

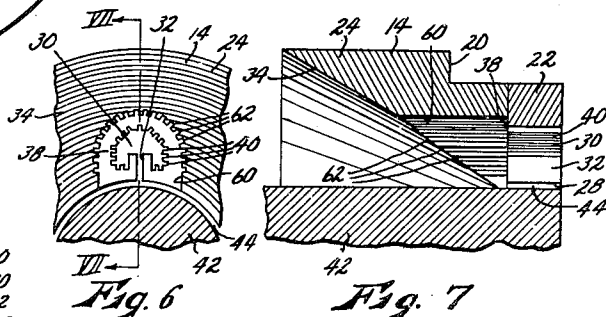
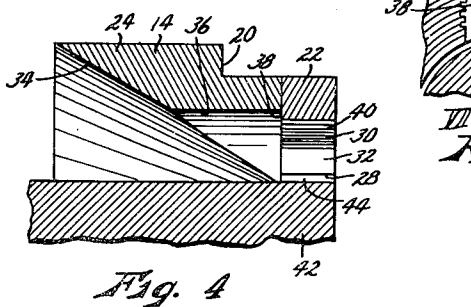
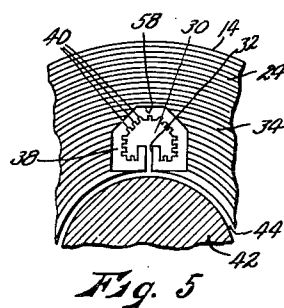
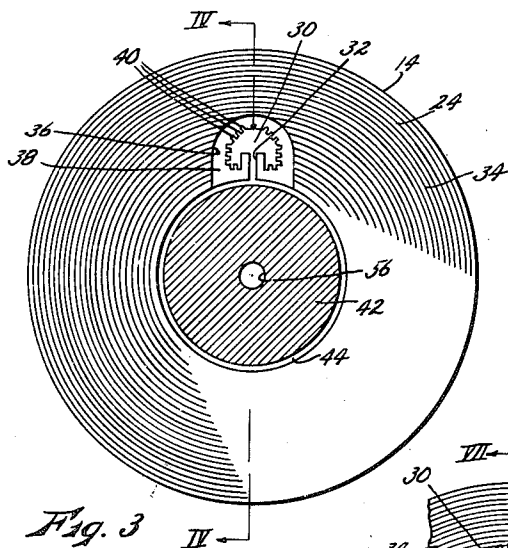
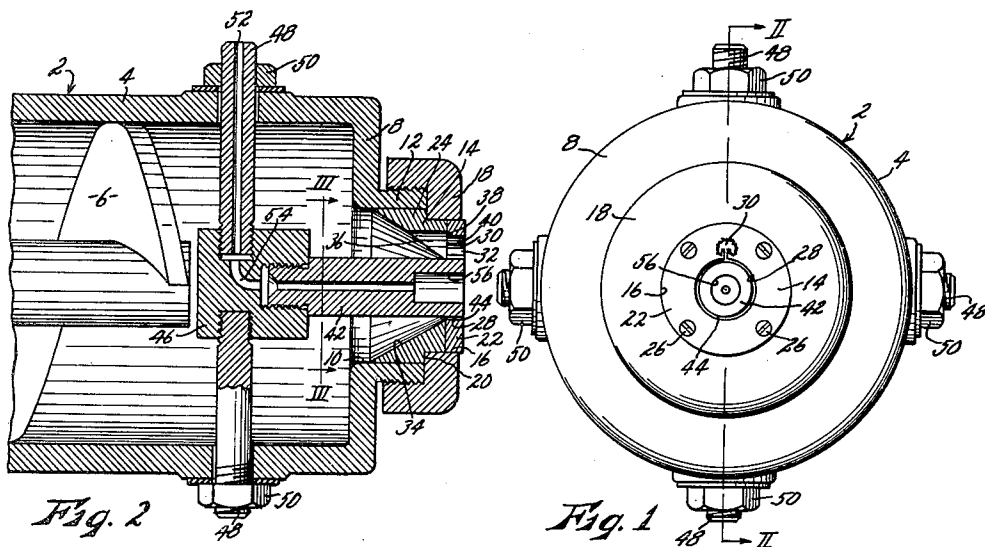
July 20, 1954

H. W. PATTERSON

2,683,897

EXTRUSION DIE

Filed Aug. 29, 1951



INVENTOR.
Herman W. Patterson
BY
Hamilton & Hamilton
Attorneys.

UNITED STATES PATENT OFFICE

2,683,897

EXTRUSION DIE

Herman W. Patterson, Overland Park, Kans.

Application August 29, 1951, Serial No. 244,203

1 Claim. (Cl. 18—14)

1

This invention relates to new and useful improvements in extrusion dies, having particular reference to a die for producing articles having both relatively thick and relatively thin wall sections, and is an improvement on the die disclosed in my copending application Serial No. 201,402, filed December 18, 1950.

The principal object of the present invention is the provision of a die for extruding articles having relatively thick and relatively thin wall sections, particularly of rubber but also of other materials and compositions. Heretofore, when extruding articles of this nature, great difficulty has been experienced in producing articles which are straight and of uniform cross-section. This difficulty is caused by the fact that the stock material, being plastic and more or less free-flowing as it passes through the die, passes through the relatively thick portions of the die orifice much more rapidly and easily, and at a lower pressure, than through the relatively thin portions of said orifice. This results in an extruded product which, due to the inequality of the thick and thin portions thereof, may be badly distorted or "scalloped." Particularly when working with rubber, the product may be so badly distorted as to resemble the convolutions of the human brain or intestines. Moreover, the rapid flow of the material in the thick portions of the die orifice causes a deficiency of material in the thin sections, resulting in thin, poorly compacted, perforate, and weak walls in the product.

My previous application contemplated principally the longitudinal grooving of the die walls adjacent the thick portions of the die orifice and increasing the axial length of the thick portion of the die orifice whereby to impose a frictional brake on the flow of material through that portion of the die, in order to equalize the pressure and flow rate in all portions of the orifice. The present invention contemplates principally changing the flow conditions at the entry to various portions of the die. Specifically, the flow passages leading to the thin portions of the orifice are taperingly reduced at a uniform rate, whereby a minimum of friction is imposed on the material passing therethrough, while the flow passage to the thick portion of the orifice is reduced abruptly at the entry face of the die by means of a right angled shoulder. This shoulder creates an uneven, turbulent flow of material as it enters the die, and effectually impedes the flow of material through the thick portion of the die orifice, with the result that the rate of flow therein may be equalized with that in the thin portions.

Other objects are extreme simplicity and economy of structure, efficiency and dependability of operation, adaptability for use in connection with dies of substantially any size or shape.

With these objects in view, as well as other

2

objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Fig. 1 is a front elevation of an extruding machine including a die embodying the present invention.

Fig. 2 is a fragmentary section taken on line II—II of Fig. 1, with parts left in elevation.

Fig. 3 is an enlarged section taken on line III—III of Fig. 2, showing only the die and core piece.

Fig. 4 is a fragmentary section taken on line IV—IV of Fig. 3.

Fig. 5 is a fragmentary view similar to Fig. 3, showing a die of slightly modified form.

Fig. 6 is a fragmentary view similar to Fig. 3, showing a second modified form of the die.

Fig. 7 is a fragmentary sectional view taken on line VII—VII of Fig. 6.

Like reference numerals apply to similar parts throughout the several views and the numeral 2 applies generally to a fragmentary showing of a representative extruding machine including a hollow cylinder 4 in which is axially disposed an auger 6. Said auger may be rotated axially by power means, not shown, whereby stock material introduced into the rearward portion of cylinder 4 is advanced through said cylinder toward the forward end thereof. The forward end wall 8 of the cylinder has a central aperture 10 formed therein about which is disposed an outwardly extending cylindrical flange 12 integral with wall 8. An externally cylindrical die 14 fits slidably in flange 12, and extends outwardly through an aperture 16 in a cap 18 which is internally threaded to engage external threads formed on flange 12. Said cap engages a shoulder 20 formed externally on die 14 to hold said die firmly in place against the outward pressure of the stock material thereagainst.

The specific formation of the die depends of course on the article to be produced. While it is intended that the present invention shall be applicable to produce any article having relatively thick and thin wall sections, the representative die shown is adapted to produce an article having a thin-wall cylindrical portion and a longitudinal heavy rib connected to the body portion by a radial neck. Die 14 comprises a flat circular die plate 22 and an externally cylindrical body member 24, said die plate and body member being rigidly secured together by screws 26, although it will be apparent that they could be formed integrally if so desired without departing from the spirit of the invention. A circular hole 28 corresponding to the outer diameter of the body portion of the extruded article is formed centrally in the die plate. An orifice 30 for producing the rib of the extruded article is formed through the die plate parallel to the axis of hole

28, and is connected with hole 28 by a slit 32 suitable for producing the neck of the extended article. Body member 24 has a conical bore 34 formed axially therethrough, the smaller forward end of said bore coinciding with hole 28 in the die plate. A passageway 36 is formed through said body member parallel to the axis thereof and coinciding with die plate aperture 30. Said passageway is larger in all transverse directions than aperture 30, whereby the inner face of the die plate forms a shoulder 38 about said aperture, as shown in Figs. 1, 3, and 4. The walls of the die plate encompassing aperture 30 thereof have a plurality of closely spaced parallel grooves 40 formed therein, said grooves being parallel to the axis of the die and extending entirely through the die plate.

A cylindrical core piece 42 is disposed axially within the die member 14, being of smaller diameter than hole 28 of the die plate, whereby to form a thin annular space 44 therebetween, said annular space constituting the orifice for producing the cylindrical body portion of the finished product. Core piece 42 extends axially into cylinder 4, and is threaded at its inner end into a block 45 disposed centrally within said cylinder. Said block is supported by a spider comprising four rods 48 which are threaded at their inner ends into the block and which extend radially outwardly therefrom through the wall of cylinder 4, being threaded at their outer ends to receive nuts 50, whereby the core piece may be positively and accurately positioned within the die. One of rods 48 has an axial bore 52 formed therethrough, said bore communicating by means of a passage 54 formed in block 46 with a bore 56 formed axially through core piece 42 and opening at the outer end thereof. Passageway 52, 54, 56 provides a means whereby the internal surface of the finished product may be sprayed with powder or the like as it leaves the die, in order to facilitate the subsequent positioning of the product over drying and curing forms and the like.

As the stock material is forced through the die by auger 6, that portion thereof which eventually will pass through the thin annular portion 44 of the die orifice passes through the smooth conical portion of the die body 24, whereby the area thereof, is gradually and uniformly reduced to the final die dimensions with a minimum of friction. On the other hand, that portion of the material which eventually will pass through die orifice 30 passes through passageway 36 of the die body, and the area thereof is suddenly and sharply reduced by shoulder 38. This sudden reduction of area creates a degree of internal friction and turbulence in the material as it enters die orifice 30. By varying the width and extent of shoulder 38 experimentally, a condition may be reached wherein the flow pressure and extruding speed will be substantially equalized in all portions of the die orifice, and the extruded product will be straight, free from distortions, and of uniform texture. The grooves 40 in the die orifice 30 also tend to impede the material flow through said orifice, since they substantially increase the peripheral surface area of said orifice without substantially increasing the cross-sectional area thereof, and hence increase the frictional drag on the material passing therethrough. This frictional drag may of course be altered by changing the number, size, and disposition of the grooves. While under some

circumstances said grooves might alone provide all the necessary drag, their chief purpose in the present invention is to supplement the flow restriction provided by shoulder 38, and to provide a convenient method for changing the total frictional drag.

The modification shown in Fig. 5 differs from that shown in Figs. 3 and 4 only in that passageway 58, which corresponds to passageway 36 in Fig. 3 is shaped to conform to the shape of die plate orifice 30, each portion of the wall thereof being parallel to the adjacent portion of the wall of orifice 30. This provides that shoulder 38 is of substantially uniform width around orifice 30. Particularly when conditions call for a rather narrow shoulder, this arrangement has been found to produce a more uniform flow rate over the area of orifice 30.

The modification shown in Figs. 6 and 7 differs from that shown in Figs. 3 and 4 in that the wall of die body 24 encompassing passageway 60, which corresponds to passageway 36 in Figs. 3 and 4, is provided with a plurality of closely spaced grooves 62 extending the full length of said passageway parallel to the axis of the die, in the same manner in which orifice 30 of the die plate is grooved. This arrangement provides a still greater frictional drag on the material entering the thick portion of the die orifice, and has been found useful when for example, extruding a composition of relatively high fluidity.

While I have shown and described specific embodiments of my invention it is apparent that minor changes of structure and operation could be made without departing from the scope and spirit of the invention as defined in the appended claim.

What I claim as new and desire to protect by Letters Patent is:

A die for extruding an article having a relatively thick and a relatively thin wall section, said die comprising a die plate of uniform thickness having an orifice formed therethrough conforming to the shape of the article to be extruded, the walls of said die plate encompassing said orifice being parallel to the axis of the die, and a body portion rigidly attached to said die plate and having a passageway formed therethrough communicating with the orifice of said die plate, said passageway being taperingly reduced toward said die plate, the peripheral edge of said passageway adjacent said die plate coinciding with the edges of those portions of said die orifice adapted to produce said thin wall section, but being spaced transversely outwardly from the edges of that portion of the die orifice adapted to produce said thick wall section, whereby a shoulder is formed about the last named portion of the die orifice, the die plate walls adjacent said thick wall section having a plurality of grooves found therein parallel to the axis of the die.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
670,611	Hoffmann	Mar. 26, 1901
747,377	Coldren	Dec. 22, 1903
1,133,892	Swartz	Mar. 30, 1915
1,443,324	McGovern	Jan. 23, 1923
1,914,689	Humphrey	June 20, 1933
2,446,493	Silvia et al.	Aug. 3, 1948