July 12, 1938. O. OECKL 2,123,683

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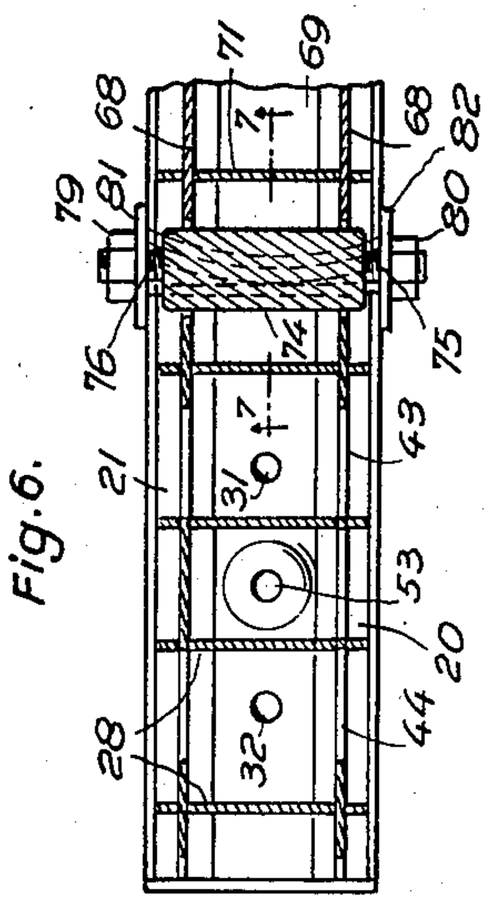

Fig. 6.

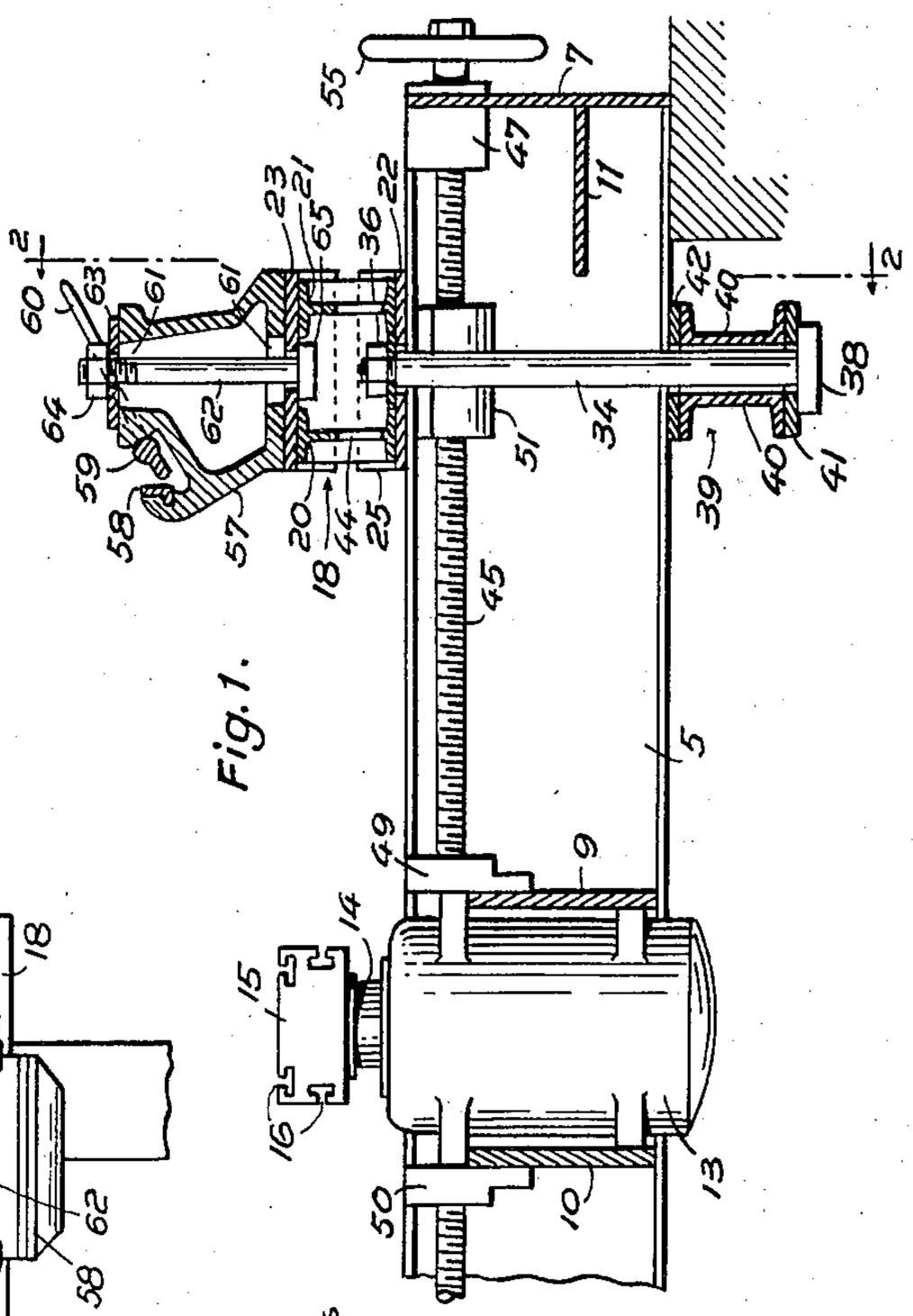

Fig. 1.

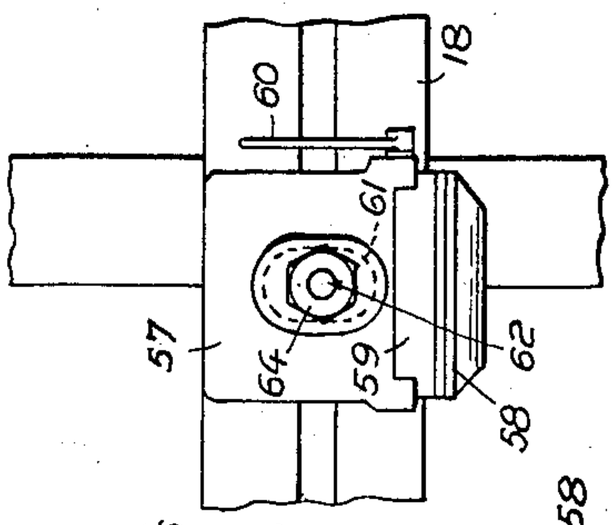

Fig. 5.

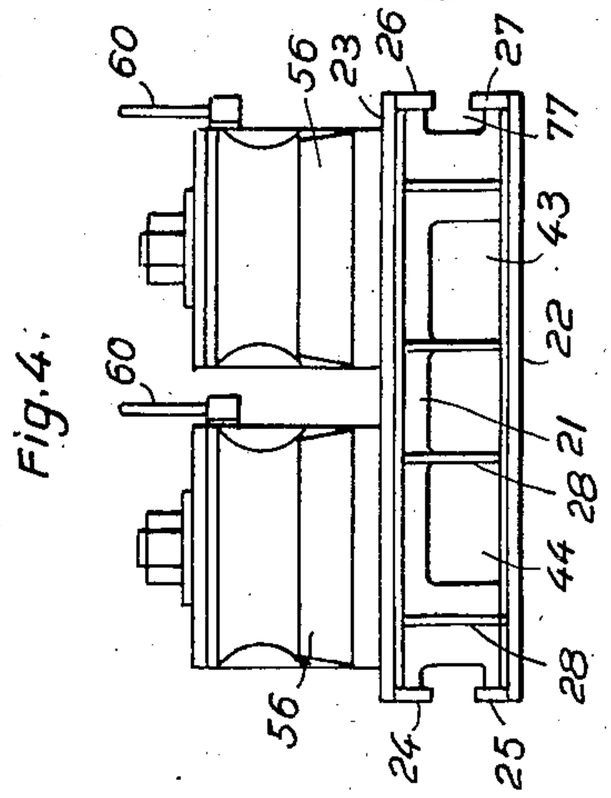

Fig. 4.

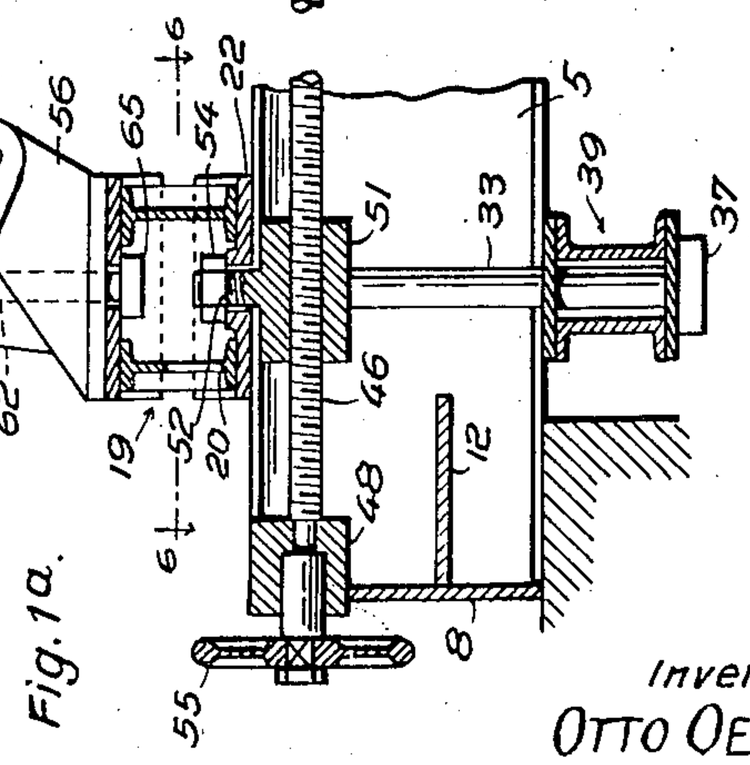

Fig. 1a.

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Fig.2.

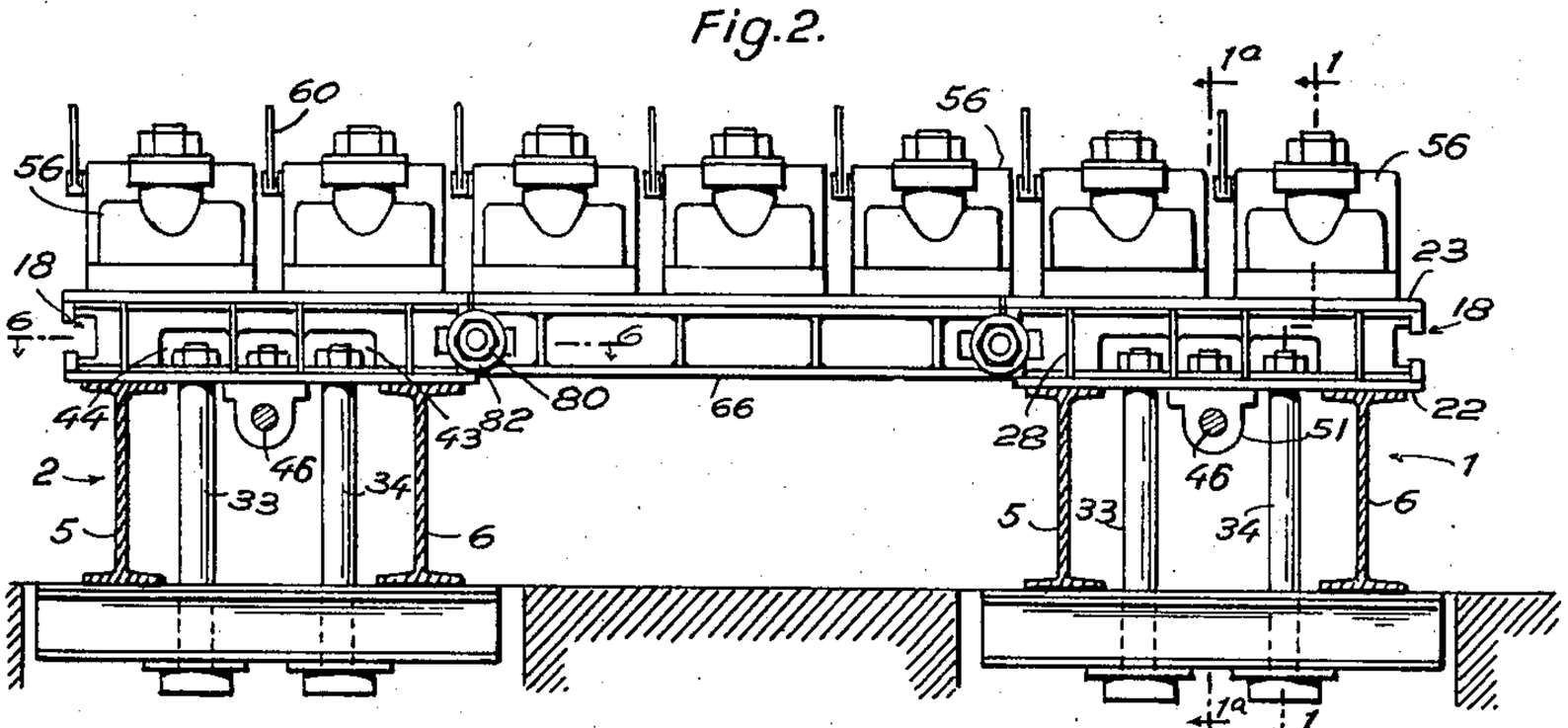

Fig.3.

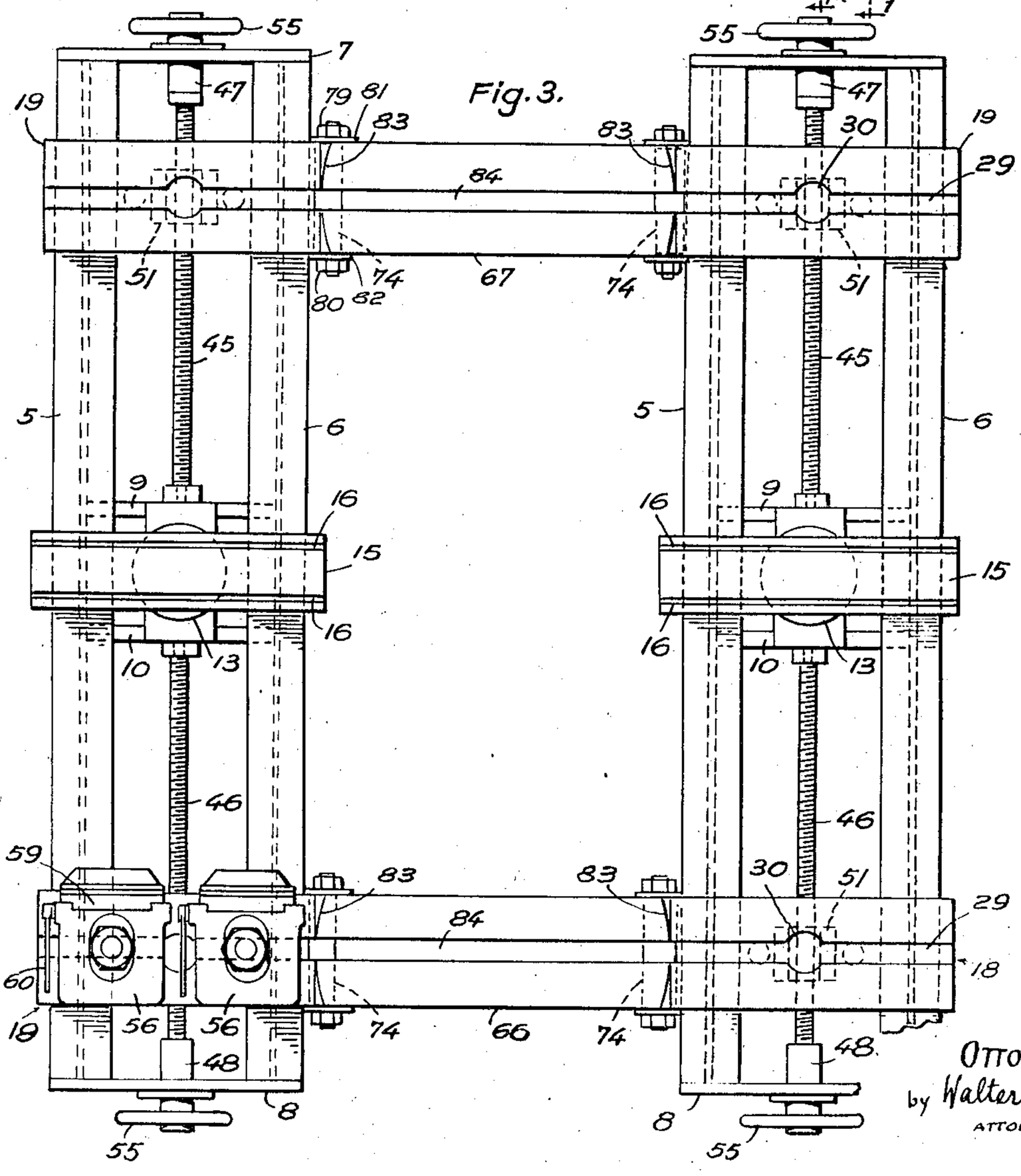

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Fig.7.

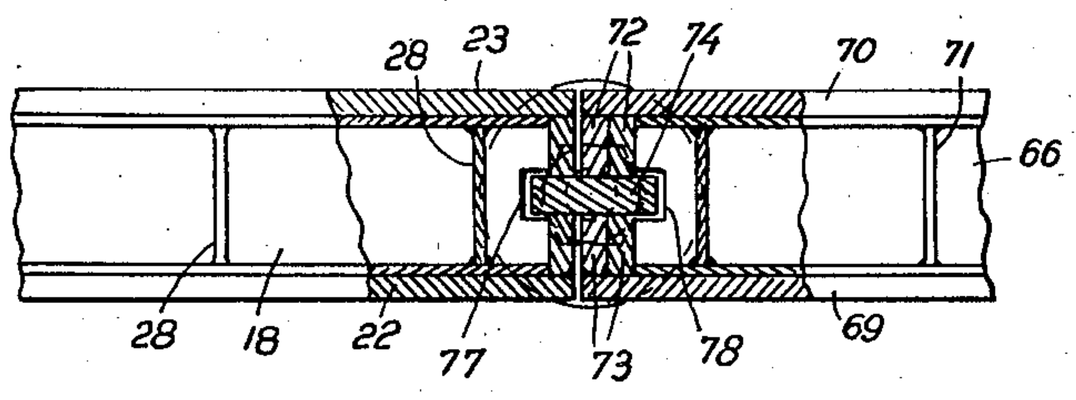

Fig.8.

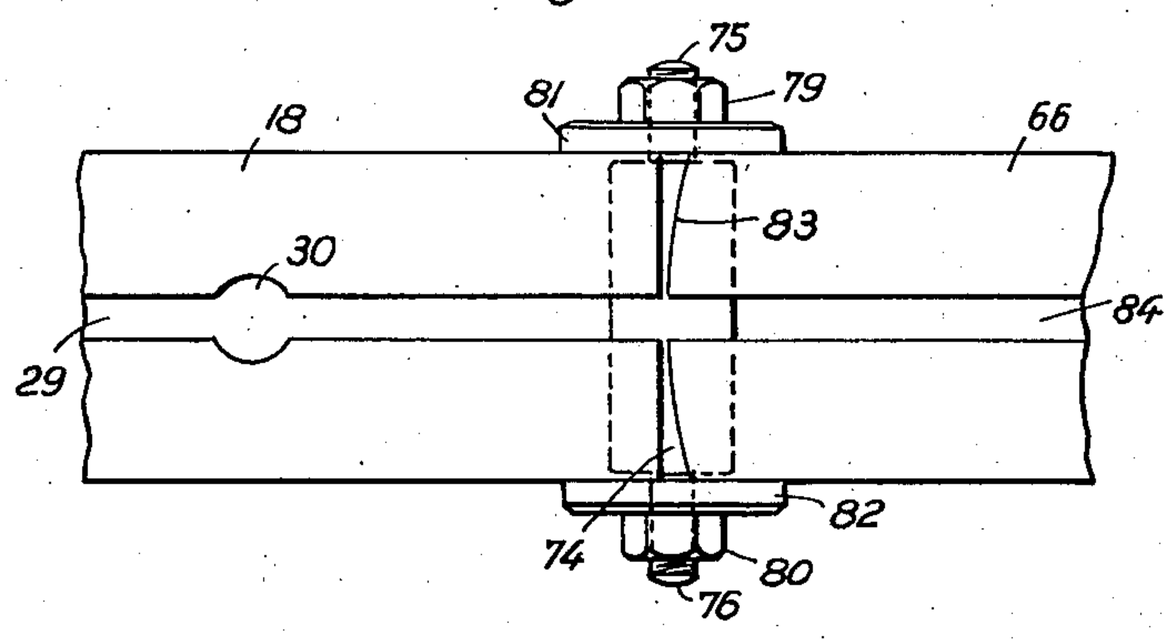

Fig.9.

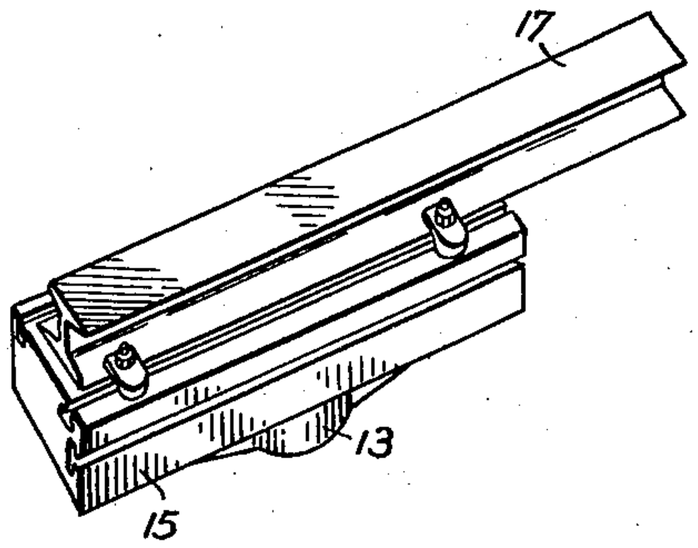

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Fig. 10.

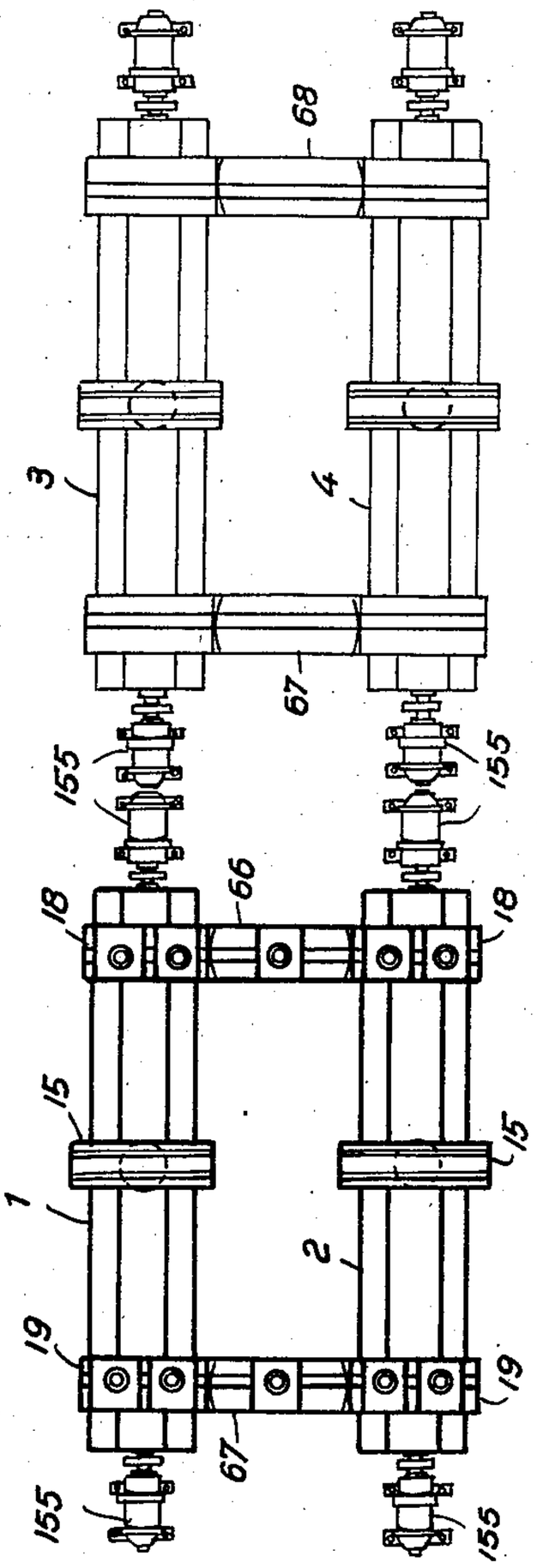
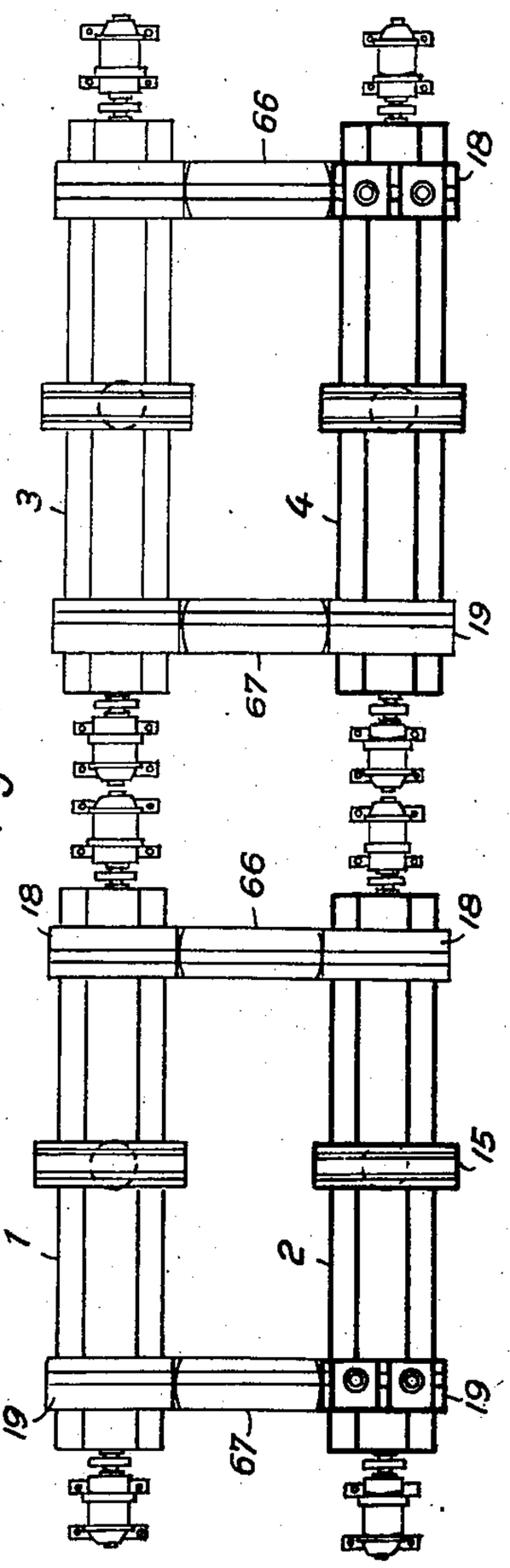


Fig. 11.



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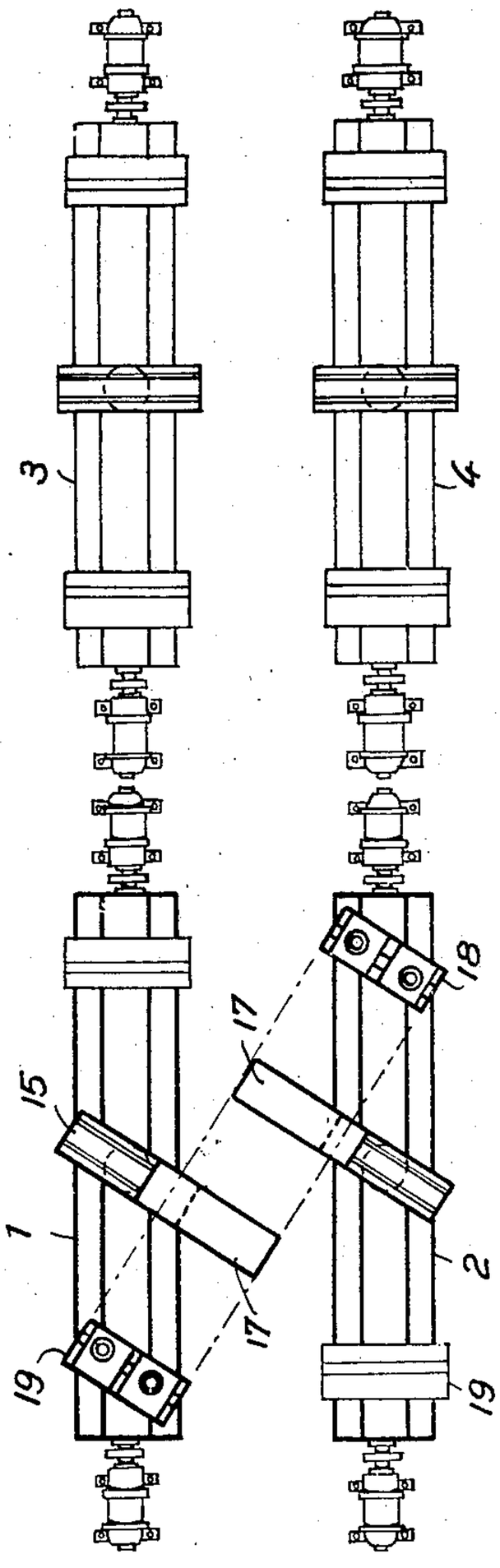

Fig.12.

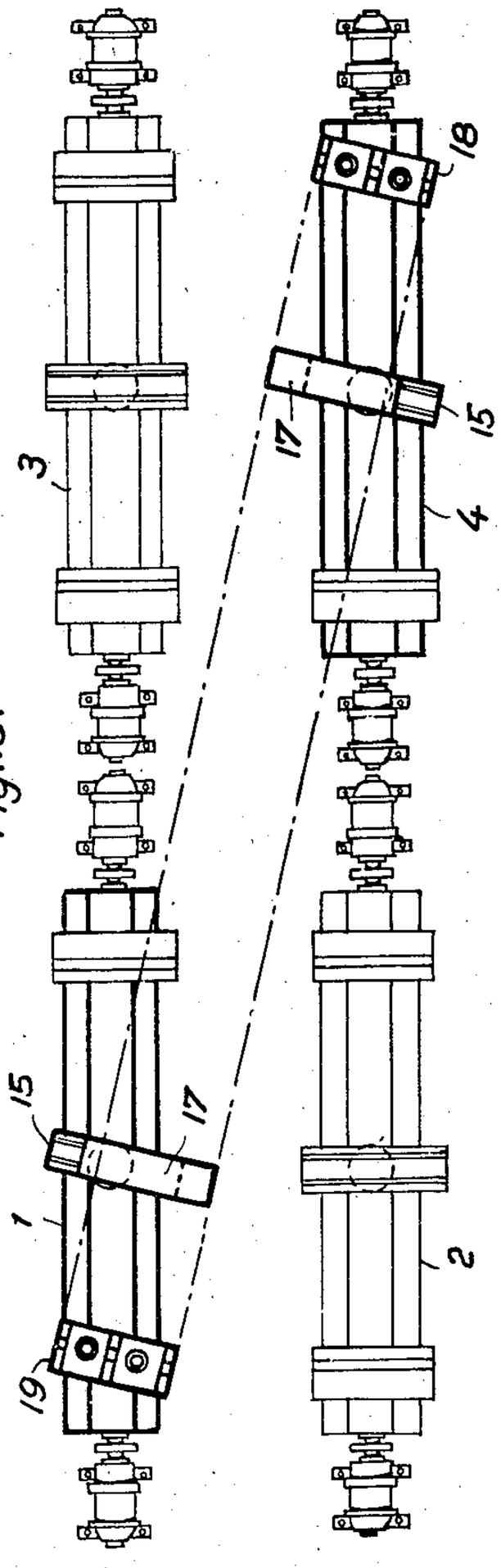

Fig.13.

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Patented July 12, 1938 2,123,683

UNITED STATES PATENT OFFICE

2,123,683

DIE PRESS

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Application March 30, 1937, Serial No. 133,812

5 Claims. (Cl. 153—48)

This invention relates to a die press for shaping metal sheets, and its principal object is to provide a machine which is serviceable in the production of panels of light metal as for instance the metal sheets of the outer skin of airplane wings. Such metal sheets require bending and/or drawing, substantially in one direction only with merely slight deformations occurring in the other direction.

Another object of the invention is to provide means for bending and/or drawing metal sheets the edges of which may largely vary in shape.

A further object is to provide means for working sheet metal blanks with bent or angular edges.

The invention primarily consists in a pressing machine comprising a frame with a pressing head and two supports individually movable on the frame by self-locking means, towards and away from said pressing head. At least two individually operative vises are mounted on each support in such a manner, however, that their relative position with respect to the supports may be altered, within certain limits, i. e. laterally, forward and backward, and about an axis at right angles to the afore-mentioned directions of movement.

The invention further consists in a machine comprising two or four press units of the mentioned type in parallel or twin-parallel arrangement which permits use in many combinations as best suited to the shape and size of the metal sheets to be worked in each instance.

Further objects and details of my invention will be apparent from the description hereinafter and from the accompanying drawings showing embodiments of my invention by way of example. The drawings show in

Fig. 1 a longitudinal section along line 1—1 of Fig. 2 of a portion of a machine according to my invention;

Fig. 1*a* another longitudinal section along line 1*a*—1*a* of Fig. 2;

Fig. 2 a section along line 2—2 of Fig. 1, the combination of two press units being illustrated;

Fig. 3 a top plan view of the combination of Fig. 2, only two of the vises being shown;

Fig. 4 a side elevation of a support with the vises;

Fig. 5 a top plan view of one of the vises;

Fig. 6 a section along line 6—6 of Fig. 2;

Fig. 7 a section along line 7—7 of Fig. 6 showing a portion of a support coupled with a bridging support;

Fig. 8 a top plan view of the parts illustrated in Fig. 7;

Fig. 9 a perspective view of a pressing head with lateral extension;

Figs. 10 to 13 diagrammatic plan views of a twin-parallel arrangement of four press units illustrating different combinations of cooperating pressing heads and vise supports.

In the figures, reference characters 1, 2, 3, 4 designate four press units respectively, each of which may be used separately as a self-contained binding and/or drawing press provided the sheet metal blank to be machined does not exceed the maximum dimensions for which the unit is built. The four press units are of similar design. Each has a frame comprising two beams 5 and 6 of I-iron. The beams are parallel with each other, and are held a predetermined distance apart by two end plates 7 and 8, two brackets 9 and 10, and two rib plates 11 and 12. The plates and brackets are rigidly united with the beams by any suitable means for instance by welding. A press cylinder 13 with a ram 14 is mounted on said brackets 9 and 10 substantially in the center of the press unit to which it belongs. Ram 14 carries a pressing head 15 with grooves 16 which serve for attaching thereto a die (not shown) or a lateral extension 17 (see Figs. 9, 12 and 13) for a purpose to be described later.

Vises on movable supports are provided to grip and hold the edges of the sheet metal plate while it is shaped by a die mounted on the pressing head. Only two such vises are shown in Fig. 3; and in Figs. 10 to 13, vises are indicated only in as much as needed in the combination illustrated by the respective figure. Care is taken to permit the vises and supports to be adjusted in correspondence to the shape of the edges of the sheets to be machined, and to allow even for bent or angular edges of such sheets. For this purpose, vise supports 18 and 19 are arranged on said beams 5 and 6 of each unit at opposite sides of the pressing head, and may be individually moved towards the center or the ends of beams 5 and 6. Each of the supports 18 and 19 is made of two parallel I-bars 20 and 21 spaced from and connected to each other by a foot plate 22, a top plate 23, end pieces 24, 25, 26 and 27, and a number of ribs 28. Top plate 23 is slotted or grooved at 29, and the slot or groove may be widened at 30 as clearly shown in Figs. 3 and 8. The bottom or foot plate 22 has two holes 31 and 32 through which bolts 33 and 34 respectively may be passed to hang by their nuts 35 and 36 between beams 5 and 6. By their heads 37, 38,

bolts 33 and 34 carry a transverse beam 39 formed of two channels 40 with connecting plates 41 and 42. Transverse beams 39 are suspended below beams 5 and 6, and are preferably longer than the transverse distance of said beams 5 and 6.

Now it is obvious that each support may be shifted along the beams 5 and 6, and that the transverse beam 39 associated therewith will follow such movement. Furthermore, each support may be placed on beams 5 and 6 so as to include with their direction an angle differing from 90 degrees without bolts 34 and 35 interfering with the beams. When a support is correctly adjusted, nuts 35 and 36 may be tightened by a wrench through windows 43 and 44 of I-bar 20 whereby the support will be securely clamped to the frame beams 5 and 6 by means of transverse bar 39.

Means may be provided for facilitating the shifting of the supports. Threaded spindles 45 and 46 may serve this purpose. Each of the spindles is associated with one of the supports, and is journaled in a bearing at one of the end plates 7, 8 of the beams and in another bearing at the brackets 9, 10. These bearings are designated with 47, 48, 49 and 50 respectively. Each spindle carries a nut 51 which has an upward extension 52 as clearly shown in Fig. 1*a*. Extension 52 passes through a hole 53 in the bottom plate 22 of the associated support, and forms a pivot for the latter. A nut 54 is screwed on the end of the extension 52 and safeguards, if tightened, that the support be shifted parallel with itself when the spindle 46 is turned by means of a hand wheel 55 or by a power operated means such as an electric motor 155 indicated in Fig. 10. If on the other hand nut 54 is loose, support 19 may be turned about extension 52. Support 18 is connected with its associated spindle 45 in the same manner as support 19 with its spindle 46.

On each support, at least two vises 56 may be mounted as clearly shown in Fig. 4. Each vise 56 comprises a body 57 with a stationary jaw 58 and a movable jaw 59 which may be operated by means of a lever arm 60 to clamp the edge of a metal sheet between both jaws. A bolt 62 is passed through a wide hole 61 of vise 56, so that if the bolt is secured with its lower end in a support the vise may be moved in all directions in the plane of its supporting surface as far as the size of the hole 61 permits, and that the vise may be also turned about volt 62. A large washer 63 covers the hole 61 of the vise, and nut 64 of bolt 62 bears upon this washer when it is screwed on in order to hold the vise in an adjusted position with regard to its support while head 65 of bolt 62 is inserted in groove 29 of the top plate 23 of one of the supports.

The device according to the present invention, and which has been described hereinbefore, consists of a die press comprising the combined means for holding the edges of a metal sheet during the bending and/or drawing operation without causing undue local stresses of the material. The new device permits the machining of metal sheets having practically any size within the limits of the dimensions of the machine, and any desired edge shape, that is to say, even of sheets with bent or angular edges. For this purpose the clamping jaws are adjustable in accordance with the outline of the metal sheet to be shaped by the bending and/or drawing action of a die secured to the pressing head 15. The adjustment may be accomplished by any or all of the following operations: First, by turning the threaded spindles 45 and 46 with the aid of hand wheels 55 or a motor 155, supports 18 and 19 carrying vises 56 may be moved towards or away from the pressing head 15. Second, by turning the supports 18 and 19 about their associated spindle nut extensions 52, the supports may be set parallel with the general direction of the blank edges to be held by the vises. Third, by shifting the individual vises 56 with their bolts 62 along the grooves 29 of the supports 18 and 19, the vises may be set opposite the desired portions of the blank edges. Fourth, by moving the individual vises 56 with respect to their bolts 62 in the plane of their supporting surfaces, and fifth by turning the vises about their bolts, the vises may be further adjusted to follow concavities and convexities of the blank edges. When the supports and vises are properly set and secured in their adjusted position by tightening the screw nuts 35, 36, 54, and 64, the blank edges may be clamped between the vise jaws 58 and 59 with the aid of the lever arms 60. Thereafter, a die secured to the pressure head may be raised by the ram 14 to engage the blank from below and to bend and/or draw it into the desired shape. Owing to the preceding accurate adjustment of the vises, undue stresses of the blank will be eliminated or at least minimized during the machining operation. On the other hand, there is the possibility of deliberately producing localized stresses by adjusting the individual vises accordingly. There is also the possibility of first adjusting the vises and clamping the metal sheet to be machined as stated hereinbefore. Then the die may be raised until a certain first bending and drawing of the metal sheet has been accomplished near the apex of the die. Thereafter, the vises may be reset, particularly by advancing the supports towards the pressing head, whereupon the raising of the die may be continued. Such alternating setting of the vises and lifting of the die may be repeated depending upon the required final shape of the blank. Such stepwise operation offers the advantage that the relative movement of the metal sheet does not cause a detrimental friction at the sides of the die.

The invention further contemplates the arrangement of two and of four press units of the type described in order to form combinations of machines as best suited for the particular shape of metal sheets to be bent and/or drawn in each instance.

In the embodiment shown in Figs. 2 and 3, two press units 1 and 2 are mounted parallel with each other. In order to combine both units so as to form an entirety, bridges 66 and 67 are provided which may be coupled with the supports 18 and 19 respectively of both press units 1 and 2. Each of the bridges forms a support of at least two vises, in the example of Fig. 2 of three vises which are of the same design as the vises 56 on supports 18 and 19, and which for this reason are designated with the same reference character. The supporting bridges 66 and 67 may be of a structure similar to that of supports 18 and 19, that is to say, each bridge comprises two I-bars 68 connected by a bottom plate 69, a top plate 70, a number of transverse ribs 71, and end pieces 72, 73 which may be doubled as shown in Fig. 7. The end pieces 26 and 27 of the supports 18, and the end pieces 72 and 73 of the bridges are so spaced that coupling pieces 74 may be inserted. For the same purpose, recesses 77

and 78 are provided in the webs of the I-bars of the supports and the bridges respectively. Pieces 74 have substantially the shape of a quadrangle with threaded extensions 75 and 76 at the front sides thereof. Coupling pieces 74 are held in their positions by nuts 79 and 80 bearing against washers 81 and 82 which in turn engage the pertaining support and bridge simultaneously. As clearly shown, the coupling pieces 74 are so located that they do not protrude beyond the upper surfaces of the connected bridge and supports. The top or vise-supporting surfaces of the bridges are flush with the top surfaces of supports 18 and 19, and a slot or groove 84 is provided in the top plate 70 of each bridge and forms the continuation of the grooves 29 of the supports when the bridge is connected thereto. Grooves 84 serve to hold the ends of bolts 62 of the vises which are carried by the bridges. The arrangement permits shifting of a vise from a support to a bridge connected therewith, and back again. In order to facilitate the insertion and the removal of the bridges, the ends of the bridges are rounded off as shown at 83 in Figs. 3 and 8.

With both bridges in position, the units 1 and 2 form a combined press with two pressing heads which may be connected by simultaneously securing one die to both of them. The vises and the supports together with the bridges are individually operative and movable in the same manner as described heretofore with the exception, however, that the supports cannot be turned about pivots 52. When the bridges are removed, each unit may be separately operated as stated above.

The twin-parallel arrangement of four press units permits a number of combinations some of which are illustrated in Figs. 10 to 13.

Fig. 10 shows a duplication of the arrangement just described with reference to Figs. 2 and 3, inasmuch as bridges 66 and 67 connect units 1 and 2 on the one hand, and units 3 and 4 on the other hand so as to form two twin presses. When the bridges are removed each unit may be used separately.

With the vises removed from support 18 of unit 2, and from support 19 of unit 4 as in Fig. 11, units 2 and 4 may be used as a combined press having the combined working length of both. In the same manner units 1 and 3 may be used. If, then, bridges 66 and 67 are coupled to the pertaining supports 18 of units 3 and 4, and 19 of units 1 and 2, all four units form one press having their combined length and width.

If the lateral extensions 17 are applied to the pressing heads 15 of units 1 and 2, and if, then, both pressing heads, and support 18 of the one unit, and support 19 of the other are turned parallel to each other as in Fig. 12, a metal sheet may be machined which has a width equal to the length of the supports, and a length equal to the distance of the diagonally opposite supports 18 and 19. Simultaneously, units 3 and 4 may be used in the same way or in a manner as described with reference to Fig. 10.

If, finally, support 19 of unit 1, and support 18 of unit 4 are used as indicated in Fig. 13, the metal sheet to be worked may still be longer, in fact as long as the maximum distance of the mentioned supports from each other.

While I have shown and described certain new and novel features of my invention it will be understood that well known equivalents of the illustrated elements may be used, and that other substitutions, omissions and modifications in the structure and details of the illustrated machine may be made by those skilled in the art without departing from the spirit and the scope of the invention which is indicated in the following claims.

What I claim is:

1. A die press for shaping metal sheets comprising a frame, a pressing head to which a die may be attached, two vise supports having supporting surfaces and being movable on said frame at opposite sides of said pressing head, self-locking and individually operative means for moving said supports towards and away from said pressing head, means for securing said supports to said frame, and at least two vises on each of said supports, each of said vises being individually operative and movable relatively to its associated support in the plane of its supporting surface, and being also rotatable about an axis at right angles to said plane.

2. A die press for shaping metal sheets comprising a frame, a pressing head to which a die may be attached, two vise supports having supporting surfaces and being movable on said frame at opposite sides of said pressing head, two individually operative screw-and-nut drives for moving said supports towards and away from said pressing head, a pivot on each nut for its associated support so as to permit a slanting adjustment of the support with respect to the direction of its drive, and at least two vises on each of said supports, each of said vises being individually operative and movable relatively to its associated support in the plane of its supporting surface, and being also rotatable about an axis at right angles to said plane.

3. A die press for shaping metal sheets comprising a frame including two parallel longitudinal members spaced from each other, a pressing head to which a die may be attached, two upper transverse members having supporting surfaces and being movable on said frame at opposite sides of said pressing head, two lower transverse members associated to said upper transverse members respectively and extending below both said longitudinal members, two pairs of screw bolts extending between said longitudinal members and connecting each upper transverse member with its associated lower transverse member for clamping said upper transverse members to said longitudinal members in an adjusted position, self-locking and individually operative means for moving said upper transverse members towards and away from said pressing head, and at least two vises on each of said upper transverse members, each of said vises being individually operative and movable relatively to its associated transverse member in the plane of its supporting surface, and being also rotatable about an axis at right angles to said plane.

4. A die press for shaping metal sheets comprising a frame, a pressing head to which a die may be attached, two vise supports having supporting surfaces and being movable on said frame at opposite sides of said pressing head, self-locking and individually operative means for moving said supports towards and away from said pressing head, at least two vises on each of said supports, each of said vises being individually operative, and one clamping bolt for each of said vises, each bolt passing through a wide hole of its associated vise and being attached to the associated support so as to permit a limited movement of the vise relatively to the associated support

in the plane of its supporting surface and also a rotation of the vise about an axis at right angles to said plane.

5. A die press for shaping metal sheets comprising a frame including two longitudinal parallel members spaced from each other, a pressing head to which a die may be attached, two transverse members having supporting surfaces and being movable on said frame at opposite sides of said pressing head, each of said transverse members having a groove extending in the longitudinal direction of said transverse member, at least two vises on each of said transverse members, each of said vises being individually operative, and one clamping bolt for each of said vises, each bolt being attached to the associated transverse member so as to be shiftable in said groove, and being passed through a wide hole of its associated vise so as to permit a limited movement of the vise relatively to the associated transverse member in the plane of its supporting surface, and also a rotation of the vise about an axis at right angles to said plane.

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