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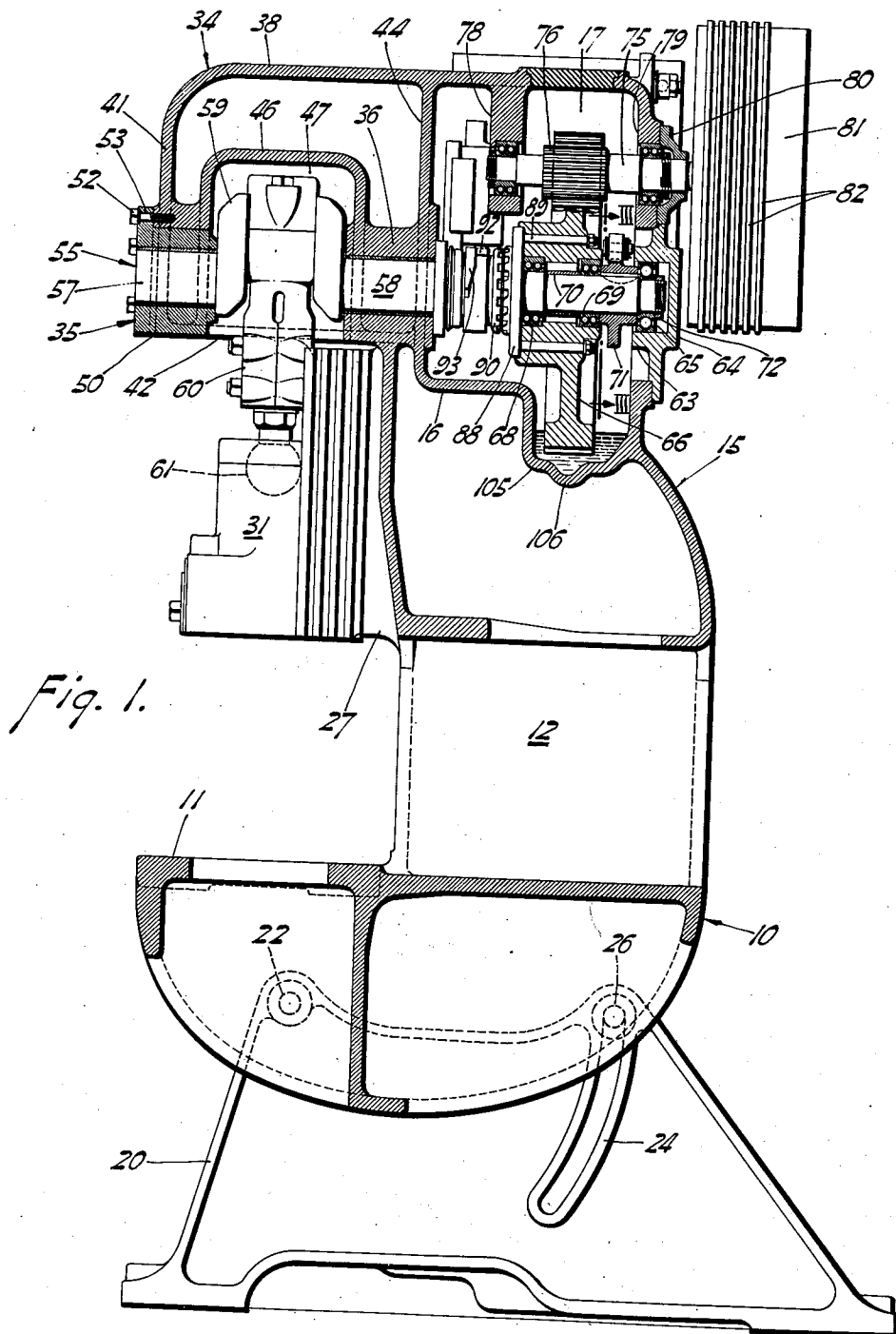
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2,213,451

PUNCH PRESS

Filed Oct. 30, 1939

3 Sheets-Sheet 1



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FIG. 4.

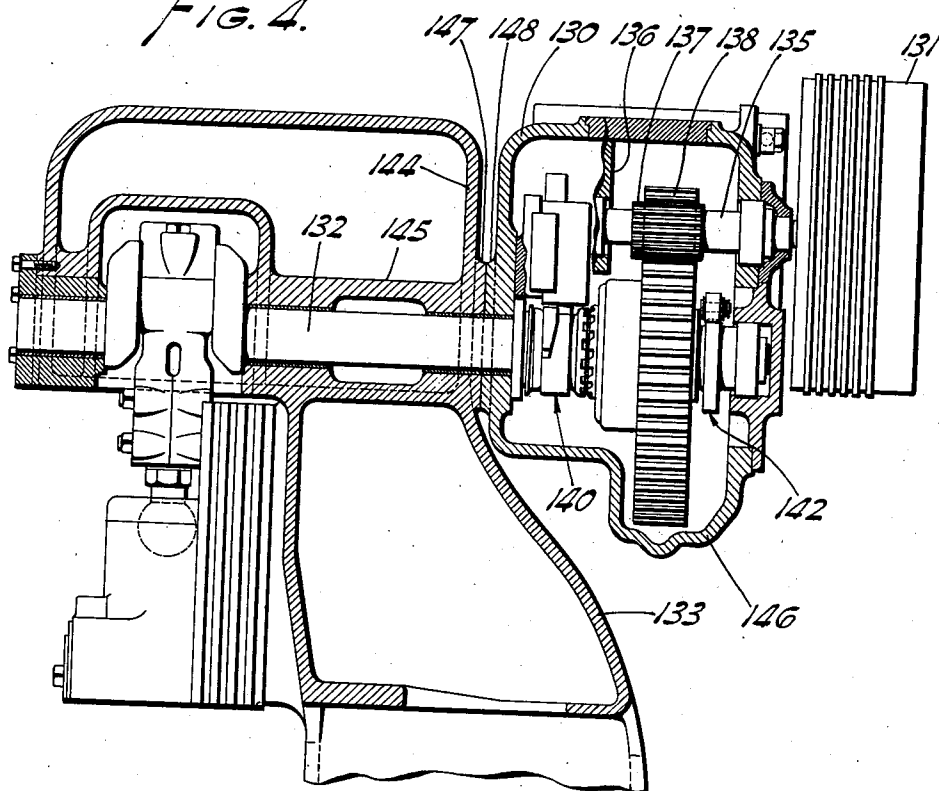
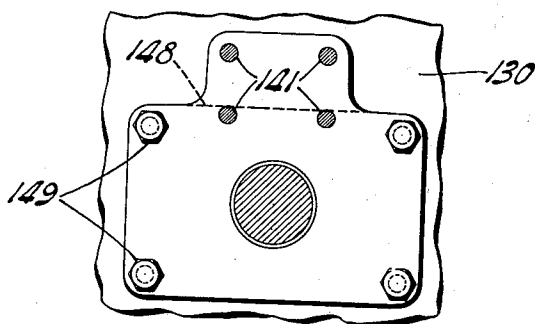


FIG. 5.



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PUNCH PRESS

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15 Claims. (Cl. 164—86)

This invention relates to punching and stamping machinery and has particular reference to machines of the class known as punch presses.

Heretofore machines of the general type under consideration in this application have been provided with integrally formed structural frame elements comprising the major portion of the structural framework of the machines. These frame elements usually comprised iron or steel castings and were provided with suitable bearings and other devices for supporting the transmission means and other movable elements ordinarily associated with presses of this class. The novel punch press of our invention has a frame element for performing functions corresponding to those of press frames in the prior art but we have so arranged the component stress members of this element as to materially increase the structural efficiency of the frame element and consequently of the punch press with which it is associated.

In our present invention the stress members of the punch press frame are so shaped and arranged that the external loads and forces which may be applied within safe practical limits of deflection and internal stress of the frame element are very much higher than is the case with press frames of prior art presses of comparable size, weight and die capacity. The structural efficiency of the punch press frame which forms a part of our invention is in large part attributable to the novel arrangement of transmission means from the point where kinetic energy is delivered to the press to the actual point of application in the reciprocation or manipulation of a punch or die or the like.

The novel arrangement of transmission means alluded to effect the operation of our punch press beneficially in two ways. First, it permits the highly efficient arrangement of structural elements of the punch press frame, as set forth above; and second, it results in the application of external loads to the press frame in such manner as to minimize their resultant moments. It is to be borne in mind of course that all of the external forces applied to the press frame are through the medium of the several elements of the transmission means, using that term in its broadest significance, and usually at points on the press frame where the elements of the transmission means have bearing.

A further substantial advantage in the punch press constructions herein disclosed resides in the greatly increased safety which results from designs which present a minimum of exposed

moving parts. Substantially all of the transmission elements save the driving pulley, which may be associated with a driving motor or a line shaft, and the actual die supporting slide itself, are completely housed and protected, both from themselves doing harm and from being harmed or impaired by outside agencies.

An advantage which accompanies such housing of the transmission means resides in the fact that adequate lubrication of the several moving parts may be conveniently and readily effected and special arrangement of the transmission means in the structural frame element is provided for the purpose of still further facilitating and insuring the provision of adequate lubrication of all parts which are subject to wear.

In the provision of a punch press possessing the advantages and desirabilities recited in the foregoing, numerous problems have been encountered in previous attempts to achieve the objects of the present invention. In our improved punch press, exemplary embodiments of which are shown in the accompanying drawings and described in the ensuing specification, these problems have been disposed of in a manner which reconciles the frequently conflicting interests of facility and economy of manufacture, convenience in use, long machine life, and the utmost in safety both to the machine itself and to the operator or operators.

In the drawings:

Fig. 1 is a vertical cross sectional side elevational view of one form of the machine of our invention;

Fig. 2 is a front elevational view thereof with portions of the upper part of the machine frame broken away;

Fig. 3 is a fragmentary cross sectional view taken on the line III—III of Fig. 1 and showing the crank shaft detent mechanism in detail;

Fig. 4 is a fragmentary sectional view similar to Fig. 1 but showing the upper portion only of a modified form of the invention; and

Fig. 5 is a fragmentary rear elevational view of a casing mounting portion of the machine of Fig. 4.

In the drawings like characters of reference denote like parts and the numeral 10 designates generally the main frame member of the punch press of Figs. 1 through 3, such main frame member usually comprising a unitary steel or iron casting. In the form illustrated in the drawings the main frame member includes a bed 11 for supporting a die or similar tool and spaced columns 12 and 13 extend upwardly adjacent the

rear portion of the bed 11. The spaced columns are for the purpose of supporting a superstructure which carries the principal moving parts of the punch press and which is of novel conformation and arrangement in the present invention.

The form of the columns 12 and 13 and the manner of their association with the bed 11 is not directly a part of the inventive concept embodied in the punch press set forth in this application and it is to be understood that the details of the machine in this particular may be varied to satisfy various considerations of design and use. In the form illustrated the columns 12 and 13 are of hollow rectangular cross section with their depths or major cross sectional axes extending rearwardly from the rear edge of the bed 11. The columns 12 and 13 are, as illustrated in Fig. 1, curved forwardly at their lower portions so that they come up beneath and merge with the bed 11 and support the latter. The spaced column arrangement is desirable because it permits work pieces and scrap to be passed therebetween, usually after the work piece or scrap has been operated upon by a die supported upon the bed 11 and has passed therethrough.

The columns 12 and 13 support, at their upper ends, a casing portion 15 and the interior of the casing portion 15 has a partition 16 which divides the casing into upper and lower chambers. The upper chamber, designated 17, is arranged to house transmission means for operation of the press in a manner which will hereinafter appear and the partition 16 serves the added purpose of reinforcing and stiffening the upper portion of the frame 10.

Various means for supporting the frame 10 upon a suitable foundation may be employed. If, as is frequently the case in presses of the class under consideration, it be desired that the press be inclinable to and from an erect or vertical position the supports 20 and 21 illustrated in the drawings may be provided. In such case pivot means connect the main frame 10 and the supports 20 and 21 at a point beneath the bed 11 of the press. Such pivot means may comprise a pair of axially aligned pivot pins 22 and 23 which pass through the supports 20 and 21, respectively, and are secured in the forwardly extending portions of the columns 12 and 13.

Mechanism for moving the frame 10 about the pivot pins 22 and 23 from a vertical position to various rearwardly inclined positions is conventionally provided and it is not believed necessary to an understanding of the principles of the present invention that such means be illustrated. One form of press inclining means may be found in Letters Patent to Frederick Orton, Numbered 2,106,917 and dated February 1, 1938. For relatively bracing the main frame 10 and the supports 20 and 21 with respect to each other arcuate slots 24 struck from the pivot pins 22 and 23 are formed in the supports 20 and 21. A nut and bolt assembly 26 is associated with each of the slots 24 and an aligned opening formed in the lower portion of each of columns 12 and 13.

At the outside of the front face of the casing portion 15, and usually adjacent the lower portion thereof, there is provided a pair of integrally formed and laterally spaced projections 27 and 28 for receiving a pair of adjustably and removably associated gibs 29 and 30 which are adapted to retain and guide a slide member or ram 31 for vertical reciprocation against the front of the casing 15. The slide member 31 is

provided with suitable means for securely engaging the upper or movable element of a die. The adjustable and removable gib construction and the details of the slide are conventional and well known and since such details do not directly and specifically form a part of the present invention, they will not be further particularized herein.

Adjacent the upper portion of the outer or front face of the front wall of the casing 15 of the frame member 10 there is an integrally formed projecting portion 34 which provides a pair of spaced coaxial bearings 35 and 36 whose axes extend from front to rear of the punch press. The rear bearing 36 may in fact be said to be supported jointly in the front wall of the casing 15 and in a portion of the projection 34.

The projection 34 comprises a hollow casing having a top wall 38, side walls 39 and 40, a front wall 41, and a bottom wall 42. The rear wall of the hollow casing which comprises the projection 34 is identical with an upper portion 44 of the front wall of the casing 15. The bottom wall 42 of the projection 34 is provided with an approximately central upwardly directed formation 46 which provides a recess 47 in such bottom wall adapted to receive and provide clearance for the crank portion of a crank shaft. The walls of the upward formation 46 are spaced at all points from the interior of the top, side, front and rear walls which form the outer casing of the projection 34 so that, considering the projection 34 as a cantilever beam with upward bending loads occasioned by the forces against the crank shaft, spaced but rigidly constrained tension and compression members are provided.

While the various portions of the frame have been shown as substantially closed hollow box sections, it will be clear that suitable provision must be made for supporting and removing cores in the course of casting the frame. This is preferably accomplished by locating core prints at points which coincide with relatively little stressed portions of the frame structure, such portions lying close to the neutral fibre of the frame, considering the various cross sections thereof as beam sections. The holes left by the core prints may, after removal of the cores, be permanently closed by welding plates in or over the openings, which would be the case in the press illustrated in the drawings, or the holes may be closed by removable plates or even left open. In any event the disposition of the holes is such as not to materially lessen the strength of the frame.

Adjacent the bottom of the projection 34 and at opposite sides of the recess 47, front and rear, are the bearings 35 and 36, respectively, previously referred to. It will be noted from an inspection of Fig. 1 that each of the bearings 35 and 36 is of substantial length and is supported and directly backed at each of its ends by either an inner or an outer wall portion of the projection 34. It will further be noted that each such backing wall portion extends directly vertically to the point where it merges with one of the spaced top wall portions and the structural efficiency of the arrangement and disposition of these elements and the rigidity thereby afforded will be apparent.

The front bearing 35 includes a cylindrical bearing block 50 which is removably associated with the lower forward portion of the projection 34. This end may be accomplished by providing an arcuate or circular opening or recess

in the projection 34. The cylindrical bearing block may conveniently be held against accidental removal by screws 52 which pass through an annular flange 53 formed on the cylindrical bearing block and engage in the projection 34. This construction of the front bearing 35 permits ready removal or assembly of the bearing block in the process of erecting or dismantling a punch press.

10 A crank shaft 55 for effecting reciprocation of the slide 31 has journal portions 57 and 58 which are supported in the bearings 35 and 36, respectively, and intermediate such journal portions the crank shaft is provided with a crank 59, 15 the crank pin of which engages rotatably with one end of a connecting member or pitman 60. The other end of the connecting member 60 is engaged with the slide 31 by means of a ball and socket joint designated generally 61 and 20 which permits the connecting member 60 to incline freely with respect to the slide 31 as the opposite end of the connecting member is caused to revolve with the crank pin.

The details of the connecting member and of its connection with the crank 59 and the slide 31, respectively, are not new excepting in that the plane of rotation of the crank 59 is at right angles to the usual plane of rotation of cranks in presses of the general class comprehended in the present invention and consequently the axis 30 of the crank shaft runs from front to rear of the machine generally and of the slide in particular.

Referring now to the means for rotating the 35 crank shaft 55 and for controlling its rotation, special attention is directed to Fig. 1 where the crank shaft is shown extending rearwardly into the interior of the casing portion 15 for engagement with and by suitable transmission means 40 which are arranged and disposed in a novel manner. In addition to the bearings 35 and 36 the crank shaft is provided with a rear bearing 63 formed in a removable cover member 64 which is disposed over an opening provided in the rear 45 wall of the casing 15. For smoother and more nearly frictionless operation a ball bearing 65 or the like may be provided in association with the bearings 63 and the rear journal portion of the crank shaft 55.

50 A flywheel 66 is rotatably disposed on the crank shaft intermediate the bearings 36 and 63 and the flywheel may have gear teeth formed thereon, as in the illustrated embodiment, and thereby constitute an element in the means for transmitting rotary motion to the crank shaft 55. The flywheel is supported for rotation on the crank shaft 55 by means of a pair of ball bearings 68 and 69 and the right hand ball bearing 69, as viewed in Fig. 1 is held against axial displacement by reason of the provision, at its left side, 60 of a collar or sleeve 70 which is disposed about the crank shaft 55 and between the ball bearing 69 and a shoulder formed by a reduction in diameter of the crank shaft 55.

65 At its other side the ball bearing 69 is in abutment with the hub of a cam 71 which is provided for a purpose which will hereinafter appear and the hub of the cam extends to the ball bearing 65 which mounts the rear end of the crank shaft 55. 70 The ball bearing 65 is held against axial displacement by a nut 72 which engages the threaded end of the shaft 55 and urges the bearing 65 against another shoulder formed by a still further reduction in the diameter of the crank shaft 75 55 at this point.

A countershaft 75 is provided for imparting rotative motion to the crank shaft 55 through engagement between a pinion 76 carried by the countershaft 75 and the gear teeth formed on the flywheel 66. The flywheel is adapted to be 5 selectively and intermittently connected to the crank shaft 55 for transmitting its rotative movement to the latter in a manner which will presently appear. The countershaft 75 is supported by means of bearings 78 and 79 which 10 may be formed integrally with the frame member 10 and the latter of which is associated with the rear wall of the casing portion 15 of the frame member.

Ball bearings are preferably provided in conjunction with the bearings 78 and 79 for more efficient operation as indicated in Fig. 1 of the drawings. It will be noted that in the illustrated embodiment a portion of the countershaft projects rearwardly through rear bearing 79 and 20 through a cap 80 which is provided for the purpose of retaining the ball bearing and consequently the countershaft itself in proper axial position.

This rearward projection of the countershaft 25 75 is provided for the purpose of supporting a drive pulley 81 which may be connected with means for imparting rotative movement thereto by belts 82. Such motive means may constitute a line shaft or, as in the illustrated instance, an individual motor drive including an electric motor 30 83 disposed at the outside of the frame of the press 10 and secured thereto by a pivot 84 and a screw connection 85, the latter being adjustable to regulate the tension of the belts 82. 35

From the previous description it will be apparent that the flywheel 66 is mounted for normally free rotation with respect to the crank shaft 55, but suitable mechanism is provided for selectively establishing driving engagement between the flywheel and the crank shaft. Such mechanism is provided, in the illustrated embodiment, in the form of a jaw clutch which is similar in form and arrangement to clutches well known in the art, save with respect to its arrangement and disposition with relation to the remaining elements of the present new combination. 45

One clutch element 88 is secured against the flywheel 66 as by the screws or studs 89 and has 50 on its outer radial face spaced radially extending clutch teeth for cooperation with the teeth of a complementary clutch element 90. The latter element is slidable axially with respect to the crank shaft 55 but has a spline or feather key connection therewith for causing joint rotation 55 of the clutch element 90 and the crank shaft. A conventional spring, which does not appear in the drawings, is provided for normally urging the clutch element 90 into clutching engagement 60 with the clutch 89. With the clutch parts in the position illustrated in Fig. 1 the clutch elements 89 and 90 are relatively disengaged by virtue of the engagement of a clutch pin 92 with at camming shoulder 93 formed on the clutch element 65 90.

The clutch mechanism is of the single revolution type and the pin 92 is connected in a conventional manner with manual operating means for withdrawing the pin radially away from the 70 clutch element 90 and out of engagement with the shoulder 93 against the resistance of a spring which tends to urge the pin toward the axis of the clutch element. When the pin 92 is momentarily withdrawn from its engagement with the 75

shoulder 93 by operation of the manual means the clutch element 90 is moved into engagement with the clutch element 89 and joint revolution of the flywheel and the crank shaft ensues.

5 If the manual operating means is released before a predetermined portion of a single revolution is completed the pin 92 is moved, by means of the spring previously referred to, toward the axis of the crank shaft and to the position it occupies in Fig. 1, whereupon subsequent rotation of the clutch element 90 brings the shoulder 93 and the pin 92 into camming engagement and the clutch element 90 is cammed axially to the left and out of clutching engagement with the element 89, the position in which the parts are shown in Fig. 1.

10 The stopping of the crank shaft in a predetermined angular position upon interruption of clutching engagement is assured by means which will now be described. Having reference particularly to Fig. 3, the cam 71 previously mentioned is fixed to the crank shaft 55 by a key connection. A cam follower or roller 95 is rotatably supported by one end of a lever 96 whose opposite end engages about a spring pin 97 and the lever 96 is pivotally secured to a portion of the stationary frame member of the punch press intermediate its ends and by means of a pivot pin 98.

15 The spring pin 97 also has pivotal support against the frame member as by means of the pivot pin 99 and the pivot pins 98 and 99 may conveniently be associated with the rear wall of the casing portion 15 of the frame of the press. The engagement of the end of the lever 96 about the spring pin 97 is such as to permit pivotal movement of the lever about its fulcrum and a coil spring 100 surrounds the pin 97 below the lever 96. The coil spring 100 is compressed between the under side of the end of the lever 96 and a nut 101 by means of which the initial tension of the spring may be selectively adjusted. A locking nut 102 is also preferably provided.

20 The cam means thus provided is arranged to cooperate with the clutching means to effect stopping of the crank shaft and the parts driven thereby in a predetermined phase of their cycle of movement and at the same time serve to modify the distribution of the several loads throughout the operating cycle so that the available torque may be more efficiently applied and utilized. To this end the cam 71 is formed so that its outline is generally that of an eccentric circle with a lower and somewhat more abrupt inwardly curving portion at the point where the eccentric outline most nearly approaches the axis of rotation of the cam. In actual practice the general outline of the cam 71 is not truly that of an eccentric circle but the contour may be so classified here for the purpose of describing its relation to the present invention.

25 In the illustration of Fig. 3 the cam follower 95 is shown in engagement with this latter inwardly curving portion and as the several parts approach the illustrated position toward the conclusion of a cycle of rotation, and with the clutch already disengaged, a resilient but sufficiently positive tendency to detain the cam and its related parts in the position illustrated is exerted by reason of the spring 100.

30 Apart from this local tendency of the cam to be retained in a predetermined position with the follower disposed in engagement with the inwardly curving portion, the general eccentricity of the cam outline is such that during approximately half of the revolution of the crank shaft the

35 follower is moved away from the axis of the cam and through the medium of the lever 96 the spring 100 is compressed by such movement in a manner which will be clear from an inspection of Fig. 3. This loading of the spring 100 is arranged to take place when the crank of the crank shaft, the slide, the connection between the crank and the slide, and the punch secured to the slide, are all moving downward and the spring loading thus tends to absorb and neutralize the kinetic energy released by those elements in their downward movement. Conversely, the remaining portion of the cam outline is such that the cam follower has a return movement toward the axis of the cam during which time the spring 100 is unloaded and the kinetic energy previously stored in the spring serves to assist in lifting the weight of the parts previously recited as they are moved upwardly.

40 Referring to Fig. 1, it will be noted that the partition 16 which forms the bottom wall of the chamber 17 which houses the transmission means is formed to provide a sump 105 adjacent the lower portion of the flywheel gear 66 whereby the moving parts of the transmission means may be adequately lubricated by filling such sump to a sufficient level so that the lower portion of the flywheel runs in the lubricant. Lubricant entrained by the flywheel is lifted and a portion thereof flows over the closely adjacent clutch mechanism at one side of the flywheel and the detent and counterbalance mechanism at the other side of the flywheel. A slightly inclined groove 106 is formed in the bottom wall of the sump 105 and leads to a drain plug 107 at one side of the frame of the press, as may be seen from Fig. 2, for the purpose of draining the sump 105 when desired.

45 Reference will now be had to the modified form of press illustrated in Figs. 4 and 5 and to avoid needless repetition, the modification of Figs. 4 and 5 will be discussed with reference to the manner in which it differs from the construction of Figs. 1, 2 and 3, it being understood that all details not specifically mentioned are to be as nearly the same as corresponding details in the first-described embodiment as conditions permit. Speaking generally, the main distinguishing feature of the embodiment of Figs. 4 and 5 resides in the fact that a separate casing portion 130 is provided for housing the portion of the transmission means which acts between and serves to connect the drive pulley 131 with the crank shaft 132. Certain advantages are secured by thus providing a transmission housing which is formed separate from the main frame of the press, which in Figs. 4 and 5 is designated generally 133.

50 By forming the casing portion 130 separately the machining of the several bearings and other finished surfaces thereof is substantially facilitated since those operations can in that way be accomplished on a smaller machine than if such casing portion were formed integrally with the main frame of the machine as in the embodiments of Figs. 1 through 3. From the standpoint of economy of production this is an important consideration and the attainment of the general objects of the present invention by using a separate transmission housing for cooperation with the main frame of the machine represents a highly satisfactory alternative mode of carrying out the principles of the invention which form the subject of this application.

With further reference to Fig. 4, a pulley shaft 135 is journaled in the casing 130, one bearing therefor being disposed in the rear wall of the casing 130 and another being provided inside the casing and preferably formed integrally therewith as at 136. A pinion 137 on the pulley shaft 135 meshes with a gear 138 which is rotatably disposed upon the crank shaft 130. For effecting rotation of the crank shaft with the gear 138, clutch mechanism indicated generally at 140 is provided. Since such clutch mechanism may be the same as that illustrated in connection with the first-described modification no further description thereof is necessary, save to state that the stationary portions thereof are secured to the front wall of the casing member 130 and securing screws therefor are indicated at 141 in Fig. 5, which is a cross sectional view looking at the inside of the front wall of the casing member 130 from the rear of the machine.

Counterbalancing and detent mechanism is associated with the rear end of the crank shaft 132 as in the previously described embodiment, and such mechanism is indicated by the numeral 142 in Fig. 5.

The main portion of the press frame 133 is formed similarly to the press frame 10 of Figs. 1 through 3 with the exception of the fact that upper rear portion for housing the transmission means is omitted and what constituted the partition 44 of the previous embodiment is, in the present modification, the rear wall 144 of the press frame. Such rear wall 144 is located a greater distance back from the crank of the crank shaft than in the former case to give ample strength to the frame and to afford, at this point, a beam of ample depth for resisting and absorbing the bending moments which are applied to the press frame in this region. Such greater depth of the frame 133 at this point dictates the use of a longer medial bearing 145 for the crankshaft which actually results in a very rigid and vibrationless crank shaft and bearing construction.

The transmission casing 130 is provided with a sump portion 146 for containing a lubricant supply for the same purpose as in the construction of Figs. 1 through 3. The rear wall 144 of the frame member 133 and the front wall of the casing 130 are provided with complementary machined pads 147 and 148 respectively and screws 149, see Fig. 5, serve to keep these pads in abutment and the frame 133 and the casing 130 in assembled relation.

While specific embodiments of the principles of our invention have been shown in the drawings and described herein, it is to be understood that the invention is not limited thereto or otherwise than as defined in the appended claims.

We claim:

1. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a bearing element provided at the forward portion of said extension and an aligned bearing element spaced rearwardly of the first bearing element, a crank shaft journaled in said bearings and having a crank therebetween for connection with the slide to reciprocate the

latter, said crank shaft having a portion thereof extending rearwardly into the interior of the hollow casing portion, bearing means associated with said frame member for supporting the rear terminal portion of the crank shaft, a countershaft journaled in said casing portion, a flywheel on said crank shaft within said casing portion and means for transmitting rotary motion from said countershaft to said flywheel, and means adjacent said flywheel for selectively engaging and disengaging said flywheel and said crank shaft for joint and relative rotation respectively.

2. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a crank shaft journaled in said forward extension and extending rearwardly into the interior of said casing portion, said crank shaft having a crank for connection with the slide to reciprocate the latter, bearing means associated with said frame member for supporting the rear terminal portion of the crank shaft, a flywheel rotatably mounted upon said crank shaft between said forward extension and said bearing means and within said casing portion, a clutch element secured to said flywheel and a cooperating clutch element fixed for rotation with said crank shaft and movable axially to and from engagement with said first clutch element, a cam fixed for rotation with said crank shaft and disposed adjacent said flywheel, and a follower and resilient means for urging said follower against said cam, said cam being arranged in timed relation with respect to said clutch elements and having rises and falls arranged to load and unload said resilient means as the several bodily moving elements of the punch press move downwardly and upwardly respectively to counterbalance said bodily moving elements.

3. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a crank shaft journaled in said forward extension and extending rearwardly into the interior of said casing portion, said crank shaft having a crank for connection with said slide to reciprocate the latter, bearing means associated with said frame member for supporting the rear terminal portion of the crank shaft, a flywheel rotatably mounted upon said crank shaft intermediate said forward extension and said bearing means and within said casing portion, a clutch element secured to the forward face of said flywheel and a cooperating clutch element fixed for rotation with said crank shaft and movable axially to and from clutching engagement with said first clutch element, a cam fixed for rotation with said crank shaft and disposed thereon rearwardly of said flywheel, a follower for said cam, and resilient means supported upon the rear wall of said casing portion and acting between said stationary casing portion and said follower to urge the latter into engagement with the cam path of said cam, said cam being arranged in timed relation with respect to said clutch elements and having rises and falls arranged to load and unload said resilient means as the slide and a movable portion

of a die normally carried thereby move downwardly and upwardly respectively to counterbalance said downwardly and upwardly moving elements.

4. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a crank shaft journaled in said forward extension and extending rearwardly into the interior of said casing portion, said crank shaft having a crank for connection with said slide to reciprocate the latter, bearing means associated with said frame member for supporting the rear terminal portion of the crank shaft, a flywheel rotatably mounted upon said crank shaft intermediate said forward extension and said bearing means and within said casing portion, a clutch element secured to the forward face of said flywheel and a cooperating clutch element fixed for rotation with said crank shaft and movable axially to and from clutching engagement with said first clutch element, a cam fixed for rotation with said crank shaft and disposed thereon rearwardly of said flywheel, a follower for said cam, and resilient means supported upon the rear wall of said casing portion and acting between said stationary casing portion and said follower to urge the latter into engagement with the cam path of said cam, said cam being arranged in timed relation with respect to said clutch elements and having rises and falls arranged to load and unload said resilient means as the slide and a movable portion of a die normally carried thereby move downwardly and upwardly respectively to counterbalance said downwardly and upwardly moving elements, said cam having in its outline a detent depression whereby the cam follower, under the urge of the resilient means, is adapted to ride into said depression after said clutch elements have been disengaged to accurately determine the angular relation of the crank shaft at the end of an operating cycle.

5. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said hollow casing portion having a bottom wall and a sump formed in said bottom wall and disposed about a lower portion of said flywheel, whereby rotation of said flywheel entrains lubricant provided in said sump for lubrication of the rotation controlling means.

6. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel

disposed upon said crank shaft within said hollow casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said hollow casing portion having a bottom wall and a sump formed in said bottom wall and disposed about a lower portion of said flywheel, whereby rotation of said flywheel entrains lubricant provided in said sump for lubrication of the rotation controlling means, said hollow casing portion being sealed against egress of the lubricant contained and circulating therein.

7. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion, and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising a positive mechanical clutch for effecting driving connection and disconnection between said flywheel and said crank shaft and mechanical detent means synchronized therewith and operative to resiliently arrest movement of said crank shaft after disconnection is effected by said clutch and at a predetermined phase of its angular cycle of movement.

8. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising a positive mechanical clutch for effecting driving connection and disconnection between said flywheel and said crank shaft and mechanical detent means synchronized therewith and operative to resiliently arrest movement of said crank shaft after disconnection is effected by said clutch and at a predetermined phase in its angular cycle of movement, said casing portion having a bottom wall, and a sump formed in said bottom wall and disposed about a lower portion of said flywheel, whereby rotation of said flywheel entrains lubricant provided in said sump for lubrication of the rotation controlling means.

9. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising

ing a positive mechanical clutch for effecting driving connection and disconnection between said flywheel and said crank shaft and disposed adjacent said flywheel at one side thereof, said means also comprising mechanical detent means synchronized with said clutch and disposed adjacent said flywheel at the opposite side thereof for resiliently arresting movement of said crank shaft after disconnection of said clutch is effected and at a predetermined phase in the angular cycle of movement of said crank shaft, said casing portion having a bottom wall, and a sump formed in said bottom wall and disposed about a lower portion of said flywheel, whereby rotation of said flywheel entrains lubricant provided in said sump for lubrication of the clutch and detent means lying on opposite sides of said flywheel.

10. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion, and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising a positive mechanical clutch for effecting driving connection and disconnection between said flywheel and said crank shaft and disposed adjacent said flywheel at one side thereof, said means also comprising mechanical detent means synchronized with said clutch and disposed adjacent said flywheel at the opposite side thereof for resiliently arresting movement of said crank shaft after disconnection of said clutch is effected and at a predetermined phase in the angular cycle of movement of said crank shaft.

11. In a punch press, a frame member comprising a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the casing portion for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide, a crank shaft journaled in the front and rear walls of said hollow casing portion and having a crank outside of said casing at the front thereof for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said hollow casing portion, and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising a positive mechanical clutch disposed forwardly of said flywheel for effecting driving connection and disconnection between said flywheel and said crank shaft, said means also comprising a mechanical detent disposed rearwardly of said flywheel for arresting movement of said crank shaft, said detent including a cam fixed for rotation with said crank shaft and resilient means supported by the rear wall of said casing portion and acting against said cam to resiliently detain said cam and said crank shaft in a predetermined position after clutch disconnection.

12. In a punch press, frame means including a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the frame means for supporting and guiding the same, said frame means having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a

bearing element provided at the forward portion of said extension and an aligned bearing element spaced rearwardly of the first bearing element, a crank shaft journaled in said bearings and having a crank therebetween for connection with the slide to reciprocate the latter, said crank shaft having a portion thereof extending rearwardly into the interior of the hollow casing portion, bearing means associated with said hollow casing portion for supporting the rear terminal portion of the crank shaft, a countershaft journaled in said casing portion, a flywheel on said crank shaft within said casing portion and means for transmitting rotary motion from said countershaft to said flywheel, and means adjacent said flywheel for selectively engaging and disengaging said flywheel and said crank shaft for joint and relative rotation respectively.

13. In a punch press, frame means including a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the frame means for supporting and guiding the same, said frame means having a die-receiving bed disposed below said slide, a crank shaft journaled in said hollow casing portion and having a crank portion disposed forwardly of said casing portion for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said hollow casing portion having a bottom wall and a sump formed in said bottom wall and disposed about a lower portion of said flywheel, whereby rotation of said flywheel entrains lubricant provided in said sump for lubrication of the rotation controlling means.

14. In a punch press, frame means including a hollow casing portion, a reciprocable slide and means at the outside of the front wall of the frame means for supporting and guiding the same, said frame means having a die-receiving bed disposed below said slide, a crank shaft journaled in said hollow casing portion and having a crank portion disposed forwardly of said casing portion for connection with said slide to reciprocate the same, a flywheel disposed upon said crank shaft within said casing portion and means within said casing portion and associated with said crank shaft for controlling the rotation thereof, said means comprising a positive mechanical clutch for effecting driving connection and disconnection between said flywheel and said crank shaft and mechanical detent means synchronized therewith and operative to resiliently arrest movement of said crank shaft after disconnection is effected by said clutch and at a predetermined phase of its angular cycle of movement.

15. In a punch press, a main frame member and a hollow casing portion associated therewith and disposed to the rear of the upper portion of said frame member, a reciprocable slide and means at the outside of the front wall of the frame member for supporting and guiding the same, said frame member having a die-receiving bed disposed below said slide and a forward extension at its front wall and above said slide, a bearing element provided at the forward portion of said extension and an aligned bearing element spaced rearwardly of the first bearing element, a crank shaft journaled in said bearings and having a crank therebetween for connection with the slide to reciprocate the latter, said crank shaft

5 having a portion thereof extending rearwardly into the interior of the hollow casing portion, bearing means associated with the rear wall of the casing portion for supporting the rear terminal portion of the crank shaft, a countershaft journaled in said casing portion, a flywheel on said crank shaft within said casing portion and

means for transmitting rotary motion from said countershaft to said flywheel, and means adjacent said flywheel for selectively engaging said flywheel and said crank shaft for joint and relative rotation respectively.

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