

April 27, 1948.

E. M. WELSER

2,440,529

BALANCED ADAPTER AND NARROW DIE FOR STRETCHING PRESSES

Filed May 8, 1945

2 Sheets-Sheet 1

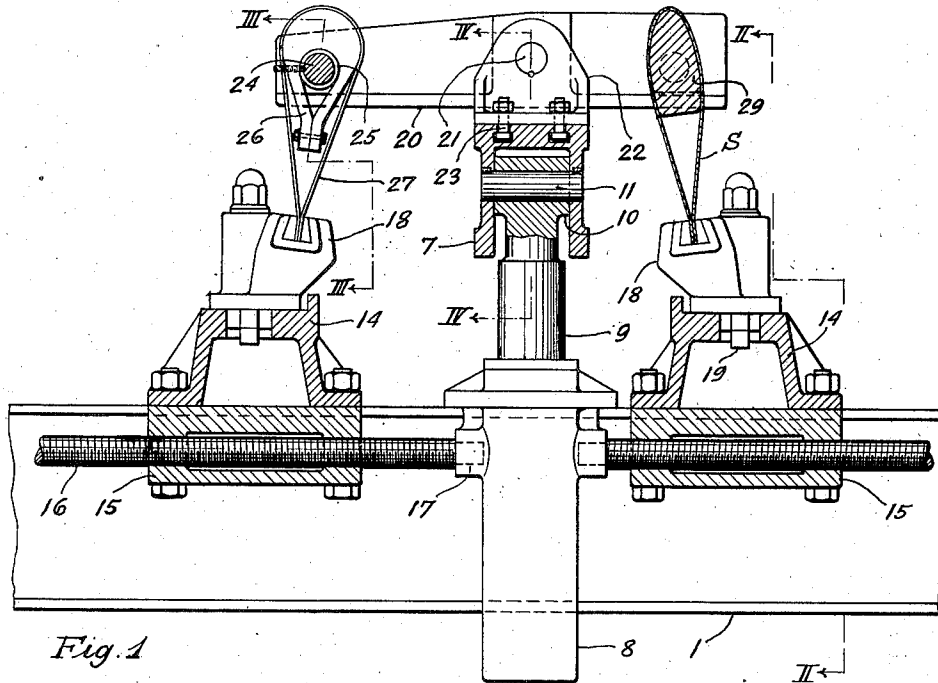


Fig. 1

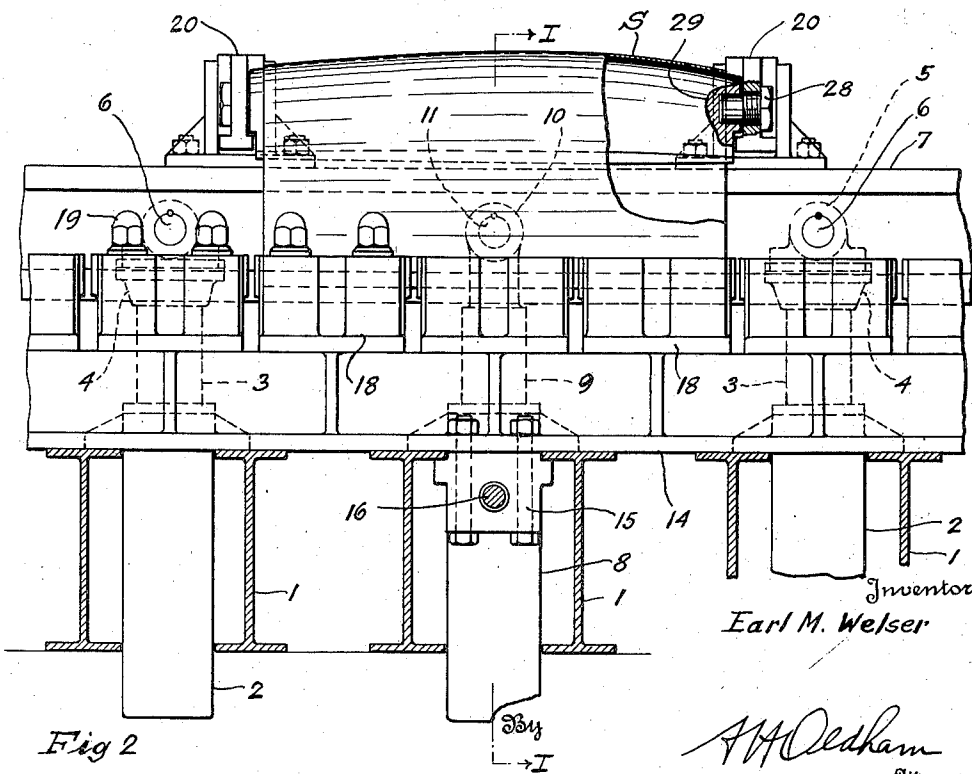


Fig 2

Inventor  
Earl M. Welser

A. H. Oldham  
Attorney

April 27, 1948.

E. M. WELSER

2,440,529

BALANCED ADAPTER AND NARROW DIE FOR STRETCHING PRESSES

Filed May 8, 1945

2 Sheets-Sheet 2

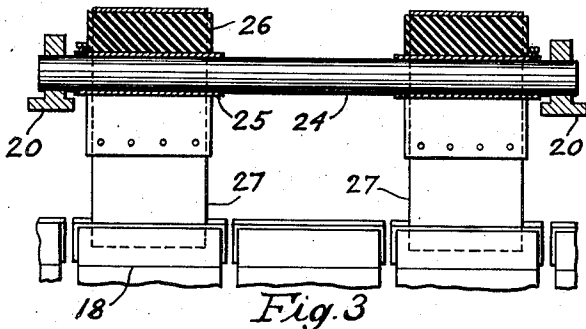


Fig. 3

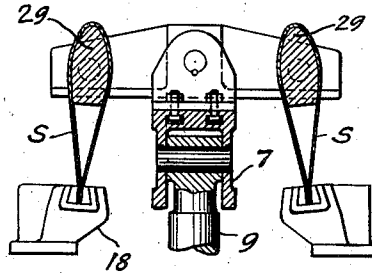


Fig. 6

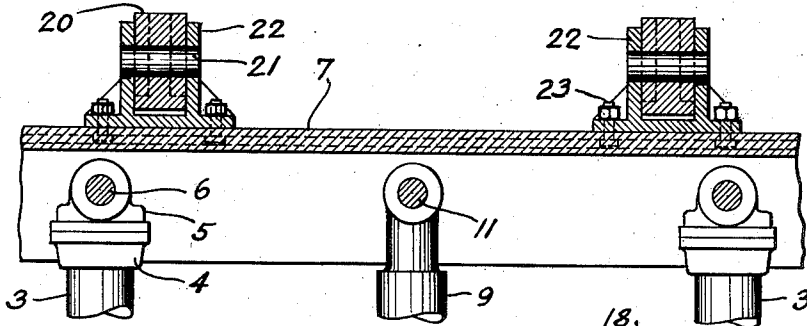


Fig. 4

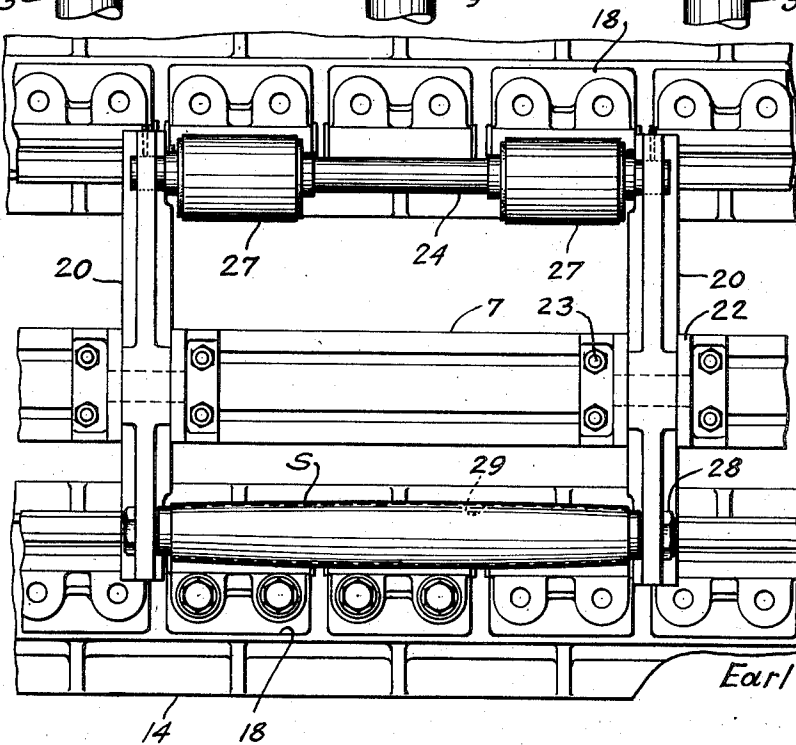


Fig. 5

Inventor  
Earl M. Welser

334

A. A. Oldham  
Attorney

# UNITED STATES PATENT OFFICE

2,440,529

## BALANCED ADAPTER AND NARROW DIE FOR STRETCHING PRESSES

Earl M. Welser, Akron, Ohio, assignor to Good-year Aircraft Corporation, Akron, Ohio, a corporation of Delaware

Application May 8, 1945, Serial No. 592,704

10 Claims. (Cl. 153—48)

1

This invention relates to a draw press of the pressure cylinder type for stretching and forming sheet metal, and in particular, to an improvement thereto for the purpose of increasing the variety of articles to be made thereon.

Hitherto, vertical cylinder and like type draw presses have been used in the aircraft and other industries for forming sheet metal parts over shaping dies and into compound curves. However, when the parts have relatively narrow, curved cross-sections and longitudinally curved contours, as, for instance, edges for airplane wings and empennages, these parts could not be produced on standard apparatus without stretching the work piece longitudinally which required special clamping means for each different cross-section to be attached to both ends of the work piece. Nor, on the other hand, could the work piece be drawn on standard presses in a direction transverse to its length, because the ram beam is too wide and the clamps for holding the material are too far apart to be adapted for the production of pieces of narrow cross section. This condition led to special draw press constructions for this purpose. However, because of the large capital investment involved in such specialized machines, the cost of production is raised and valuable floor space is needed.

It is the general object of the invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of a simple, easily operative and inexpensive device in the form of an adapter which can be used in combination with a vertically operating draw press of conventional construction to increase its usefulness.

Another object of the invention is to simplify and to reduce the cost of production of longitudinally curved sheet metal parts having narrow cross sections.

Another object of the invention is to stretch the sheet material in only a vertical direction, whereby its placing on the die is made less complicated and special clamps for holding the material are avoided.

Another object of the invention is to provide a balanced adapter structure including a shaft located opposite the die, the shaft having rubber cushions which compensate due to their compressibility the stretch in the work piece to avoid bending forces in the cylinder rams.

The aforesaid objects of the invention, and other objects which will become apparent as the description proceeds, are achieved by providing a die adapter mounted on the platen or ram beam

2

which is vertically movable by hydraulically operated rams moving in cylinders. This adapter consists of two adjustably spaced transverse supports or arms extending to both sides of the ram beam and which at one end carry the die over which the sheet to be formed is slung in substantially vertical position in the shape of a loop. Both ends of the loop are held by the standard set of clamps located at one side of the platen, whereas the other ends of the transverse supports carry a shaft over which are slung rubber cushioned metal bands, preferably made of steel, held by the other standard set of clamps located at the other side of the platen so that the forces acting on the platen produce balanced momentums about the center of the platen. By this arrangement work pieces made of thin sheet metal can be stretched and formed into narrow cross sections which could not be drawn prior to this invention, because of the greater width of the platen and the greater distance from each other of the clamps positioned at opposite sides thereof.

For a better understanding of the invention reference should now be had to the accompanying drawings, wherein

Figure 1 is a fragmentary cross-sectional view of the invention taken on line I—I of Figure 2.

Figure 2 is a front view taken in the direction II—II of Figure 1, with a portion shown in section.

Figure 3 is a cross section taken on line III—III of Figure 1.

Figure 4 is a cross-sectional view taken on line IV—IV of Figure 1 through the center of the transverse supports.

Figure 5 is a plan view of Figure 2, and Figure 6 is a view similar to Figure 1, showing a modification of the invention.

Although the principles of the invention are applicable with a symmetrical arrangement for two work pieces, one at each side, the invention is usually employed in conjunction with only one work piece and hence it has been so illustrated and will be so described.

With specific reference to the form of the invention illustrated in the drawings, the numeral 1 indicates supporting beams to two pairs of which are fastened hydraulic cylinders 2 in each of which is movable a ram 3 provided at its upper end with a head 4 on which is slidable a bearing 5 carrying a pivot 6 secured to the ram beam or platen 7. Between the hydraulic cylinders 2 is disposed a cylindrical guide 8 also fastened to a pair of supporting beams 1 and in which is slidable a stem 9 carrying an eye 10 in which is

swingable a pin 11, secured in the ram beam 7. The stem 9 holds the ram beam, swingable about the pin 11, longitudinally in a fixed position, whereas the hydraulic rams 3 raise and lower the ram beam 7 in either horizontal or longitudinally inclined positions, as desired, and whereby the bearings 5 swingable about the pivots 6 may slide on the ram heads 4. On the supporting beams 1 at both sides of the ram beam are slidable beams 14 underneath each of which is bolted a nut 15 guided by and between the two supporting beams 1 and through which passes a spindle 16 turning in the bearing 17, and driven by some hand or electrically driven mechanism (not shown) to move the beams 14 toward or away from each other. On top along the beams 14 are secured series of clamps 18 by bolts 19 each series of which usually holds one edge of a metal sheet to be formed over a die.

According to the invention, the ram beam 7 is provided with two spaced transverse draw arms 20 tiltable about pivots 21 secured to brackets 22, which are adjustably mounted by bolts 23 on the ram beam. One end of these arms 20 carries a shaft 24 fixed thereto and over which are laid upon sleeves 25 adjacent each end rubber cushions 26 or the like to resiliently support preferably sheet steel loops 27 both ends of which are held by one or more clamps 18 secured to the one beam 14. Between the other ends of the balancing arms 20 is inserted and swingably fastened thereto by pins 28 screwed into the arms, the die 29 over which is looped the metal sheet S to be stretch-formed. The ends of the loop are held by one or more clamps 18 secured to the other beam 14. Usually the arms 20 are made longer on the shaft side than on the die side to reduce the force pressing against the cushion. Instead of making the arms tiltable, they may be immovably fastened directly to the ram beam and, likewise, the die may be bolted in fixed position to the arms, since by the upward movement of the ram beam the angular position of the die hardly changes in case both, the straps and the die, are slanted in the direction of the clamp opening, but not at all when both are put in vertically. In slanted position the slanting can be so arranged that the transverse components of the unequal pulling forces at both sides are equal so that they balance each other and do not tend to bend the pistons and the guide stem. The rubber padding is so made that the amount of its compression approximately corresponds to the stretch of the material to be formed so that least bending stress, if any, is exerted upon the cylinder pistons and the guide stem. By tilting the ram beam during the drawing operation the stretching of the sheet between front and rear can be controlled to a certain extent if necessary.

The operation of the device which can be readily attached to or dismantled from the draw press is extremely simple and practical. When the ram beam is in low position the rubber cushioned resilient steel loops or straps while held in the clamps are spaced from the cushion and sprung outwardly. In this position of the ram beam the work material is laid loosely over the vertically placed forming die and its free edges held by the clamps. The ram beam is now raised, the die takes hold of the work sheet and at the same time the shaft at the opposite side presses against the rubber cushion surrounded by the steel band and compressing by a force approximately counterbalancing the pulling in the work material which, while being stretched, is formed without wrinkles

into a permanent shape conforming to that of the die. Due to the fact that the die is held in vertical position, it is so much easier to apply the work material thereto than can be done on especially designed machines for horizontal pull. The advantage of the invention is that it fully serves its purpose and saves the necessity of having an additional press which also occupies valuable floor space for this special work which usually can be done during idle periods of a conventional press available.

It will be recognized, therefore, that a conventional vertically operated draw press equipped with an adapter, according to the invention is a definite improvement, very practical, lowering production cost, and quickly removable when other work is to be done on the press.

While in accordance with the patent statutes one best embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby, but that the inventive scope is defined in the claims.

I claim:

1. In combination with a conventional sheet metal draw press, including a vertically movable hydraulically operated ram beam and vertically immovable but laterally adjustable clamping means at both sides of said ram beam, a die adapter consisting of a pair of adjustably spaced draw arms secured to and extending at both sides of said ram beam, a shaft connecting and being supported by the ends at one side of said arms, resiliently cushioned holding-down-means between said shaft and one set of said clamping means, and a form die of smaller width than that of the ram beam held between the other ends of said arms for stretching and forming a work sheet in looped condition over said die and held at its opposite edges between the other set of said clamping means.

2. In combination with a conventional sheet metal draw press, including a vertically movable hydraulically operated ram beam and vertically immovable but laterally adjustable clamping means at both sides of said ram beam, a die adapter consisting of a pair of adjustably spaced draw arms pivotally mounted to and extending at both sides of said ram beam, a shaft connecting and being supported by the ends at one side of said arms, resiliently cushioned holding-down-means between said shaft and one set of said clamping means, and a form die of smaller width than that of the ram beam pivotally mounted between the other ends of said arms for stretching and forming a work sheet in looped condition over said die and held at its opposite edges between the other set of said clamping means.

3. In combination with a conventional sheet metal draw press, including a vertically movable hydraulically operated ram beam and vertically immovable but laterally adjustable clamping means at both sides of said ram beam, a die adapter consisting of a pair of adjustably spaced draw arms secured to and extending at both sides of said ram beam, a shaft connecting and being supported by the ends at one side of said arms, a rubber cushion covering said shaft, a sheet metal loop surrounding said cushion and having its free edges inserted in one set of said clamping means, and a form die of smaller width than that of the ram beam held between the other ends of said arms for stretching and forming a work sheet in looped condition over said die and held at its opposite edges between the other set of

5

said clamping means, the compression of said cushion being approximately as great as the stretching of the material.

4. In combination with a conventional sheet metal draw press, including a vertically movable hydraulically operated ram beam and vertically immovable but laterally adjustable clamping means at both sides of said ram beam, a die adapter consisting of a pair of adjustably spaced draw arms secured to and extending at both sides of said ram beam, but more at one side than at the other, a shaft connecting and being supported by the longer arm extensions, resiliently cushioned holding-down-means between said shaft and one set of said clamping means, and a form die held between the shorter arm extensions for stretching and forming a work sheet in looped condition over said die and held at its opposite edges between another set of said clamping means.

5. In combination with a conventional sheet metal draw press, including a vertically movable hydraulically operated ram beam and vertically immovable but laterally adjustable clamping means at both sides of said ram beam, a die adapter consisting of a pair of adjustably spaced draw arms secured to and extending at both sides of said ram beam, and identical form dies between the ends of said arms at both sides and equally distant from the center of the ram beam for stretching and forming work sheets in looped condition over said dies and held at their opposite edges between said clamping means.

6. In combination with a conventional sheet metal draw press, including a vertically movable, hydraulically operated ram beam and vertically immovable, but in their position laterally adjustable clamping means at both sides of said ram beam, and a die adapter transversely disposed and pivotally supported by said ram beam on an axis substantially at right angle to the axis of ram movement, said adapter acting in cooperation with said clamping means and adapted to stretch and form a looped metal sheet in substantially vertical direction whereby the forces acting at both ends of the adapter substantially equalize each other.

7. In combination with a conventional sheet metal draw press, including a vertically movable, hydraulically operated ram beam and vertically immovable, but in their position laterally adjustable clamping means at both sides of said ram beam, a pair of spaced transverse die supports extending in opposite directions from said ram beam, a connecting beam carried by one side of said die support, resilient suspension members loosely attached to said connecting beam and held by one set of said clamping means, and a

6

forming die carried by the other end of said die supports for stretching and forming a work sheet in looped condition over the forming die with its free edges held by another set of said clamping means.

8. In combination with a conventional sheet metal draw press, including a vertically movable, hydraulically operated ram beam and vertically immovable, but in their position laterally adjustable clamping means at both sides of said ram beam, a pair of spaced transverse die supports extending in opposite directions from said ram beam, a connecting beam carried by one side of said die support, resilient suspension members slippable over and loosely attached to said connecting beam and held by one set of said clamping means, and a forming die carried by the other end of said clamping means a work sheet in looped condition over the forming die with its free edges held by another set of said clamping means.

9. In combination, a base, a ram beam, means for moving the ram beam away from the base, a set of clamps associated with the base on each side of the ram beam, a die, means mounting the die on the ram beam so that the die is positioned to one side thereof substantially in alignment with one set of clamps, and counterbalancing means positioned between the set of clamps on the other side of the beam and the means mounting the die.

10. In combination, a die, beam means mounting the die adjacent one end of the beam means, a hold-down secured adjacent the other end of the beam means, clamping means in substantial alignment with the die, means pivotally supporting the beam means between its ends, and means for effecting relative movement of the beam supporting means with respect to the clamping means and hold-down so as to stretch material over the die when held by the clamping means.

EARL M. WELSER.

## REFERENCES CITED

The following references are of record in the file of this patent:

## UNITED STATES PATENTS

Number	Name	Date
902,716	Cross	Nov. 3, 1908
1,812,726	Stevens	June 30, 1931
2,123,683	Oeckl	July 12, 1938
2,163,531	Wettstein	June 20, 1939
2,245,723	Salzmann	June 17, 1941
2,279,964	Berliner	Apr. 14, 1942
2,342,437	Summers	Feb. 22, 1944
2,346,213	Flowers	Apr. 11, 1944