Feb. 17, 1953

H. T. TORNBERG

2,628,386

WEB EXTRUSION DIE

Filed April 29, 1952

2 SHEETS—SHEET 1

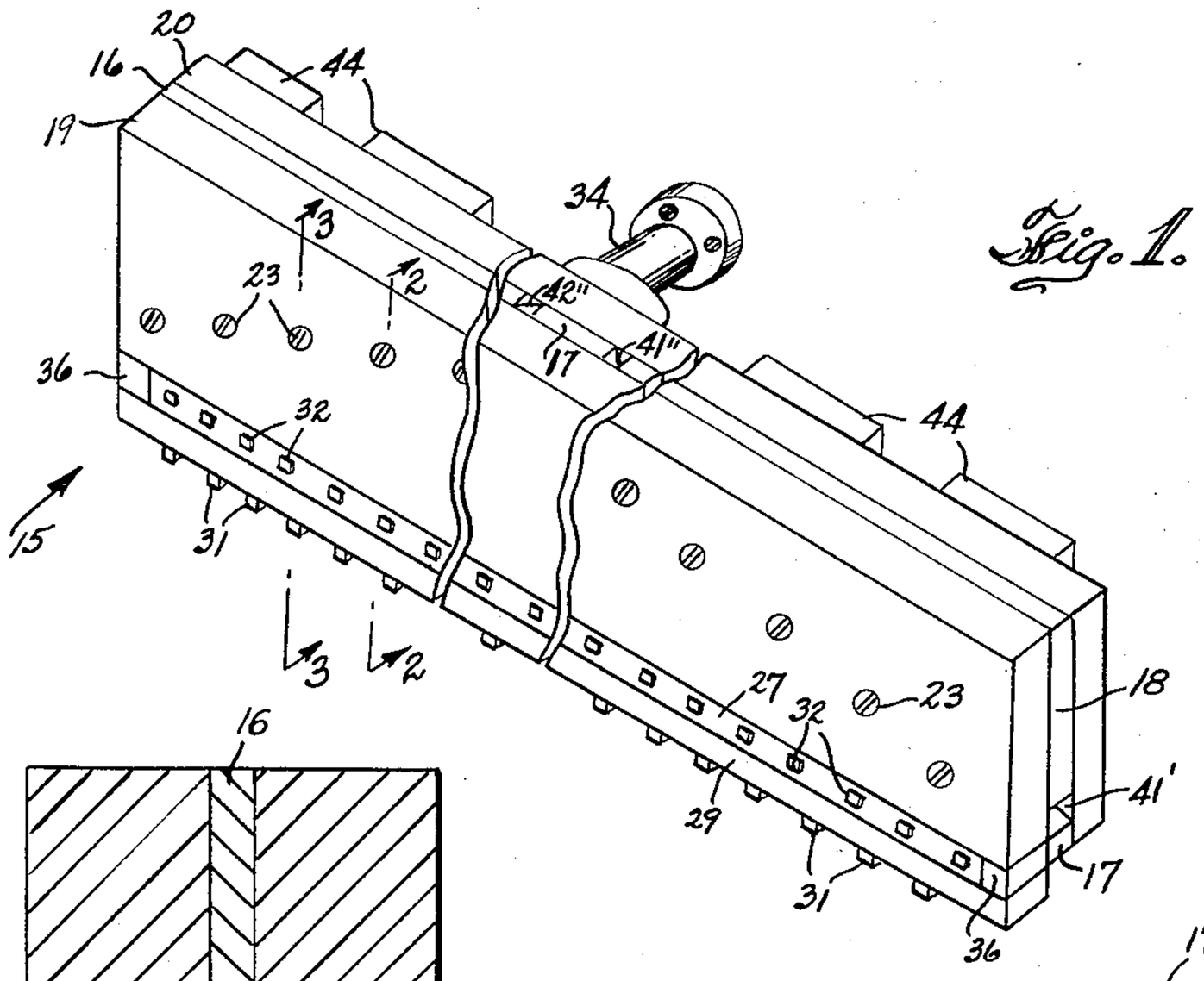

Fig. 1.

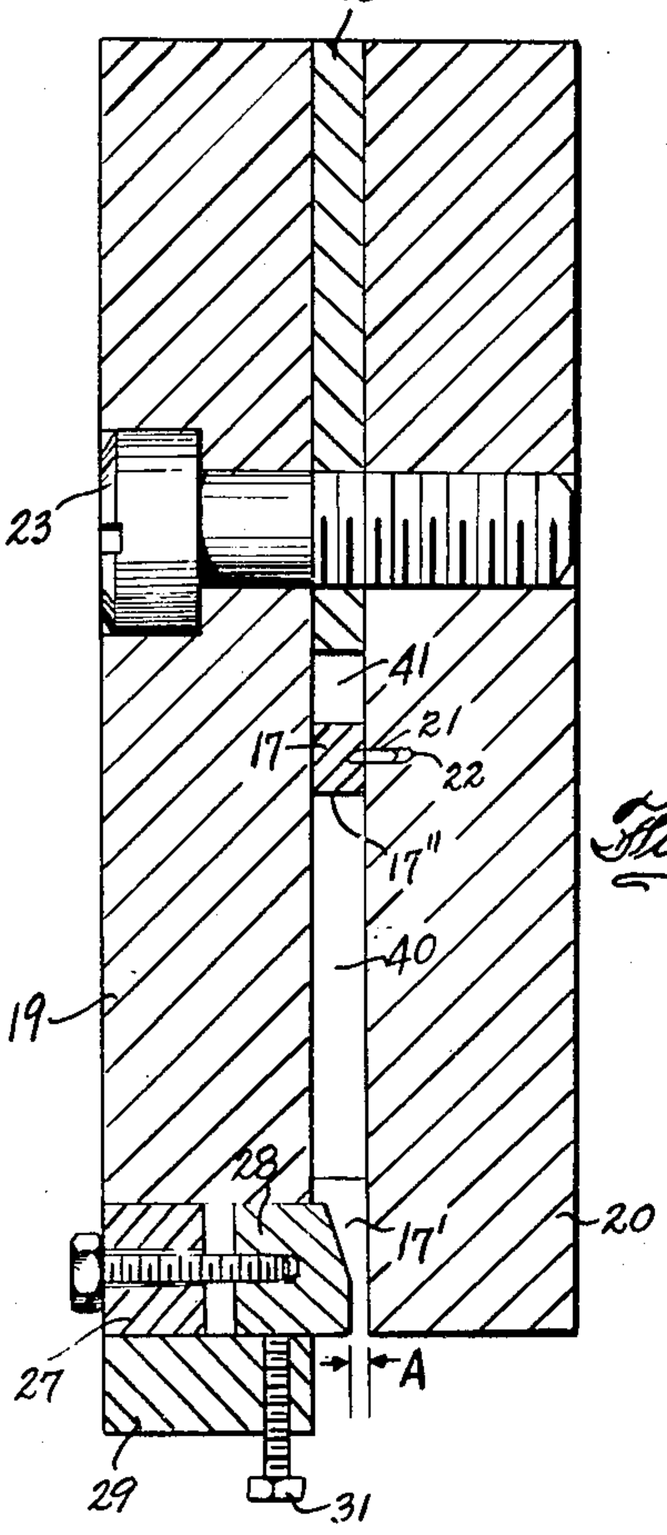

Fig. 2.

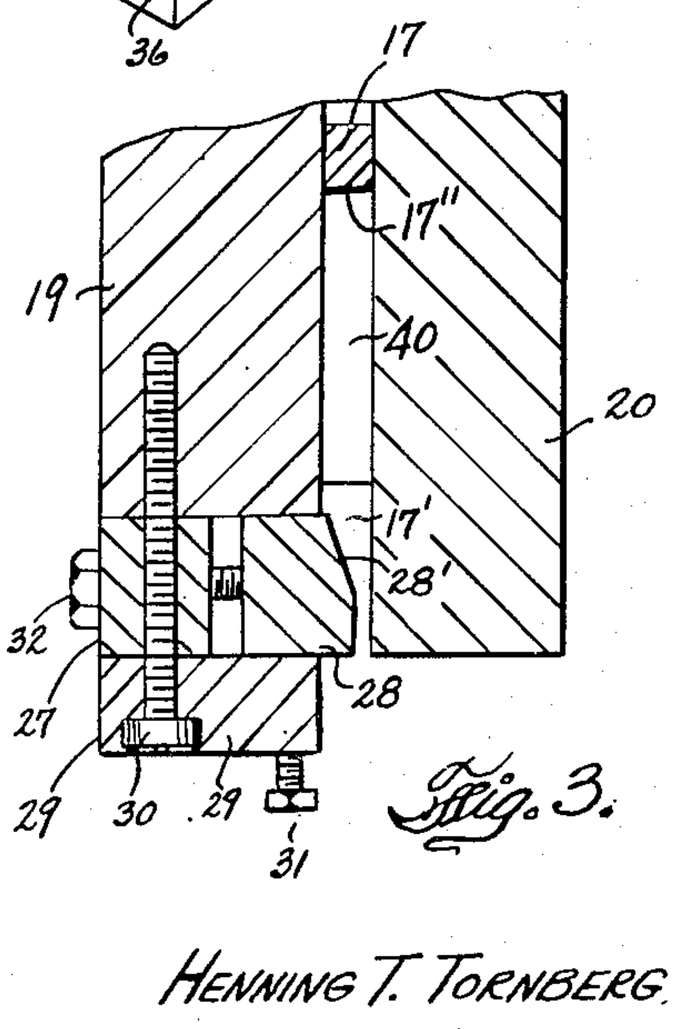

Fig. 3.

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Feb. 17, 1953 H. T. TORNBERG 2,628,386

WEB EXTRUSION DIE

Filed April 29, 1952 2 SHEETS—SHEET 2

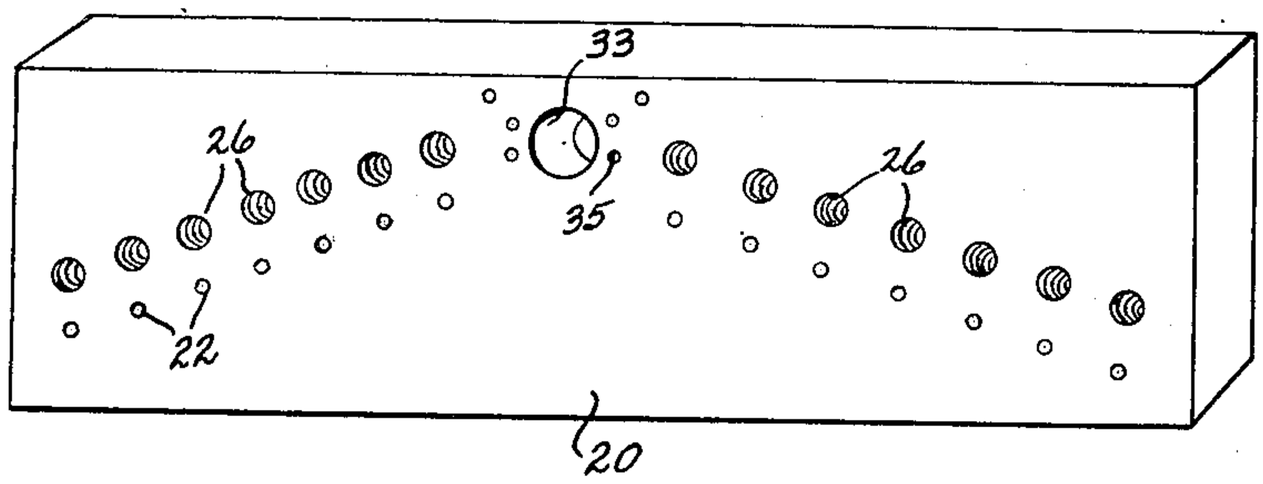

Fig. 4.

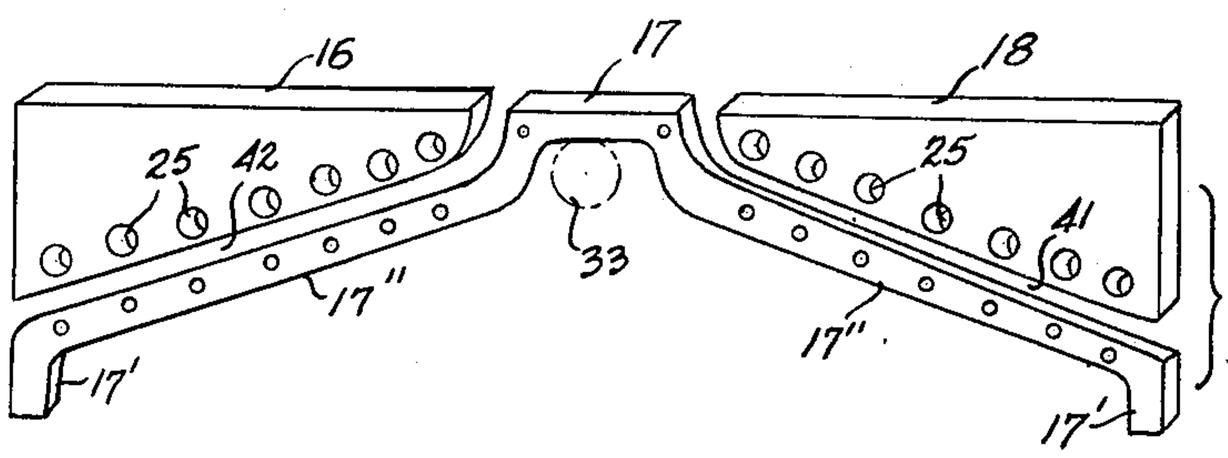

Fig. 5.

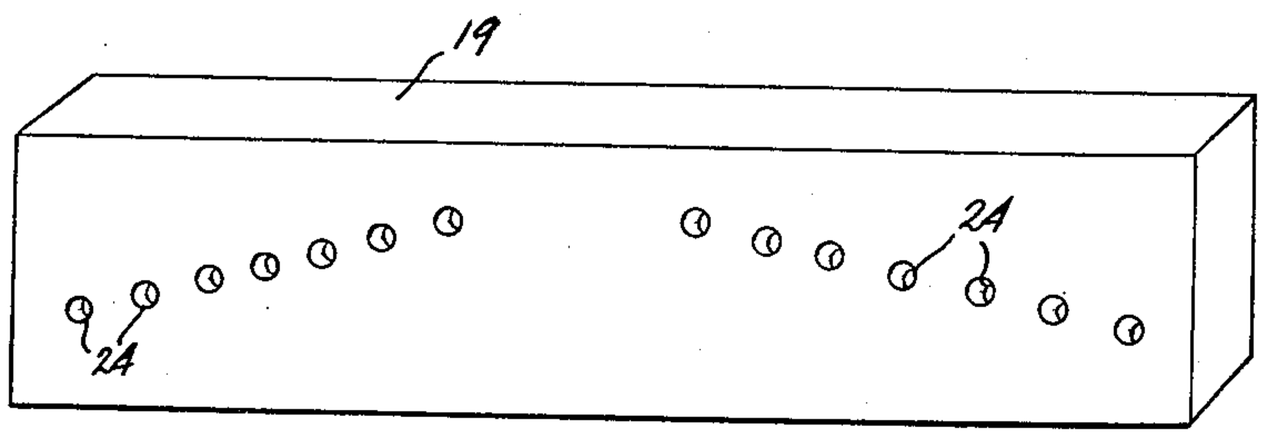

Fig. 6.

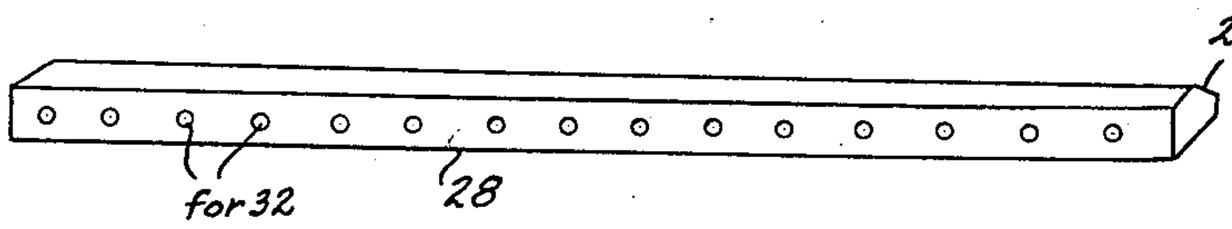

Fig. 7.

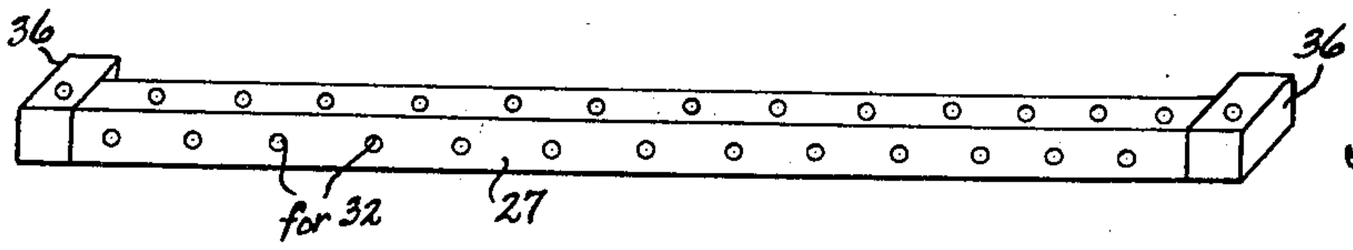

Fig. 8.

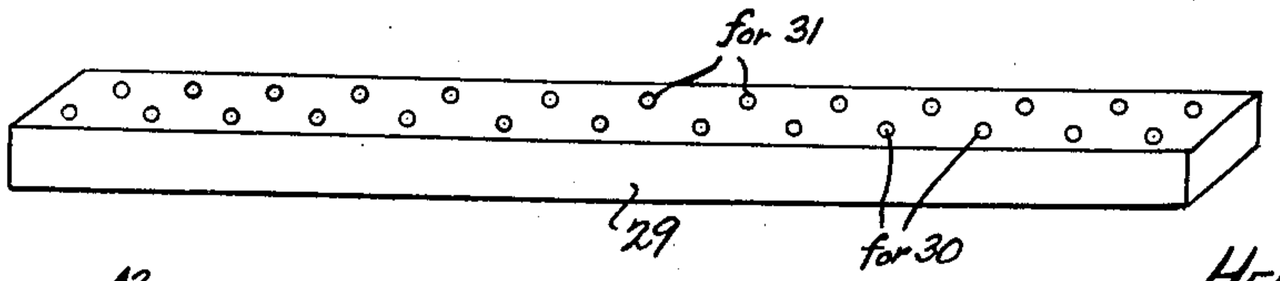

Fig. 9.

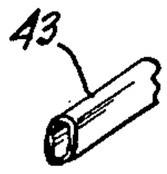

Fig. 10

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UNITED STATES PATENT OFFICE

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WEB EXTRUSION DIE

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Application April 29, 1952, Serial No. 284,991

6 Claims. (Cl. 18—12)

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The present invention relates to plastic extruding machinery and more particularly to a die construction for the extrusion of a web.

The die is an elongated structure having a passage therethrough for the plasticized material fed to it by the extruder. The entrance to such passage is a central opening in a wall of the die and the exit of said passage is a long and narrow discharge orifice. In practice, at least two opposite walls of this passage are divergent from the entrance opening so that the material in its flow through the die, spreads to web width which is the length of the discharge orifice. The latter being along a straight line, the distance for the stuff to travel through the die increases as the point of discharge is nearer the ends of the discharge orifice. Provision is made to adjust for web thickness and adjustment is also provided to attain uniformity of web thickness.

The flow of plasticized material through the central portion of the discharge orifice and its adjustment presents no difficulty, but the stuff flowing along the divergent die passage walls, due to the longer interval it remains in the die, too often becomes burnt, adheres to said walls, clogs the passage at such regions and thereby causes the web edges to be irregular. This especially occurs when the web is of film thickness.

It is therefore one of the objects of this invention to provide a die of the type set forth, of novel and improved construction which avoids such objectionable condition by affording properly positioned and effective cooling ducts for the control of temperature along said divergent walls of the die passage.

Another object hereof is to provide a die of the character set forth, of novel and improved construction, made up of plates and bars, some of which when changed, adapt the die for the extrusion of webs of different widths, selectively.

A further object hereof is to provide a novel, simple and improved die of the kind described, which is relatively cheap to manufacture, easy to manipulate to accomplish various adjustments and replacements, and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

In the accompanying drawings forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

Fig. 1 is a perspective view of an extrusion die embodying the teachings of this invention.

Fig. 2 is a section taken at lines 2—2 in Fig. 1.

Fig. 3 is a fragmentary section taken at lines 3—3 in Fig. 1.

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Fig. 4 is a perspective view of the back plate of said die structure.

Fig. 5 is a perspective view of the spacer parts which lie between the front and back plates; such parts being shown in their relative position in the assembly.

Fig. 6 is a perspective view of the front plate.

Fig. 7 is a perspective view of the bar which is adjustably positionable to set the thickness of web to be extruded.

Fig. 8 is a perspective view of a bar fixed to the front plate when mounted. This bar carries certain adjustment screws shown in the assembly for shifting the bar shown in Fig. 7.

Fig. 9 is a perspective view of a bar which serves as a shelf for holding the bar of Fig. 7, and is used for having a series of set screws to hold said bar of Fig. 7 in a set position.

Fig. 10 shows a fragment of flattened tubing which may be used as a duct for the passage of cooling liquids, as will be explained.

In the drawings, the die indicated generally by the numeral 15, comprises a spacer made up of three separate parts 16, 17, 18, between a front plate 19 and a back plate 20. The spacer part 17 may have pins 21, spaced therealong and extending laterally from one face thereof to be removably received in the socket holes 22 in the back plate. Bolts 23 hold all of said components in assembly. These bolts are through the counterbored holes 24 in the front plate 18, the holes 25 in the spacer parts 16 and 18, and the threaded holes 26 in the back plate 20. Lengthwise along the underside of the front plate 18 and in contact therewith, are the two bars 27 and 28 which are of equal height; the latter being free to slide on a shelf provided by the bar 29 beneath it. The bars 27 and 29 are secured to the front plate by means of the bolts 30. The shelf bar 29 has a series of set screws 31 therealong to secure the laterally adjustable bar 28, which is always spaced from the back plate 20, to form the discharge orifice A in width. The heads of these set screws 31 are of course below the shelf bar in which they are threaded. The bar 27 has a series of adjustment screws 32, respectively positioned between the screws 30. The heads of said adjustment screws 32 are at the front of the die. Alternate adjustment screws 32 are through clear holes in the bar 27 and in threaded sockets in the adjustable bar 28. The remainder of said adjustment screws 32 are in threaded holes in the bar 27 and in clear sockets in the adjustable bar 28. Said bar 28 having some resiliency, slight variance of distance A can be effected at the respective regions of said adjustment screws 32.

The set screws 31 are in the planes respectively of the adjustment screws 32.

The spacer part 17 is made very narrow and is substantially V-shaped in form. Its arms extend to the sides of the die and their free ends are formed to extend parallel; the distance between such parallel portions 17', determining the width of the web to be extruded. At the vertex between such arms, the back plate 20 has an opening 33 therethrough which serves as the entrance to the die's passage 40 formed by the front and back plates 19, 20 as one pair of opposite walls, and the divergent walls 17'' as the other pair of opposite walls. Said entrance opening 33 is connected to the extruder's discharge port by means for instance of a flanged pipe 34 which is secured to the back plate 20 by means of bolts through the threaded holes 35.

The portions 17' of the spacer part 17, extend to the bottom edge of the back plate 20. The adjustable blade or bar 28, just fits between said portions 17' and between the rearward end blocks 36 on the fixed front bar 27. The rear surfaces of these end blocks, contact the spacer portions 17' respectively; the bottom surface of the back plate 20, being in the plane of the bottom surface of the adjustable bar 28.

The die is adaptable for the extrusion of webs of different widths respectively, by having available replacements for the parts 17, 28, 27 and 36, of appropriate dimension.

The spacer parts 16 and 18 are identical and have the spacer part 17 between them and are spaced therefrom in order to form in the assembly, the ducts 41 and 42 through which air or other cooling media may be forced into duct entrances 41' at the sides of the die structure 15, leaving at the exits 41'' and 42''. If desired, flattened tubing of the type 43 shown in Fig. 10, may be placed in each of said ducts, with its ends extending from the die structure at the mentioned entrances and exits for use as a passage for the cooling agent. Or else, when such tubing is directly on the arms of the spacer 17, spacer parts 16 and 18 may be omitted. In any event, the distance the cooling agent works through to effect the plasticized materials in the space between the arms of the spacer member 17, should be indeed very short in comparison to the long length of said arms. The numerals 44 denote electric heater units carried on the die structure as is common practice.

The die illustrated is easily made at a relatively cheap cost out of standard bar and plate stock. Besides drilling and tapping, no other machining operations are required except to bevel the edge 28' of the adjustable bar 28.

The control of the temperature along the surfaces 17'', affords proper and unspoiled web extrusion.

This invention is capable of various forms and applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiment shown herein shall be deemed illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

I claim:

1. A web extrusion die comprising a pair of opposite plate components, a V-shaped spacer component positioned between and in contact with each of said plates along a V-shaped lane respectively; one of said components having an opening at the vertex region of said V-shaped spacer for the introduction of a constant flow of plasticized material between the arms of said spacer and duct means along the arms of said spacer for the passage of a cooling agent directly lengthwise along the arms of said spacer; said duct means having openings outside the space between the arms of said spacer, for the entrance and exit of such cooling agent; the length of each of the arms of the spacer being comparatively large in relation to substantially all distances between the passageway for the cooling agent and the space between the said arms for flowing plasticized material.

2. A web extrusion die as defined in claim 1, wherein said openings for the cooling agent are near both ends of each of the arms of said V-shaped spacer.

3. A web extrusion die as defined in claim 1, wherein the means forming the duct comprise spacer means mounted between the plates outside the space between the arms of the V-shaped spacer, said arms and plates.

4. A web extrusion die as defined in claim 1, wherein the duct is afforded by tube structure positioned along and in contact with each of the arms of the V-shaped spacer.

5. A web extrusion die as defined in claim 1, wherein the inner opposite surfaces of the remote free end portions of the arms of the V-shaped spacer are parallel; the distance between said surfaces at said free end portions, determining the width of the web to be extruded from the die; said free end portions of the arms being in contact with one of the plates and extending beyond the second plate in the plane of the spacer; said second plate extending from the vertex region of the said V-shaped spacer a lesser distance than the first plate, a bar having some resilient quality extending between and in contact with said opposite parallel surfaces and supported in contact with the edge of the second plate toward which the arms of said spacer diverge; said bar being spaced from the first plate and capable of lateral movement between said free end portions and screw means carried on the second plate at a series of points along said bar, to adjust the space between said bar and the first plate for determining the thickness of the web to be extruded from the die.

6. A web extrusion die as defined in claim 5, wherein the plates, spacer and bar are separable whereby different spacers and corresponding bars may be selectively associated with the plates and means to detachably hold said plates and spacer in assembly.

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