June 30, 1942. K. JANISZEWSKI 2,288,136

DIE SET

Filed Sept. 20, 1939 2 Sheets-Sheet 1

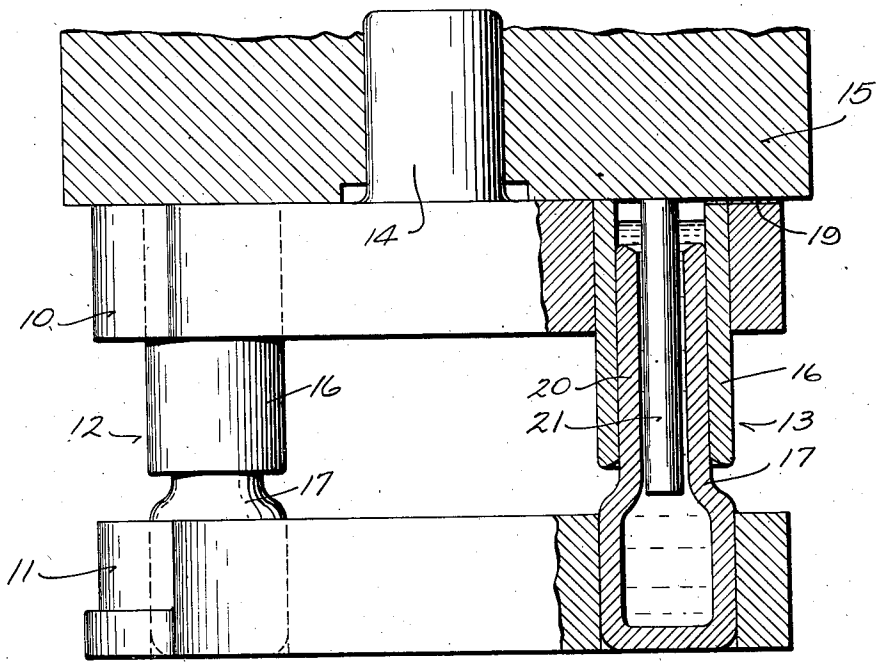

Fig. 1.

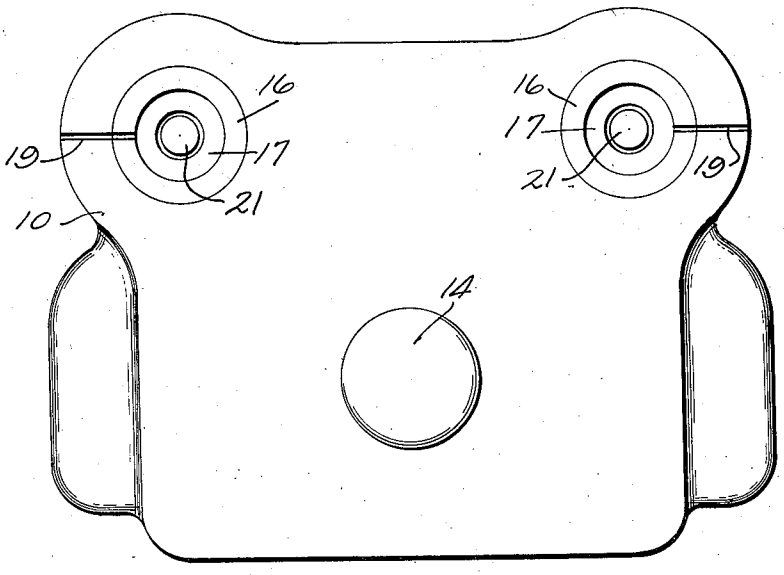

Fig. 2.

INVENTOR
KASIMIR JANISZEWSKI

BY
Wheeler, Wheeler & Wheeler
ATTORNEYS

June 30, 1942. K. JANISZEWSKI 2,288,136

DIE SET

Filed Sept. 20, 1939 2 Sheets-Sheet 2

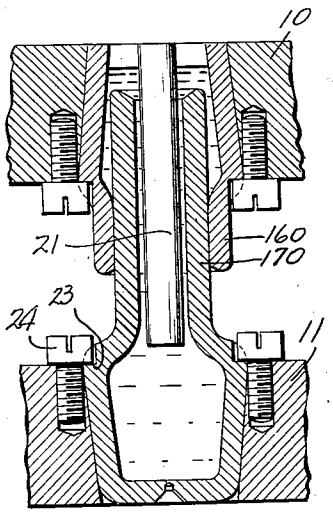

Fig. 3.

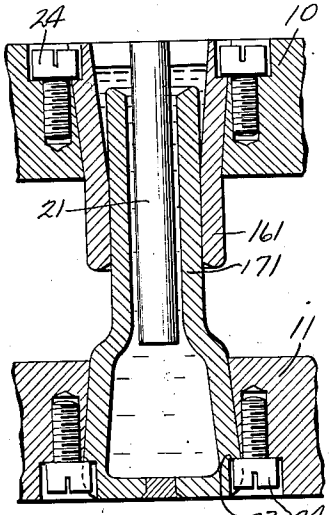

Fig. 4.

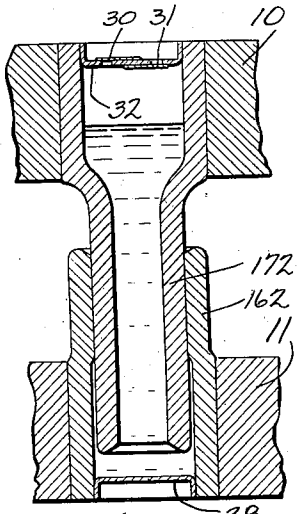

Fig. 5.

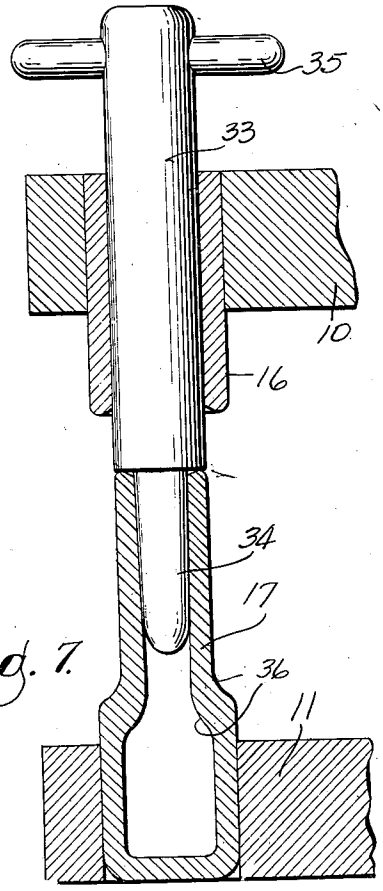

Fig. 7.

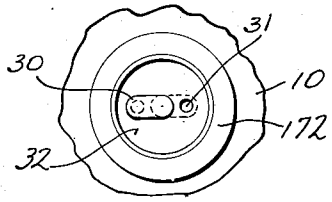

Fig. 6.

INVENTOR
KASIMIR JANISZEWSKI
BY
Wheeler, Wheeler & Wheeler
ATTORNEYS.

Patented June 30, 1942

2,288,136

UNITED STATES PATENT OFFICE

2,288,136

DIE SET

Kasimir Janiszewski, West Allis, Wis.

Application September 20, 1939, Serial No. 295,785

15 Claims. (Cl. 308—5)

My invention relates to improvements in die sets.

Objects of my invention are to provide:

1. An improved die of the self-lubricating type wherein lubricating fluid is stored within lower tubular portions of guide members and is automatically fed by displacement to slide bearing surfaces during the operation of the device;

2. An improved die wherein a mounting terminus of a leader pin is identical in outside diameter to the mounting terminus of an associated sleeve, thereby greatly simplifying the correct alignment and mounting of these members during manufacture;

3. A die provided with tubular members adapted for telescopic association during operation of the device and containing lubricating fluid which is displaced by plunger means whereby to lubricate the bearing surfaces of the telescopic members; and

4. An improved method of manufacturing telescopic guide members, wherein a guide sleeve and its associated leader pin are formed from a single sheet of flat metal stock.

Other objects of my invention will be apparent to those skilled in the art upon inspection of the following disclosure.

In the drawings:

Fig. 1 is a front elevation of a die set incorporating my invention, with parts broken away to best disclose the inner construction.

Fig. 2 is a plan view of a die set shown in Fig. 1.

Figs. 3, 4 and 5 are sectional views of guide units having incorporated therein several embodiments of the invention.

Fig. 6 is a fragmentary plan view of the guide unit shown in Fig. 5.

Fig. 7 is an elevation in section disclosing a tool adapted for use in axial alignment of the guide members during assembly.

Like parts are identified by the same reference characters throughout the several views.

While my invention is particularly adapted for incorporation in sub-press dies, as illustratively shown herein, it will be apparent to those skilled in the art that the invention may be incorporated directly into a stamp press or the like with advantageous results. The invention resides not only in an improvement of the slide or positioning units whereby I obtain advantageous and desirable results not heretofore known in the art, but, also, in an improved method of manufacturing said slide units. For purpose of illustration, I have shown a die set wherein two guide units are disclosed in operative association intermediate the upper and lower die mounting plates, but I do not limit my invention to the use of any specified number of guide units; it may be desirable to employ a greater number depending on the work to be done by the die set.

Main structural elements of my invention, as best shown in the preferred embodiment, Fig. 1, include upper and lower plates 10 and 11 and at least two guide units 12 and 13, including tubular telescopic members 16 and 17 having termini fixedly mounted in plates 10 and 11, respectively, in position for slidable association therebetween during reciprocation of plates 10 and 11 toward and away from each other during operation of the device. When my invention is incorporated in a sub press die, plate 10 is provided with a conventional mounting lug 14 by means of which it is fastened to a ram member 15 of a conventional stamp press. Plate 11 is adapted to be secured to the bed of the stamp press in the conventional manner.

Each guide unit 12 and 13 includes a sleeve portion 16 which has one terminus mounted in a hole provided in one of the plates where it is preferably secured by means of a pressed fit, or a retaining screw and a tubular leader pin 17 provided with a sealed terminus which is similarly mounted in the opposite plate. Pin 17 is provided with a reduced portion 20 adapted to project into sleeve 16 where it is snugly disposed in slidable relation to said sleeve. A lubricant displacing plunger 21, which may be floatably disposed within tubular pin 17 and is adapted to be buoyed upwardly by lubricant, is contained therein.

Upward movement of plunger 21 is restricted by contact with the press ram member 15. When the press ram is in its lowermost position as shown in Fig. 1, plunger 21 projects well into tubular leader pin 17, thereby displacing the lubricating fluid, which flows upwardly and out of the leader pin 17 to partially fill the chamber defined by the inner wall of sleeve 16. As ram 15 raises and draws plate 10 away from plate 11, plunger 21 also rises due to the buoyancy of the fluid and the lubricating fluid flows back into the central chamber of pin 17, leaving only a thin film of oil on the inner wall of the sleeve to provide lubrication between the telescopic bearing surfaces. The cycle is repeated during each reciprocation of ram 15 and hence a continuous supply of lubricant is furnished to the bearing surfaces.

During operation of the device, air may be ex-

pelled from and allowed to re-enter the lubricant-containing chamber through a small passage 19 which leads from the top of the chamber, through the wall thereof and the upper die-mounting plate to communicate with the atmosphere.

Because the leader pins have a mounting terminus of the same outside diameter as the associated guide sleeve, the holes in each plate do not have to be separately drilled. Thereby I avoid expensive procedures and equipment in the alignment of the respective holes in order to obtain free acting guides.

My invention not only eliminates the necessity for the use of expensive equipment, but I greatly reduce the time required by an operator to properly align the holes in the respective plates. Sleeve 16 is of equal outside diameter to the outside diameter of the mounting terminus pin 17. Therefore, during manufacture an operator simply superposes one plate upon the other, fastens them together (as, for example, by temporary tack-welding), and drills the holes. The holes may then be finished while the plates are together to ensure perfect alignment. Because the exact distance between the centers of the pins has no bearing on the accuracy of the die so long as the holes are respectively in perfect alignment, there remains no necessity for an operator to be extremely meticulous about the spacing or location of the guides.

Figs. 3 and 4 disclose further embodiments of my invention wherein leader pins and their associated sleeves have termini removably mounted in the respective die set plates. Guide members 180 and 170, Fig. 3, are provided with convergent mounting portions seated in tapered holes provided in plates 10 and 11. Shoulder portions 23 are provided in the outer walls of the guide members and engaged by retaining screws 24 having heads overlapping said shoulders to provide means, when tight, for locking the tubular guide member termini into the respective die set plates. Fig. 4 shows the converse of the embodiment disclosed in Fig. 3 wherein the guide members 161 and 171 are provided with divergent mounting termini which are removably fastened by means of screws 24 to the plates. A further advantage of the construction disclosed in Figs. 3 and 4 resides in the fact that during operation of the device lubricant surrounds a substantial area of the pin bearing surface when the press ram is at its lowermost position.

Fig. 5 discloses another embodiment wherein the tubular guide members are arranged conversely of the construction shown in Fig. 1, the leader pin having a terminus mounted to the upper die plate and the sleeve having a terminus mounted to the lower die plate. In common with the embodiments heretofore described, lubricant is stored in the bottom portion of the telescopic guide unit; hence sleeve 162 has its lower terminus plugged at 28. Displacement of the lubricant within the sleeve is effected without the use of a plunger as employed in the other embodiments, pin 172 providing the sole means for displacing the lubricant as it reciprocates in a vertical plane during operation of the associated press ram. The air displaced by the lubricant as the press ram descends is vented through a flap valve 30 provided in plug 32. Replacement air is admitted through a similar flap valve 31 on the upward stroke of the ram. The flaps of valves 30 and 31 may be of light sheet metal or other suitable material.

Difficulty has been encountered in the assembly of the plate units in obtaining perfect alignment necessary to permit the leader pins to enter the guide sleeves. Heretofore, tools for guiding the pins into the sleeves have not been practical because the pins were either of solid material or were provided with grooves or wicks to effect lubrication between the bearings. The provision of one or more sockets in the end of the leader pin enables the use of a centering tool, as shown in Fig. 7, and by the use thereof all such difficulty has been eliminated. The tool includes a cylindrical portion 33 adapted to be snugly disposed within the guide unit sleeve, and a reduced portion 34 adapted to fit into the open end of the leader pin. The handle 35 is provided to facilitate manipulation by an operator.

My invention includes a new method for the manufacture of both the leader pins and their associated sleeves. I have found that it is economical in manufacturing cost and more satisfactory to produce the pins and sleeves in the following manner. A sheet of flat metal stock is drawn into the form of a closed end tube having an outside diameter slightly larger than the desired diameter of the pin mounting terminus and the sleeve. A portion of the open end of the tube is then cut off to form sleeve 16. A portion of the remaining closed end tube is then reduced in size. The wall thickness of the tube may be varied as desired to make it thicker at deflection points as indicated, for example, in Fig. 7 at 36. This leaves a tapered interior opening in which the portion 34 of the guide tool 33 will center without accurate sizing.

Both portions are then heat treated. One important feature of the invention involves the saving in cost of heat treatment due to reduced weight of the tubular stock as compared with bar stock. The resulting parts also have greater elastic resistance to bending because the heat treatment hardens the inner surfaces as well as the outer surfaces. By this method, I obtain an integral tubular leader pin 17 which is of superior quality as compared to one manufactured from bar stock or conventional tubular stock and I have greatly reduced the cost of manufacture.

Where the leader pin 20 and the bushing 16 are made of the length indicated in Fig. 1, they will maintain their telescopic relationship throughout the stroke of press member 15. This is a safety feature tending to make it impossible for the operator to get any part of his body between the leader pin and bushing. However, where the displacement plunger 21 is employed, this will always fill the gap, if there be a gap, between the leader pin and bushing and thus will tend to prevent the operator from getting his fingers into the danger zone.

Where the relative lengths of the leader pin and bushing are reduced, as indicated in Figs. 3 to 5 and 7, there is frequently an advantage in raising the holder portion 35 to a level above the top of die plate 11, as indicated in Fig. 7. Under a given lateral pressure, the deflection of a bushing or pin of large diameter is very slight as compared to the deflection of a bushing or pin of smaller diameter. As between two members of like diameter, the deflection at the end under a given load will, in general, be proportioned to the length of the member. Thus, by raising the shoulders 35 for a substantial distance above the plate 11, the length of the smaller diametered portion of the pin is reduced, thereby giving added strength with relatively

little stock by reducing the moment of deflection to which the small portion of the pin is subject.

Where the die set requires the use of leader pins and bushings of various diameters, the deflection to which each bushing and pin is subject under a given pressure, can be equalized by adjusting the diameters and lengths of the larger portions of the leader pins.

I claim:

1. In a device of the type described, a vertically positioned tubular leader pin having its lower terminus closed to provide a lubricant retaining chamber, a guide sleeve having its upper terminus mounted in an upper die set plate, said sleeve snugly enclosing a portion of the pin in slidable relation thereto, plunger means disposed within the chamber, and means operable with the sleeve for actuating the plunger into the chamber whereby lubricant is forced from the pin chamber by displacement, thereby lubricating the pin and sleeve bearings.

2. A die set including a pair of plates adapted to provide mounting for dies, means providing reciprocation of one plate in respect to the other plate, guide means intermediate the plates including a pair of tubular members each having one terminus mounted in one of the plates and bearing portions in telescopic association therebetween, one of said members having a sealed terminus to provide an oil retaining reservoir, and plunger means floatably disposed within said reservoir whereby during operation of the device oil is displaced from the reservoir to provide lubrication between the telescopically associated bearing surfaces.

3. A die set comprising a pair of telescopically related guide members, the lower of which constitutes a reservoir for lubricant, and the upper of which comprises a displacement body periodically movable in said reservoir in the operation of said die set for displacing the lubricant during the relative reciprocation of the members, and an elevated lubricant chamber adapted to receive lubricant displaced by said body and freely communicating with the reservoir for return of lubricant thereto.

4. A die set as described in claim 3 provided with an air passage leading from the elevated lubricant receiving chamber to communicate with the atmosphere, whereby during operation of the device air is admitted into and expelled from said chamber.

5. A die set having upper and lower plates, a guide unit including a tubular member secured to the upper plate and a tubular member secured to the lower plate to telescopically associate with the upper plate member, the mounting portions of said members diverging toward the terminus thereof, and screw means securing said divergent member portions into companion holes provided in the plates.

6. In a die set, the combination with a leader pin having an enlarged terminus mounted in one die set plate, a sleeve adapted to have one terminus mounted in the opposite plate and to telescopically receive said leader pin during operation of the device, said enlarged pin terminus being of equal diameter to said sleeve.

7. In a die set including upper and lower plates, a guide unit including a tubular member secured to the upper plate, a second tubular member telescopically associating with said first mentioned member and secured to the lower plate, means sealing the lower end wall of said second mentioned member to provide an oil reservoir within said member, and valve means whereby during operation of the device air is permitted to escape from and to re-enter said oil reservoir.

8. The combination with upper and lower die set plates, of a sleeve mounted in the lower plate having a portion projecting vertically therefrom, a leader pin mounted in the upper plate and having a portion depending therefrom, said depending portion being snugly and slidably disposed within said sleeve whereby to provide guide means between said plates.

9. In a device as described, a self-lubricating guide comprising a hollow leader pin secured to a lower die plate to project upwardly therefrom in a vertical plane, a complementary leader pin sleeve secured to an upper die plate to depend therefrom in a vertical plane and to partially enclose said upwardly projecting leader pin, said sleeve and pin being in concentric slidable relation, an elongated plunger floatably disposed within the hollow portion of said leader pin and adapted to be buoyed upwardly into the sleeve by lubricant contained within the lower portion of said hollow pin and to reciprocate axially of said hollow pin portion during operation of the device whereby to alternately reject and permit re-entry of said lubricant into said hollow pin portion to provide automatic bearing lubrication between the slidably associated surfaces of said pin and said sleeve.

10. In a die set, the combination with a telescopically related leader pin element and sleeve element in operative bearing engagement, one of said elements comprising an open reservoir for lubricant and the other of said elements comprising an expansion chamber into which said lubricant is receivable upon its displacement from said reservoir, and means for displacing lubricant from the reservoir into the expansion chamber in the course of the relative reciprocation of said elements.

11. In a die set, the combination with relatively reciprocable upper and lower plates, of guide means for directing relative reciprocation thereof, said guide means comprising a reservoir connected with the lower plate and having a tubular cylindrical bearing portion, and a sleeve connected with the upper plate and comprising a complementary bearing portion telescopically slidable upon the bearing portion of said reservoir, and a vented but otherwise substantially closed lubricant-receiving chamber in free communication with said reservoir, and means for displacing lubricant from said reservoir into said chamber in the course of telescopic reciprocation of the sleeve bearing portion upon the bearing portion of the reservoir.

12. In a die set, the combination with relatively reciprocable upper and lower plates, of guide means for directing relative reciprocation thereof, said guide means comprising a reservoir connected with the lower plate and having a tubular cylindrical bearing portion, and a sleeve connected with the upper plate and having a complementary bearing portion telescopically slidable upon the bearing portion of said reservoir, said sleeve comprising displacement means operable in the relative reciprocation of said plates to enter lubricant in said reservoir to displace such lubricant onto the telescopically movable bearing surfaces aforesaid and comprising an elevated chamber means to receive and confine the lubricant displaced for gravity return of such

lubricant to the reservoir upon the converse reciprocation of the plates.

13. In a die set, the combination with relative reciprocable upper and lower plates, of telescopic guide means for directing the reciprocation of one of said plates with reference to the other and comprising tubular parts connected to the respective plates and having telescopically related bearing surfaces and constituting a lubricant chamber, the lower of said tubular parts comprising a reservoir and the upper comprising a chamber in free communication with the reservoir and having adequate capacity to receive lubricant displaced from said reservoir and displacement means movable with the upper plate for varying immersion in the lubricant in said reservoir, whereby to displace lubricant bodily from the reservoir to the said chamber during each approach of said plates and to lubricate the telescopically related bearing surfaces of said parts.

14. In a die set, the combination with relatively reciprocable plates having aligned bores of substantially identical diameter, of a tubular leader pin having an enlarged anchorage portion fitted to one of said bores and having a bearing portion of reduced diameter as compared with the diameter of said bore and said anchorage portion, and a bushing having an anchorage portion corresponding in diameter to the bore of the other plate and fixed therein, said bushing having a bearing portion in telescopic sliding bearing contact with the bearing portion of said pin.

15. In a die set, the combination with bed and platen members having substantially aligned holes, of a leader pin fitted in the hole of the bed member and provided with an exposed end having a cavity with a wholly unobstructed portion, a bushing in the hole of the platen member having an internal diameter corresponding to the external diameter of the leader pin, whereby to be telescopically slidable thereon, and a leader pin extension having a portion of reduced cross section fitted to said unobstructed cavity portion of said leader pin and having a body portion corresponding in diameter to the leader pin and extending therefrom into sliding bearing engagement with said bushing and constituting means for guiding said bushing onto said leader pin, the extension leader pin extending completely through the bushing and being provided with means for its removal.

KASIMIR JANISZEWSKI.