June 1, 1965 J. B. NEWMAN, JR 3,186,033

ADJUSTABLE AIR RING

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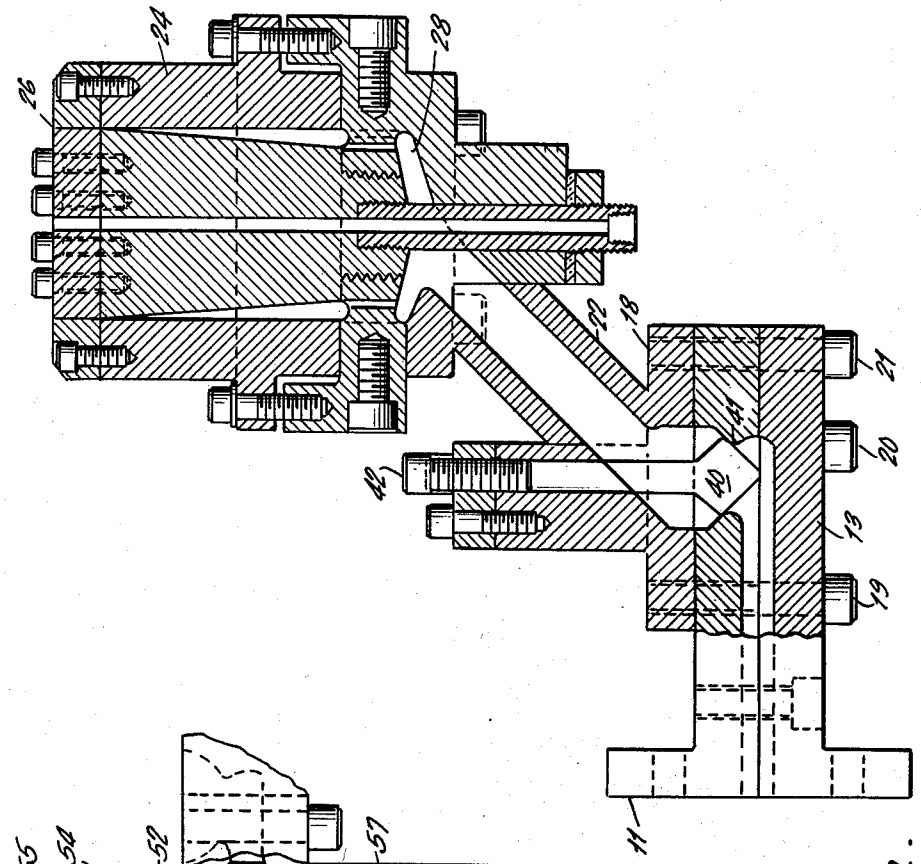


FIG. 1.

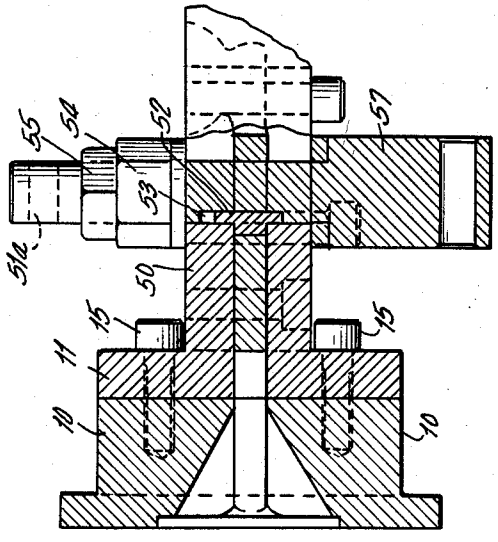


FIG. 4.

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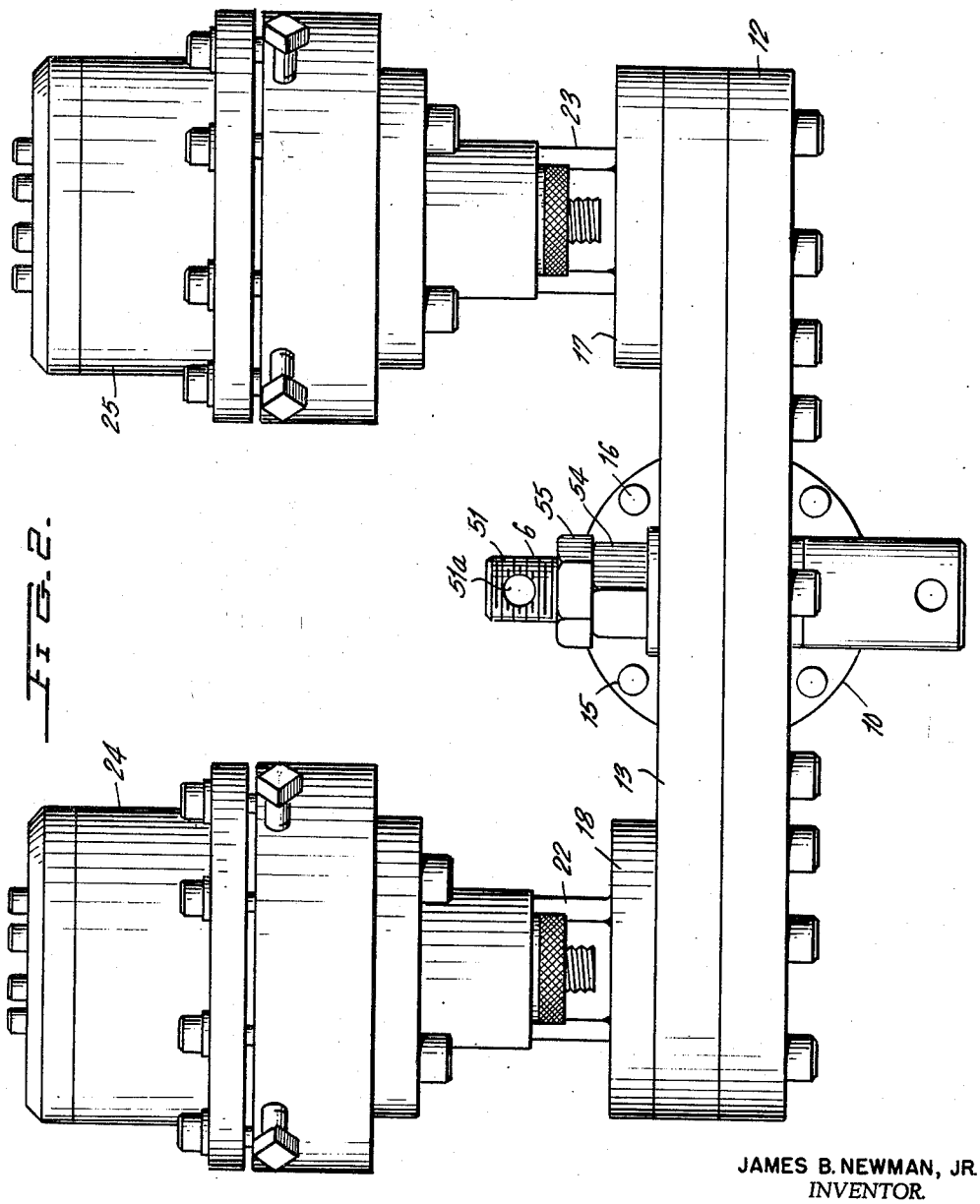


FIG. 2.

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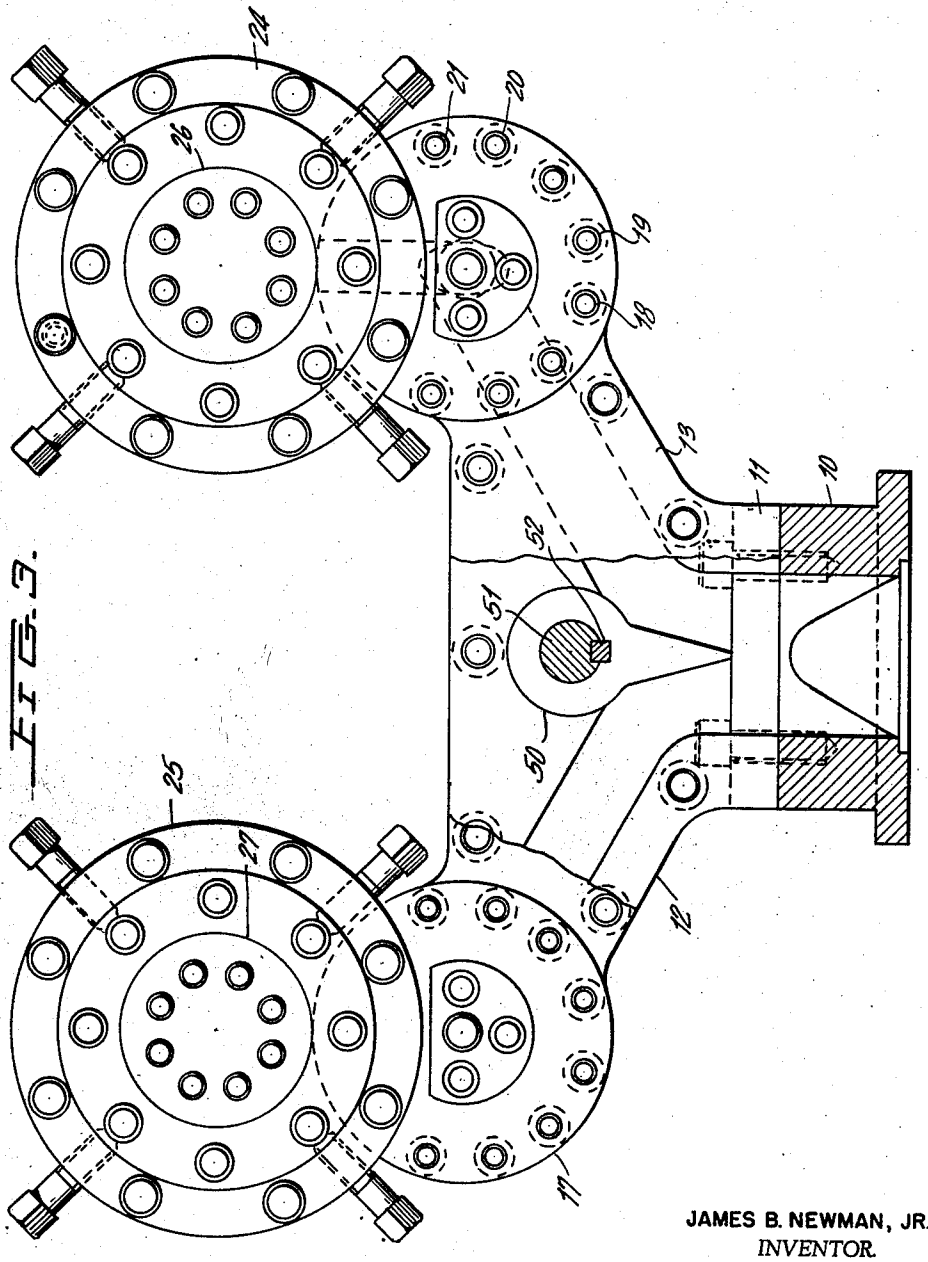


FIG. 3.

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FIG. 6.

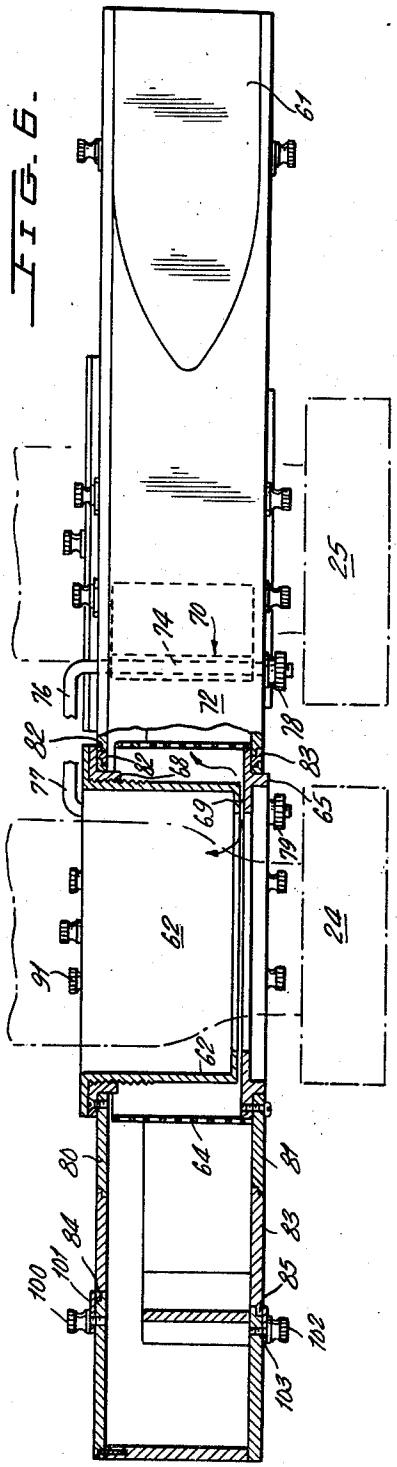
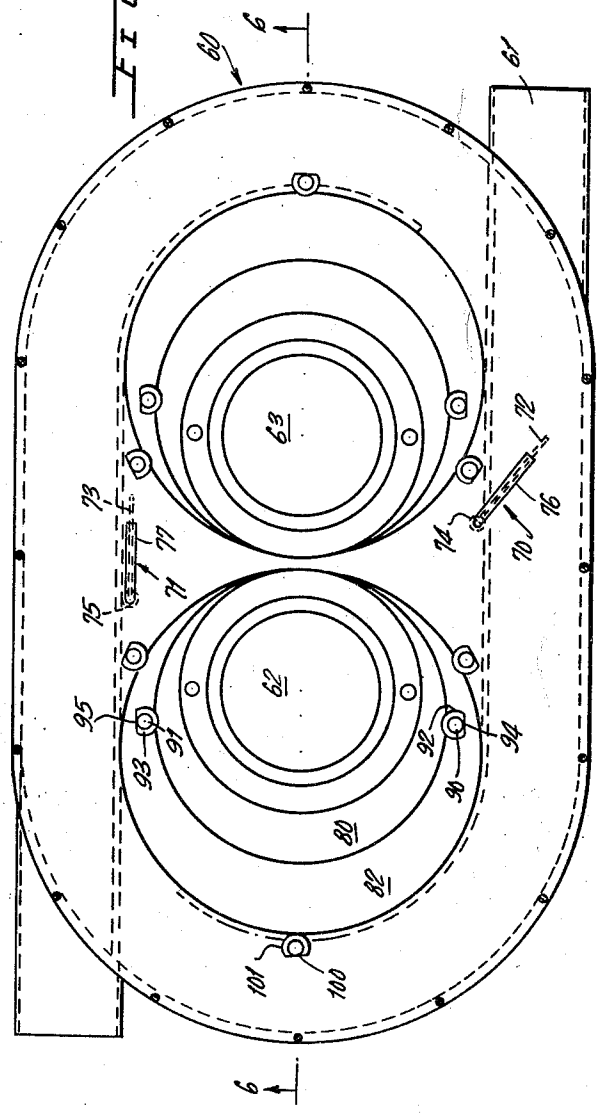


FIG. 5.



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United States Patent Office 3,186,033 Patented June 1, 1965

3,186,033

ADJUSTABLE AIR RING

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Filed Oct. 23, 1962, Ser. No. 232,369
6 Claims. (Cl. 18—14)

This invention relates to a novel air ring structure for cooling extruded tubes of thermoplastic films, and more specifically relates to a dual air ring structure wherein two air rings having adjustable center line distances are provided for cooperation with a dual extrusion die.

It is common practice in the extrusion of tubes of thermoplastic film to apply a concentric flow of air to the outer surface of the tube being extruded to cool and freeze the tube.

In copending application Serial No. 232,414, filed October 23, 1962 entitled "Dual Extrusion Die," there is illustrated a novel dual die structure which may be mounted on a common extruder wherein two parallel tubes are simultaneously extruded and move parallel to one another along a common line of subsequent treating and operating positions.

The novel dual adjustable air ring of the present invention provides, in a single structure, first and second radially directed sources of air which will play on the outer surfaces of the two parallel tubes of film being extruded from such a dual die structure. Clearly, where a die is provided with more than two extruding dies, the air ring of the invention can be provided with more than two openings for receiving the respective tubular films.

When the dual die is utilized to extrude different diameters of film, the die centers must be changed. Accordingly, the placement of the air rings for the two tubes must be similarly changed.

The present invention provides a novel eccentric support for the air ring outlets, whereupon rotation of a first and second eccentric support can adjust the two air ring outlets over a large number of positions within a plane. Therefore, the novel air ring can be adjusted to receive any center-to-center distance of a dual die to avoid the need for changing the complete air ring structure when different diameter tubes are drawn.

Accordingly, a primary object of this invention is to provide a novel air ring structure for a dual die arrangement.

Another object of this invention is to provide a novel air ring structure wherein the air ring position is adjustable to place its center at any point within a given plane.

Another object of this invention is to provide a novel air ring structure in which the air ring is eccentrically carried by two concentric rotatable members, whereby the center line of the air ring outlet can be adjustably positioned at any point within a given plane.

Another object of this invention is to provide a novel dual air ring construction in which the air rings can be adjustably positioned with respect to one another to accommodate the center-to-center spacing of two parallel tubes being drawn.

These and other objects of this invention will become apparent from the following description when taken in connection with the drawings, in which:

FIGURE 1 shows a side cross-sectional view through a die head which could be used in connection with one of the air rings of the invention.

FIGURE 2 shows a side plan view of a dual die arrangement.

FIGURE 3 shows a top view partially in cross-section of FIGURE 2.

FIGURE 4 is a cross-sectional view across the lines 4—4 of FIGURE 3.

FIGURE 5 is a top plan view of the novel dual adjustable air ring of the invention.

FIGURE 6 is a side cross-sectional view of the air ring of FIGURE 5.

Referring now to the figures, there is illustrated the novel dual extrusion die as being carried from a standard die base mount 10 which has appropriate flange means for permitting its connection to a standard type of extruder which provides a source of molten resin.

A feed manifold 11 which has extending manifold halves 12 and 13 respectively is connected to die base mount 10 by appropriate bolt means such as the bolts 15 and 16 shown in FIGURES 2 and 4 which pass through a ring of openings in the feed manifold base and are threaded into registering threaded openings in the die base 10.

Manifold portions 12 and 13 then carry the mounting plates 17 and 18 respectively at their outer ends by a series of bolts which pass through the end of the manifold halves and into their respective mounting plates. By way of example, the mounting plate 18 is connected to manifold half 13 by means of bolts such as bolts 19, 20 and 21. Each of the mounting plates 17 and 18 then have a conduit extending outwardly therefrom such as conduit 22 which is best shown in FIGURES 2 and 4 for the conduit extending from mounting plate 18 and conduit 23 which extends from mounting plate 17, as best shown in FIGURE 2.

The conduits 22 and 23 then communicate with and support extrusion dies 24 and 25 respectively which are illustrated to be of the type which has been fully described in copending application, Serial No. 232,414, filed October 23, 1962. Details of the die structure can be had from the aforementioned application. For purposes of the present invention, it is necessary only to understand that the extrusion dies 24 and 25 have extrusion orifices 26 and 27 respectively where, as best shown in FIGURE 1 for the case of die 24, the orifice 27 extends downwardly to a chamber 28 which communicates with the interior of conduit 22.

The interior of conduit 22, as is further shown in FIGURE 1, communicates with the interior of manifold section 13, while, as shown in FIGURE 3, the interior of manifold section 13 as well as the interior of manifold section 12 communicate with the interior of the die base mount 10 which is fed with molten plastic from an appropriate extruder.

Accordingly, it is clear that the plastic melt can be transmitted from the extruder to the orifices 26 and 27 of dies 24 and 25 where each of the individual dies operates to extrude its own respective tube of plastic film. The two tubes of film extruded by these two dies may then be carried in parallel through the common equipment of the line which would normally be used for a single tube of larger diameter film which would have normally been extruded by a single extrusion die secured to the die base mount 10. Thus, where smaller diameter films can be extruded to permit the parallel operation provided by the present invention, it will be apparent that the production of a single system can be considerably increased.

In order to control the distance between the two parallel films being extruded, the mounting plates 27 and 28 can be rotated by removing their retaining bolts and rotating the assembly to the next bolt position, whereby the center spacing between dies 24 and 25 can be changed to the desired amount for the two tubes being drawn. It will be obvious that dies 24 and 25 can extrude different

diameter tubes, whereby the structure lends itself to great manufacturing flexibility.

Each of the conduits 22 and 23 which supply dies 24 and 25 respectively are provided with respective control valves such as valve 40 which is adjustably positioned with respect to ring seat 41 by screws 42. Details of this construction of this type of valve which controls the flow to a single die is more fully set forth in copending application, Serial No. 219,469, filed August 27, 1962 in the name of Corbett, entitled Balanced Flow Die, and assigned to the assignee of the instant invention.

A further and novel valve structure is provided in the present invention for appropriately dividing the flow of molten resin into manifold sections 12 and 13. More specifically, a valve member 50 is secured to rotatable pin 51 by means of a T-shaped key 52 (FIGURE 4) in keyway 53 in pin 51. The pin 51 is rotatably received by the manifold frame 13 with nuts 54 and 55 being threadably received by pin 51 to secure it, and thus valve 50 in a predetermined adjusted position. The end of pin 51 then has a tool-receiving opening 51*a* to permit adjustment of the position of valve 50.

In operation, it will be apparent that the valve member 50 can be rotated about its axis to divide the flow between manifolds 12 and 13 in a highly accurate, controlled manner.

In order to cool the tube being extruded from die heads 24 and 25, common practice is the utilization of an air ring which directs a flow of cooling air toward the outer surfaces of the tube.

A novel air ring which has particular useful application in connection with a dual die construction of the type described hereinbefore is set forth in FIGURES 5 and 6.

Referring now to FIGURES 5 and 6, the ring is comprised of a welded chamber 60 which has an input conduit 61 communicating therewith which can be connected to an appropriate compressor for forcing aid into chamber 60.

A first and second air ring 62 and 63 are carried in chamber 60 and receive the tubes extruded from dies 24 and 25 respectively, as illustrated in FIGURE 6. It will be noted that chamber 60 will be supported in any desired manner with respect to dies 24 and 25.

Each of the air rings 62 and 63 are formed of a circular external screen 64 shown for air ring 62 in FIGURE 6, which is secured to lower disc 65. A cylinder 66 having a lower opening 67 is then threadably received by disc 68 which is secured to the upper surface of chamber 60 in any desired manner.

It will now be observed that air entering conduit 61 will flow through screen 64 which serves to distribute the air around the periphery of the screen so that the air will enter the gap 69, as indicated by the arrows, between the lower surface of member 66 and the upper surface of disc 65 in a distributed manner. The air will then flow upwardly along the surface of the tube being drawn from die 24 to cool the tube. Clearly, the air ring 63 is constructed in a manner identical to that described for air ring 62.

In order to distribute the air between the rings 62 and 63 in a controlled manner, two control vanes 70 and 71 are placed, as illustrated in FIGURE 5. Each of vanes 70 and 71 are provided with extending butterflies 72 and 73 respectively which are pivotally mounted on shafts 74 and 75, respectively. The shafts 74 and 75 have operating handles 76 and 77 respectively which extend beyond the housing 60 to be externally operable.

The lower portion of shafts 74 and 75 have threaded ends which receive fastening nuts 78 and 79 respectively which lock the shafts in position after an appropriate adjustment has been made.

The vane 70, when in the position shown, will divert air coming from conduit 61 toward the air ring 63. In a similar manner, the valve 71 can be adjusted to provide an appropriate pressure drop to divert more or less air into ring 62. It will be clear that by apppropriate adjustment of valves 70 and 71 any desired distribution of pressure for rings 62 and 63 can be achieved.

Returning now to the specific construction of the manner in which either of the air rings are adjustable, it will be seen that the air ring 62 is carried in circular upper and lower plates 80 and 81 respectively which are received by disc-shaped upper and lower plates 82 and 83 respectively in a tongue and groove manner.

The upper and lower disc-shaped plates 82 and 83 are similarly received in the main upper surface of housing 60 in the tongue and groove connections 84 and 85 respectively.

As best shown in FIGURE 5, plates 80 and 81 can be secured in position with respect to plates 82 and 83 by means of a series of lock screws and washers such as screws 90 and 91 having washers 92 and 93 respectively. When the screws 90 and 91 are tightened, they operate to secure the tongue and groove connections between plate 80 and 82 so that the plate 80 becomes non-rotatable with respect to plate 82, while similar lock screw arrangements may be provided for the lower plates 81 and 83. It will be observed that washers 92 and 93 have flat portions 94 and 95 respectively to permit the simple withdrawal of plate 80 and the air ring 62 without requiring removal of screws 90 and 91.

A similar lock screw arrangement is provided for securing the plate 82 with respect to the main housing. By way of example, a lockscrew 100 having washer 101 is operable to secure disc 82 to the main surface, as best illustrated in FIGURE 6, while a similar screw 102 and washer 103 secure the bottom disc 83 to the bottom of chamber 60. It will be observed that all of the lock screws are constructed as illustrated for lock screws 100 and 102.

It will now be clearly understood that when lock screws 90 and 91 are loosened, and the similar lower lock screws are loosened, the plate 80 can be rotated within disc 82. Since air ring 62 is eccentrically located with respect to plate 80, the center of air ring 62 can be placed at any point around the eccentric circle through which it may move.

The disc 82 is similarly rotatable so that it, too, can locate the center of air ring 62 at any point on its eccentric circle. By appropriately coordinating the rotation of plate 80 and disc 82, it will be apparent that the center of air ring 62 can be located at any point within some predetermined area. Accordingly, the center-to-center distance of air rings 62 and 63 can be modified in accordance with the invention so as to accommodate the center-to-center spacing of two tubes which are to be received by the air rings.

While it is sufficient for many purposes to have only one of the air rings such as air ring 62 adjustable, as illustrated, greater flexibility can be obtained if both air rings 62 and 63 are adjustable. Accordingly, FIGURES 5 and 6 illustrate the air ring 63 as being contained within two eccentric members so as to be adjustable in a manner identical to that described for air ring 62.

While the present invention has described the use of an adjustable air ring primarily for reception of two or more extrusions, it will be further noted that the broad concept of the invention has utility for single air ring arrangements which receive single thermoplastic extrusions. That is to say, at the present time, the air ring used for cooling an extruded film or tube is adjusted by appropriately locating the air ring during mounting of the air ring. In accordance with the invention, however, the air ring need only be approximately located during its main mounting with the accurate air ring position being adjusted at a later time by appropriate control of the two eccentrics which mount the air ring.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore,

that the scope of this invention be limited not by the specific disclosure herein but only by the appended claims.

What is claimed is:

1. An air ring for cooling an extruded tube of plastic film comprising a circular outlet orifice ring, a first support ring, a second support ring, and a frame; said orifice ring, said first support ring, and said second support ring being concentrically disposed with respect to one another; said orifice ring being rotatably mounted in said first support ring; the axis of said orifice ring being displaced from the axis of said first support ring; said first support ring being rotatably mounted within said second support ring; the said axis of said first support ring being displaced from the axis of said second support ring; said second support ring being rotatably mounted within said frame.

2. In combination; a first and second extrusion die mounted on and connected to a common extruder and a first and second air ring for receiving and cooling the film extruded by said first and second extrusion dies respectively; a common air receiving frame; said first and second air rings being adjustably mounted on said common frame; said common frame defining air supply channel means for supplying air under pressure around the periphery of each of said first and second air rings; said first and second air rings being movable toward and away from one another whereby the center to center distance of said first and second air rings is adjustable.

3. In combination; a first and second extrusion die mounted on and connected to a common extruder and a first and second air ring for receiving and cooling the film extruded by said first and second extrusion dies respectively; a common air receiving frame; said first and second air rings being adjustably mounted on said common frame; said common frame defining air supply channel means for supplying air under pressure around the periphery of each said first and second air rings and first and second air valves mounted in said frame; said first and second air rings being movable toward and away from one another whereby the center-to-center distance of said first and second air rings is adjustable, said first and second air valves being mounted on opposite sides of a line through the axes of said first and second air rings.

4. In combination; a first and second extrusion die mounted on and connected to a common extruder and a first and second air ring for receiving and cooling the film extruded by said first and second extrusion dies respectively; a common air receiving frame; said first and second air rings being adjustably mounted on said common frame; said common frame defining air supply channel means for supplying air under pressure around the periphery of each of said first and second air rings; said first and second air rings being movable toward and away from one another whereby the center to center distance of said first and second air rings is adjustable; said first and second air valves being mounted on opposite sides of a line through the axes of said first and second air rings.

5. In combination; a first and second extrusion die mounted on and connected to a common extruder and a first and second air ring for receiving and cooling the film extruded by said first and second extrusion dies respectively; a common air receiving frame; said first and second air rings being mounted on said common frame; said common frame defining air supply channel means for supplying air under pressure around the periphery of each of said first and second air rings; each of said first and second air rings comprising a circular outlet orifice ring, a first support ring, a second support ring, and a frame; said orifice ring, said first support ring and second support ring being concentrically disposed with respect to one another; said orifice ring being rotatably mounted in said first support ring; the axis of said orifice ring being displaced from the axis of said first support ring; said first support ring being rotatably mounted within said second support ring; the said axis of said first support ring being displaced from the axis of said second support ring; said second support ring being rotatably mounted within said frame.

6. In combination; a first and second extrusion die mounted on and connected to a common extruder and a first and second air ring for receiving and cooling the film extruded by said first and second extrusion dies respectively; a common air receiving frame; said first and second air rings being mounted on said common frame; said common frame defining air supply channel means for supplying air under pressure around the periphery of each of said first and second air rings; each of said first and second air rings comprising a circular outlet orifice ring, a first support ring, a second support ring, and a frame; said orifice ring, said first support ring and second support ring being concentrically disposed with respect to one another; said orifice ring being rotatably mounted in said first support ring; the axis of said orifice ring being displaced from the axis of said first support ring; said first support ring being rotatably mounted within said second support ring; the said axis of said first support ring being displaced from the axis of said second support ring; said second support ring being rotatably mounted within said frame and first and second air valves mounted in said frame; said first and second air valves being mounted on opposite sides of a line through the axes of said first and second air rings.

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