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APPARATUS FOR FORMING MATERIAL

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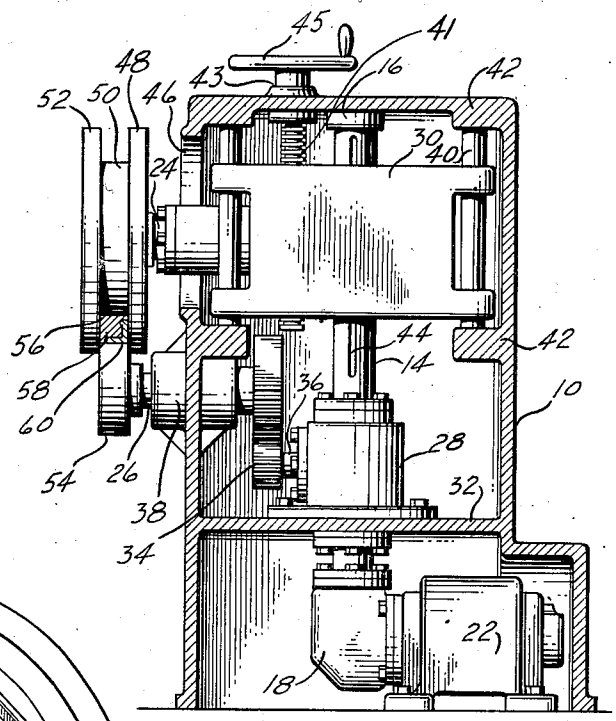


Fig. 1

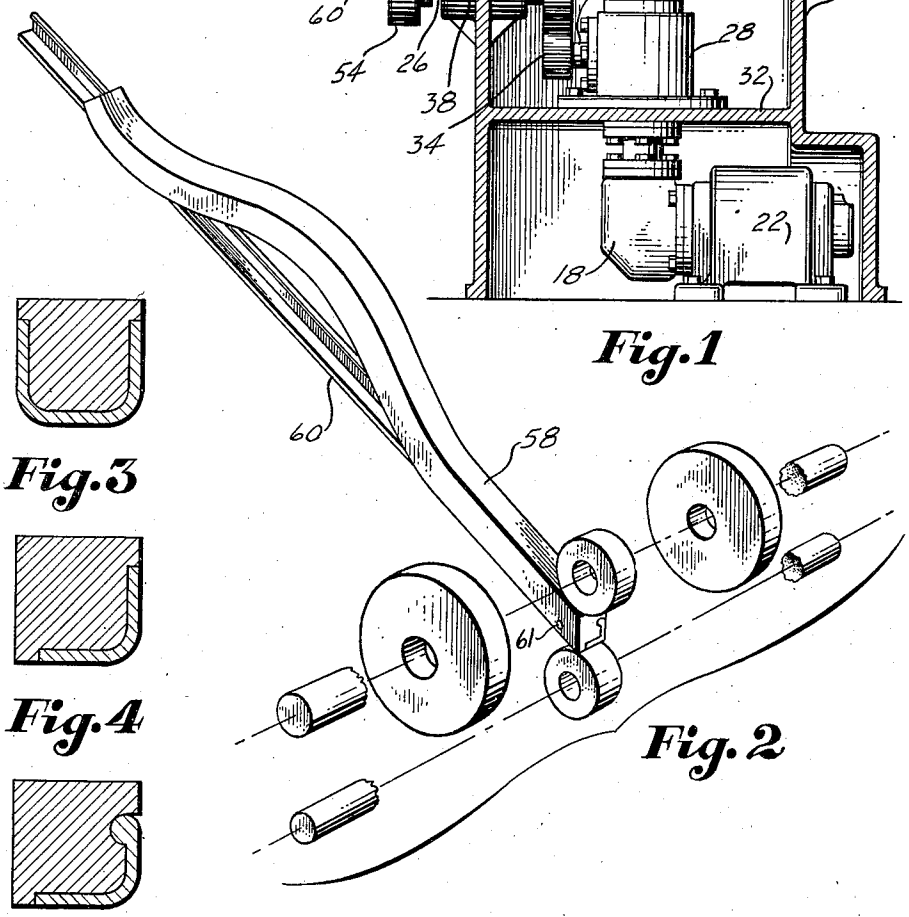


Fig. 2

Fig. 3

Fig. 4

Fig. 5

INVENTORS
FRED. M. COMBS
STARLING A. SQUIERS

BY J. Edwin Coates
ATTORNEY.

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APPARATUS FOR FORMING MATERIAL

Frederick M. Combs, El Segundo, and Starling A. Squiers, Hawthorne, Calif., assignors to Douglas Aircraft Company, Inc., Santa Monica, Calif.

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1 Claim. (Cl. 153—32)

Our invention relates to a simple apparatus for forming material, preferably strip stock and extruded sections of metal such as aluminum and aluminum alloys.

It is the principal object of our invention to provide a device for forming eccentric and non-arcuate bends and curves in strip material through the use of a "floating" die and simple mechanism.

Another object of the invention is to provide a device for deforming substantially straight extruded sections of material to predetermined configurations of a "floating" die which is fed with the material through a tractive restraining and guiding mechanism.

A still further object of the invention is to provide a device for forming a piece of material to curvate configuration as determined by a "floating" die of relatively rigid material placed in nesting relationship with the piece to be formed and fed into a mechanism adapted to force the piece of material progressively throughout its length, into contact with the die.

Other and further objects will become apparent after reading the description and studying the drawing in which:

Figure 1 is an elevational view of our machine with the housing shown in cross section so as to disclose the relative positions of the various driving members.

Figure 2 is an exploded perspective view of forming and guiding rollers and their respective shafts, and showing a piece of material and die in the proper position for the beginning of their travel between the rollers.

Figure 3 is a cross sectional view taken transversely through a channel shaped piece of material and its forming die showing it properly nested for forming.

Figure 4 is a cross sectional view similar to Figure 3 showing an angle shaped piece of material with its mating die; and

Figure 5 is a cross sectional view similar to Figure 4 showing a bulb angle shaped piece of material with its mating die.

With reference to Figure 1 our apparatus is shown enclosed in a housing 10. This housing 10 serves to support various moving parts such as a main drive shaft 14 mounted for rotation in a vertical plane and journaled at its upper end to the housing 10 at 16. The lower end of the shaft is equipped with a gear (not shown) mounted for rotation in a gear box 18 and adapted to be driven by another gear (not shown) fixed to a driving shaft of a power supply 22. The main shaft 14 is adapted to drive a pair of shafts 24 and 26 through a worm and gear arrangement enclosed in a pair of gear boxes 28 and 30. Gear box 28, supported by the partition 32, is attached to the housing 10 in fixed relationship to the shaft 14 which is adapted to pass therethrough. The shaft 26 is driven from this gear box through a pair of gears 34, the lower one of which is fixed to a stub shaft 36 protruding from the gear box. The shaft 26 is supported in a bearing 38 mounted on the housing 10.

The upper gear box 30 is also adapted to accommodate the shaft 14 and is supported in a manner such that it may slide vertically with respect to the shaft. The supporting means comprises a plurality of rods 40 bracketed to the housing at 42 and the driving worm within this gear box is of a type suitable for movement on the shaft upon a key 44. In this way, the worm may be driven by the shaft 14 at any point in the vertical range of travel of the gear box 30. The shaft 24 has a gear fixed at its end within the gear box so as to be driven by the worm.

A slot 46 is provided in the housing to afford passage for the shaft 24 therethrough and to permit the shaft to be moved up and down in a vertical plane with the gear box 30. The purpose of this sliding arrangement is to permit variation in the distance between the shafts 24 and 26 to accommodate various sizes of rollers and dies as will be later explained. Any suitable means may be used to raise and lower the assembly of gear box 30 and shaft 24. As an example, a screw shaft 41 may be in threaded engagement with gear box 30. This shaft is supported in bearing 43 and is provided with a hand wheel 45. This arrangement provides for setting and holding the gear box in any desired position in its range of adjustment.

Mounted upon the exterior end of the shaft 24 and fixed thereto are a plurality of rollers 48, 50, and 52. Rollers 48 and 52 are provided for guiding purposes and are of a diameter considerably larger than the roller 50. Their arrangement is such that all three are fixed to the shaft in abutting relationship, with the small roller 50 held between the rollers 48 and 52. On the shaft 26 is fixed a single roller 54, this roller being of a thickness substantially identical with the roller 50 in order that its outer rim or periphery may also lie between the outer rims and in abutting relationship to the large rollers 48 and 52 just described. As will be seen in the drawing, a space 56 is formed by this roller ar-

rangement which may be increased or decreased in size through movement of the gear box 30 and shaft 24 in a vertical plane. The space 56 is provided to accommodate a die 58 and a piece of material 60 to be formed thereon.

Such a die is shown at 58 in Figure 2. In addition, this figure shows the positioning of the die as it is fed into the roller arrangement. The die is shown in the form of a heavy strip of metal which is bent to a desired curvate configuration and it is the purpose of this invention to cause a strip of metal such as shown at 60, to be formed to the configuration of the die 58 by passing both the die and the piece of material through the rollers. Extruded sections of material are especially adaptable for forming in this machine and representative types of such sections are shown in Figures 3, 4, and 5. It will be noted that Figure 3 shows a channel shaped section, Figure 4 an angle shaped section and Figure 5 a bulb angle shaped section. These various shaped sections are shown with their forming dies for the purpose of illustrating the manner in which the die is fabricated to permit the various sections to nest in close relationship thereto so that the external boundaries of the die and piece of material form a rectangle.

From the teaching here given it is obvious that almost any type of extrusion may be formed with a die specifically made to accommodate the particular configuration. The purpose of having the smooth sided rectangular assembly of die and piece of material is to simplify construction where possible and to permit contact on all sides between the roller arrangement and the nested piece of material and die. Other shapes may obviously be used where necessary or desirable.

The method of forming a piece of material to a die on the machine as described is as follows:

An end of a piece of material, such as the piece 60, is secured together firmly by holding means as diagrammatically shown at 61 to an end of a die to which the piece is to be formed, such as the die 58, and the two pieces when fastened together form an assembly such as that shown in any of the Figures 3, 4, or 5. The fastened end of this assembly is then fed into the space 56 formed by the rollers, and the upper rollers may be moved downward into engagement with the top and sides of the die 58. The width of the rollers 50 and 54 should be just sufficient to accommodate the overall width of the die and piece of material to be formed. The rollers are then caused to revolve by the power supply 22 through the various gears previously described and the gearing is such that the shafts 24 and 26 rotate in opposite directions. This permits the rollers to exert a tractive force upon the die assembly to pull it therethrough and, as the assembly passes, it is restrained against sideward movement by the inside faces of the rollers 48 and 52. It may be seen then that as the piece of material and die enter the space 56 formed by the rollers the piece of material will be forced into nesting engagement with the die and thereby caused to assume the curvate configuration of the die as the entire length of the die and piece of material passes through the space 56. Thus by this simple means and method a piece of material may be formed to almost any desired shape as determined by a floating die in a single operation and through the use of a simple and inexpensive operating mechanism. As the sizes of the dies change, the roller sizes are likewise changed in order that the space 56 may be just sufficient to accommodate the overall dimensions of the die and piece of material. As the roller sizes increase or decrease the gear box 30 and its shaft 24 are moved up or down so that a proper relationship between the rollers may be maintained. As previously stated, this is made possible by reason of the fact that the gears inside the box 30 are constantly driven by the shaft 14 through the keyed connection which is of sufficient length to accommodate the entire upward or downward range of travel of the gear box.

When forming small pieces of material or material of light gauge it may not be necessary to drive the lower shaft 26 as sufficient tractive force will no doubt be supplied solely by the engagement of the rollers 48, 50, and 52 with the piece of material and die. It is also feasible in certain instances to place the three rollers on the lower shaft 26 and drive only that shaft which may then be held in fixed relationship to the driving means. In this way, a single roller on the shaft 24 would be mounted to rotate freely and this shaft would be capable of vertical adjustment thus eliminating the necessity for the sliding gear box arrangement.

While we have herein shown and described our invention in its present preferred embodiment it will be apparent to those skilled in the art after understanding the invention that various changes and modifications may be made therein without departing from the scope thereof as set forth in the appended claim.

We claim:

In a machine for bending to a desired longitudinal curvature an elongated work piece of material having a cross section characterized by concavities, the combination of: a pair of juxtaposed rollers having substantially parallel flat treads facing each other; a work engaging elongated combination supporting and forming means of greater strength against flexure than the work piece and having a cross section so complementary of the work piece cross section as to provide an assembled body having two external surfaces so contoured and spaced in cross section as to be simultaneously flatly pressurally engageable with said treads respectively, said body being longitudinally movable between said rollers with said surfaces engaging said treads, said supporting means including an elongated member longitudinally curvate in a plane perpendicular to the axes of the rollers, and further including means for securing said elongated member and work piece at one end against separation in said perpendicular plane, said supporting means being interchangeable with other similar supporting means; means to laterally engage and prevent lateral movement of said body across said treads in a direction parallel to the axes of the rollers as it passes between said rollers; and means for rotating at least one of said rollers to pass said body between said rollers, whereby when said elongated member and work piece are thus secured and said body at the secured end is introduced between said rollers, and said rotating means is energized, said work piece is bent to the longitudinally curvate contour of said member.

FREDERICK M. COMBS.
STARLING A. SQUIERS.