed die and engaging said locking shafts, said locking member applying to at least one said locking shaft a force for urging said pressure plate and said fixed die together while said pressure plate engages said movable die.

5. A device according to claim **4** wherein each of said locking shafts includes an inclined shaft shoulder and said locking member comprises an annular ring disposed about said fixed die and rotatably movable thereabout, said annular ring having corresponding inclined ring shoulders to engage said shaft shoulder and being coupled to means for rotating said annular ring to engage said shoulders, whereby rotation of said ring causes camming action between said inclined shoulders resulting in a displacing force being applied to said locking shaft and urging together of said pressure plate and said fixed die.

6. A device according to claim **4** wherein one of said punches is associated with said movable die and the other of said punches is associated with said fixed die, said pressure plate being operated by said one punch.

7. A device according to claim **6** wherein said pressure plate is disposed about said one punch and is relatively movable with respect thereto, and said device further comprises flange means attached to said one punch and spaced from said pressure plate and resilient compression means interposed between said flange means and said pressure plate, whereby said pressure plate is operated into engagement with said movable die through said resilient compression means.

8. A device according to claim **7** further comprising disengaging means connected between said flange means and said pressure plate to move said pressure plate out of engagement with said movable die when said one punch retracts after said compression stroke.

9. A device according to claim **8** wherein said resilient compression means comprises at least one compression spring, and said disengaging means comprises a shaft coaxial with each of said springs and having a pair of flanges at opposite ends engaging said pressure plate and said flange means to limit the outward relative movement thereof.

10. A device according to claim **9** wherein said one punch extends through an opening in said movable die substantially perpendicularly to said movable die and said pressure plate is slidable on the outer surfaces of said one punch, said pressure plate pressing said movable die against said fixed die, and wherein said compression means and said disengaging means are disposed about said die.

* * * * *