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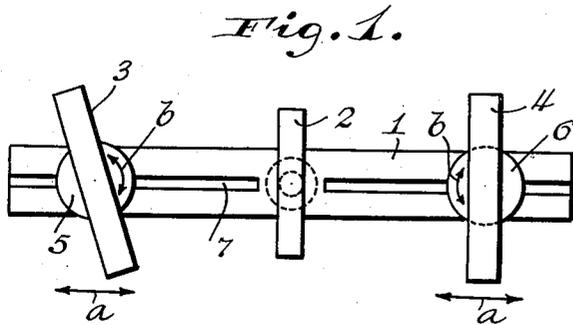
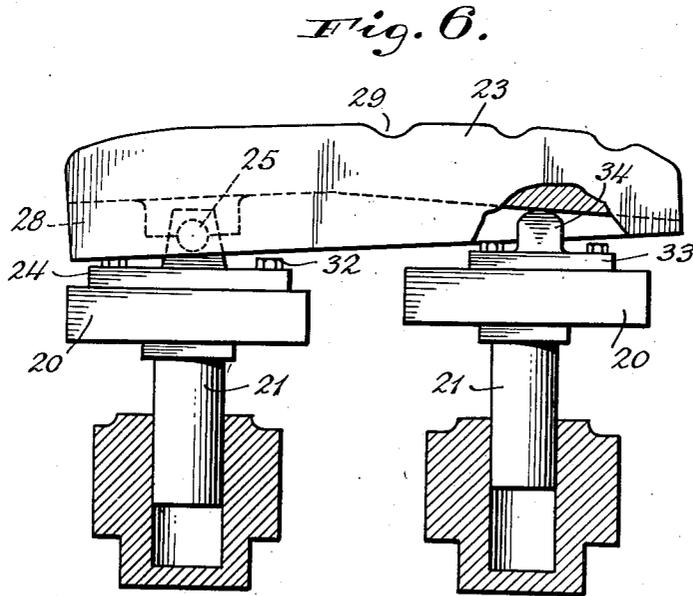
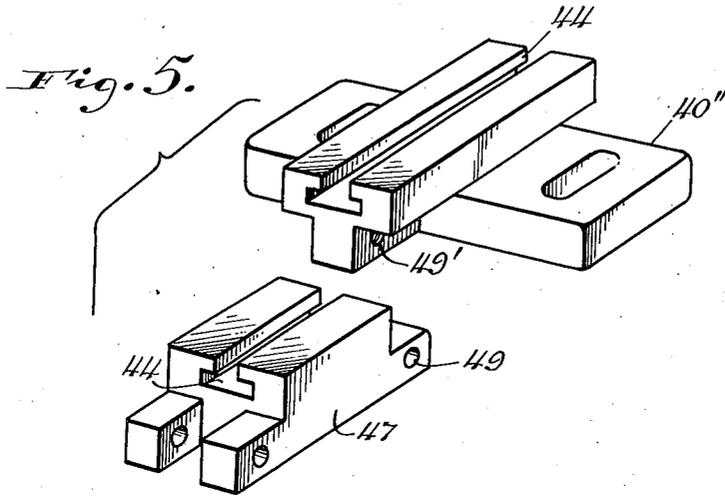
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2,269,549

DRAWING MACHINE FOR METAL SHEETS

Filed April 8, 1938

4 Sheets-Sheet 1



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Jan. 13, 1942.

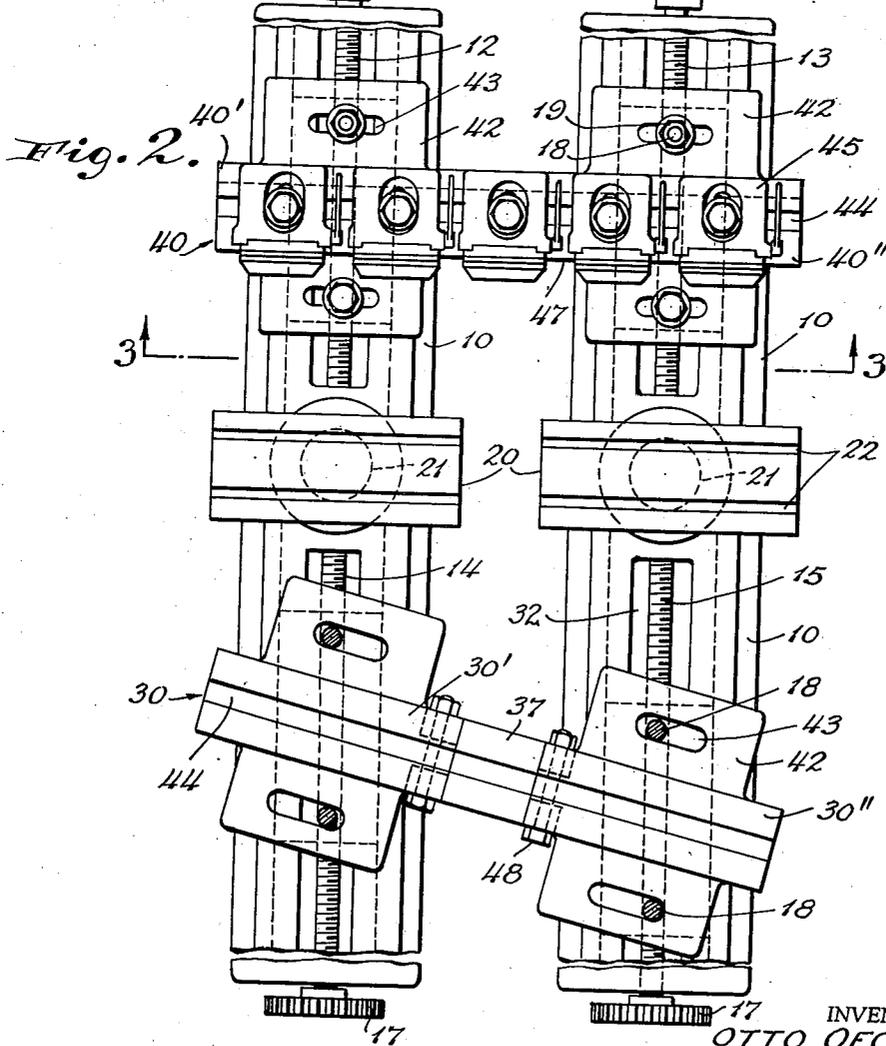
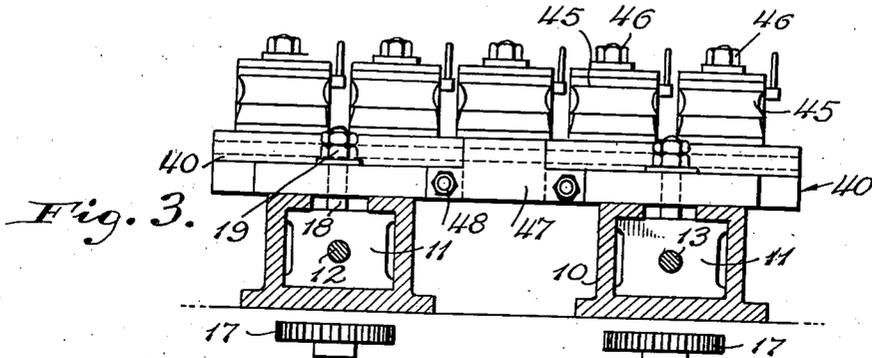
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2,269,549

DRAWING MACHINE FOR METAL SHEETS

Filed April 8, 1938

4 Sheets-Sheet 2



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2,269,549

DRAWING MACHINE FOR METAL SHEETS

Filed April 8, 1938

4 Sheets-Sheet 3

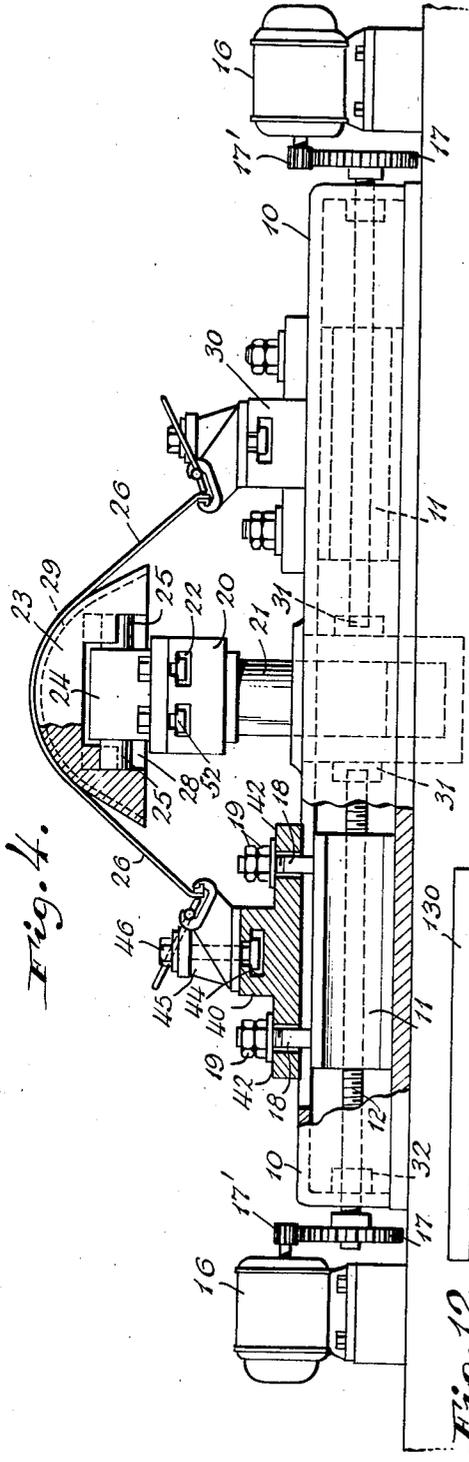


Fig. 4.

Fig. 15.

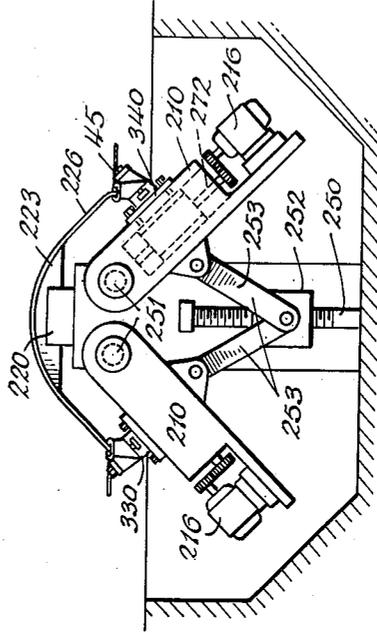


Fig. 12.

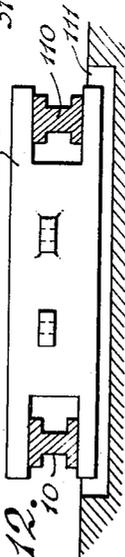
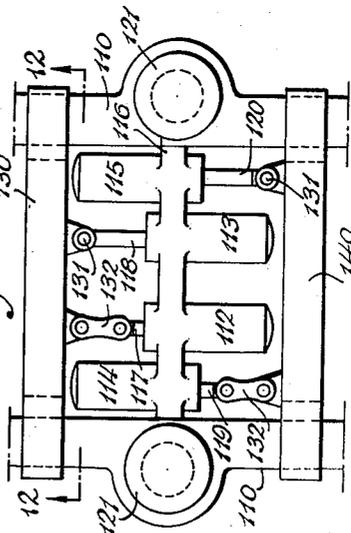


Fig. 11.



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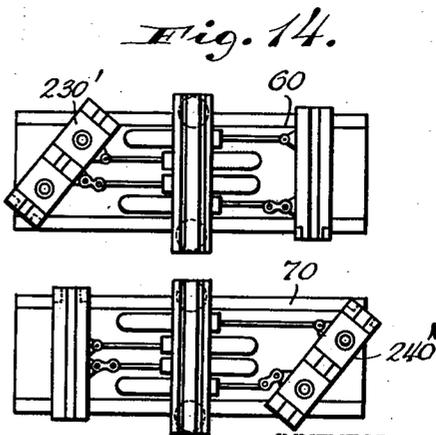
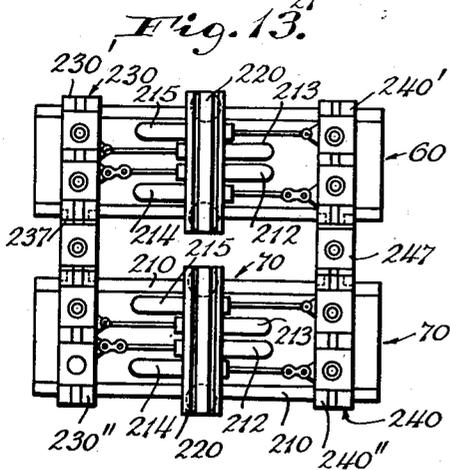
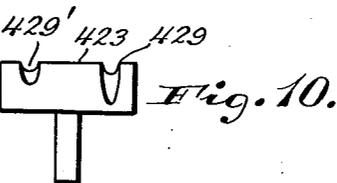
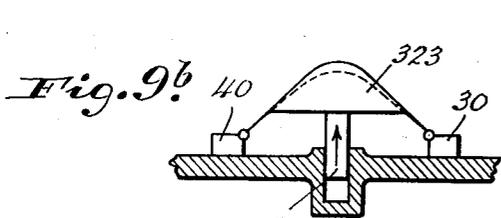
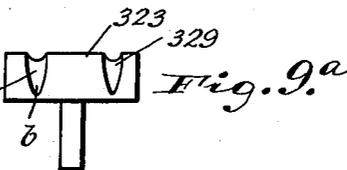
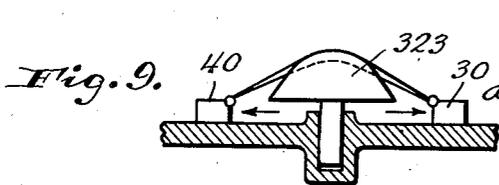
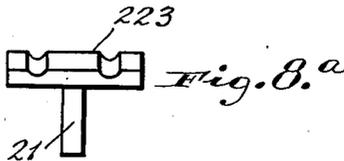
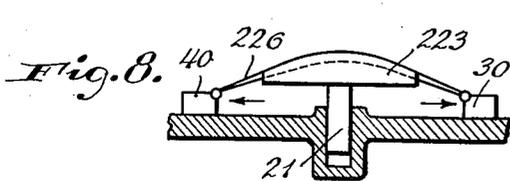
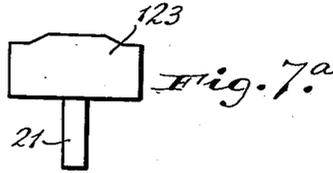
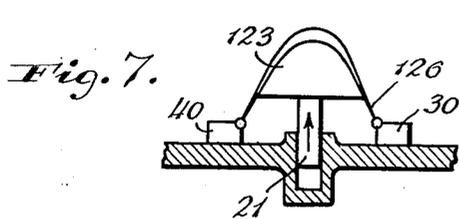
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2,269,549

DRAWING MACHINE FOR METAL SHEETS

Filed April 8, 1938

4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,269,549

## DRAWING MACHINE FOR METAL SHEETS

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Application April 8, 1938, Serial No. 200,820. In  
France, Great Britain, Italy, and Czecho-  
slovakia November 15, 1937

14 Claims. (Cl. 153—48)

The present invention relates to a drawing machine or die press for metal sheets, of the type described in my co-pending application Serial No. 133,812, filed March 30, 1937 (Patent No. 2,123,683, July 12, 1938). A machine of said kind serves to shape a metal sheet by drawing and bending it over a die. In such an operation, the metal sheet may receive any suitable form and, more particularly, metal sheets may be produced having surfaces which cannot be geometrically developed since, depending upon the shape of the die, the individual sections of the sheet width may be differently elongated during the drawing operation. Machines of said type are used in making cover sheets of bodies which are to be bent in a predetermined shape as for instance in the manufacture of airplanes or of other vehicles.

An object of the present invention is to provide a machine which permits to perform the job with as little work and time as possible, and to limit the elongation of the metal sheet to the least extent required. It is a further object of the invention to provide a machine of said type in which a very great variety of dies may be applied.

Another object of the invention is to provide means for producing asymmetrical shapes in which less elongation of the materials is required in one portion of the job than in another portion in order to give the metal sheet the desired final shape.

The invention consists of a machine including a plurality of vises arranged on supports, and a drive which permits said supports to be moved parallel to themselves or to alter, during the drawing operation, the angles of the support axes in relation to the direction of drawing, or to perform both movements simultaneously.

The invention also consists in the arrangement of two vise supports at opposite sides of a die carrier and movable on guides, in combination with a drive of the supports for performing or assisting the drawing operation, said drive comprising at least two parts which are operative independently of each other.

Further objects and details of my invention are apparent from the description hereinafter and the accompanying drawings showing several embodiments of my invention by way of example.

In the drawings,

Fig. 1 is a diagrammatic view to illustrate the mobility of the vise supports;

Fig. 2 is a top plan view of the main parts of an embodiment according to my invention;

Fig. 3 is a vertical section along the line 3—3 of Fig. 2;

Fig. 4 is a side elevation of the embodiment of Figs. 1 and 2, parts being shown in section;

Fig. 5 is a perspective view of two parts of a

vise support of the same embodiment, said parts being in a position for being assembled;

Fig. 6 is a front view of the die carriers;

Figs. 7 to 10 illustrate the drawing operations for various shapes of dies;

Fig. 11 is a diagrammatic top plan view of another embodiment of my invention;

Fig. 12 is a section along line 12—12 of Fig. 11;

Fig. 13 is a modification of the embodiment of Fig. 11;

Fig. 14 shows the same modification in another position of operation, and

Fig. 15 is a side view of a third embodiment of the invention.

The desired complex movement of the vise supports in a machine according to my invention is indicated in Fig. 1 in which 1 represents a frame structure and 3 and 4 two vise supports at opposite sides of a die carrier 2. The vise supports are respectively mounted on turntables 5 and 6, which may be shifted in a straight line as constituted by a groove 7 or the like. In consequence thereof, each support may be moved in the direction of the arrows *a*, and may be turned about the turntable centers in the direction of arrows *b*. Although a machine constructed according to the principle of a turntable shiftable along a straight-lined path would be satisfactory from the view point of operation, its design and particularly its gearing would be rather complicated. For this reason, I prefer to apply other driving systems for creating the required movement of the parts. Such systems are hereinafter described in connection with the embodiments of Figs. 2 to 15.

In the embodiment according to Figs. 2 to 10, two frame girders 10 are arranged parallel to each other. Means are provided for carrying a die approximately in the middle of the girders 10.

In the present embodiment, said means consists of two table-like bodies 20, one coordinated to each of said girders. Vise supports 30 and 40 are respectively located on said girders 10 at opposite sides of said table-like bodies or die carriers 20.

For reasons to be explained later, the vise support 30, rather than being one piece, may be made of two individual parts 30', 30'' rigidly connected to each other by means of a bridging member 37. The same is true with respect to vise support 40 consisting of parts 40', 40'' and a bridging member 47. In order to allow an easy assembling and disassembling, the support portions may be designed as clearly shown in Fig. 5 with respect to parts 40'' and 47. Screws 48 (see Fig. 2) passed through the holes 49 and 49' serve to unite the parts. In order to bring the holes 49 and 49' in registry, part 47 is to be raised in Fig. 5 until the grooves 44 of both parts 40'' and 47 form the continuation of each other. The vise supports 30 and 40 are individually movable towards and away

from the die carriers 20. A suitable driving means is provided to cause such movement whereby each support may be shifted in the longitudinal direction of the girders 10 while all points of the support move the same distance, or the individual support may be turned to take a slanting position in relation to the girders 10 as shown with respect to the support 30 in Fig. 2; or the support may be caused to perform both said movements simultaneously. For this purpose, the frame girders 10 of the embodiment of Figs. 2 to 4 are hollow and shaped as guides for prismatic slides or nuts 11. Four such nuts are provided, two for each support 30 and 40. Each nut is connected to one of the support portions 30', 30'', 40' and 40'', and is movable by means of one of four spindles 14, 15, 12 and 13 respectively. Each of the spindles is journaled at 31 and 32, i. e. near the middle portion and the end of the pertaining girder 10 from which it projects. Gear wheels 17 are fastened to the projecting ends of the spindles and engage pinions 17' mounted on the shafts of electric motors 16. Thus, each spindle may be individually shifted by supplying the pertaining motor 16 with current.

In order to connect the nuts with the supports so as to transmit movement of the former to the latter, each nut is provided with two studs 18 projecting upwards through an elongated opening 41 of the pertaining girder 10, and through slots 43 in the flange-like projections 42 of the coordinated portion of one of the supports 30, 40. The slots 43 are so shaped and so dimensioned as to their length and width that the supports may take the maximum slant required with respect to the girders 10. In Fig. 2, support 30 is shown in such a slanting position, and it will be noted that the lower stud 18 in portion 42 bears against the end of its slot 43 so as to take up certain lateral forces which may occur. Tilting of the supports under forces occurring during the drawing operation may be prevented by nuts 19 on studs 18. These nuts are to be tightened only so far that the sliding of the supports on the girders 10 under the action of the spindles is not hindered. A check nut shown adjacent to each of said nuts serves to lock the respective nut in its adjusted position.

The vise supports 30 and 40 have a longitudinal slot 44 in their top body portions as shown in Fig. 4. The slots 44 are shaped like an inverted T and serve for receiving the heads of bolts 46 by which the vises 45 are attached to the supports. The individual vises are preferably of the type described in my co-pending application, Serial No. 133,812, filed March 30, 1937, that is to say, they are movable along the slots 44, rotatable about their respective bolts 46, and to a limited extent shiftable on their supports in relation to their bolts 46. Thus, each vise is widely adjustable, and such adjustability of the vises permits the sheet-metal to be machined to be placed in such a position as may be most favorable for the drawing operation. Thereby, the metal-sheet can be adapted, within certain limits, to the die surface even prior to the subsequent machining.

Although both die carriers 20 may be operated by a common lifting device, it is advisable to provide each table with a separate drive such as for instance a hydraulic plunger 21 indicated in Figs. 2 and 4. This arrangement permits a die supported by both carrier tables 20 not only to be raised in an inclined position if necessary, but also to be tilted during the drawing operation. In order to permit an independent raising of both

tables 20 when carrying a die the latter should be movably attached thereto. Figs. 4 and 6 show an example of a suitable attachment. The carrier tables 20 are provided with longitudinal grooves 22 of an inversely T-shaped cross-section, said grooves being adapted to receive the heads of attachment screws 52. To one of the tables 20 an intermediate member 24 is secured. Member 24 has two horizontal journals 25 laterally projecting from the main portion of said member. The die 23 is recessed at 28 and rests, near its one end, with the bottom of the recess upon the journals 25. The other carrier table 20 is provided with a member 33 having a rounded head 34 on which the die rests with its other end. Thus, the die may swing about the journals 25 and move with its other end on the upper surface of the intermediate member 33.

The drawing machine according to my invention operates in the following manner: The die is attached to the die carriers 20 as described hereinbefore. By rotating the spindles 12, 13, 14 and 15 with the aid of the motors 16, the supports 30 and 40 are shifted into the required positions relatively to the die carriers and the metal sheet 26 to be machined is placed on top of the die 23. Then the vises 45 are adjusted on their supports so as to be capable of grasping the edges of the metal sheet, and the metal sheet edges are clamped in the vises 45. Thereupon, the die carriers 20 may be raised with the aid of the hydraulic plungers 21 whereupon the metal sheet will be drawn in the shape of the die. Owing to the fact that each of the two vise supports 30 and 40 has two drives independent of each other, a parallel shifting of each support or a turn about a vertical axis, or a combination of both movements, can be accomplished during the drawing operation.

Thus, as regards the vise support 30, the spindle 14 with its nut 11 having studs 18 constitutes one of the independent driving means, the other of said means consisting of the spindle 15 with its sliding nut 11 and studs 18. If both spindles are rotated in the same direction at the same speed, the vise support 30 will, while remaining parallel to its original position, simply move along the guiding girders 10, inwardly or outwardly according to the direction in which the said spindles are rotated. That is to say, in this case the vise support 30 will not turn to change the position of the studs 18 in its slots 43. If it is desired to swing the vise support 30 about a vertical axis, without moving the said support bodily lengthwise of its guiding girders 10, the two spindles 14 and 15 will be rotated at the same speed, but in opposite directions. Instead of this, I may rotate one of the spindles while leaving the other stationary, and thus, adjust the vise support 30 to different angular positions relatively to the guiding girders 10. When both, the longitudinal movement of the vise support 30 along the girders 10 and its swinging about the above-mentioned vertical axis are to be effected simultaneously, this is accomplished by rotating both spindles in the same direction, but at different speeds. The supports can respond to the drives in the indicated manner since they are held to the supports by means which allow an alteration of the support length bridging the span between the frame girders 11, as described with reference to the slots 43 and studs 18.

Various operations of the machine are diagrammatically illustrated in Figs. 7 to 10. Fig. 7 shows the application of a die 123 for a hood

which cannot be geometrically developed, as apparent from its front view in Fig. 7<sup>a</sup>. The die has a high dome shape, and the metal sheet 126 may be formed by raising the plunger 21, while the vise supports 30 and 40 remain stationary.

Shaping of the metal sheet 226 with the aid of die 223 of Figs. 8, 8<sup>a</sup>, having a rather flat top is accomplished with better results by moving the vise supports 30 and 40 apart in opposite directions while the die remains stationary.

Straight drawing or stretching of a bent or bulged metal sheet may be effected in a similar manner by moving the vise supports. It goes without saying that, in that event, no die will be used. If the bulges are exclusively near one of the longitudinal edges of the metal sheet, then, a stronger tensioning of that edge may be effected by turning the vise supports as disclosed hereinbefore.

Shaping of a metal sheet with a die 323 shown in Figs. 9, 9<sup>a</sup> and 9<sup>b</sup>, and having tapering grooves 329 may be accomplished in two steps. In the first step, the supports 30 and 40 are moved in the directions indicated by the arrows. At the end of this step, the portions of the sheet metal covering the bottom of the grooves are not elongated, while the portions on the top surface of the die have been elongated. The intermediate portions at the side walls of the grooves have been subjected to a certain elongation in a direction transverse to the direction of drawing. Thereafter, the operation is completed in a step according to Fig. 9<sup>b</sup> wherein the die 323 is raised while the supports 30 and 40 remain stationary. This causes the metal sheet to engage also the lower portions of the die which it did not touch in the step described with reference to Fig. 9. If one would try to complete the drawing operation in a single step, for instance, according to Fig. 9, a transverse elongation would at first occur at *a* in Fig. 9<sup>a</sup>. If, then the operation is continued, and the transversely elongated portion has moved from *a* to *b*, folds will be caused. The formation of such folds is minimized by an operation in two steps as described.

A modified operation is advisable if the die 423 of Fig. 10 is applied which has a long groove 429 and a short one 429'. In this event, the first step is similar to that shown in Fig. 9. In the second step, the supports may not only be shifted apart but also turned simultaneously, so that the sheet edge near the short groove is only slightly elongated while the other edge is subjected to a much stronger elongation. One-sided raising of the die would not have the same result as the turning of the supports, because such one-sided raising would cause an elongation obliquely relative to the direction of the grooves. Thus the adjustability of the various parts does not only permit their proper adjustment to the different dimensions and shapes of the dies but also the application of particularly favorable methods of operation. In fact, owing to the movability of the parts cooperating in the drawing operation, the shaping of a metal sheet may be so influenced that said shaping may be started at any suitable portion of the die, and that, thereafter, the parts of the machine may be adjusted as required in accordance with other portions of the die surface.

It has been stated for what purpose the carrier of the die consists of two independent carrier tables 20 with plungers 21. It has been also described that the supports 30 and 40 may be made each of three parts. By removing bolts 48 (Figs. 2 and 3) securing the bridge members

47 and 37 to the portions 40' and 40'', and 30' and 30'', respectively, the bridge members proper may also be removed. By so doing the machine described hereinbefore will be converted into two separate die-press units of a type similar to that disclosed in my co-pending application Serial No. 133,812, filed March 30, 1937. The smaller units may be used for machining correspondingly smaller jobs. The vise supports 30', 40', and 30'' and 40'' of these smaller units are adjustable at a desired angle relatively to the girders 10 with the aid of the slots 43, bolts 18 and nuts 19. However, it is to be noted that in these smaller units, the once adjusted angle can no more be changed by a positive drive during the drawing operation, as in the arrangement first described. Nevertheless, there is a considerable advantage in the possibility of easily converting a machine adaptable and adjustable for the most intricate jobs, into two smaller even through less adaptable units since extremely difficult jobs frequently alternate with simpler jobs in one and the same plant. In the conversion of the complete machine into two smaller units, the twin arrangement of the die carrier as described hereinbefore is also helpful because it permits the use of each of the smaller units with an individual carrier having a drive independent of that of the die carrier of the other unit.

In structural relation the invention is not limited to the embodiment shown in Figs. 2 to 4. Another embodiment representing a different design but comprising all main features of the first one is illustrated in Figs. 11 and 12. This machine has two frame members 110 in parallel arrangement. Members 110 are arranged on top of a pit 111, and their upper and lower surfaces serve as guides for the vise supports 130 and 140. The latter are safeguarded by the guiding surfaces from tilting over; in other respects they are entirely free to move in the plane determined by said surfaces. Both supports 130 and 140 may be shifted with the aid of hydraulic cylinders 112, 113, 114, 115 arranged between the supports 130 and 140 and the members 110, and rigidly secured to the latter by suitable means as indicated at 116. Plungers 117 and 118 of the cylinders 112 and 113 respectively are connected with support 130, and plungers 119 and 120 of the cylinders 114 and 115 with support 140. The connections of the plungers 118 and 120 are accomplished directly by means of pivots 131, while in the connection of the plungers 112 and 114 with the respective supports connecting rods 132 are provided. Thereby, the vise supports 130 and 140 have the same movability and adjustability as the supports 30 and 40 of the embodiment of the Figs. 2 to 4. The advantage of the embodiment according to Figs. 11 and 12 consists in the particular simplicity of the drive which also allows very high shifting forces to be applied. Hydraulic cylinders 121 rigidly connected with the middle portions of the members 110 serve to move a die carrier not shown. The machine of Figs. 11 and 12 is operative in a manner similar to that described with respect to the device of Figs. 2 to 4, except that it cannot be subdivided into two smaller independent units.

Particular advantages are offered by the modification illustrated in Fig. 13. This modification does not only permit, without exception, all operations and applications as described with respect to the embodiment of Figs. 2 to 6, but in addition thereto it permits still higher drawing forces to be exerted in a more even distribution

upon the vise supports than in the embodiment of Figs. 11 and 12. The machine according to Fig. 13 comprises two parallel sets 60 and 70, each of which is similar to the device illustrated in Figs. 11 and 12. However, the two sets have common vise supports 230 and 240. The vise supports are designed in the manner illustrated in Fig. 5, that is to say, the support 230 is composed of parts 230', 230'' and a bridging portion 237 releasably attached to parts 230' and 230''. In the same manner support 240 consists of parts 240', 240'' and a bridging portion 247. Each of the supports 230 and 240 may be shifted by four hydraulic cylinders 214, 215, 212, 213 in the illustrated arrangement. The two die carrier tables 220 permit the arrangement of a die similar to Fig. 6. When the bridging portions 237 and 247 are removed, each set 60 and 70 may be individually used the same as the device of Figs. 11 and 12. In addition thereto, it is also possible to operate the machine by utilizing only the part supports 230' and 240'' in diagonal position as indicated in Fig. 14.

It is to be understood that movability of the die in a vertical direction is no prerequisite of the present invention. The embodiment diagrammatically shown in Fig. 15 is an example of a machine with stationary die carrier. Nevertheless, the machine is adapted to perform drawing operations of the same kind as described hereinbefore with reference to the embodiment of Figs. 2 to 6. With the machine according to Fig. 15 the drawing operation is performed by the movements of the vise supports alone, each of said supports being provided, according to the invention, with two independently controllable drives of one of the types shown in Figs. 2 to 4, and Figs. 11 and 12 respectively.

In Fig. 15, the die 223 is mounted on a stationary die carrier 220. At opposite sides of the carrier 220 there are frame girder systems 210 with vise supports 330 and 340 respectively. Each frame girder system is similar in its structure to half of the pair of girders 10 of Figs. 2 to 4, and the supports and their drive parts are of the same design as the corresponding parts of said figures, that means, each support is provided with two driving spindles only one of which is shown by dash lines at 272 in connection with support 340. However, the motors 216 driving said spindles are directly mounted on the frame girders 210. The peculiarity of the embodiment of Fig. 15 consists in the fact that the frame girders 210 do not rest stationary on the ground but are linked to the die carrier 220 with the aid of pivots 251. Means are provided for swinging the girders about said pivots. For this purpose a threaded spindle 250 is provided on which a nut 252 can travel when the spindle is turned by any suitable means (not shown). Rod members 253 are linked to said nut 252 and to the girders 210, so as to swing the girders upward or downward depending upon the movement of nut 252. In this manner, the plane of movement of each of the vise supports 330 and 340 is adjustable to a desired angle with the vertical plane and may be adapted to the shape of the die employed in each instance. The operations which may be performed with the device correspond in principle to those of the embodiments described hereinbefore. In particular, the shaping of a metal sheet 226 may be accomplished in a plurality of steps, owing to the fact that the vise supports have the same movability as in the embodiments of Figs. 2 to 4, and that in addition thereto the individual

steps of operation may be performed at different inclinations of the frame girders 210.

Various changes may be made by those skilled in the art in the combination, construction and arrangement of the parts described without departing from the spirit and scope of my invention as expressed in the appended claims.

I claim:

1. In a drawing machine for metal sheets, the combination of means for carrying a die, two movable vise supports at opposite sides of said means, each of said vise supports having a straight line path of movement in a direction towards and away from said means, and being adapted to swing relatively to said path, and two individual and independently controllable driving means for each of said vise supports and in pivoted engagement therewith at different points of the associated support in substantially the same plane, said driving means being operative in parallel paths to impart to the associated vise support movements having straight line and angular components in a plane intersecting the vertical, whereby the character of said movements differs according to the manner in which said driving means are operated relatively to each other.

2. In a drawing machine for metal sheets, the combination of a die carrier, two frame members pivoted with one of their ends at opposite sides of said die carrier so as to be swingable in a vertical plane, means for swinging said members, two movable vise supports, one on each of said frame members, and means for individually moving said vise supports along their associated frame members, said vise supports being swingable about axes at right angles to their associated frame members.

3. In a drawing machine for metal sheets, the combination of vertically movable means for carrying a die, two horizontally movable vise supports at opposite sides of said means, at least two individual and independently controllable driving means for each vise support, said driving means being so arranged as to exert forces in parallel directions, and means for operatively connecting said driving means with said vise supports at different points of the same vise support, whereby each vise support will be moved parallel to itself when both its driving means act equally, and will be turned when the action of one of the driving means differs from that of the other one.

4. In a drawing machine for metal sheets, the combination of two parallel frame members, two die carriers on said frame members, one opposite the other one, two vise supports at opposite sides of said die carriers, each of said vise supports being mounted transversely on both said frame members and movable along the same, four individually controllable driving means in parallel arrangement for moving said vise supports along said frame members, each two of said driving means being pivotally connected to one of said vise supports so as to permit slanting positions of said vise supports with respect to the longitudinal direction of said frame members.

5. In a drawing machine for metal sheets, the combination of two parallel frame members, two die carriers on said frame members, one opposite the other one, two vise supports at opposite sides of said die carriers, each of said vise supports being mounted transversely on both said frame members and movable along the same, four individually controllable driving means in parallel

arrangement for moving said vise supports along said frame members, each two of said driving means being operatively connected with one of said vise supports, each of said vise supports and its associated driving means embodying cooperative means to permit variations of the distance of the points of engagement at the same vise support.

6. In a drawing machine for metal sheets, the combination of two parallel horizontal frame members, two die carriers on said frame members, one opposite the other one, individual means for moving said die carriers in vertical directions, two vise supports at opposite sides of said die carriers, each of said vise supports being mounted transversely on both said frame members and movable along the same, four individually controllable driving means in parallel arrangement for moving said vise supports along said frame members, each two of said driving means being pivotally connected to one of said vise supports so as to permit slanting positions of said vise supports with respect to the longitudinal direction of said frame members.

7. A device as claimed in claim 4 in which each of said driving means comprises a screwthreaded shaft, and a nut guided by one of said frame members, said nut including a pivot engaging the associated vise supports in an elongated slot of the latter.

8. A device as claimed in claim 4 in which each of said driving means comprises a screwthreaded shaft and a nut guided in said frame member, said nut including two pins, and said pins engaging the associated vise support in slots so as to permit slanting positions of the latter relatively to the longitudinal direction of said frame members.

9. A device as claimed in claim 6 in which each of said vise supports consists of three parts, two of said parts being in engagement with the associated driving means respectively and the third part being adapted to be releasably connected to both said first mentioned parts, so as to form with the latter, one uninterrupted vise support.

10. In a drawing machine for metal sheets, the combination of two parallel horizontal frame members, two die carriers on said frame members, one opposite the other one, individual means for moving said die carriers independently of each other in vertical directions, two vise supports at opposite sides of said die carriers, each of said vise supports consisting of three parts, two of said parts being movably mounted on said frame members and the third part being releasably connected to said first mentioned parts so as to form their continuation, four screwthreaded shafts, means for individually turning said shafts, a nut on each of said shafts and guided longitudinally by one of said frame members, each nut including two pins engaging one of said first mentioned two parts of one of said vise supports in slots, so as to permit slanting positions of said vise supports relatively to the longitudinal direction of said frame members.

11. In a drawing machine for metal sheets, the combination of two parallel frame members, die carrying means on said frame members, means for moving said die carrying means in vertical direction, two vise supports at opposite sides of said die carrying means, said vise supports being mounted transversely of said

frame members and movable on the same, at least one pair of independently controllable hydraulic drives including cylinders and plungers for each of said supports, a pivot pin connection of one of said plungers of each pair with the associated vise support, and a connecting rod connection of the other plunger with the associated vise support at a point distanced from said pivot pin connection, said plungers being movable in a horizontal plane and parallel to each other and to the longitudinal direction of said frame members.

12. In a drawing machine for metal sheets, the combination of two parallel frames, die carrying means on said frames, means for moving said die carrying means in vertical direction, two vise supports at opposite sides of said die carrying means, said vise supports being mounted transversely of said frames and movable on the same, and comprising two end members and a bridging member releasably connected to said end members, one pair of independently controllable hydraulic drives including cylinders and plungers for each of said support end members, a pivot pin connection of one of said plungers of each pair with the associated support end member, and a connecting rod connection of the other plunger with the associated support end member at a point distanced from said pivot pin connection, said plungers being movable in a horizontal plane and parallel to each other and to the longitudinal direction of said frames.

13. In a drawing machine for metal sheets, the combination of a stationary die carrier, two frame members pivoted with one of their ends at opposite sides of said die carrier so as to be swingable in a vertical plane, means for swinging said members, two movable vise supports, one on each of said frame members, two independently controllable drives for moving said vise supports along their associated frame members towards and away from said die carrier, and for causing them to swing in a plane defined by their associated frame members respectively, each drive comprising a threaded spindle, a nut thereon and in operative connection with the associated support, and an electric motor for rotating said spindle, said spindle, said nut, and said motor being mounted on the associated frame member.

14. In a drawing machine for sheet metal, the combination of first means for carrying a die, two parallel guides extending toward said first means at one side thereof, two slides movable along said guides, a vise support extending from one of said slides to the other and movably connected with both of them to permit said support to swing relatively to said slides, second means for moving one of said slides along its guide in one direction or the other, and independently operable third means for moving the other slide along its guide in either direction, whereby, according to different manners of operating said third means, both slides may be moved equally in the same direction, to carry the vise support bodily toward or from said first means, or equally in opposite direction, to swing the vise support, or unequally in the same direction, to carry said vise support toward or from said first means and simultaneously swing said vise support.

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