

July 4, 1939.

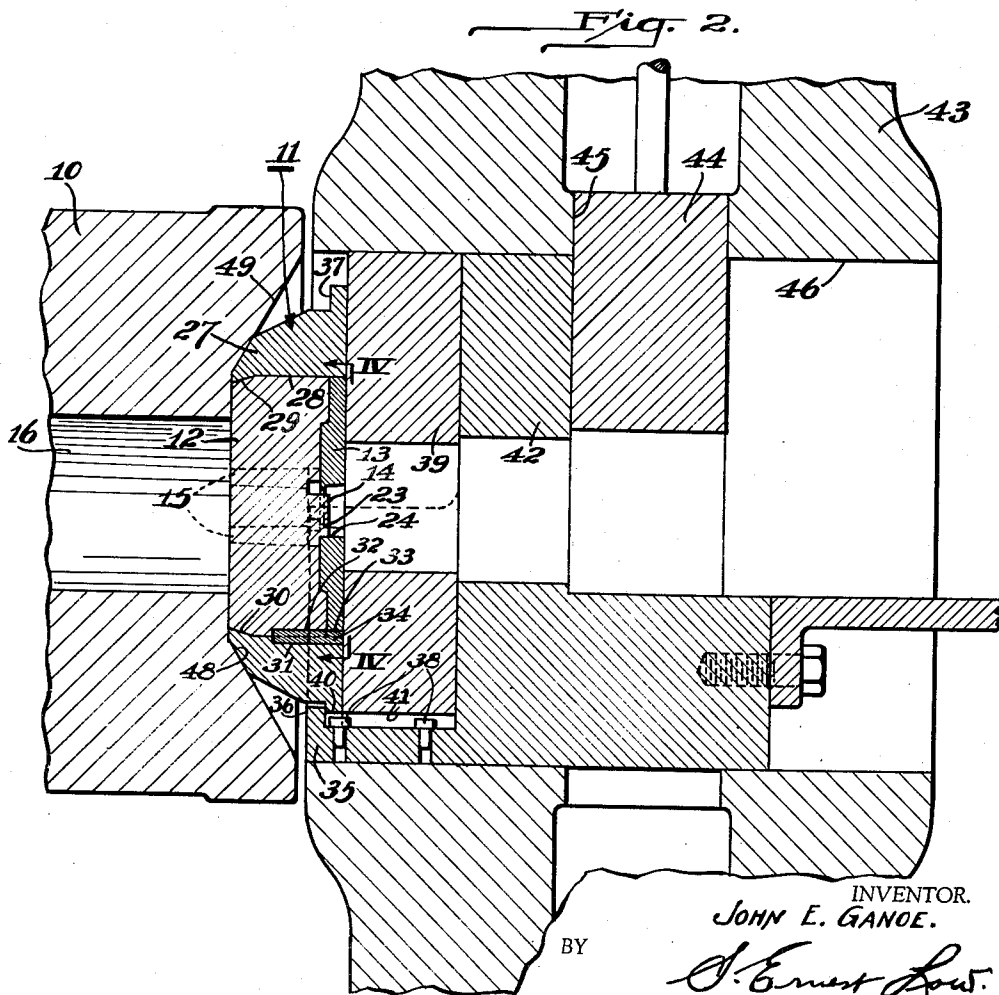
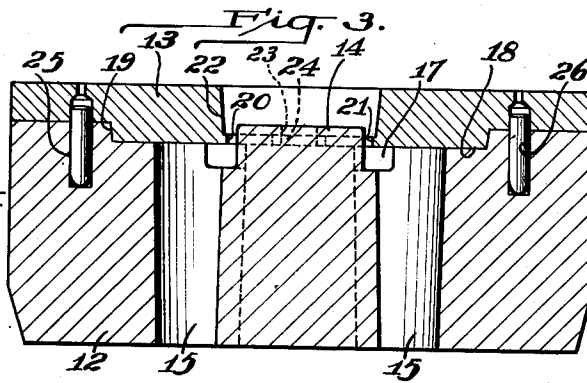
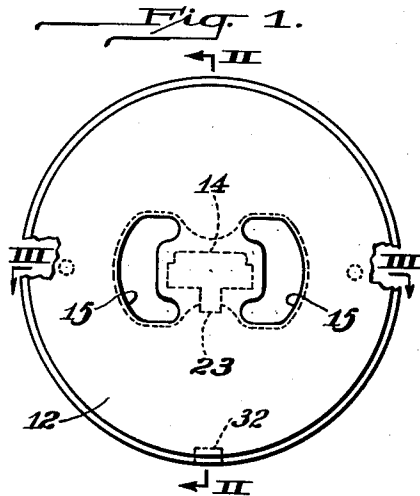
J. E. GANOE

2,164,397

EXTRUSION

Filed Dec. 3, 1935

2 Sheets-Sheet 1



INVENTOR.
JOHN E. GANOE.

BY
J. Ernest Low.
ATTORNEY.

July 4, 1939.

J. E. GANOE

2,164,397

EXTRUSION

Filed Dec. 3, 1935

2 Sheets-Sheet 2

Fig. 4.

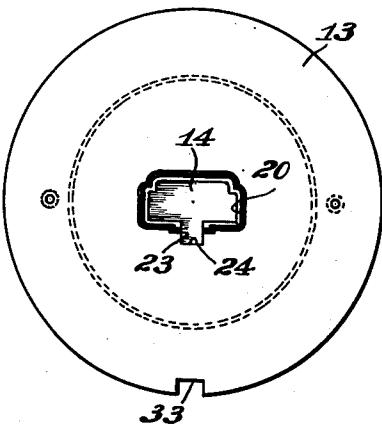


Fig. 5.

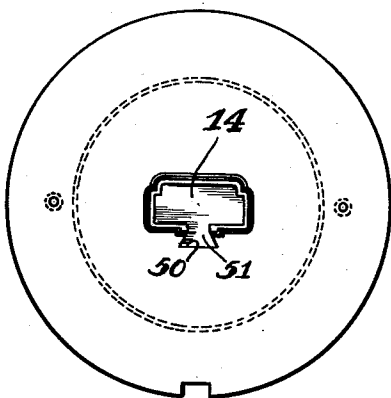


Fig. 6.

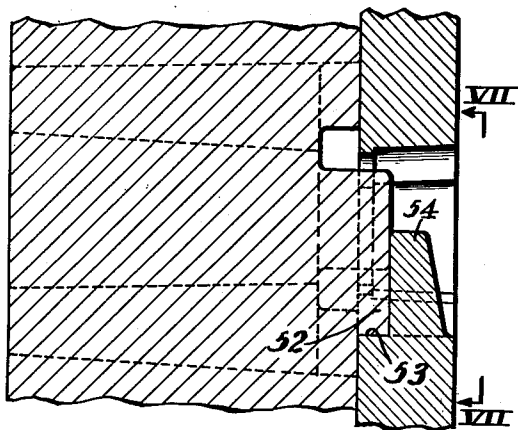


Fig. 7.

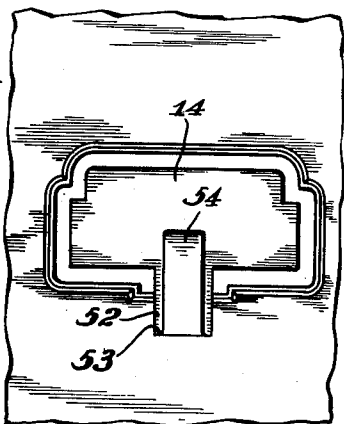


Fig. 8.

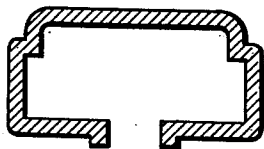


Fig. 9.

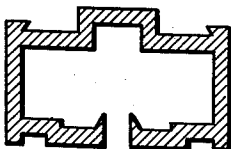
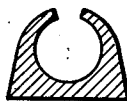


Fig. 10.



BY

INVENTOR.
JOHN E. GANOE.
J. Ernest Low.
ATTORNEY.

UNITED STATES PATENT OFFICE

2,164,397

EXTRUSION

John E. Ganoe, New Kensington, Pa., assignor to
Aluminum Company of America, Pittsburgh,
Pa., a corporation of Pennsylvania

Application December 3, 1935, Serial No. 52,658

2 Claims. (Cl. 207—17)

This invention relates to improvements in extrusion and is particularly concerned with a die or tool organization for the production of shapes or sections of substantially tubular form, but having an opening through a wall portion thereof leading into the interior of such extruded shapes or sections, the opening extending the entire length of said sections. The extruded shapes, which the tools and mechanism herein are preferably adapted to produce, are generally substantially hollow, the otherwise continuous walls thereof being interrupted at a point in their periphery.

In known extrusion practice, it has been customary in the production of hollow seamless shapes to employ hollow billets, or metal charges, through the central opening of which extends a mandrel terminating within an extrusion die orifice, the die orifice controlling the exterior configuration of the final extruded shape or die expressed product, and the mandrel controlling the interior configuration of the product. On completion of such sections, if it was desired to produce a substantially hollow section having an opening through a wall thereof, a cutting or slitting operation was required and the shape thus operated upon was drawn open or otherwise formed to impart the final configuration thereto.

It has likewise been known to extrude a section or shape from a solid metal billet or charge, without the use of a mandrel, in a form appreciably removed from that finally desired, and thereafter to draw the extruded shape into its final configuration.

In both instances referred to hereinabove, two or more operations have been required in the production of the desired product, and it is an object of the present invention to provide suitable extrusion mechanism whereby one or more of the operations heretofore required are eliminated.

It is a further object of the invention to provide extrusion mechanism which permits the extrusion, in a single operation, of a shape or shapes of partially closed, substantially tubular configuration from billets or metal charges which are preferably of original solid cross section.

Other objects and advantages will present themselves on consideration of the following specification when read in conjunction with the drawings appended hereto and forming a part hereof in which:

Figure 1 represents an end view in elevation of a suitable front extrusion die through which the metal of an extrusion billet may be first expressed during a metal-extruding operation, in

accordance with the characteristics of the invention;

Figure 2 represents a sectional elevation through an extrusion press incorporating the die shown in Figure 1 taken along the line II—II of Figure 1;

Figure 3 represents a sectional plan view of front and back extrusion dies, removed from the mechanism illustrated in Figure 2, taken along the line III—III of Figure 1;

Figure 4 represents an end view in elevation of the back extrusion die as viewed in the direction of the arrows IV—IV of Figure 2;

Figure 5 represents an end view in elevation, as taken in the direction of the arrows referred to in the description of Figure 4, illustrating a modification of the preferred form of the invention;

Figure 6 represents a fragmentary sectional elevation of a further modification of the preferred form of the invention, illustrating similar elements in the same relationship as shown in Figure 2;

Figure 7 represents an end elevation taken in the direction of the arrows VII—VII in Figure 6; and

Figures 8, 9, and 10 represent in cross sectional elevation types or forms of extruded sections or shapes which may be manufactured by means of the die organizations constituting the invention.

Referring now to the drawings, wherein like reference numerals represent similar parts in all views, the preferred form of the invention is illustrated in Figures 1, 2, 3, and 4. Therein 10 represents the billet cylinder of a standard type of extrusion apparatus and 11 the extrusion die assembly in its entirety. The die assembly comprises a front die 12 adjacent the billet cylinder and a back die 13 in aligned and abutting relationship with the die 12.

The front die is preferably formed with an integral mandrel 14, the function of which controls or imparts the interior configuration or shape to the final extruded product, and apertures 15 through this die provide passages for metal flow from a billet 16 (not shown), within the billet cylinder 10, forwardly into a mixing or coalescing chamber 17 directly adjacent the flat face of the back die 13. Although two apertures 15 have been illustrated, it will be quite manifest that any suitable number, one or more, may be selected in accordance with the shape to be extruded, the equalization of pressure on the mandrel 14 being the desideratum and obtainable

by proper distribution of the metal flow into the mixing chamber 17.

The back die 13 is provided on its face in contact with the front die with a boss or raised portion 18 which fits within a suitable complementary cavity or bore 19 provided in the face of the front die 12 furthest removed from the billet cylinder 10. This construction assists in aligning the two extrusion dies, as will further detailed features to be hereinafter described. The back die 13 is provided with an aperture 20 which controls, or imparts thereto, the desired exterior contour or configuration of the final extruded product. The aperture 20 in the back or female die 13 is formed with a relatively narrow bearing surface 21, the purpose of which is to alleviate any undue friction generated by the metal flowing thereover, and the aperture is thereafter immediately relieved as at 22.

The extrusion dies 12 and 13 herein provided are for the purpose of producing a substantially tubular shape, or an extruded shape having reentrant angular portions, provided with an opening into the interior of the shape extending along the entire length thereof, and the particular mandrel structure that has been developed is of a form and construction never heretofore employed. In the preferred form of the invention, Figures 1, 2, 3, and 4, it is to be noted that the mandrel 14 is reduced in cross sectional area, with respect to the die orifice 20, an amount equal to the wall thickness of the extruded shape (Figures 8, 9, and 10). It is also to be noted that the mandrel 14 is equipped with a depending tongue 23 adjacent its normally free or unsupported end. This tongue 23 fits snugly within a cavity 24 machined or otherwise produced in the back die 13 and, in so doing, closes the die aperture 20 over a portion of its periphery. This construction, then, not only provides for the extrusion of a substantially tubular shape having an opening through its wall along its entire length, but further provides an extrusion die assembly, comprising dual extrusion tools 12 and 13, wherein a mandrel is rigidly supported at both ends, integral or otherwise fixed at one end to the front die 12 and supported at its opposite end within the bearing cavity 24 in the back die 13.

With the front extrusion die 12 and back extrusion die 13 assembled in abutting relationship, suitable dowel pins 25 and complementary apertures 26 being provided to assist in the further alignment of the dual extrusion dies, an annulus or die holder 27 is provided for supporting the dies in operative relationship with respect to the remaining elements of an extrusion press. Herein, the die holder 27 is equipped with an interior through-bore 28 terminating adjacent the billet cylinder 10 with an inwardly-directed lip 29 which engages a complementary chamfer 30, turned or otherwise formed on the exterior circumferential surface of the front die 12. This construction insures proper seating of the front die 12 and its aligned back die 13 within the die holder 27, and also insures against release of the dies from the die holder after assembly except in one direction, namely, away from the in-turned lip 29. To further insure a correct tool assembly, the interior bore 28 of the die holder or annulus 27 is provided with a keyway 31, complementary keyways 32 and 33 being provided in the front and back dies, respectively. A key 34 positioned within the aligned keyways 31, 32, and 33 completes the assembly of the dual extrusion dies

12 and 13 and properly aligns these dies within the die holder 27.

The die holder 27 is supported within a bracket or tool carrier 35. This device is constructed in the general form of a semi-circular bracket or channel with its open side disposed on the top surface thereof. The tool carrier 35 is equipped with an inwardly-projecting tongue or flange 36 which engages not more than one-half of the circumference of a peripheral shoulder 37 provided upon the exterior surface of the die holder 27. Keys in the form of bolt-like members having squared heads 38 inserted within suitable apertures in the tool carrier 35 serve to position the die holder 27 and a back-up block 39 through the medium of keyways 40 and 41 in the die holder and back-up block, respectively. The back-up block 39, interposed the die holder 27 and a flange 42 integral with the tool carrier 35, permits removal of the die holder 27 with its assembled extrusion dies 12 and 13 on removal of the back-up block 39 and movement of the die holder to the right (Figure 2) into the space vacated by the back-up block 39.

The tool carrier 35 is preferably reciprocally mounted with respect to the billet cylinder 10 and front platen 43 of the extrusion press, a suitable locking bar arrangement 44 extending through the platen, as at 45, holding and restraining the assembled tools in pressure-resisting arrangement. By means of a tool or die-receiving aperture 46 through the platen 43, the assembled dies 12 and 13 within their tool carrier 35 may be horizontally translated away from the billet cylinder 10 on withdrawal of the locking bar 44, and the chamfered surface 48 provided on the exterior surface of the die holder 27 insures a metal seal upon the complementary surface 49 on the billet cylinder 10. It will also be manifest that the billet cylinder 10 could be translated away from the front platen 43, and the tool carrier 35 reciprocated in a direction opposite to that described above. With the tool carrier 35 removed from within the cavity 46 in the platen 43, as by horizontal translatable movement with respect thereto, the extrusion dies 12 and 13 may be readily removed and replaced by lifting the back-up block 39 and die holder 27 through the open top of the channel-formed tool carrier 35.

Referring now to Figure 5, a fragmentary end view is disclosed which illustrates a modification of the depending mandrel tongue and cavity construction incorporated in the front and back extrusion dies. Herein the depending tongue 51 is of dovetail construction and assumes its position within a complementary groove 50 in the back die. This construction affords a greater bearing area against the tendency to any lateral movement of the mandrel under pressure and serves to assist in the axial alignment of the front and back dies on assembly.

In Figures 6 and 7 a fragmentary sectional side elevation, and end view in the direction of the arrows VII—VII in Figure 6, respectively, are disclosed and illustrate a further modification of a mandrel tongue and groove construction between the back and front dual extrusion dies. In this instance, the depending tongue 52 of the mandrel is similar to that disclosed in the preferred form of the invention, namely, of substantially rectangular cross section, but the cavity 53 for receiving and supporting the tongue is formed with a shoulder or abutment 54 against which the tongue 52 abuts in the direction of the

applied extrusion pressure. This construction provides an additional means against axial thrust on the mandrel under operating extrusion pressures.

5 In the operation of the mechanism of the invention, with the tools assembled as illustrated in Figure 2, a solid metal billet 16 (not shown), suitably preheated to the required temperature in accordance with the nature of the metal being
10 extruded, is introduced into the billet cylinder 10 and pressure is exerted upon the billet through the medium of a ram, not shown. The metal billet under extrusion pressure is divided into streams or rods of solid metal in accordance
15 with the number of passages through the front die 12, the single or several streams of metal meeting the front wall of the mixing chamber 17 where further forward movement is arrested. Thereafter the metal of the aforementioned solid
20 rods or streams expands and completely fills the chamber 17 and passages 15 through the die 12, and further extrusion exudes the metal from within the chamber 17 through the die orifice defined between the mandrel 14 and the aperture
25 20, thereby producing a section substantially tubular in form but having an opening, into reentrant portions thereof, extending over its entire length, examples of which are illustrated in Figures 8, 9, and 10.

30 Although specific illustrations have been resorted to in describing the nature of the contribution to the art represented by this invention, it is to be understood that the invention is susceptible to a wide variety of uses in the production of extruded products from various ferrous
35 or non-ferrous metals, aluminum and its alloys

being particularly adaptable to extrusion by means of the apparatus herein disclosed, and the invention is not to be interpreted except as defined in the appended claims.

What I claim is:

5 1. An extrusion apparatus comprising a front mandrel-carrying die and a back exterior configuration-controlling die, an annulus surrounding said dies and embracing the same, and a key
10 connection between said dies and annulus, a tool carrier for receiving said assembled dies and annulus, and means associated with said tool carrier and annulus for maintaining the annulus
15 in fixed position therein, said last-mentioned means and key connection cooperating to insure fixed alignment of the horizontal and vertical
15 axes of the dies.

2. An extrusion apparatus comprising a front mandrel-carrying die and a back exterior configuration-controlling die, said mandrel being supported at its ends by both dies when assembled
20 in abutting axial relationship, an annulus surrounding said dies and embracing the same, a key connection between said dies and annulus, a tool carrier for receiving said assembled dies
25 and annulus, and means associated with said tool carrier and annulus for maintaining the annulus in fixed position therein, said last-mentioned means and key connection cooperating to insure fixed horizontal and vertical alignment
30 of the axes of the dies, said tool carrier with its assembled dies being adapted to be held in thrust engagement with an extrusion cylinder, and said annulus being adapted to seal upon said
35 cylinder.

JOHN E. GANOE.