Sept. 22, 1953 K. JANISZEWSKI 2,652,893

DIE SET LEADER BEARINGS WITH VARIABLE CLEARANCE

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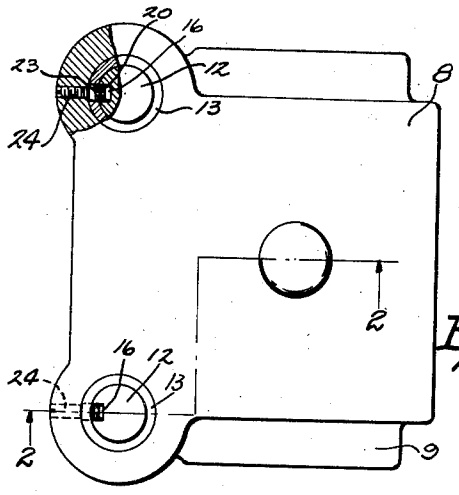


Fig. 1

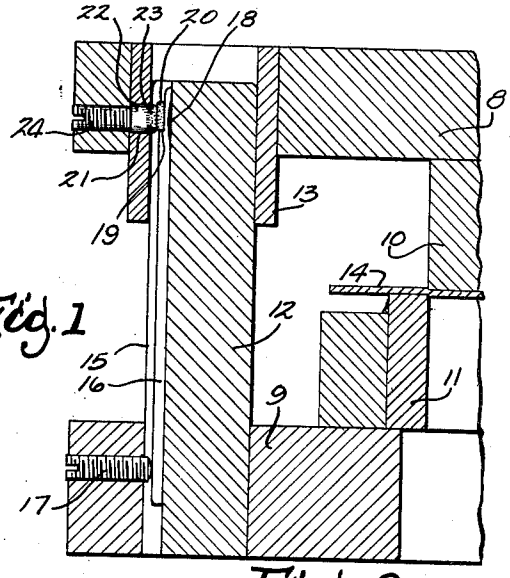


Fig. 2

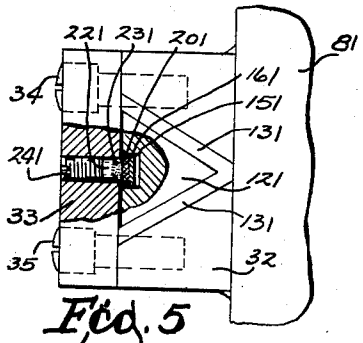


Fig. 5

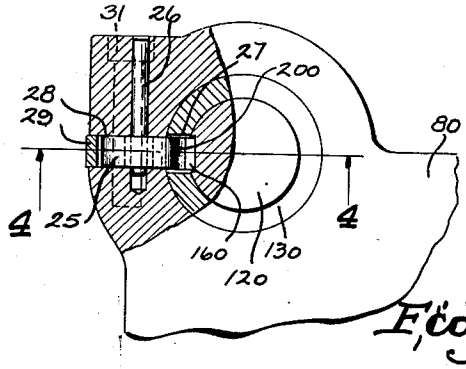


Fig. 3

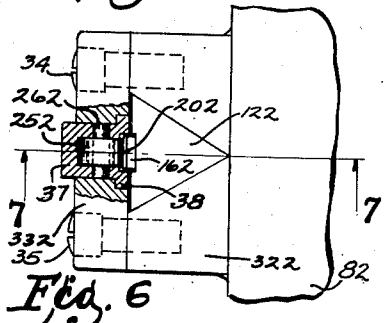


Fig. 6

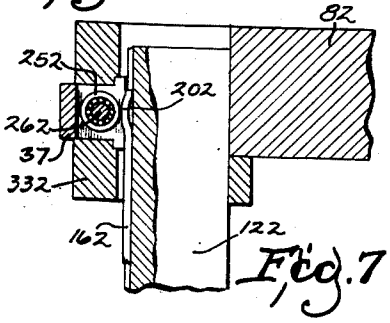


Fig. 7

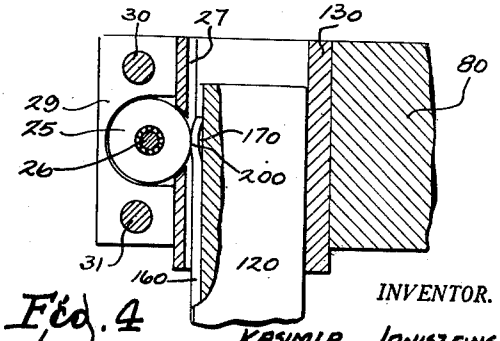


Fig. 4

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DIE SET LEADER BEARINGS WITH VARIABLE CLEARANCE

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18 Claims. (Cl. 164—118)

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This invention relates to die set leader bearings with variable clearance.

A punch and die require mounting in such a manner that they may be operated with the greatest of accuracy. The punch and the die are ordinarily mounted upon upper and lower plates known as punch carrier and die shoe respectively. These plates are usually guided for vertical reciprocation by means of leader pins mounted on the shoe and bushings slidable on the leader pins and mounted in the punch carrier. Because of the high degree of accuracy required to assure proper co-action of the punch with the die it has been customary to make the leader pin and bushing with an extremely close fit. This has made somewhat difficult the problem of assembling the punch and die and it has also resulted in a rather stiff action. Many times the punch and die can be separated only by the exercise of power. Even during normal use in a press considerable power has been required to operate the press in both directions due to the tight fit of the bushing on the leader pin to assure the desired accuracy.

The present invention has for its object the provision of a leader pin and bushing assembly which conforms to the highest standards of accuracy only at the precise moment when the accuracy is needed—that is to say, at the moment when the punch and die commence to act upon the work, there being considerable freedom of movement between the leader pin and the bushing at all other points in the stroke of the press.

Other objects of the invention and the manner in which they are achieved will be more apparent from the following disclosure of the invention.

In the drawings:

Figure 1 is a view in plan of a die set embodying the invention, portions of the punch carrier being broken away to expose the means for varying the clearance between the parts automatically in the operation thereof.

Figure 2 is a view taken in section on the line 2—2 of Fig. 1.

Figure 3 is a fragmentary detail view on an enlarged scale similar to a portion of Fig. 1.

Figure 4 is a fragmentary detail view in transverse section on an enlarged scale on the line 4—4 of Fig. 3.

Figure 5 is a view in plan, partially broken away to a horizontal section, showing a modified embodiment of the invention.

Figure 6 is a view similar to Fig. 5 showing a further modified embodiment of the invention.

Figure 7 is a view taken in section on the line 7—7 of Fig. 6.

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Figures 1 and 2 show an assembly comprising a punch carrier 8, a shoe 9, a punch 10, and a die 11, the punch carrier and punch being guided for movement respecting the die and the shoe by means of a leader pin 12 mounted in the shoe, and a bushing 13 carried by the punch carrier. In accordance with conventional practice, two leader pins and bushings are employed. They are identical and consequently the description of one will serve to disclose the structure of both.

The leader pin 12 is driven into an opening in the shoe 9 to fit therein as tightly as possible. No play is provided between the leader pin and the shoe. Similarly the bushing 13 has a driven fit in the punch carrier 8. The present construction deviates from standard practice, however, in the fact that between the bushing 13 and the leader pin 12 considerable clearance is provided so that there is a very free running fit between these parts. Means is provided, however, to assure that at the moment of interaction of the punch and the die upon the work piece 14, the fit is suddenly tightened to assure the greatest accuracy at the only time when accuracy is required.

To this end the leader pin 12 is provided with a longitudinal channel at 15. In this channel there is an inserted strip 16 which can conveniently be held by a set screw 17 threaded into the shoe 9 and engaging the insert. For the greater part of its length the back side of the insert is rectilinear to fit closely to the back of the channel 15 in the leader pin. However, at a predetermined point, which is usually near the upper end of a leader pin, the back side of the insert 16 is cut away as indicated at 18 in Fig. 2 to provide a certain amount of resilience. Directly opposite the point where the insert is relieved, its outer face is shouldered at 19 and in the shoulder is fitted a cam button 20 which may be welded in place or otherwise securely fixed to the insert 16 as a part thereof. The button 20 is preferably made of the hardest available material.

At a corresponding point the bushing 13 is provided with a transverse bore 21 opening into the bearing through which the leader pin slides. In this bore I insert a plunger or rod 22 having welded to its inner end a cam follower button 23 complementary to the cam button 20 and likewise made of the hardest available material. The unit comprising the rod or cylinder 22 and the hardened button 23 at the end thereof is positioned by means of a set screw 24 threaded into the outer wall of the punch carrier plate 8 in registry with the opening 21 of the bushing so that the set screw acting against the plunger and button unit

22, 23, may position such unit where, upon engagement of button 23 with the cam button 20, all of the clearance between the leader 12 and the bushing 13 will be fully taken up, the bushing and leader pin being thereupon abruptly forced into intimate contact. Since the button 20 is mounted on the insert 16 and since the vertical position of the latter is relatively easily adjustable by loosening the set screw 17, it will be evident that the point at which the clearance between the leader pin and the bushing is taken up can be accurately fixed with reference to the point where accuracy is required due to the engagement of the punch with the work piece 14.

As best shown in Fig. 2, the margins of the cam and cam follower 20, 23, are slightly rounded so that these two buttons contact each other only momentarily, thus limiting the tight fit between the leader pin and the bushing solely to the instant of engagement of the punch and die. At all other times, the bearing is very free—sufficiently so to offer little or no resistance to the sliding movement of the carrier respecting shoe 9.

In the construction shown in Figures 3 and 4 the leader pin 120 is likewise free throughout most of its range of movement in the bushing 130. The insert, 160, instead of having a hardened button welded to it, is outwardly bowed at 200 to provide a cam surface. The space behind the outwardly bowed portion of the insert is indicated at 170 in Fig. 4 and provides resilience for the purposes above described. The outwardly bowed cam 200 co-acts with a cam follower which comprises a wheel or disk 25 rotatably mounted upon anti-friction bearings as shown in Fig. 4 to rotate upon the guide pin 26 which extends inwardly of the plate 80 from the rear thereof. A slot at 27 in the bushing affords access of the cam follower disk 25 to the cam 200. The disk turns in a slot 28 provided in the punch carrier plate 80 and the space around the disk is enclosed by filling the slot with an insert 29 held in place by cap screws 30, 31. The operation is exactly in accordance with the operation of the device of Figures 1 and 2. There is ample clearance between the leader pin and the bushing for perfectly free reciprocable movement of the punch carrier except at the very instant when accuracy is desired. At that instant the cam 200 engages the cam follower roller 25 to take up all clearance and assure, at that point alone, an extremely tight fit between the leader pin and the bushing for the purpose of assuring accuracy of registration of the punch and die.

Figure 5 illustrates the application of the invention to a leader pin of triangular cross section of the general type disclosed in my application Serial No. 672,053 entitled "Die Sets" and filed May 24, 1946, now Patent No. 2,611,435. The bushing comprises a pair of hardened metal plates 131, set at an angle into a boss 32 at the side of the punch carrier plate 81. The outside bearing surface for the triangular leader pin is provided by a plate 33 anchored to the boss by cap screws 34, 35. The outer face of the leader pin 121 is channeled at 151 in the same manner above described. The insert 161 corresponds in general to the insert 16 shown in Fig. 2. It is similarly provided with a hardened button at 201 which co-acts with a relatively fixed hardened button 231 carried by a rod or plunger 221 positioned by set screw 241, screw threaded into the cap 33.

Figures 6 and 7 suggest the application of the cam roller principle to a triangular leader pin construction. The leader pin 122 is reciprocable in angular bearing surfaces formed, in this instance, directly in the boss 322 of the carrier plate 82. As in the construction of Fig. 5, the outer side of the bearing is closed by a cap 332 anchored by cap screws 34, 35. The roller 252 may conveniently be mounted with or without anti-friction bearings upon a pin 262 disposed in a plug 37. The plug is provided with a head at 38 to fix it in a counterbore in a suitable opening bored from the inner face of the cap 332. The diameter of the roller 252 is such that at the selected point where accuracy is required, the roller rides on to the cam surface formed by the outward curvature at 202 of the insert 162 of the leader pin 122.

I claim:

1. In a die set comprising a punch carrier member having a punch mounted thereon and a die shoe member having a die mounted thereon for coaction with the punch requiring accuracy of relative position at the time of contact with the work of a die and punch respectively carried thereby, the combination of guide means for guiding said carrier and shoe members for relative reciprocation and comprising a leader pin connected to one of said members and a bushing connected to the other of said members, said leader pin and bushing being machined to provide free sliding fit throughout the greater range of reciprocation of the pin respecting the bushing, and cam and cam follower means mounted on said guide means and positioned for engagement solely in a range of movement including the point of co-action between the punch and die, said cam and cam follower acting laterally upon the leader pin and bushing to tighten the bearing engagement therebetween in said range to steady the punch carrier plate at said point.

2. In a die set comprising a die and punch and relatively reciprocable plates upon which the die and punch are respectively mounted for interaction, the combination with a relatively reciprocable leader pin member and a bushing member respectively connected to said plates and machined to provide bearing surfaces affording relative freedom of movement throughout the greater range of relative reciprocation of said members, of a cam projecting laterally from the bearing surface of one of said members and a cam follower projecting laterally from the bearing surface of the other and positioned for engagement as the die and punch approach the point of interaction, said cam and cam follower having limited co-action in a direction laterally of the path of relative movement between said members, whereby to tighten said members in bearing engagement upon each other adjacent the predetermined point in their range of relative reciprocation where the die and punch interact.

3. In a die set comprising a die and punch and relatively reciprocable plates upon which the die and punch are respectively mounted for interaction, the combination with a bushing and a leader pin respectively connected to said plates, said leader pin being relatively reciprocable freely through said bushing, of a cam button connected with the bushing, a second cam button connected with the leader pin, the cam button of the bushing being mounted for projection into the bore of the bushing and the cam button of the leader pin being outwardly projecting, the respective buttons being positioned for engagement substantially limited to a point in the course

of relative reciprocation of the leader pin and bushing where the die and punch interact.

4. In a die set comprising a die and punch and relatively reciprocable plates upon which the die and punch are respectively mounted for interaction, the combination with a leader pin and tubular bearing means respectively connected to said members, said pin being reciprocable through said tubular bearing means, of a cam connected with the leader pin, a cam follower within the tube of the bearing means, and a support of limited resilience between the leader pin and said cam, said cam and cam follower being positioned for coaction in the range of movement of the plates where the die and punch interact.

5. In a die set comprising a die and punch and relatively reciprocable plates upon which the die and punch are respectively mounted for interaction, the combination with a leader pin member and a tubular bearing member in which the leader pin is relatively movable, said members being respectively connected to said plates, of laterally engageable cam and cam follower elements structurally associated with the respective members and disposed for engagement with each other in the zone in which the die and punch interact in the course of such movement, the said members having bearing surfaces free for relative movement throughout the greater part of a predetermined range of movement and adapted to be tightened upon the engagement of said elements at the said point in such range where the punch interacts with the die.

6. The device of claim 5 in which one of said elements is provided with an adjustable support mounting it upon one of said members.

7. The device of claim 5 in which one of said elements is provided with a relatively yieldable support longitudinally adjustable upon one of said members.

8. The device of claim 5 in which one of said members is longitudinally slotted and provided with an insert longitudinally adjustable in said slot and upon which one of said elements is mounted.

9. The device of claim 5 in which one of said members is longitudinally slotted and provided with an insert longitudinally adjustable in said slot and upon which one of said elements is mounted, the said insert having a concave recess between it and the member on which it is mounted at the point at which said element is carried by said insert.

10. The device of claim 5 in which said elements comprise a pair of hardened metal buttons.

11. The device of claim 5 in which one of said elements comprises a roller mounted for rotation on engagement of the other element therewith.

12. In a die set comprising punch and shoe plates having a punch and die respectively mounted thereon for action upon intervening work, the combination with leader pin and bushing members connected with the respective plates and having bearing surfaces machined for relatively free reciprocation, of cam and cam follower elements mounted upon the respective members in positions for mutual engagement at a predetermined point in the range of such reciprocation where the punch acts on the work to take up the play between the leader pin and bushing members to steady the punch plate at that point, said cam and cam follower being elsewhere out of engagement whereby to permit play between said members.

13. The device of claim 12 in which the leader pin member is longitudinally slotted and provided with an insert adjustable in said slot and upon which one of said elements is mounted.

14. The device of claim 12 in which the bushing member is provided with a transverse bore and a plunger positioned in said bore and upon which one of said elements is mounted, the punch plate being provided with a set screw acting upon said plunger for the positioning thereof in said bore.

15. The combination with a punch carrier plate and a shoe plate having a punch and die respectively mounted thereon for action on intervening work, of a leader pin connected to one of said plates, the other plate being provided with bearing means in which said leader pin is freely reciprocable, a roller mounted on said last mentioned plate, and cam means carried by the leader pin and so positioned as to coact with said roller at the point in the course of leader pin reciprocation in the bearing means where said die and punch act on the work to take up play between the leader pin and said bearing means at said point.

16. The combination set forth in claim 15 in which the leader pin is channeled and provided with an insert formed outwardly to provide said cam means and to constitute a resilient support therefor.

17. The combination set forth in claim 15 in which the leader pin is longitudinally channeled and provided with an insert adjustable in said slot and formed outwardly to provide said cam means and to constitute a resilient support therefor, together with means for fixing the adjustment of said insert respecting said leader pin whereby the point of interaction of the cam means and roller is adjustable.

18. The combination set forth in claim 15 in which said roller is mounted in a plug and the bearing means of said plate comprises a cap having a recess in which said plug is positioned.

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