

PATENT SPECIFICATION

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(19)



(54) A DIE SET

(71) We, ALPHA INDUSTRIES INC., a Corporation organized under the laws of the State of Michigan, United States of America, of 9281 Freeland Avenue, Detroit, Michigan 48228, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention is directed to improvements in die sets and including improvements in arrangements for interconnecting and guiding relatively movable parts of die sets. As described herein, in its preferred embodiment the die set is one for cutting off tubing; however, the principles of the invention are applicable to other types of die sets.

According to the present invention there is provided a die set operable in various mechanical press arrangements for performing work on a workpiece, the die set comprising, in combination, a lower die shoe, an upper die shoe, guide post means fixed to the shoes and interconnecting the shoes for guided relative reciprocation to effect the work, the guide post means consisting of guide post bushings and guide posts, each post being slidable in a respective one of the bushings; the die set including clamping jaw means mounted on one of the shoes for holding the workpiece during the work operation, the clamping jaw means comprising a first carriage slidably mounted on one of the shoes for movement transverse to the direction of relative reciprocation of the shoes and comprising a second carriage slidably mounted on the first carriage for movement opposite to that of the first carriage; and means adapted to move the said carriages. Thus, in a die set according to the invention one of the jaws is mounted on a first slide which is reciprocally guided on one die shoe, while the other jaw is mounted on a second slide which is reciprocally mounted on the first slide. This promotes a simpler and lighter structure and better alignment of the clamping jaws.

Preferably, the guide post means comprises three guide post bushings and three guide posts with a first and second of the

posts having parallel axes lying spaced apart in a first plane parallel to the direction of the said reciprocation and the third post and one of the first and second posts having parallel axes lying spaced apart in a second plane parallel to the direction of the said reciprocation and substantially perpendicular to the said first plane, so that the die set is tolerant of side thrusts of various orientation exerted by a ram operating the die set. Thus, with an arrangement of only three guide posts, the structure is supported so as to be free from likelihood of binding resulting from transverse forces engendered by the transverse component of motion of the ram which may drive the die parts together. This fits the die set for use with presses of different types; specifically, those cut-off die sets in which the ram has a component of motion along the axis of a tube which is being cut, and those in which the ram has a component of motion transverse to the tube axis.

The principal objects of the invention are to provide improved die sets better adapted to the requirements of practice and to effect economies in the manufacture of such die sets.

The nature of the invention and its advantages will be clear to those skilled in the art from the succeeding detailed description of the preferred embodiment of the invention and the accompanying drawings thereof, in which

Figure 1 is an elevation view of a die set embodying the invention;

Figure 2 is a plan view of the lower die shoe and parts mounted directly on it;

Figure 3 is an elevation view as seen from the right hand side of Figure 1;

Figure 4 is an elevation view as seen from the left hand side of Figure 1;

Figure 5 is a vertical sectional view of the holding jaw mechanism taken on the plane indicated by the line 5-5 in Figure 2;

Figure 6 is an elevation view of a cutoff blade and mounting means therefor;

Figure 7 is a sectional view taken on the plane indicated by the line 7-7 in Figure 6;

Figure 8 is a sectional view taken on the plane indicated by the line 8-8 in Figure 6;

Figure 9 is a view similar to Figure 7 showing a different set-up of the blade mounting means;

Figure 10 is a partial elevation view of the cutoff blade.

Referring first to Figure 1, the die set 2 includes a lower die 3 and an upper die 4. The lower die parts are mounted on a lower die shoe 6 and those of the upper die on an upper die shoe 7. These are heavy machined metal plates.

The lower shoe is supported by the bed of a press and the upper die shoe is reciprocated vertically by the ram of the press. The means by which the shoes are connected to the press may follow customary practice and therefore will not be illustrated or described. The upper die will be considered as the movable die, although the lower die could be the one moved. The upper die is supported for such reciprocation on the lower die by three sets of guide means 8. Each guide means comprises a tubular guide post 10 having a flange fixed to the lower shoe 6 by socket head screws 11. A bushing 12 similarly fixed to the upper shoe 7 fits over the post. It will be most clearly apparent from Figure 2 that the three guide posts 10 are located at three of four corners of a rectangle with the axes of two of the guide posts 10 lying in a plane which makes a vertical intersection with the plane of Figure 2 whereas one of those posts and the third have axes which lie in a plane which makes a horizontal intercept with the plane of Figure 2. This disposition of the guide means provides adequate support to resist any tendency of the die parts to bind because of sidewise thrust caused by lateral components of motion of the ram of the press with respect to the bed of the press.

It may be noted that the parts of the die are shown in their closed position, that is at the bottom of the closing stroke. It may also be noted that a portion of the structure is broken away in Figure 1 to show the structure of the die set more clearly; specifically, the forward guide means 8 is omitted in that figure.

The tubing 14 which is being cut is gripped between two suitably contoured jaws 15 and 16. Jaw 15 is fixed by machine screws to a first jaw holder or cross slide 18 which is mounted on the shoe 6 to reciprocate from left to right as viewed in Figure 1.

The cross slide 18, which rides on a relieved portion of the upper surface of lower shoe 6, is guided and held down by four gibs 19 (Figures 1 and 3) received in a slot in the upper surface of the lower shoe and held in place by machine screws 20. These gibs, which are of L-shaped cross section, enter slots 22 in the sides of the slide 18. A stop plate 23 fixed to an end of the shoe 6 limits outward movement of the slide.

The jaw 16 is fixed to the second jaw holder or cross slide 24. The second slide is reciprocable on the upper surface of the slide 18 and is guided by two gibs 26 which enter the slots 22 between the gibs 19. Gibs 26 are fixed to the cross slide 24 by machine screws. The jaws 15 and 16 are biased apart by two tension springs 27, the ends of which are hooked over posts 29. Each post consists of a sockethead screw 28 and a jam nut 30.

The jaws 15 and 16 are closed by a jaw clamping cam 31 which holds the jaws clamped during the greater part of the stroke of the ram. The cam 31 is fixed to the upper shoe 7 through a retainer 38. The parts are suitably fixed together by machine screws. Cam 31 has a thinner leading portion 32 which allows the springs 27 to open the jaws when the upper shoe is at its upper limit of travel. Cam 31 acts upon the slides through two rollers 34, one mounted on each slide, which follow the cam contours. One roller is mounted on slide 18 by a cross shaft 35 and the other on slide 24 by cross shaft 36. The operation of the clamping means in the cycle of operation of the cutoff die set should be apparent from the foregoing.

The first step in cutting off the tube is to scarf the upper surface; that is, to make a horizontal cut across the top of the tubing which extends only part way through the tube wall. This is a known expedient. The structure for this comprises a scarfing blade 39 clamped to a holder 40 mounted on a carrier or slide 41 reciprocable on an I-section rail 42 bolted into a recess in the lower shoe 6. The upper surface of the rail lies in a slot in the lower surface of the slide 41, and the slide is held on the rail by a pair of gibs 43 bolted to the under surface of the slide. The slide 41 is reciprocated on the rail 42 by a dogleg cam 44. Cam 44 depends from upper shoe 7, to which it is bolted. This cam passes through a slot in the lower shoe 6 and is backed up by a cam guide 47 fixed to one end of shoe 6. Cam 44 drives the slide 41 through two rollers 48, one engaging each edge of the cam. Shafts for these rollers are provided by two bolts 50. A plate 51 held by these bolts bears against the side of cam 44. As the upper die descends from its uppermost position (not illustrated) to its lowermost position as shown in Figure 1, the dogleg portion 52 of cam 44 projects the scarfing blade 39 to notch the tubing and then retracts it so that it is out of the way of the blade 54 which completes the cut. The scarfing blade 59 is adjustable vertically to set it for tubing of different diameters. The holder 40 is adjustably fixed to the slide 41 and its vertical position may be read on a scale 55.

The upper end of the cutoff blade 54 is clamped to a blade holding block 56 which in turn is fixed to the upper shoe 7 by machine

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screws. The blade passes through opposed slots in jaws 15 and 16.

The mounting arrangement for the cutoff blade 54 is illustrated particularly in Figures 6 through 10. This provides for mounting the blade in two settings longitudinally of the blade to accommodate two ranges of diameters of the tube to be cut off and to reposition a blade shortened by sharpening.

Figures 6 and 7 illustrate a first blade setting. Blade 54 lies in a recess 60 in the face of mounting block 56. A spacer plate 61 is disposed between the blade and the block. Plates 61 of various thickness are used with blades 54 of different thickness to locate the central plane of the blade at a point along the tube aligned with the scarfing blade 39.

The upper end of the blade 54 is driven downward by a backing plate or thrust block 62 which lies between shoe 7 and the end of the blade. Block 62 is fixed to holder 56 by machine screws 63 and both are received in a recess 65 in the under surface of shoe 7.

Blade 54 is held against the holder by a clamping plate 66. This plate is held against the blade by three sockethead screws 67 which pass through three of six holes 69 in the clamping plate and through lateral holes 70 and a lower central hole 71 (Figure 10) in the blade in this setting. Screws 67 also pass through holes 73 in the spacer 61 and are received in threaded holes 74 in the mounting block 56. Holes 69, 73 and 74 lie in two horizontal rows of three holes each.

To mount blade 54 farther from shoe 7, the screws 67 are taken out and clamping plate 66 is reversed as illustrated in Figure 9. In this orientation of plate 66, a flange 75 on the clamping plate extends over the end of blade 54 and engages block 62 and the blade end to transmit the driving force to the blade. In this setting, screws 67 pass through the three holes 69, 73, 74 in parts 66, 61 and 56 which are not used in the other orientation of clamping plate 66. They pass through holes 70 and through an upper central hole 77 in the blade. Note that this arrangement of holes in the blade and the overall bolting arrangement avoid use of aligned holes across the blade which would result in a very considerably weaker blade structure.

Thus, with a very simple and easily assembled arrangement, the blade 54 is adequately supported and driven in either of two settings relative to shoe 7.

It will be clear to those skilled in the art that the preferred die structure described herein is highly versatile and advantageous and benefits from simplicity and economy.

The guiding arrangement between the die shoes, the workpiece clamping structure, and the blade mounting arrangement all contribute to the advantages of the assembly, and it is pointed out that a cut-off die set comprising the blade mounting arrangement

described above is described and claimed in our co-pending application no. 7918669 (serial no. 1577570) which is divided out of this application.

WHAT WE CLAIM IS:

1. A die set operable in various mechanical press arrangements for performing work on a workpiece, the die set comprising, in combination, a lower die shoe, an upper die shoe, guide post means fixed to the shoes and interconnecting the shoes for guided relative reciprocation to effect the work, the guide post means consisting of guide post bushings and guide posts, each post being slidable in a respective one of the bushings; the die set including clamping jaw means mounted on one of the shoes for holding the workpiece during the work operation, the clamping jaw means comprising a first carriage slidably mounted on one of the shoes for movement transverse to the direction of relative reciprocation of the shoes and comprising a second carriage slidably mounted on the first carriage for movement opposite to that of the first carriage; and means adapted to move the said carriages.

2. A die set as claimed in claim 1 in which the guide post means comprises three guide post bushings and three guide posts with a first and second of the posts having parallel axes lying spaced apart in a first plane parallel to the direction of the said reciprocation and the third post and one of the first and second posts having parallel axes lying spaced apart in a second plane parallel to the direction of the said reciprocation and substantially perpendicular to the said first plane, so that the die set is tolerant of side thrusts of various orientation exerted by a ram operating the die set.

3. A die set as claimed in claim 1 or claim 2 in which carriage moving means is operated by the relative reciprocation of the shoes.

4. A die set as claimed in any one of the preceding claims comprising tube cutting means operated by the relative reciprocation of the shoes.

5. A die set as claimed in claim 1 substantially as herein described with reference to the accompanying drawings.

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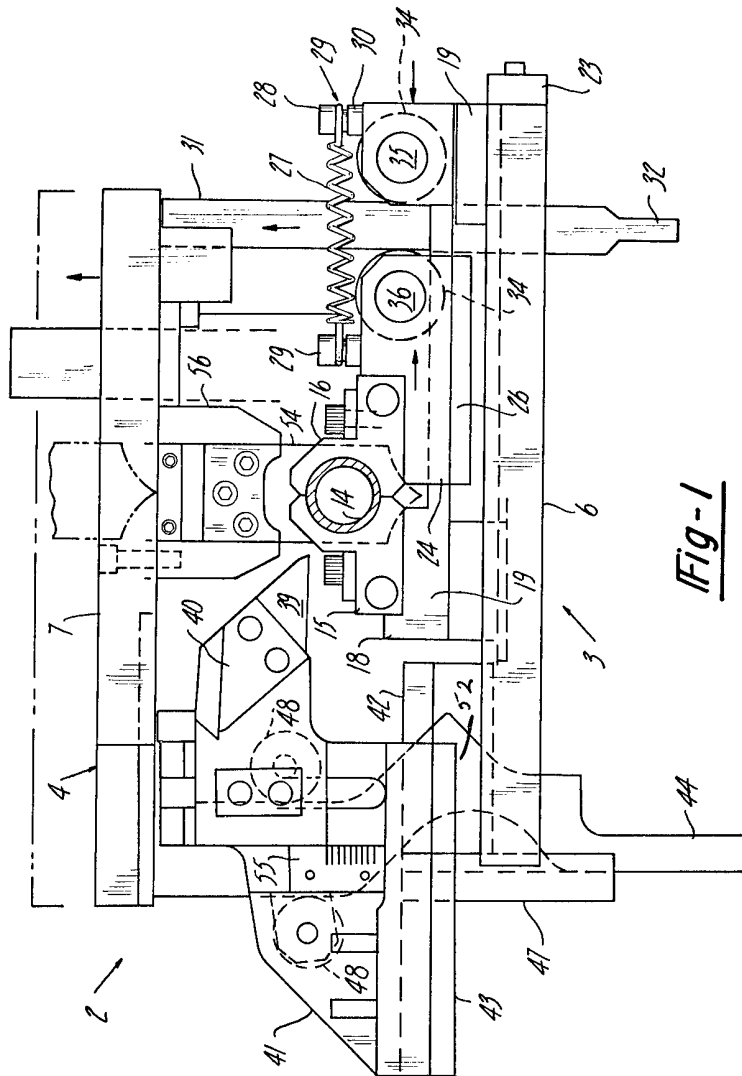


Fig-1

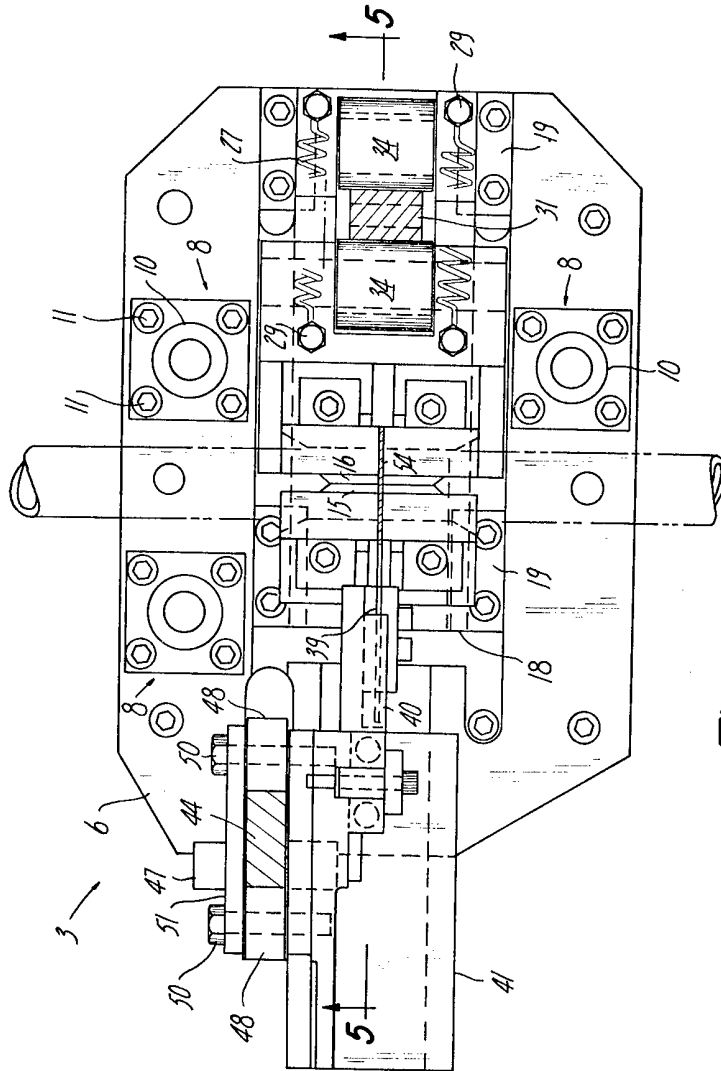


Fig-2

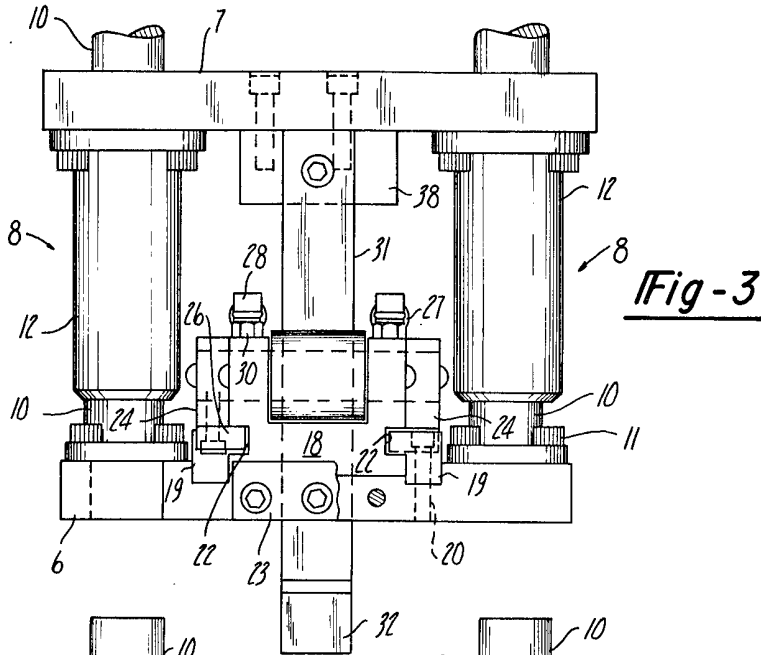


Fig-3

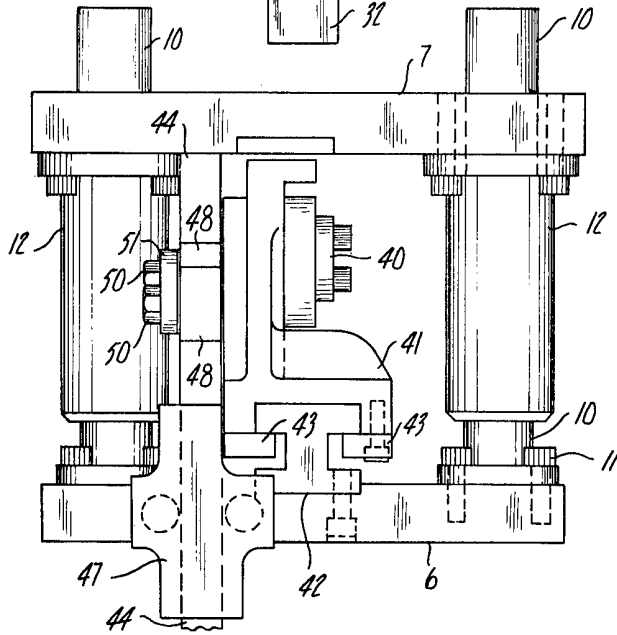


Fig-4

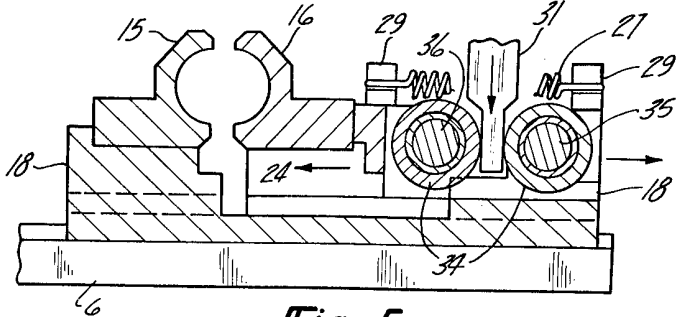


Fig-5

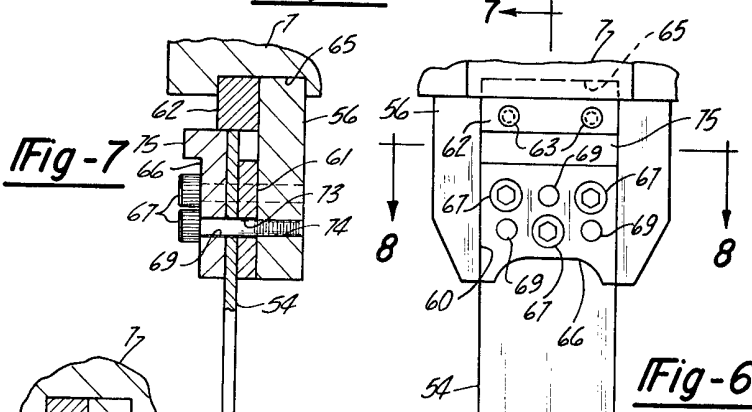


Fig-7

Fig-6

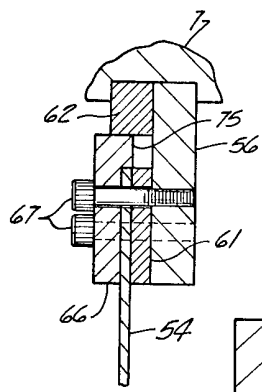


Fig-9

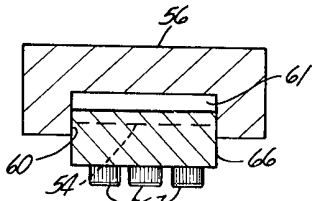


Fig-8

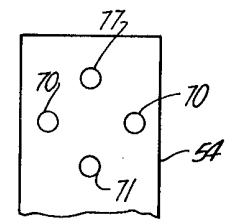


Fig-10