May 6, 1947. E. J. BODDY 2,420,064

APPARATUS FOR FLANGING AND CURVING METAL STRIPS

Filed Feb. 28, 1944 8 Sheets-Sheet 1

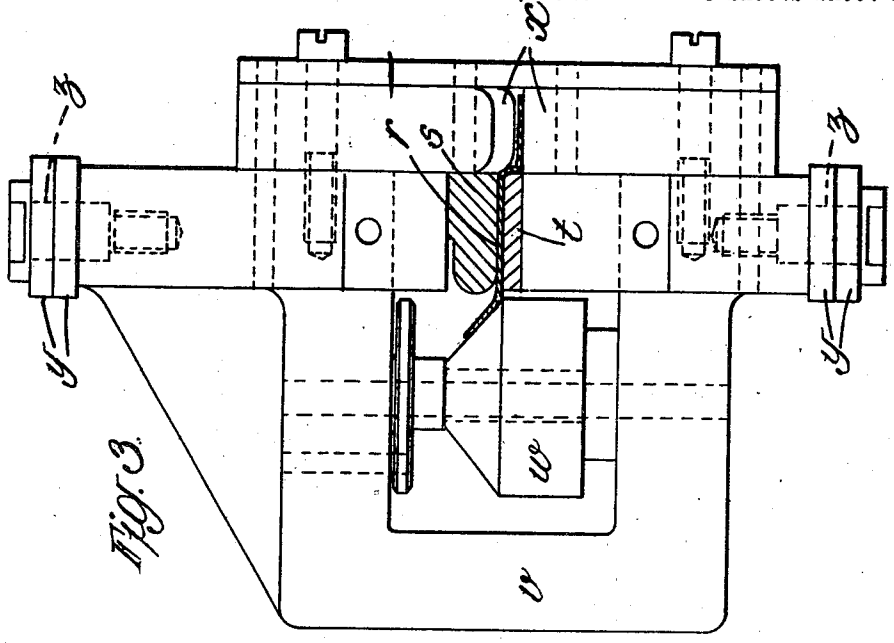

Fig. 3.

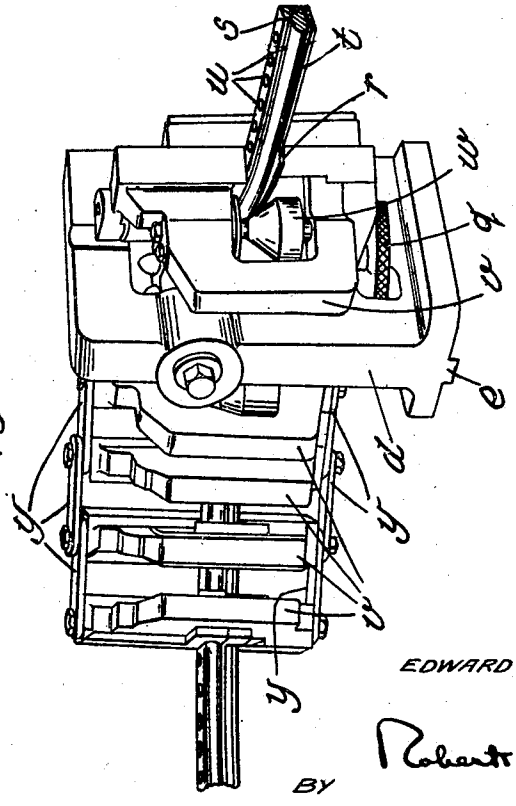

Fig. 1.

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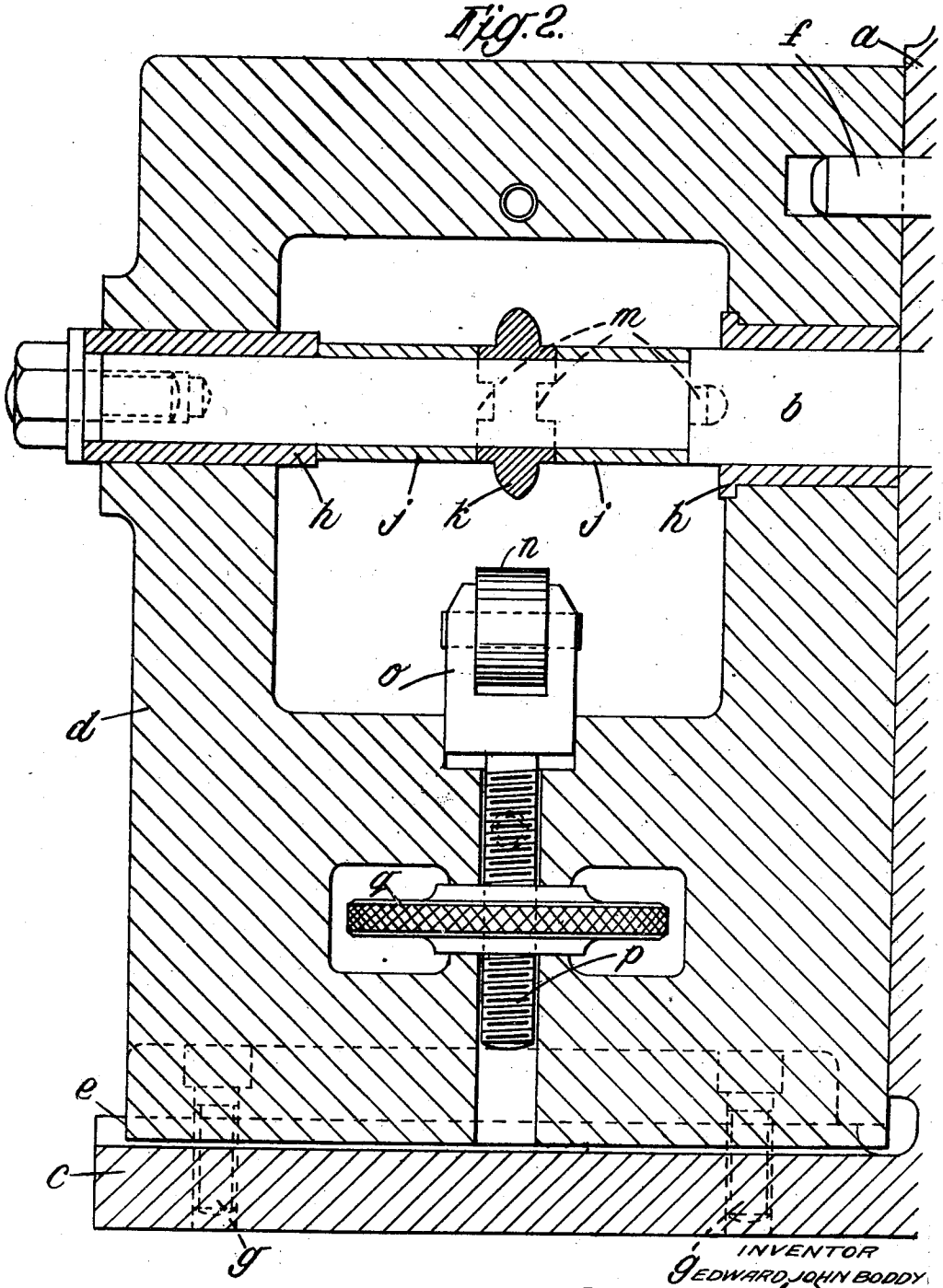
Fig. 2.



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APPARATUS FOR FLANGING AND CURVING METAL STRIPS

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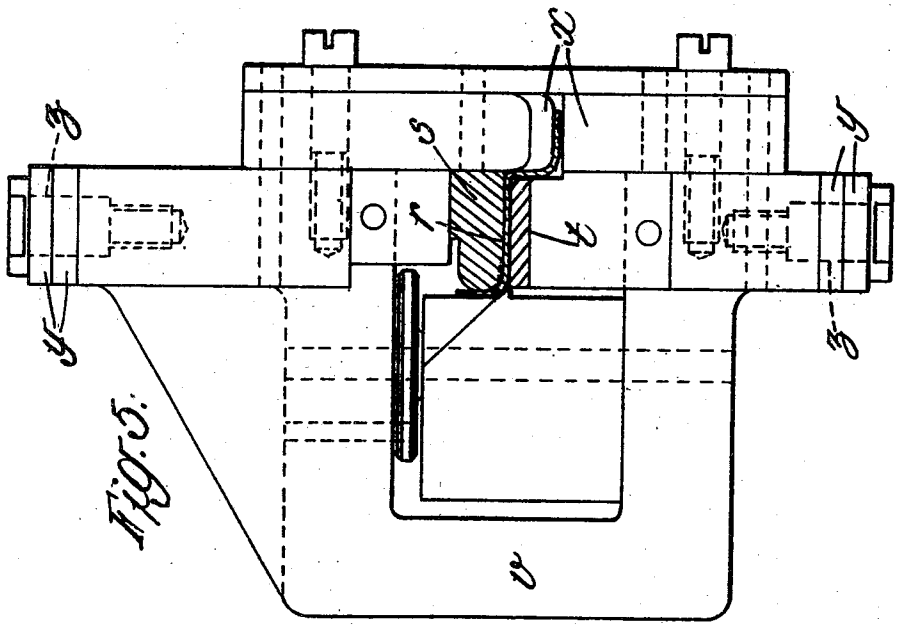

Fig. 5.

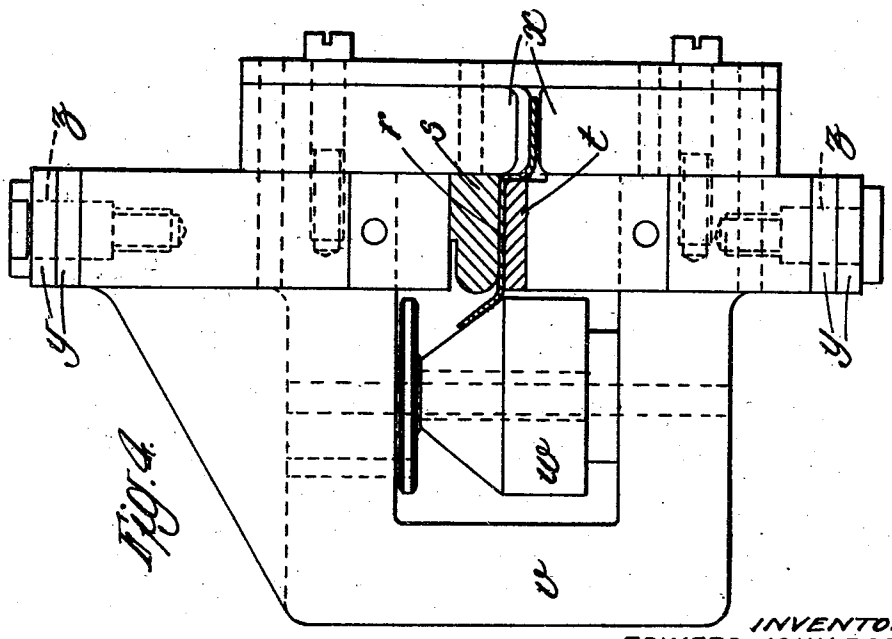

Fig. 4.

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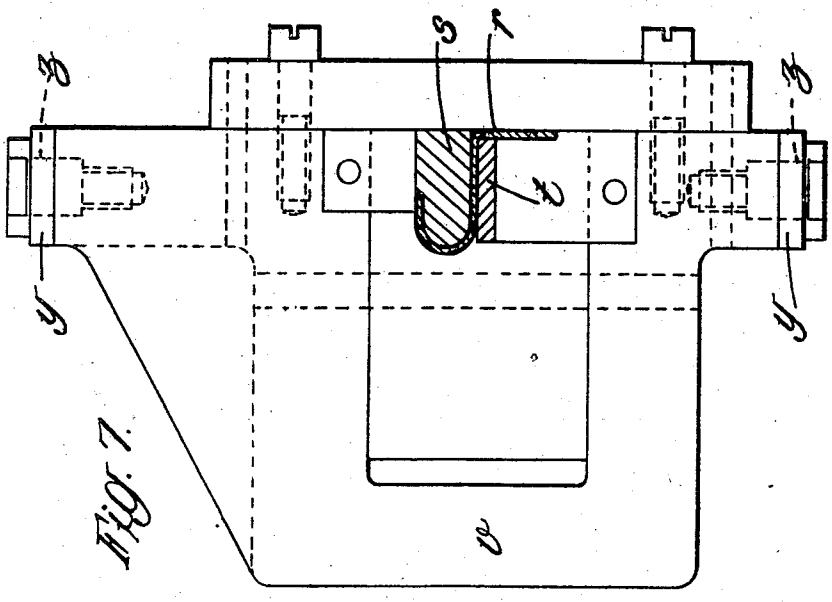

Fig. 7.

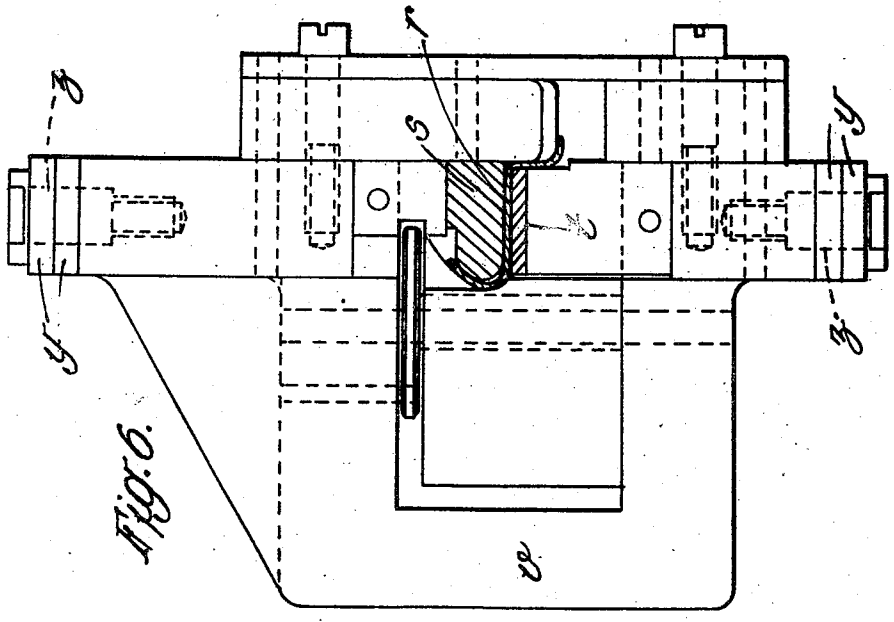

Fig. 6.

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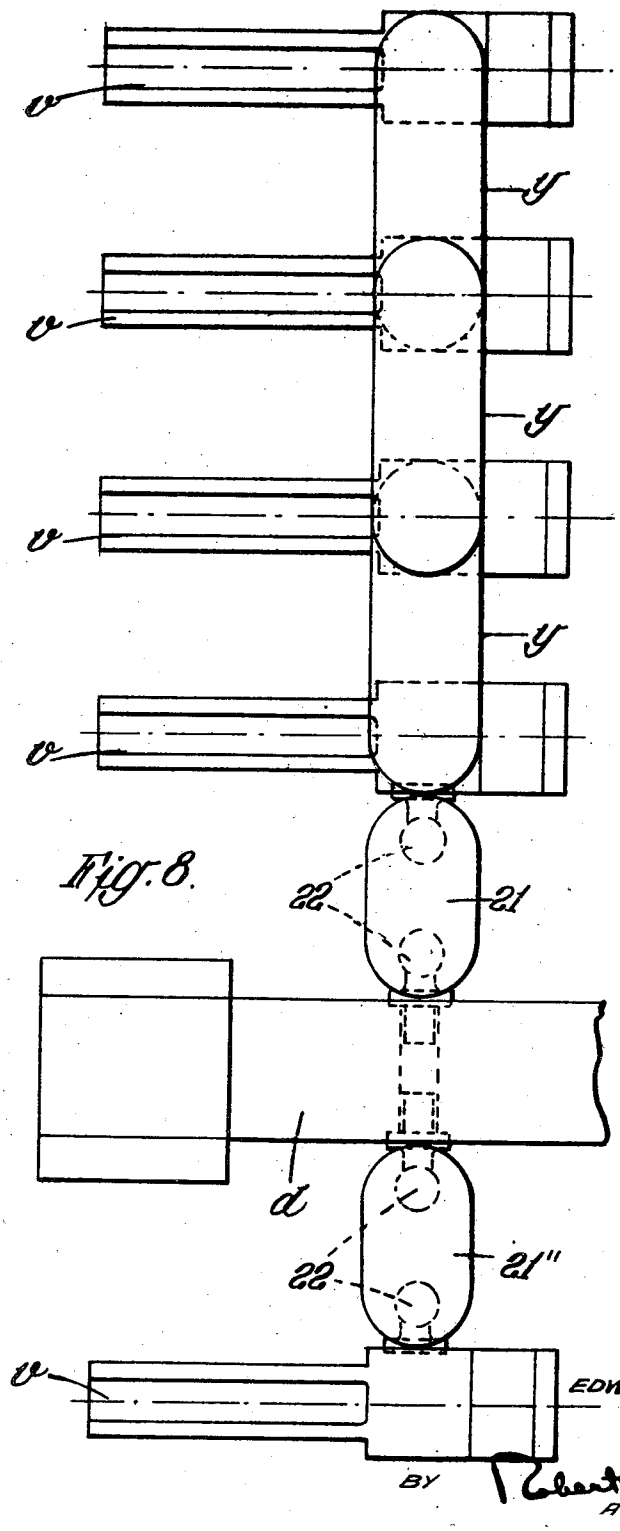

Fig. 8.

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APPARATUS FOR FLANGING AND CURVING METAL STRIPS

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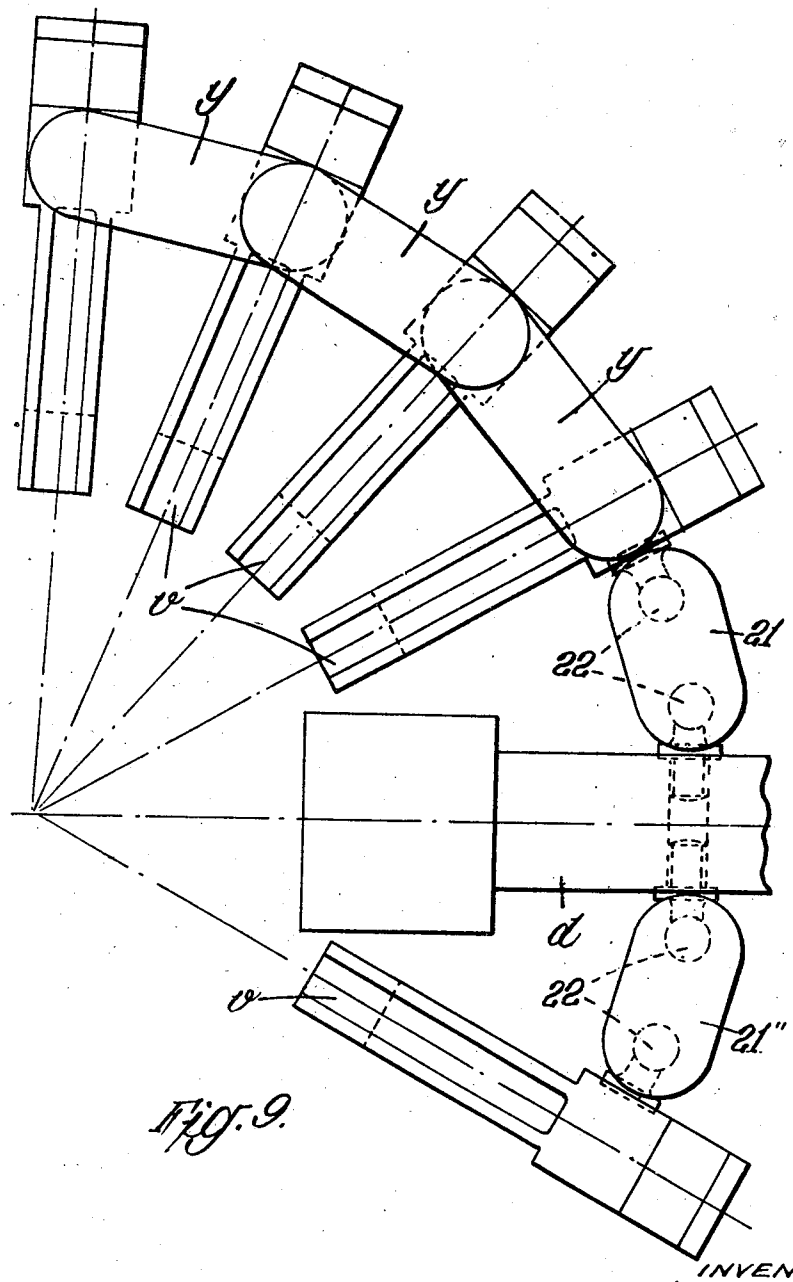

Fig. 9.

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APPARATUS FOR FLANGING AND CURVING METAL STRIPS

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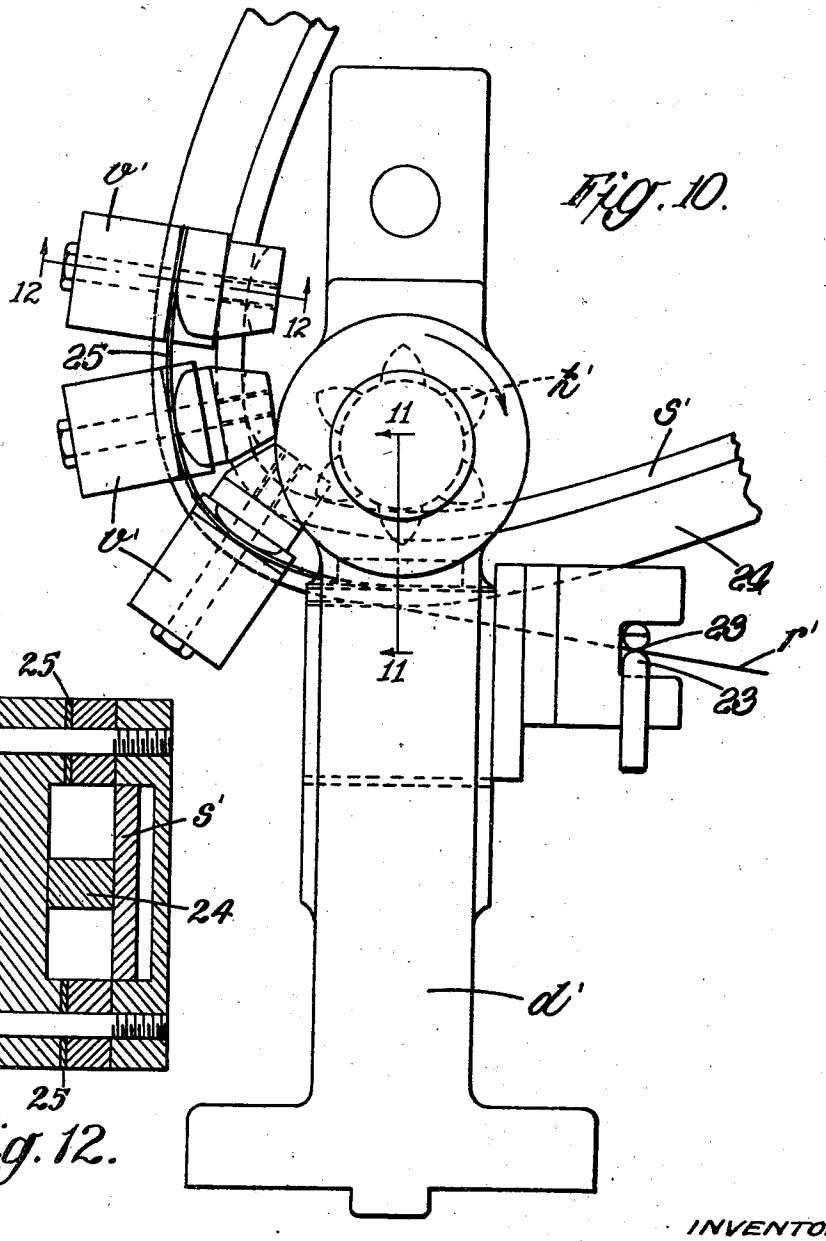

Fig. 10.

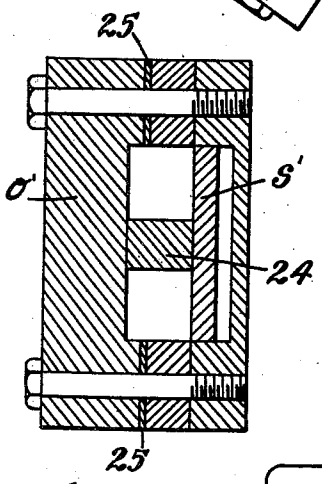

Fig. 12.

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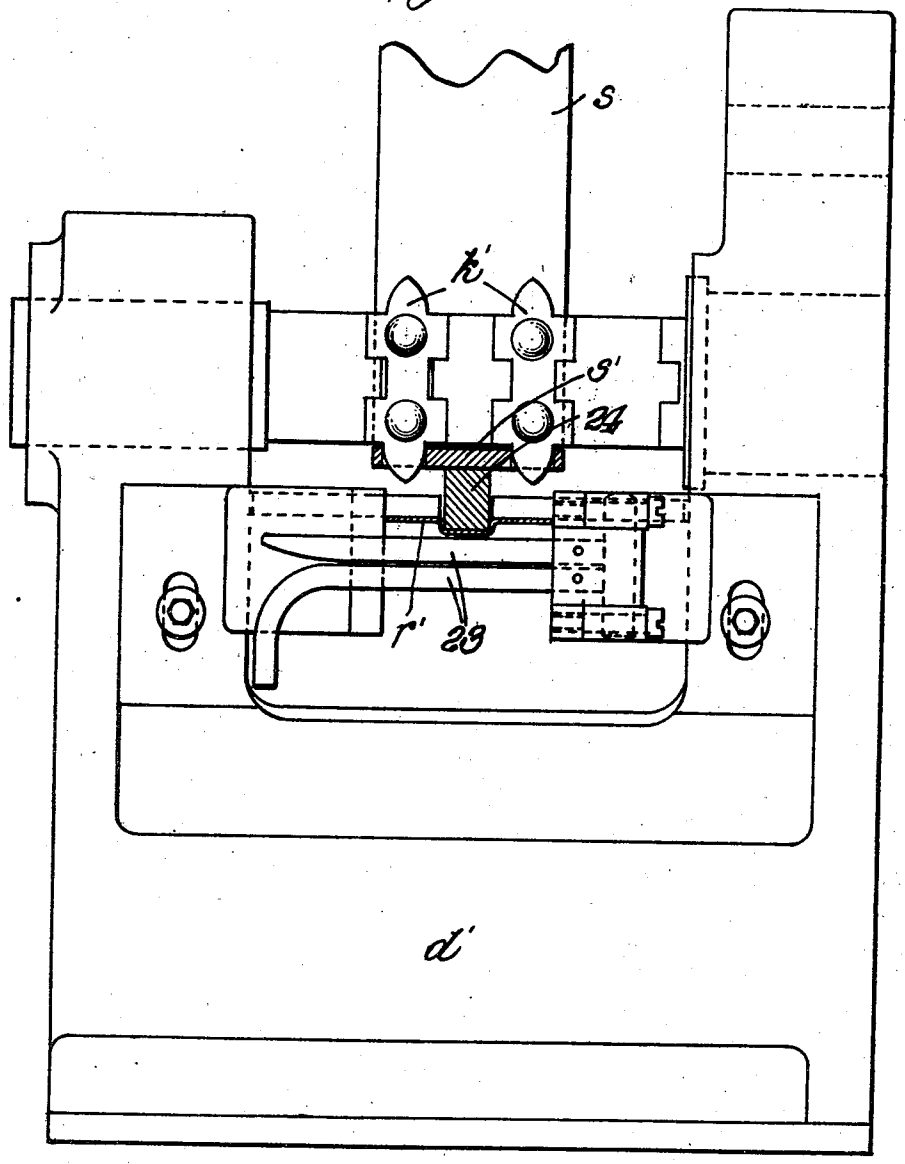
Fig. 11.



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Patented May 6, 1947 2,420,064

UNITED STATES PATENT OFFICE

2,420,064

APPARATUS FOR FLANGING AND CURVING METAL STRIPS

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Application February 28, 1944, Serial No. 524,280
In Great Britain February 17, 1943

7 Claims. (Cl. 153—3)

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Means such as shown in my British Patent No. 536,935, are known for flanging sheet metal plates, strips and the like comprising a pair of plates, strips or like members, of a shape corresponding with that of the finished article and adapted to serve as clamping members for the work, a plurality of frames adapted to be linked together and to be guided by said pair of plates, strips or like members, forming rollers and/or dies carried by said frames and means for drawing said frames, in succession, along said pair of plates, strips or like members to cause the rollers and/or dies to act progressively on the work.

In that apparatus each frame may be of substantially rectangular form with its sides bored to give passage to two cross pins which may serve as spindles for rollers or as positioning means for dies, said rollers and/or dies being so disposed within the frame that said frame with its rollers, or roller and die, or dies, may be threaded on to the clamping members which pass through a central space between two rollers or dies or between a roller and a die, whilst the means for drawing the frames, in succession, along said pair of clamping members may include a chain-like series of pivotally connected links carrying guide rollers or like means for co-operating with said clamping members so that the force necessary to draw the flanging means along said clamping members may be applied in the most advantageous direction. Further, each frame may carry at the central part of its sides adjustable or replaceable packing pieces to centralize it according to the combined thickness of the clamping members and the work held therebetween.

Whilst this known apparatus is most efficient for the purpose of "forming" the work to the required shape and cross-sectional configuration, it has the disadvantage that much space is necessary for its operation and the object of the present invention is to enable the "forming" advantages of the known apparatus to be put into practice in a more confined space.

To that end and according to the present invention, the required relative movement between the forming rollers and/or dies, on the one hand, and the work, on the other hand, is obtained by the provision of an abutment for the interconnected frames and of means for moving a clamping member and the work through said frames.

The abutment for the frames may be bifurcated to straddle a clamping member or members and the work, which may lie in a vertical plane or in a horizontal plane and the abutment may present bearings for the spindle of a gear wheel, the teeth of which are to engage corresponding teeth along one of the clamping members. Preferably the gear wheel has peg teeth and one of

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the clamping member or one of the clamping members is formed with a series of corresponding holes. The gear wheel itself may have a dog-tooth engagement with a driving sleeve, and in some cases two or more such gear wheels may be provided on the same spindle to coact with parallel sets of holes in the clamping member.

The abutment may constitute a removable head which can be fitted on to a machine having a shaft to engage and drive the driving sleeve for the gear wheel or wheels, such heads being interchangeable so that an appropriate head may be employed according to the nature (e. g. thickness of the metal to be formed) of the work and whether the work is to move in a horizontal plane or in a vertical plane. If desired, there may be mounted on the head a pressure roller screw-adjustable according to the combined thickness of the clamping members and the work.

The interconnected frames may be arranged all at the same side of the abutment, in which event the work is drawn or pushed through the dies and/or rollers; alternatively some of the frames may be on the one side and some on the other side of the abutment, in which event the work will be drawn through the dies and/or rollers at the one side of the abutment and will be pushed through those at the other side of the abutment. The linking together of the frames enables the force necessary for the forming operation to be applied in the most advantageous direction, i. e. in the present instance the frames automatically assume positions at right angles to the track of the clamping members and the work as they pass through said frames. For a like purpose the connections between the abutment and the adjacent frame (or frames, when some are on one side and some on the other side of the abutment) are preferably in the form of universal joints.

In some cases the linking together of the frames themselves and of a frame (or frames) with the abutment may be effected by clamping said parts to a pair of flexible steel strips.

The apparatus of the present invention may take different forms according to the nature of the work to be performed and for the sake of example, some of these forms are illustrated by the accompanying drawings in which Figure 1 is a perspective view of one form showing the work in progress; Figure 2 is an enlarged sectional side view of the abutment thereof; Figures 3, 4, 5, 6 and 7 are side views (i. e. in the order in which the work passes therethrough) of the frames showing the rollers and/or dies and the sections to which the work is brought successively; Figure 8 is a plan showing the frames connected with the abutment and Figure 9 is a similar view showing how the frames adapt themselves to the plan of the work to be produced;

Figures 10 and 11 are respectively a front view and a side view of another form of the apparatus, said view being partly in section and taken along the line 11—11 of Figure 10, and Figure 12 is a section along the line 12—12 of Figure 10.

As shown particularly in Figures 1 and 2, a machine *a* from which projects a spindle *b* has arranged therein means (including gearing, clutches and the like, not shown) for driving the spindle *b* and a bed *c* on which is disposed a removable abutment or head *d*, the base of which is formed with a rib *e* to fit into a groove in the bed *c* and the back of which is formed with a recess to receive a pin *f* projecting from the machine *a*, said base being apertured to give passage to holding down bolts *g* . . . . The abutment *d* is substantially rectangular and provided with bearings *hh* for the spindle *b*, the outer part of the latter being of reduced diameter and having disposed thereon sleeves *jj* and a peg-tooth gear wheel *k*, said sleeves *jj* and gear wheel *k* having a driving connection with one another and with the spindle *b* by means of dog teeth as at *m* . . . . At the lower part of the abutment *d* is arranged a pressure roller *n* mounted on a fork *o* the shank *p* of which is screw threaded and cooperates with an internally threaded, externally knurled wheel *q* rotatable in a suitable gap in said abutment.

The work, consisting initially of a suitably shaped flat strip of metal *r* is clamped along the central portion of its width (by any convenient means not shown) between a pair of correspondingly shaped plates, strips or like members *st* of which the upper member *s* is formed with a series of holes *u* . . . correspondingly with the peg teeth of the gear wheel *k* by the rotation of which it is advanced through the apparatus taking with it the work *r* and the lower member *t*. Secured to the abutment *d* are a series of frames *v* . . . each carrying forming rollers *w* and/or dies *x*; in the present instance the frame *v* carrying the first roller *w* and die *x* is mounted at the leading side of the abutment *d* (right side of Fig. 1) and the remaining frames *v* are mounted at the trailing side thereof and are interconnected by links *y* . . . through which pass pintles *z* . . . at the top and bottom of each frame *v*. As shown in Figures 8 and 9 those frames *v* which are adjacent to the abutment *d* are connected therewith through links **21**, **21** which are ball and socket jointed as at **22**. Figure 8 shows the assemblage of frames *v* . . . before the work passes therethrough and Figure 9 illustrates how the frames *v* . . . automatically assume positions at right angles to the track of the clamping members and work as they pass through said frames.

It is to be understood that the machine *a*, which may contain an electric motor, reduction, clutch and like gearing, will serve for the flanging of any sheet metal plates, strips and the like after a suitable head or abutment *d*, frames *v* . . . , sleeves *jj* and a gear wheel or gear wheels such as *k* have been mounted in position in relation to the spindle *b* of said machine, after which the work *r* and its clamping members *st* are introduced between the forming rollers and/or dies *w* and/or *x* of the first frame *v*. Thereafter the engagement of the peg teeth of the gear wheel *k* with the apertures *u* in the clamping member *s* draws the work through the first frame *v* and pushes it through the remaining frames *v* . . . , (when they are arranged as shown in Figure 1), the cross-sectional configuration of the work *r* being altered progressively, as indicated in Figures 3, 4, 5, 6 and 7, the frames *v* . . . accommodating themselves to the plan shape of the work as indicated in Figure 9.

In some cases, however, it is desirable that the work, instead of lying in a horizontal plane as shown in Figures 1 to 9, should lie in a vertical plane. Figures 10 and 11 show a U-shaped abutment *d'* for this purpose furnished with a pair of peg toothed wheels *k'k'*.

In this particular case the work *r'* is fed in between a pair of guides **23**, **23**, at the leading side of the abutment *d'*, the apertured clamping member *s'* is formed with two sets of holes to be engaged by the teeth of the wheels *k'k'* and with a rib **24** at its underside to produce a groove centrally along the work *r'*. There is no second movable clamping member *t* as the friction between the rib **24** and the work *r'* is sufficient to advance the latter, the frames *v'* . . . are all arranged on the trailing side of the abutment *d'*, and, instead of being linked together and to said abutment *d'*, are clamped near their sides to a pair of flexible steel strips such as **25**.

Inasmuch as a draw bench is unnecessary it follows that the improved apparatus of the present invention may be operated, for any given piece of work, in a more restricted space than the known apparatus.

I claim:

1. Means for flanging work consisting of sheet metal plates, strips or the like, comprising a clamping member the shape of which corresponds with that of the article to be produced, means for clamping the work to said clamping member, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of said clamping member, forming means carried by said frames, an abutment for said interconnected frames, said abutment being gapped and adapted to give passage to the clamping member and the work, a spindle and bearings therefor, means for rotating said spindle, a gear wheel on said spindle having teeth adapted to mesh with a series of holes in said clamping member, whereby the clamping member and the work clamped thereto may be moved through the frames and the forming means may be caused to act progressively on the work.

2. Means for flanging work consisting of sheet metal plates, strips or the like, comprising a clamping member the shape of which corresponds with that of the article to be produced, means for clamping the work to said clamping member, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of said clamping member, forming means carried by said frames, an abutment for said interconnected frames, said abutment being gapped and adapted to give passage to the clamping member and the work, a spindle and bearings therefor, means for rotating said spindle, driving means on said spindle, a gear wheel on said spindle and adapted to cooperate with said driving means and with a series of holes in said clamping member, whereby the clamping member and the work clamped thereto may be moved through the frames and the forming means may be caused to act progressively on the work.

3. Means for flanging work consisting of sheet metal plates, strips or the like, comprising a

clamping member the shape of which corresponds with that of the article to be produced, means for clamping the work to said clamping member, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of said clamping member, forming means carried by said frames, an abutment for said interconnected frames, said abutment being gapped and adapted to give passage to the clamping member and the work, a spindle and bearings therefor, means for rotating said spindle, dog teeth on said spindle, a sleeve on the spindle and having dog teeth engaging those on the spindle, a gear wheel slidable freely on the spindle and having dog teeth engaging those on the sleeve, said gear wheel being adapted to mesh with a series of holes in said clamping member, whereby the clamping member and the work clamped thereto may be moved through the frames and the forming means may be caused to act progressively on the work, said abutment being constituted by a removable head which can be fitted on to a machine of which said spindle forms a part.

4. Means for flanging work consisting of sheet metal plates, strips or the like, comprising a clamping member the shape of which corresponds with that of the article to be produced, means for clamping the work to said clamping member, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of said clamping member, forming means carried by said frames, an abutment for said interconnected frames, said abutment being gapped and adapted to give passage to the clamping member and the work, a spindle and bearings therefor, means for rotating said spindle, a gear wheel on said spindle having teeth adapted to mesh with a series of holes in said clamping member, whereby the clamping member and the work clamped thereto may be moved through the frames and the forming means may be caused to act progressively on the work, and an adjustable pressure roller on said abutment adapted to maintain the clamping member in an operative position in relation to the gear wheel.

5. Means for flanging work consisting of sheet metal plates, strips or the like, comprising two clamping members the shape of each of which corresponds with that of the article to be produced, means for clamping the work between said clamping members, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of the clamping members, forming means carried by the frames, an abutment for the interconnected frames said abutment being gapped and adapted to give passage to the clamping members and the work, a spindle and bearings therefor, means for rotating said spindle, a gear wheel on said spindle having teeth adapted to mesh with a series of holes in one of said clamping members, whereby the clamping members and the work clamped therebetween may be moved through the frames and the forming means may be caused to act progressively on the work.

6. Means for flanging work consisting of sheet metal plates, strips or the like, comprising two clamping members the shape of each of which corresponds with that of the article to be produced, means for clamping the work between said clamping members, a plurality of frames pivotally connected together and adapted to take up positions corresponding with the shape of the clamping members, forming means carried by the frames, an abutment for the interconnected frames said abutment being gapped and adapted to give passage to the clamping members and the work, a spindle and bearings therefor, means for rotating said spindle, a gear wheel on said spindle having teeth adapted to mesh with a series of holes in one of said clamping members, whereby the clamping members and the work clamped therebetween may be moved through the frames and the forming means may be caused to act progressively on the work and an adjustable pressure roller on the abutment adapted to force the clamping members and the work towards the gear wheel.

7. Means for flanging work consisting of sheet metal plates, strips or the like, comprising two clamping members the shape of each of which corresponds with that of the article to be produced, means for clamping the work between said clamping members, a plurality of pivotally connected frames adapted to take up positions corresponding with the shape of the clamping members, forming rollers and dies carried by the frames, an abutment for the interconnected frames, said abutment being gapped to give passage to the clamping members and the work clamped therebetween, a removable head mounted on said abutment, a spindle and bearings therefor mounted in said head, means for rotating said spindle, some of the frames being arranged at one side of the abutment and some at the opposite side thereof, the connections between the abutment and the adjacent frames being in the form of universal joints, dog teeth on the spindle, a sleeve slidable freely on the spindle and having dog teeth engaging those on the spindle, a gear wheel on the spindle and having dog teeth engaging those on the sleeve, the gear teeth of said gear wheel being adapted to mesh with a series of holes in one of said clamping members, whereby the clamping members and the work clamped therebetween may be moved through the frames and the forming rollers and dies may be caused to act progressively on the work and an adjustable pressure roller on the abutment adapted to force the clamping members and the work towards the gear wheel.

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