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Taccone

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[54] **BRIQUETTING PRESS**

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[52] **U.S. Cl.** **425/252,** 425/352, 425/355

[51] **Int. Cl.** **B29c 3/04**

[58] **Field of Search** 425/78, 252, 256, 355, 425/352, 354

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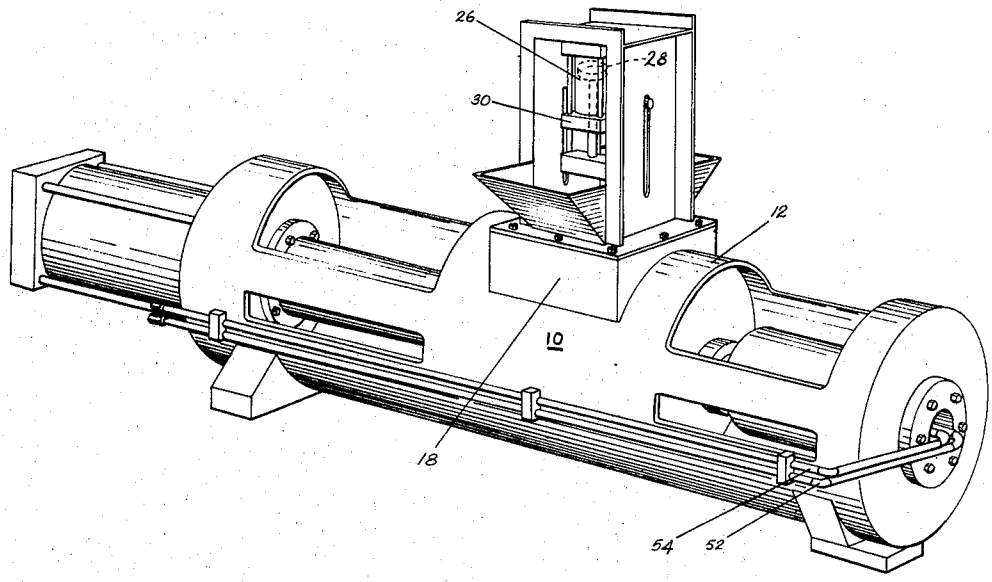
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[57] **ABSTRACT**

The press includes a stationary box for receiving metal chips. The chips are precompressed in the box by a tamping cylinder. A fixed anvil and a ram lie in horizontal registry on opposite sides of the chip box. A die encompasses the avil and is carried by a movable cylinder which allows for "floating" of the die. The movable die holding cylinder cooperates with a piston fixed on an anvil support rod to respectively extend the die toward the chip box to define a die cavity with the end face of the anvil and retract the die away from the chip box and anvil end face. The ram moves from a retracted position on one side of the chip box through the box to transfer the chips from the container into the die cavity and compress the same against the anvil end face adjacent the other side of the chip box. The die holding cylinder is neutralized during the final portion of the squeeze stroke permitting the die to float, thus equalizing the pressure applied to the opposite ends of the briquette. After the ram is retracted, the die is retracted thereby stripping the briquette from the die and permitting it to fall onto a rollout chute.

5 Claims, 7 Drawing Figures



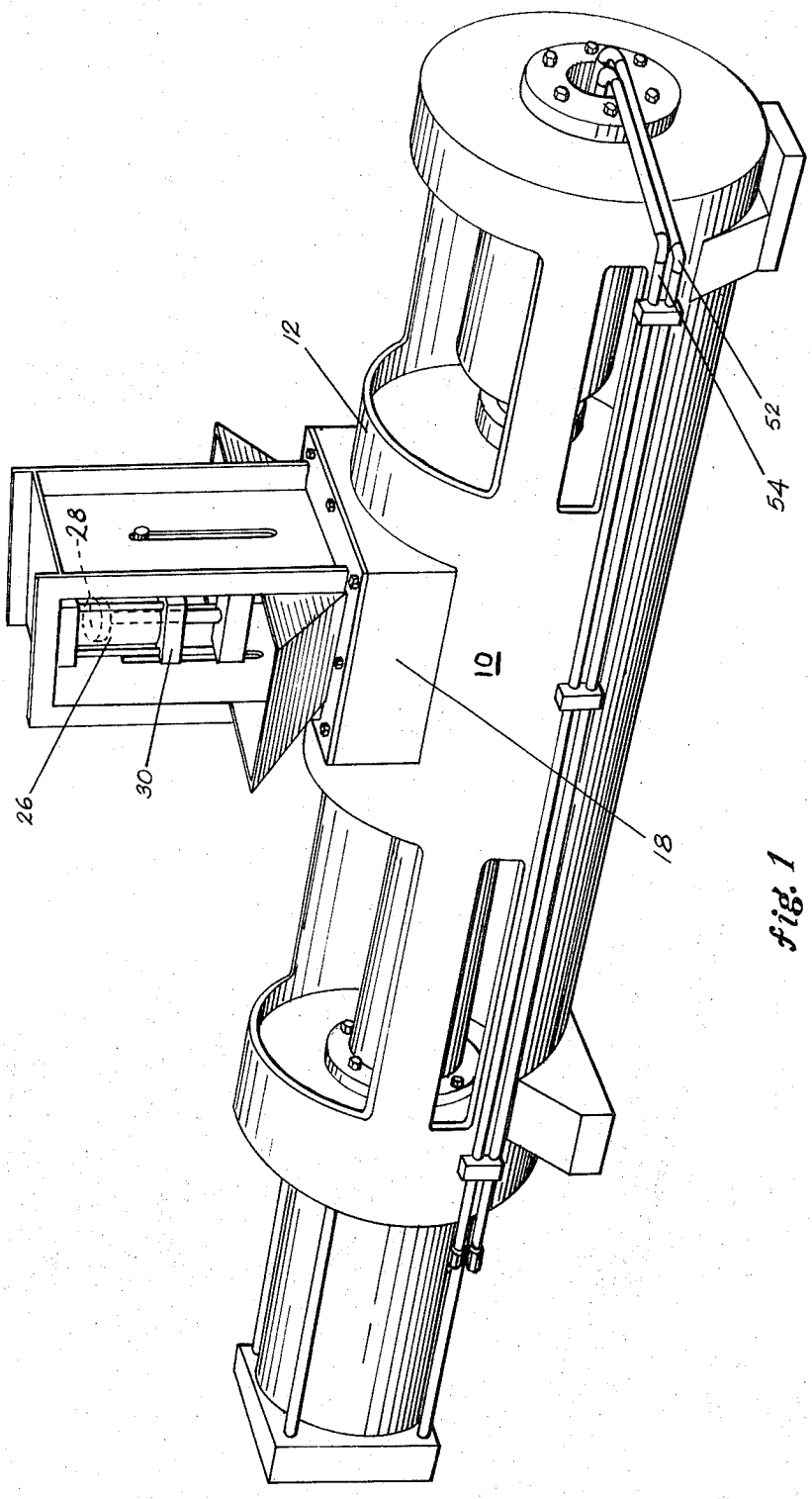


Fig. 1

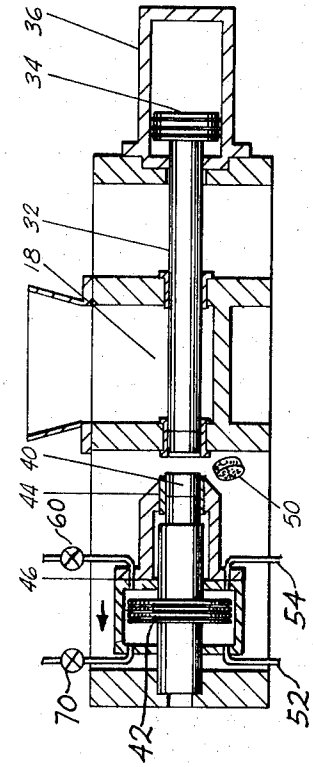


Fig. 5

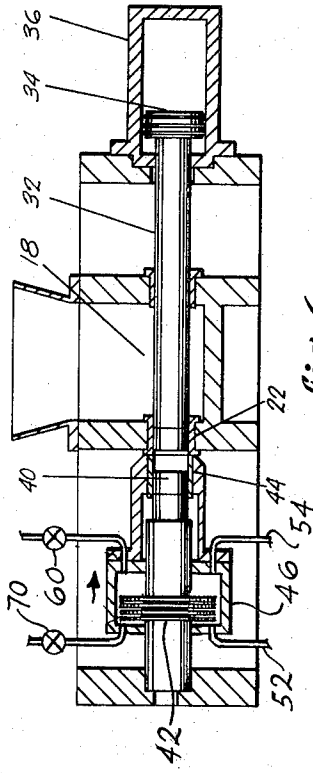


Fig. 6

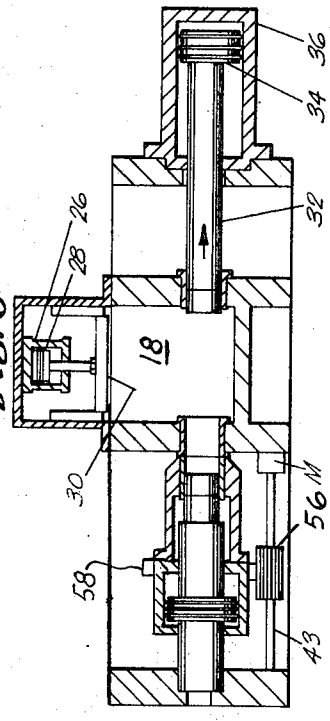


Fig. 7

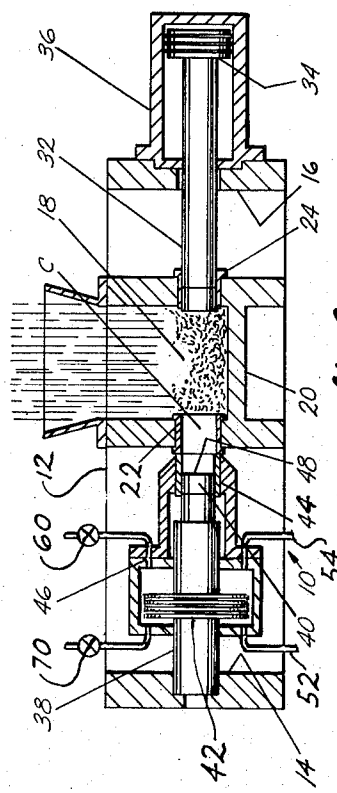


Fig. 2

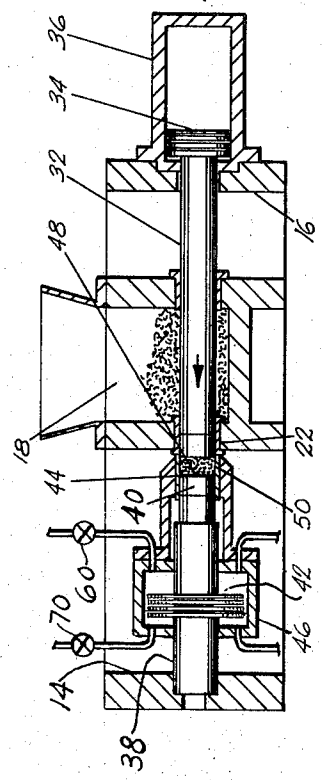


Fig. 3

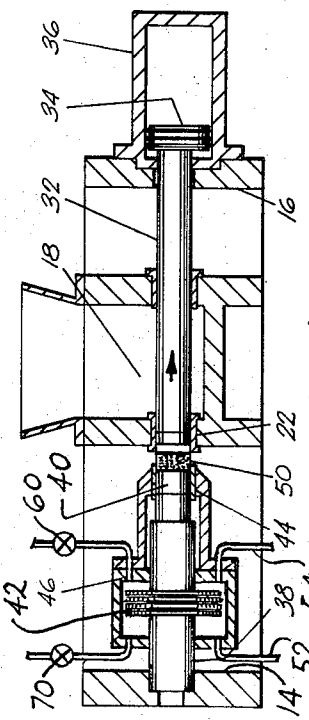


Fig. 4

BRIQUETTING PRESS

The present invention relates to a press for briquetting chips, i.e., metal borings and the like, and particularly relates to a press of the type utilizing a floating die in conjunction with a fixed anvil and movable ram for compressing chips disposed in a fixed chip box to form a briquette.

Presses for briquetting chips, i.e., metal borings and the like, have been proposed and constructed in the past. Many problems are associated with such prior presses. For example, alignment of the ram and anvil has been difficult to achieve and to achieve repeatedly. Such prior presses have also heretofore required a multiplicity of moving parts which not only adds to the initial cost of the press, but also requires significant maintenance. Also, one such prior press includes a moving chip box which has been found to be particularly difficult to fill. Further, with such prior presses, the characteristics of the resulting briquettes are not uniform, i.e., their densities are not constant throughout their length.

The present invention provides a novel and improved briquetting press which eliminates or minimizes the foregoing and other problems associated with prior briquetting presses and provides advantages in construction, mode of operation, use, and end product in comparison with such prior presses. To achieve the foregoing, the present briquetting press includes a fixed box for receiving chips, i.e., metal borings and the like, and a fixed anvil and movable ram in horizontal registry one with the other on opposite sides of the box. A die encompasses the anvil and is carried by a die holder comprised of a cylinder. By actuation of the cylinder, the die is movable between extended and retracted positions. In the extended position, the die engages a shear ring on the side wall of the box and defines a die cavity with the end face of the anvil. In its retracted position, the end of the die is withdrawn past the end of the anvil. A bearing is provided for the ram on the opposite side wall of the box for maintaining the ram in alignment with the shear ring and die cavity.

In use, the chips are precompressed if necessary or desirable in the fixed chip box by a tamping cylinder. The die holder cylinder is actuated such that the die is extended to engage the outer end of the shear ring to form the die cavity with the end face of the anvil. The ram is then displaced across the chip box and penetrates into the die and thereby transfers the precompressed chips into the die cavity. The cylinder holding the die in contact with the shear ring is neutralized allowing the die to move along the axis of the briquette. Further movement of the ram toward the anvil end face and into the die cavity presses the chips therein between the ram and the anvil to form a briquette. No lateral force is resisted by the die thus applying the full force of the press to the opposite ends of the briquette. Thereafter, the ram is retracted slightly and the die holder cylinder is actuated to retract the die past the end face of the anvil, thus stripping the die from about the briquette. The briquette is then free to fall from the anvil end face onto a rollout chute. Preferably, a suitable mechanism is employed to rotate the die as the briquettes are stripped to minimize wear on the die.

According to the present invention the cylinder which carries the die may be "floated" by relieving fluid pressure within the cylinder. At the time chips are

being compressed within the die cavity, the pressure within the cylinder is relieved so that the die carried by the cylinder floats. During chip compression the chips engage and move the free floating die slightly in the compression direction. This arrangement minimizes the development of frictional forces between the chips and the wall surface of the die, and therefore reduces the amount of compressive force dissipated through friction. Consequently, the compressive force is more effectively applied to briquette formation. A briquette of more uniform density results. In addition, there is reduced frictional wear of the die wall.

In using a floating die arrangement it is now possible to taper the die cavity slightly so that the die internal dimension is greater where the chips and compression ram enter the die and the internal dimension of the die is lesser adjacent the anvil. This taper arrangement facilitates alignment of the die and the compressive ram because of the greater die dimension at the point of ram entry. This taper arrangement also aids stripping of a briquette from the die since stripping occurs by withdrawing the die over the fixed anvil, that is, in the direction in which the die is tapered.

The present invention provides for a separate die and a separate shear ring so that if excessive wear occurs on the shear ring then only the shear ring need be replaced. Formerly, the die and shear ring were of unitary construction and both required replacement when excessive wear occurred on one portion thereof.

Accordingly, it is a primary object of the present invention to provide a novel and improved briquetting press.

It is another object of the present invention to provide a novel and improved briquetting press characterized by a stationary chip box and relatively few moving parts.

It is still another object of the present invention to provide a novel and improved briquetting press wherein accurate alignment of the ram and anvil is repeatedly achieved.

It is a further object of the present invention to provide a novel and improved briquetting press wherein the resulting briquettes have substantially uniform characteristics, i.e., density, and wherein friction losses in the briquetting operation are maintained at a minimum.

It is a related object of the present invention to provide a novel and improved briquetting press which is relatively easy to maintain and which is configured to minimize wear on the various parts thereof.

These and further objects and advantages of the present invention will become more apparent upon reference to the following specification, appended claims and drawings wherein:

FIG. 1 is a perspective view of a briquetting press constructed in accordance with the present invention; and

FIGS. 2–7 are vertical cross sectional views thereof taken through the longitudinal centerline of the press and illustrating the operational sequence of the press as it forms a briquette.

Referring now to the drawings, there is illustrated a briquetting press, generally indicated **10**, comprising a frame **12** having opposite end walls **14** and **16** and a centrally disposed chip box or container **18** open at its upper end for receiving chips, i.e., metal grindings or the like. Adjacent the bottom wall **20** of chip box **18**,

there are provided longitudinally registering apertures through the opposite side walls of the chip box and in which apertures are respectively mounted a shear ring **22** and a bearing **24** for reasons as will become apparent. Adjacent the upper chip box opening, there is mounted tamping cylinder **26** carrying a piston **28** to which is fixed a tamping platen **30.** It will be appreciated that, as the chips fall into the chip box and the tamping cylinder is actuated, the chips are precompressed by tamping platen **30** within the box **18** in the area between the side wall apertures.

At one end of frame **12** there is provided a ram **32** mounted for movement between retracted and extended positions, respectively illustrated in FIGS. **2** and **3.** Particularly, ram **32** includes a piston **34** contained in a cylinder **36** suitably secured to end wall **16.** The ram **32** extends through suitable guides at the inner end of cylinder **36** and also through ram guide bearing **24.**

Adjacent the opposite end of frame **12,** an anvil support rod **38** is fixed at one end to end wall **14** and carries an anvil **40** at its opposite end. Anvil **40** is reduced in diameter in comparison with anvil support rod **38.** A stationary piston **42** is carried on support rod **38** intermediate its ends. A die **44** encompasses anvil **40** and is carried by a die holder including a cylinder **46** which cooperates with stationary piston **42** to extend and retract die **44** between the positions illustrated in FIGS. **2** and **5,** respectively. The cylinder is provided with suitable means such as valves **60** and **70** for the purpose of relieving pressure in both ends of the cylinder. The valves when open would be effective to permit slight movement of die **44,** as explained in detail below. Die **44** and anvil **40** lie in horizontal registry with shear ring **22,** the anvil end face **48** being spaced back from the outer end of shear ring **22.** The die has a projection, not shown, which cooperates with a groove, also not shown, on the shear ring whereby the die and shear ring are repeatedly aligned one with the other in a manner to be set forth in the ensuing description.

In the extended position of die **44** as illustrated in FIG. **2,** the die **44** and end face **48** of anvil **40** form a die cavity C in communication with the chips in box **18** through shear ring **22.** In the retracted position of die **44,** it may lie flush with and preferably lies spaced back from the end face **48** of anvil **40** as illustrated in FIG. **5.**

As best illustrated in FIGS. **1** and **2,** a pair of fluid lines **54** and **52** lie in communication with respective opposite sides of stationary piston **42** within cylinder **46.** These lines should be flexible in order to accommodate movement of cylinder **46.** Corresponding fluid lines, not shown, are provided cylinder **36** on opposite sides of piston **34.** Suitable valving and timing arrangements are provided whereby the sequence of operation as will now be described can be obtained.

As illustrated, the chips are depositd in the chip box **18** through its upper opening. Tamping cylinder **26** is actuated and the chips are precompressed within box **18.** It will be appreciated that the pre-compressed chips lie in the bottom of box **18** and between the horizontally aligned ram **32** and anvil **40.** After the chips are precompressed, fluid under pressure enters cylinder **36** and drives ram **32** through chip box **18** thereby transferring the precompressed chips through shear ring **22** into the die cavity C formed by die **44** and the end face **48** of anvil **40** (FIG. **2**). As soon as the ram end extends through shear ring **22,** the pressure is relieved within the die cylinder **46** on both sides of piston **42** by opening valves **60** and **70** so that the die **44** is free to "float" during chip compression. The ram **32** continues to compress the chips to form a briquette **50.** The die ring may be slightly tapered, if desired, with its large end toward the chip box **18** to ensure alignment of the ram with the die cavity. When the chips are fully briquetted, ram **32** is retracted slightly to release the briquette and to keep the chip box closed through its shear ring opening as illustrated in FIG. **4,** leaving the briquetted chips within die **44** and against anvil end face **48.** In order to strip the die from the briquette, valve **70** is closed, and fluid under pressure is provided on the side of piston **42** remote from die **44** through line **52** to retract cylinder **46** to the position illustrated in FIG. **5.** That is, die **44** is retracted past the end face **48** of anvil **40** such that the die is fully stripped from about briquette **50.** When completely stripped, briquette **50** is free to fall from anvil **40** onto a lower rollout chute, not shown. Fluid is then provided on the side of piston **42** toward chip box **18** through line **54** and exhausted from its opposite side through valve **70** whereby cylinder **46** is displaced to the right as illustrated in FIG. **6** to align die **44** with shear ring **22** and form the die cavity. Once aligned the ram **32** is fully retracted as shown in FIG. **7** and, the foregoing described operation is repeated.

The sequence of operation may be varied. For example after briquetting formation the die may be stripped from the briquette and then the ram may be retracted slightly allowing the briquette to fall into the rollout chute. Thereafter, the die is repositioned and the ram withdrawn as above.

The slight retraction of the ram should be sufficient to disengage the ram from the briquette without allowing chips to fall from the chip box through the shear ring and possibly interfere with closing of the die. Suitable control means such as valves may be provided to stop movement of the ram away from the anvil before the ram clears the inner opening of the chip box and for continuing the ram in a stopped position until the die returns to its first or chip receiving position.

In the preferred form of the present invention, the die holder cylinder **46** and die **44** are rotated to obtain even wear on the die. The mechanism for rotating the cylinder and die may comprise an elongated pinion **56** mounted on a shaft **43** rotably carried by the frame, pinion **56** lying in meshing engagement with a drive gear ring **58** on cylinder **46.** A hydraulic motor M, timed with the hydraulic system, can be used to rotate or step pinion **56** and, hence, rotate cylinder **46.**

An alternate method of rotating the die holder cylinder and die may include a cam follower mounted on the cylinder and cam carried by the frame cooperable to rotate the cylinder and hence the die in response to retracting movement of the die when the briquette is stripped therefrom.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. A press for briquetting chips comprising a frame, a container carried by said frame for receiving the chips, an anvil carried by said frame, a ram carried by said frame for movement through said container and toward and away from said anvil, a die carried by said frame, said die encompassing a part of said anvil, said die being movable axially with respect to said anvil to first and second positions, means for moving said die between said first and second positions, said die in said first position defining with the end face of said anvil a die cavity in communication with said container and in registry with said ram, said die in said second position being disposed about said anvil and spaced back from the end face thereof, a support rod for said anvil, a piston fixed on said anvil support rod, said means for moving said die including a cylinder encompassing a part of said anvil support rod and said piston, said die being carried by said cylinder, and fluid pressure means for extending and retracting said cylinder relative to said piston to respectively move said die between said first and second positions, and means for moving said ram toward said anvil and into said die cavity to respectively displace the chips from the container into the die cavity and press the same against said anvil to form a briquette, control means to relieve the pressure in the cylinder on both sides of the piston after the ram enters the die cavity, thus effectively floating said die between said first and second positions while forming said briquette, said means for moving said ram including means for moving said ram away from said anvil, said die being stripped from the briquette in response to movement thereof from said first position to said second position.

2. A press according to claim 1 wherein said container is in part defined by a pair of oppositely disposed side walls, a shear ring carried by one of said side walls, said die in said first position butting the outer face of said shear ring, a bearing for said ram carried by the opposite side wall of said container, said ram being movable toward said anvil through said bearing, said container, and said shear ring into said die cavity.

3. A press according to claim 2 including means for axially aligning said shear ring and said die.

4. A press according to claim 1 including a tamping cylinder carried by said frame for precompressing the chips in said container.

5. A press according to claim 1 including means for rotating said die.

* * * * *