Jan. 11, 1944. C. H. TAUSER 2,338,982

SELF-CONTAINED DIE SET

Filed April 15, 1943 4 Sheets-Sheet 1

Fig. 1.

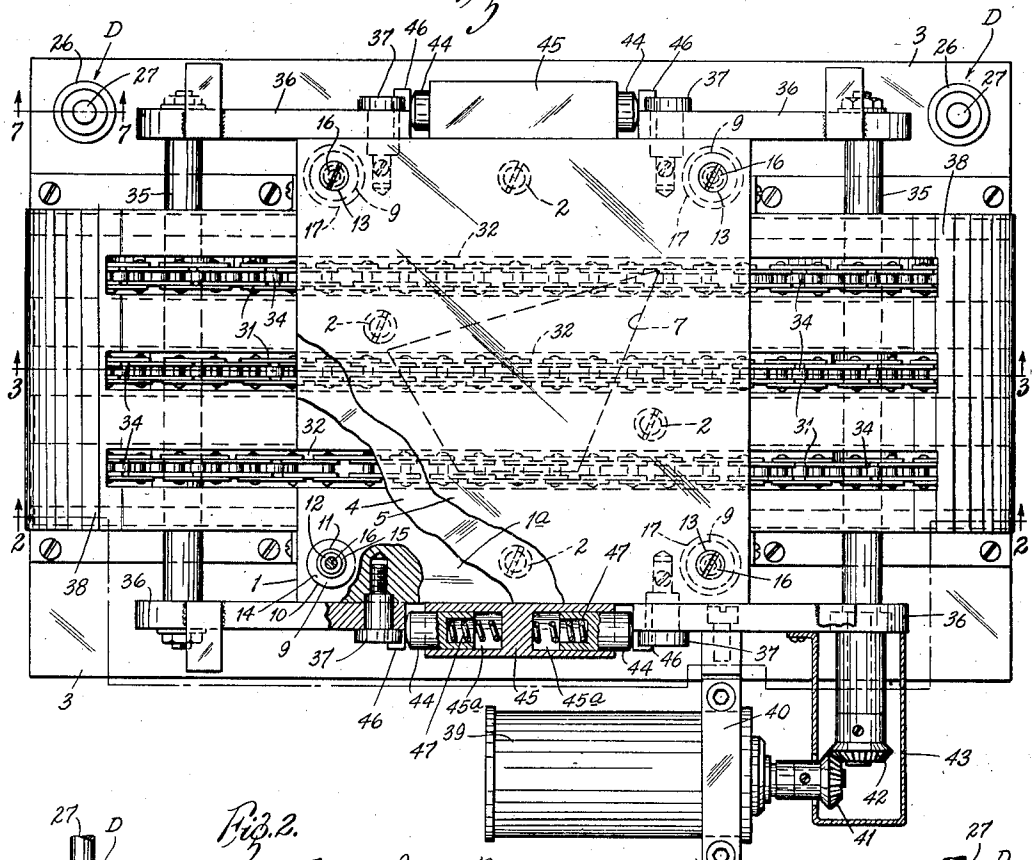
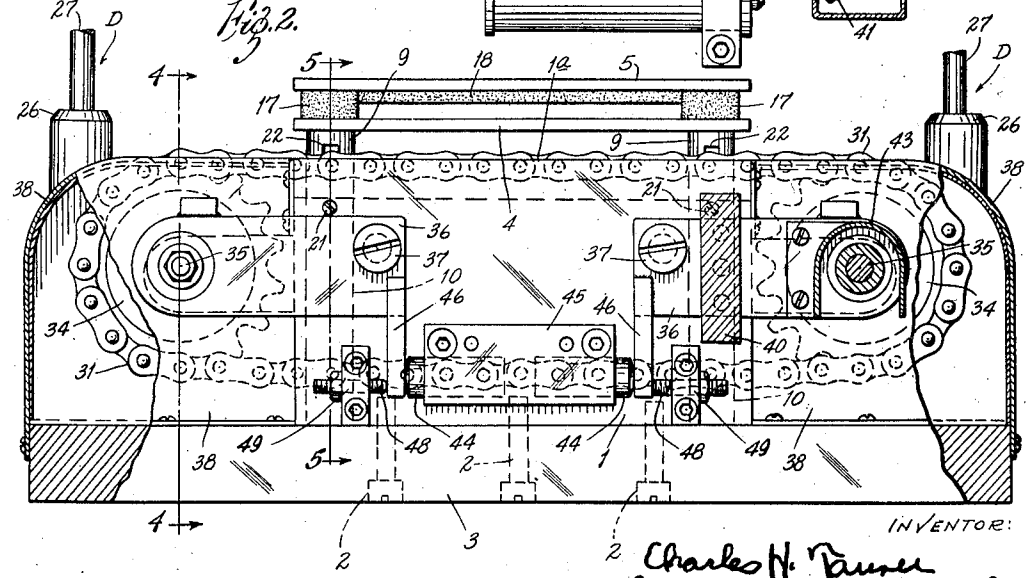


Fig. 2.



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SELF-CONTAINED DIE SET

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Fig. 3.

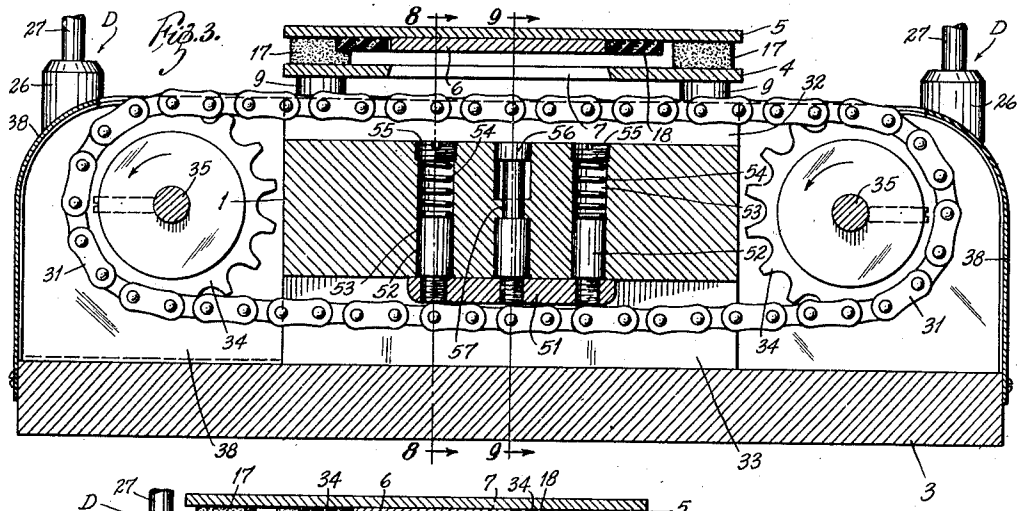


Fig. 9.

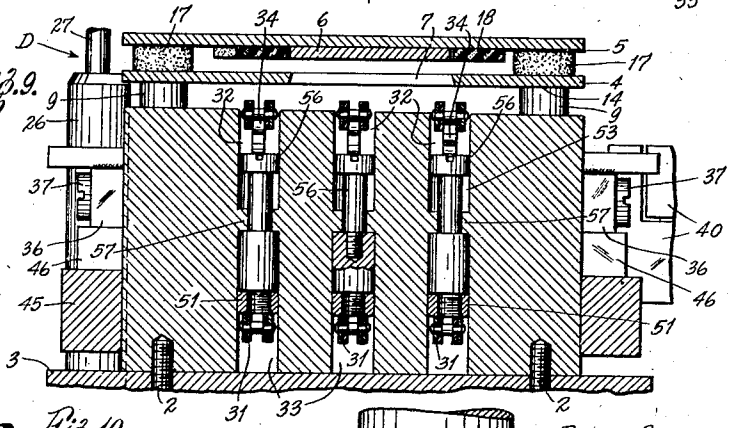
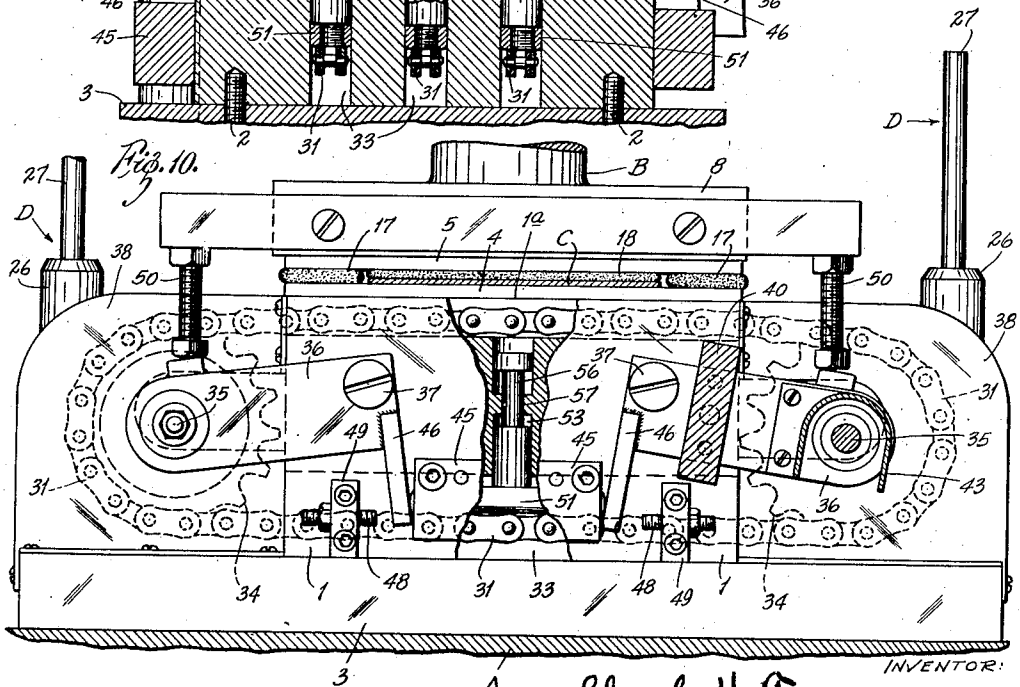


Fig. 10.



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Jan. 11, 1944. C. H. TAUSER 2,338,982

SELF-CONTAINED DIE SET

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Fig. 4.

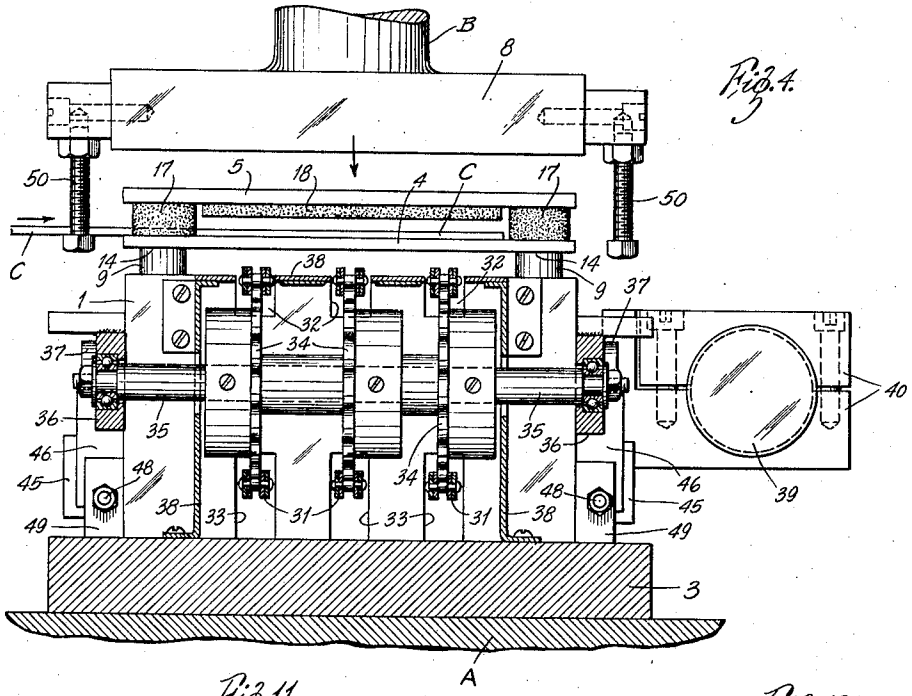


Fig. 11.

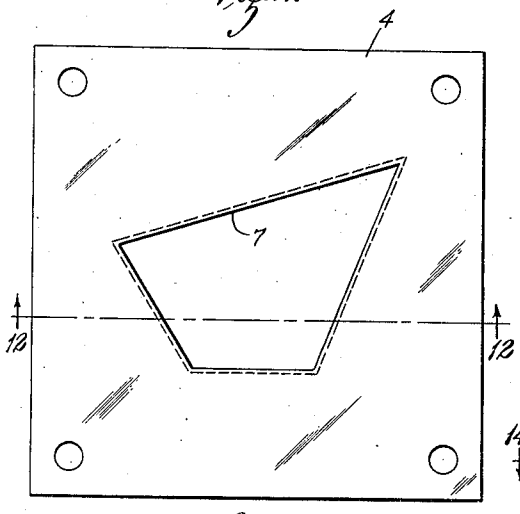


Fig. 13.

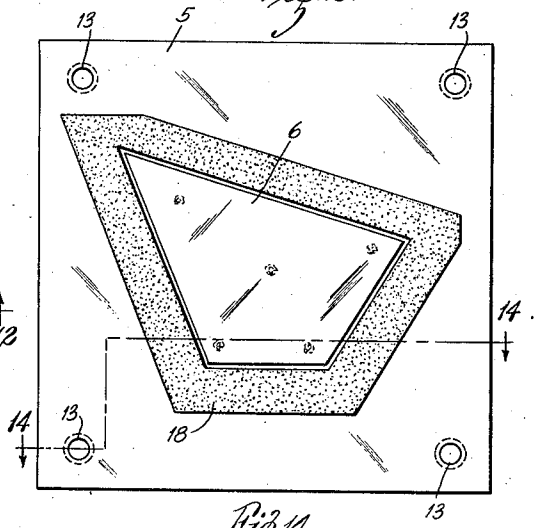


Fig. 12.

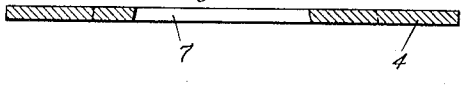
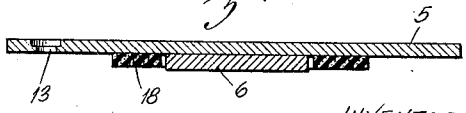


Fig. 14.



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SELF-CONTAINED DIE SET

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Fig. 5.

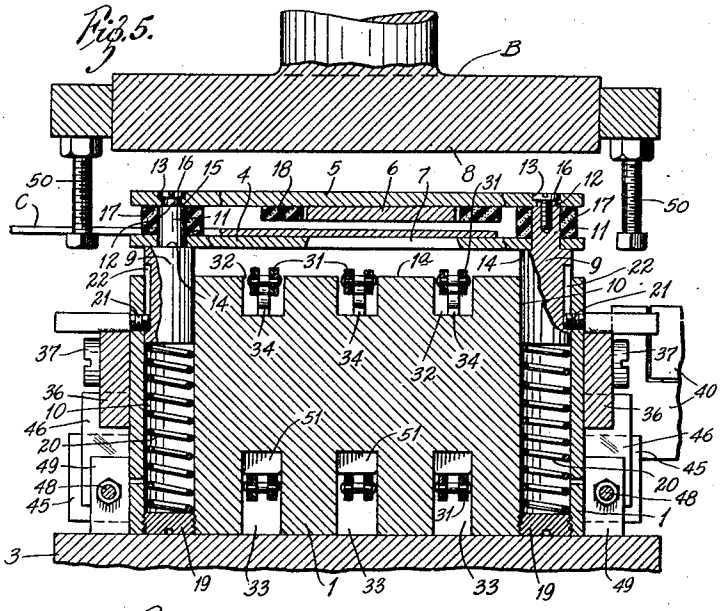


Fig. 5a.

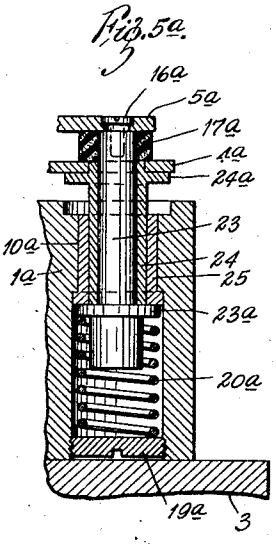


Fig. 6.

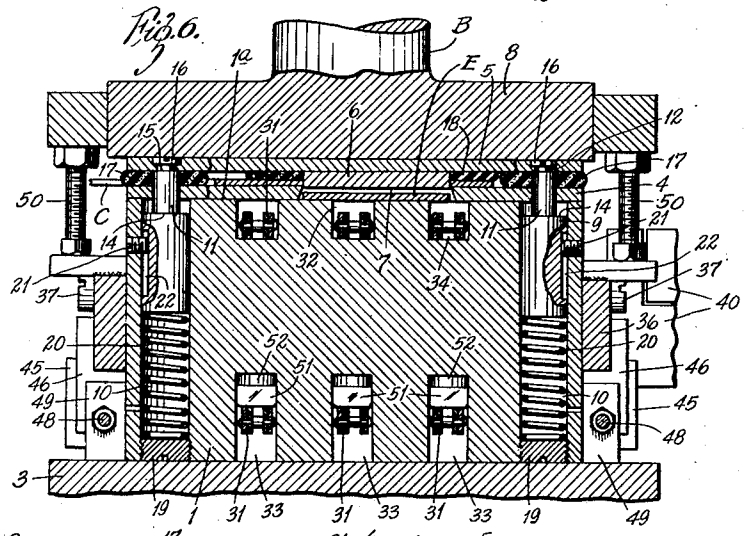


Fig. 7.

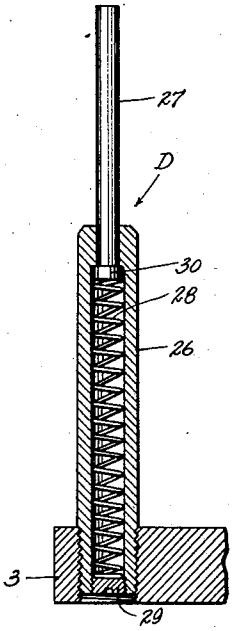
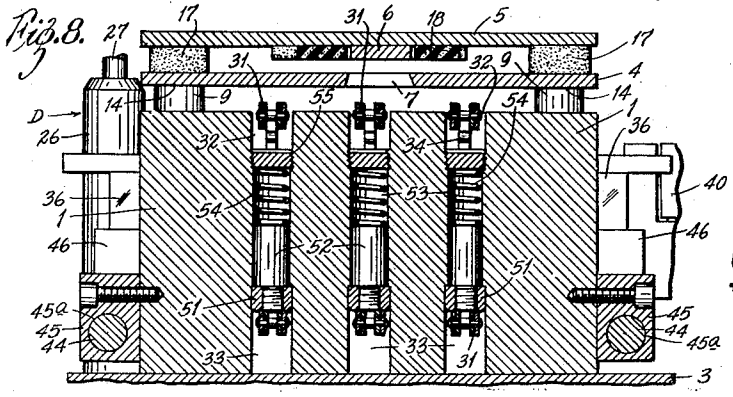


Fig. 8.



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Patented Jan. 11, 1944 2,338,982

UNITED STATES PATENT OFFICE

2,338,982

SELF-CONTAINED DIE SET

Charles H. Tauser, Venita Park, Mo., assignor to McDonnell Aircraft Corporation, St. Louis, Mo., a corporation of Maryland

Application April 15, 1943, Serial No. 483,112

20 Claims. (Cl. 164—118)

This invention principally relates to blanking die sets and has for its principal object to devise a simple, economical and compact die set adapted for ready application to and removal from a conventional die press as a complete self-contained unit. Other objects are to provide for quickly and easily changing the die and punch plates of the die set unit, to provide for accurately alining said plates in said unit, to provide means for removing the blanks from said unit after the blanking operation is completed, and to obtain other advantages hereinafter appearing. The invention consists in the self-contained die set and blank conveyor and in the construction, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a plan view of a self-contained die set and conveyor unit embodying my invention,

Fig. 2 is a vertical longitudinal section on the line 2—2 in Fig. 1,

Fig. 3 is a vertical longitudinal section on the line 3—3 in Fig. 1,

Fig. 4 is a vertical cross-section on the line 4—4 in Fig. 2, the die set unit being shown mounted on the bolster of a die press in position to be engaged by the ram thereof,

Fig. 5 is a vertical cross-section on the line 5—5 in Fig. 2,

Fig. 5a is a fragmentary central vertical sectional view showing a modified form of the guide post or leader pin construction,

Fig. 6 is a view similar to Fig. 5, showing the position of the parts during the blanking operation,

Fig. 7 is a vertical section through one of the telescopic guard posts on the line 7—7 in Fig. 1,

Figs. 8 and 9 are vertical cross-sectional views on the lines 8—8 and 9—9, respectively, in Fig. 3,

Fig. 10 is a side elevational view, partly in vertical cross-section, of the self-contained die set and the blank conveyor and the cooperating elements of the die press,

Fig. 11 is a top plan view of the die plate,

Fig. 12 is a vertical section on the line 12—12 in Fig. 11,

Fig. 13 is a bottom plan view of the punch plate; and

Fig. 14 is a vertical cross-section on the line 14—14 in Fig. 13.

In the accompanying drawings, my self-contained die set and conveyor unit is shown mounted on the bolster A of a conventional die press immediately below the vertically reciprocatory ram or slide member B thereof. Said unit comprises a rectangular body 1 that seats upon and is preferably secured by cap screws 2 to a suitable base plate 3 that rests on and is removably secured in any desired manner to the bolster A of the die press.

Located above the body A is a horizontally disposed die plate 4; and located above said die plate is a horizontally disposed punch plate 5 that is provided on its underside with a suitably shaped punch element 6 adapted for cooperation with a similarly shaped die opening 7 provided therefor in said die plate. The punch plate 5 is located below the press ram B in position to be engaged by an enlarged lower horizontal plate portion 8 thereof when said ram moves downwardly in the press.

The die plate 4 and punch plate 5 are supported at their four corners for vertical movement relative to one another and to the body 1 of the die set unit under the downward pressure of the press ram B by means of four upright cylindrical guide posts or leader pins 9.

Each of the guide posts 9 is slidably mounted in a vertical bore 10 provided therefor in the body 1 of the die set unit and has a reduced upper end portion 11 that extends through a slide hole provided therefor in the die plate 4 and terminates in its upper end in a further reduced portion 12 that fits within the lower portion of a countersunk hole 13 provided therefor in the punch plate 5, the reduced portion 11 forming a supporting shoulder 14 for said die plate and the reduced portion 12 forming a supporting shoulder 15 for said punch plate. The punch plate 5 is secured to the upper end of the vertically slidable supporting post 7 therefor preferably by means of a cap screw 16 that is threaded into the upper end of said post with its head seated in the countersunk upper end of the post receiving opening 13 in said punch plate.

Surrounding the reduced portion 11 of each die and punch plate supporting post 9 between the die plate 4 and the punch plate 5 is a washer or sleeve 17 of rubber or other resilient material which normally serves to space apart said plates, but permits downward movement of the punch plate 5 relative to the die plate 4 under the pressure of the descending press ram 6 against said punch plate after said die plate seats on top of the body 1. These resilient washers or sleeves 17, together with rubber strips 18 fixed to the underside of the punch plate 5 around the punch element 6 thereof, also serve to disengage the said

punch element from the die opening 7 after the blanking operation. Mounted in each of the vertical post supporting bores 10 of the body 1, between the underside of the post 9 and a threaded closure plug 19 for the lower end of said bore, is a coil compression spring 20, which tends to force said post upwardly in said bore and lift the die plate 4 off said body. Upward movement of the post 9 in its supporting bore 10 is limited by a stop pin 21 that is threaded into the body 1 through one end thereof and seats in a longitudinal groove 22 in the post and serves also to prevent said post from turning in said bore.

The modified guide post or leader pin construction shown in Fig. 5*a* comprises a post or pin 23 slidable in a sleeve 24 which is slidably supported in a bushing 25 fixed in a vertical bore 10*a* in the body 1*a* of the die set unit. The punch plate 5*a* is secured by means of a countersunk screw 16*a* to the top of the post 23, and the die plate 4*a* seats on a circumferential flange or collar 24*a* provided therefor on the sleeve 24 whose upper end fits in a hole provided therefor in said die plate and terminates flush with the top surface thereof. The sleeve 24 seats on a collar 23*a* on the post 23 which collar abuts against the lower end of the bushing 25 and thus limits the upward travel of said post in said bushing. The post 23 is yieldably supported in the bore 10*a* provided therefor in the body 1*a* by means of a coil compression spring 20*a* located in said bore between the collar 23 of said post and threaded closure plug 19*a* for the lower end of said bore. A rubber spacing washer 17*a* fits around the post 23 between the punch and die plates and serves normally to space them apart. When the punch plate 5*a* is engaged by the descending ram B of the punch press, the punch plate, die plate 4*a*, post 23 and sleeve 24 move downwardly together until the die plate seats on the body 1*a*, after which the punch plate continues to move downwardly to engage the punch element thereof with the die opening in the stationary die plate. During the downward travel of the punch plate, the post 23 moves downwardly in the sleeve 24 and the rubber washer 17*a* is compressed. After the blanking operation the punch and die plates are separated by the rubber washer 17*a* and are raised by the spring 20*a*.

The work, which is shown in the form of a metal strip or plate C, is inserted between the punch and die plates from one side of the die set unit; and said side of said unit is provided at the corners thereof with guards D which tend to prevent the hands of the operator from being caught between said plates as he feeds the work therebetween. Each of these guards comprises a telescopic post including a tubular base section 26 that is threaded into the base plate 3 of the die set unit, an upper section 27 supported in said base section for axial sliding movement relative thereto, and a coil compression spring 28 mounted in said base section between a closure plug 29 at the lower end thereof and a collar 30 which is rigid with the lower end of said upper section and serves to limit the upward movement thereof.

The hereinbefore described die set unit operates as follows. The sheet material C that is to be punched is slid between the vertically spaced die and punch plates between the supporting posts at the four corners thereof from the guard post side of said unit. When the press ram descends, the plate at the lower edge thereof strikes the punch plate 5, thus forcing said punch plate, together with the material C to be blanked and the die plate, downwardly until the die plate 4 seats on the top of the body 1*a* of the die set unit, after which said punch plate moves downwardly relative to said die plate until the punch element 6 engages the die opening 7 to punch a blank E from the said strip, the rubber washers 17 and pads 18 being compressed to permit such engagement. When the punch and die plate ascend with the press ram, the die plate lifts off the top of the body 1 of the die press unit, carrying with it the work that has been blanked, while the punch plate is moved upwardly away from the die plate by the expansive action of said rubber washers and sleeves, the blank D being left below said die plate.

The die set unit is preferably provided with a conveyor for carrying away the blank D after the die plate is lifted off the body 1 of the die press unit. Said conveyor preferably comprises a series of spaced parallel horizontally disposed endless conveyor chains 31 whose upper stretches run in longitudinal grooves 32 in the top of the body 1 and whose lower stretches run in longitudinal grooves 33 in the bottom of said body 1. These chains 31 are supported beyond the ends of the body 1 on sprocket wheels 34 mounted on horizontal cross shafts 35 that are supported at their ends in the free ends of arms 36 that are secured by pivot screws 37 to the sides of said body for vertical swinging movement relative thereto. As shown in the drawings, the sprocket wheels, shafts and chains are enclosed beyond the ends of the body in housings 38 fixed to the base plate 3. One of the sprocket shafts 35 is driven preferably by means of a suitable air motor 39 supported in a bracket 40 fixed to one of the pivotal supporting arms 36 for said shaft. The operative connection between the air motor 39 and the sprocket shaft driven thereby preferably comprises a bevel gear 41, which is driven by said motor and intermeshes with a bevel gear 42 fixed to said shaft, said gears being preferably covered by a suitable housing 43 fixed to the air motor supporting arm for said shaft.

The sprocket shaft supporting arms 36 are normally yieldably held in a position that will bring the tops of the upper runs of the endless sprocket chains 31 above the level of the top of the body 1 of the die set unit preferably by means of plungers 44 that are mounted in axially horizontal bores 45*a* provided therefor in opposite ends of brackets 45 that are secured to the sides of said body between abutment plates 46 that project outwardly from said arms below the pivots 37 thereof. The plungers 44 are forced outwardly into engagement with the abutment plates 46 of the sprocket supporting arms 36 preferably by coil compression springs 47 located in the bores 45*a* of the brackets 45. The abutment plates 46 of the arms 36 are normally held by the spring-pressed plungers 44 against adjustable stop pins 48 provided therefor in brackets 49 secured to the sides of the body 1 of the die press unit. The stop pins 48 limit the upward swinging movement of the arms 36 and the sprocket chains 31 sustained thereby.

When the press ram moves downwardly to simultaneously depress the punch and die plates and then cause the punch plate to move downwardly relative to the die plate to punch the blank D from the strip of material C located between said plates, the arms 36 are depressed by depending pins 50 carried by the plate 8 at the bottom of the press ram B. These arm actuating pins 50 are shown in the form of bolts so that

the effective length thereof may be regulated. When the sprocket chain supporting arms 36 are swung downwardly by the pins 50 carried by the press ram, the upper runs of the sprocket chains move downwardly in the grooves 32 far enough to bring the upper surfaces of said upper runs below the blank supporting surface of the body of the die set. When the ram ascends, the arms 36 are again swung upwardly by the spring-pressed plungers 44, thus causing the upper runs of the chains to rise above the blank supporting top surface of the body and thus lift the blank D therefrom. The blank is then conveyed from beneath the die plate by moving upper stretches of the conveyor chains.

The conveyor chains 31 are individually adjusted to render them taut at all times by means of an automatic chain adjuster comprising shoes 51 mounted in the upper portions of the grooves 33 for the lower stretches of the chains. The shoes 51 extend longitudinally of the chain grooves 33 and are provided at and intermediate between their ends with upstanding guide pins 52 that are slidably supported in vertical bores 53 provided therefor in the body 1. The shoes are pressed downwardly into engagement with the upper surface of the lower runs of the chains 31 by means of coil springs 54 located in the end bores between the upper ends of the guide pins 52 and plug closures 55 for the upper ends of said bores. The shoes are removably retained in the chain grooves 33 when the chains are removed by means of a cap screw 56 which extends downwardly through the intermediate guide pin bores and are threaded into the upper ends of the intermediate guide pins, said intermediate bores being counterbored to provide a stop shoulder 57 for the heads of the cap screws 55.

The hereinbefore described arrangement provides a simple, economical and compact self-contained die set and power driven conveyor unit which requires a minimum amount of tool crib storage space and which may be readily mounted in and dismounted from the die press without alteration thereof. The thin punch and die plates are simple and economical and are quickly and easily attached to and removed from the die set unit. The holes in the punch and die plates for the supporting posts are drilled with a master jig, while the posts themselves are accurately positioned in the body of the die set unit, thereby insuring accurate alinement of the die and punch plates. The posts also serve to raise the die plate off the body of the die set unit to permit removal of the blank by the conveyor. When the press ram rises, the rubber washers between the punch and die plates operate to hold said plates far enough apart to permit insertion of the work therebetween, while the rubber strips around the punch element of the punch plate assist the thicker rubber washers in disengaging said punch element from the die opening in the die plate. Just prior to the blanking operation, the upper blank supporting runs of the blank conveyor chains move downwardly below the level of the top of the body of the die set unit and thus permit the die plate to seat flatwise upon the upper surface of said body; and, when said die plate is raised off said body after the blanking operation, said upper runs of said chains move upwardly above the level of the top of said body into engagement with the blank and remove the latter from the die set unit. The chain is kept taut at all times by the self-adjusting take-up device located in the downwardly opening grooves formed in the bottom of the body of the die set unit for the lower runs of said chains.

The hereinbefore described self-contained die set admits of considerable modification without departing from the invention. For instance, the conveyor chains may be operated by electric or gasoline motors, depending on the type of power that is best suited and preferred by the operator; and the conveyor may be entirely dispensed with and the blanks or stampings removed by gravity or by means of an air jet.

What I claim is:

1. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, vertically movable supports sustained entirely by said body, and superimposed punch and die members mounted on said supports in normal spaced apart relation for movement therewith relative to said body and to one another.

2. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, vertically movable supports sustained by said body, superimposed punch and die members mounted on said supports for movement therewith relative to said body and to one another, and a resilient means interposed between said punch and die members for normally spacing them apart to permit entry of the work therebetween.

3. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, vertically movable supports sustained by said body and normally projecting thereabove, superimposed punch and die plates mounted on said supports above said body for movement therewith relative to said body, and means interposed between said punch and die plates for normally spacing them apart to permit entry of the work therebetween, said means being yieldable when the lower plate is moved downwardly into engagement with said body to permit continued downward movement of the upper plate.

4. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, superimposed punch and die members mounted on said body for movement relative thereto and to one another, resilient means interposed between said punch and die members for normally spacing them apart to permit entry of the work therebetween, and resilient means fixed to one of said punch and die members for assisting said resilient spacing means in disengaging the punch element from the die element.

5. A die set assembly adapted for application as a complete preassembled unit to a die press, said assembly comprising a body, a lower die plate and an upper punch plate disposed above said body and supported thereby for vertical movement relative thereto, said punch plate having a punch element on its underside and said die plate having a die opening adapted to receive said punch element, resilient means interposed between said punch and die plates for normally spacing them apart to permit entry of the work therebetween, and resilient means fixed to said punch plate around the punch element thereof for assisting said resilient spacing means in disengaging the punch element of the punch plate from the die opening of the die plate.

6. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, vertically mov-

able supports sustained entirely by said body, superimposed punch and die plates mounted on said supports for movement therewith and relative to one another, springs mounted in said body and cooperating with said supports for normally spacing the lowermost plate above the top of said body, and means interposed between said plates for normally spacing them apart.

7. A die set assembly adapted for application as a complete preassembled unit to a die press, said assembly comprising a body, a vertically movable guide post mounted in said body and projecting thereabove, superimposed punch and die plates mounted on the projecting end of said post, a spring support for said post, and a resilient member mounted around said post between said punch and die plates for normally spacing them apart, said resilient member permitting the uppermost plate to move downwardly into engagement with the lowermost plate when the latter is moved downwardly into engagement with said body by downward pressure on said uppermost plate.

8. A die set assembly adapted for application as a complete preassembled unit to a die press, said assembly comprising a body, superimposed punch and die plates, and means for supporting said plates above said body for vertical movement relative to said body and to each other, said means comprising a post mounted for vertical sliding movement in said body, said post extending upwardly through an opening provided therefor in the lowermost plate and having a supporting shoulder therefor, the uppermost plate being seated on and secured to the upper end of said post, a spring support for said post, and resilient spacing means surrounding said post between said plates.

9. A die set assembly adapted for application as a complete preassembled unit to a die press, said assembly comprising a body, superimposed punch and die plates located thereabove, a sleeve mounted for vertical sliding movement in said body and supporting the lowermost plate, a pin slidably mounted in said sleeve and supporting the upper plate, a spring support for said sleeve and pin, and resilient spacing means surrounding said pin between said plates.

10. A die set assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a plurality of supporting posts vertically slidably mounted in said body with their ends projecting thereabove, springs mounted in said body for yieldably holding said posts in such upwardly projected position, a die plate seated on said projecting portions of said posts, a punch plate removably secured to said posts above said die plate, and resilient spacing sleeves surrounding said posts between said punch and die plates.

11. A die set and conveyor assembly adapted for application as a complete preassembled unit to a die press, said assembly comprising a body, superimposed punch and die members mounted on said body for movement thereto and to each other, and a conveyor mounted on said body for removing from beneath said punch and die members stampings produced thereby.

12. A die set and conveyor assembly adapted for application as a complete preassembled unit to a die press, said die set assembly comprising a body, vertically movable supports sustained by said body, superimposed punch and die members sustained by said supports above said body for movement relative thereto and to each other, and a power driven conveyor entirely sustained by said body for removing from beneath said punch and die members stampings produced thereby.

13. A die set and conveyor assembly adapted for application as a complete preassembled unit to a die press, said die set assembly comprising a body, vertically movable supports sustained by said body, superimposed punch and die members sustained by said supports above said body for movement relative thereto and to each other, and a power driven conveyor entirely sustained by said body for removing from beneath said punch and die members stampings produced thereby, said conveyor including an endless chain with one stretch thereof disposed beneath said punch and die members.

14. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member.

15. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor being disposed with its supporting surface above the level of said seat in the raised position of said die member and below said level in the lower position of said punch member.

16. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor comprising an endless chain having its upper stretch running in a groove provided therefor in the top of said body, sprocket wheels for supporting the ends of said chain, and shafts for supporting said sprocket wheels, said shaft being mounted for vertical movement relative to said body, whereby said conveyor stretch is adapted to be raised above the level of the die member seat when said shaft is raised and is adapted to move downwardly in said groove below said level when said shaft is depressed.

17. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die

member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor comprising a vertically movable horizontally disposed endless chain having its upper stretch running in a groove provided therefor in the top of said body, said stretch being disposed with its upper surface above said die member seat in the raised position of said die member and with its upper surface below said seat in the seated position of said die member.

18. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor comprising an endless conveyor chain having its upper stretch running in a groove provided therefor in the top of said body, sprocket wheels for supporting the ends of said chain, arms pivotally supported on said body for vertical swinging movement relative thereto, supporting shafts for said sprocket wheels mounted in the free ends of said arms, whereby said upper stretch is adapted to move upwardly above the level of the die member seat when said arms swing upwardly and is adapted to move downwardy below the level of said seat when said arms swing downwardly.

19. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor comprising an endless conveyor chain having its upper stretch running in a groove provided therefor in the top of said body, sprocket wheels for supporting the ends of said chain, arms pivotally supported on said body for vertical swinging movement relative thereto, supporting shafts for said sprocket wheels mounted in the free ends of said arms, whereby said upper stretch is adapted to move upwardly above the level of the die member seat when said arms swing upwardly and is adapted to move downwardly below the level of said seat when said arms swing downwardly, means mounted on one of said arms for driving the shaft supported thereby, and means for yieldably holding said upper stretch of said chain in raised position.

20. A die set and conveyor assembly adapted for application as a complete self-contained unit to a die press, said assembly comprising a body, a die member normally spaced above said body, a punch member normally spaced above said die member, means for supporting said die and punch member for vertical movement, whereby said die member is adapted to move downwardly into engagement with a seat provided therefor on said body and said punch member is adapted to move downwardly into engagement with the seated die member, and a horizontal conveyor operating between said body and said die member, said conveyor comprising an endless conveyor chain having its upper stretch running in a groove provided therefor in the top of said body, sprocket wheels for supporting the ends of said chain, arms pivotally supported on said body for vertical swinging movement relative thereto, supporting shafts for said sprocket wheels mounted in the free ends of said arms, whereby said upper stretch is adapted to move upwardly above the level of the die member seat when said arms swing upwardly and is adapted to move downwardly below the level of said seat when said arms swing downwardly, means mounted on one of said arms for driving the shaft supported thereby, and means for yieldably holding said upper stretch of said chain in raised position, said last mentioned means comprising a spring pressed plunger bearing against said arm for swinging them upwardly, means for limiting the upward swinging movement of said arms, and means cooperating with the lower stretch of said chain for tightening the same.

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