

July 1, 1969

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3,452,626

DEVICE FOR ENTRAINING AND CUTTING A MOVING THREADLINE

Filed July 22, 1966

Sheet 1 of 2

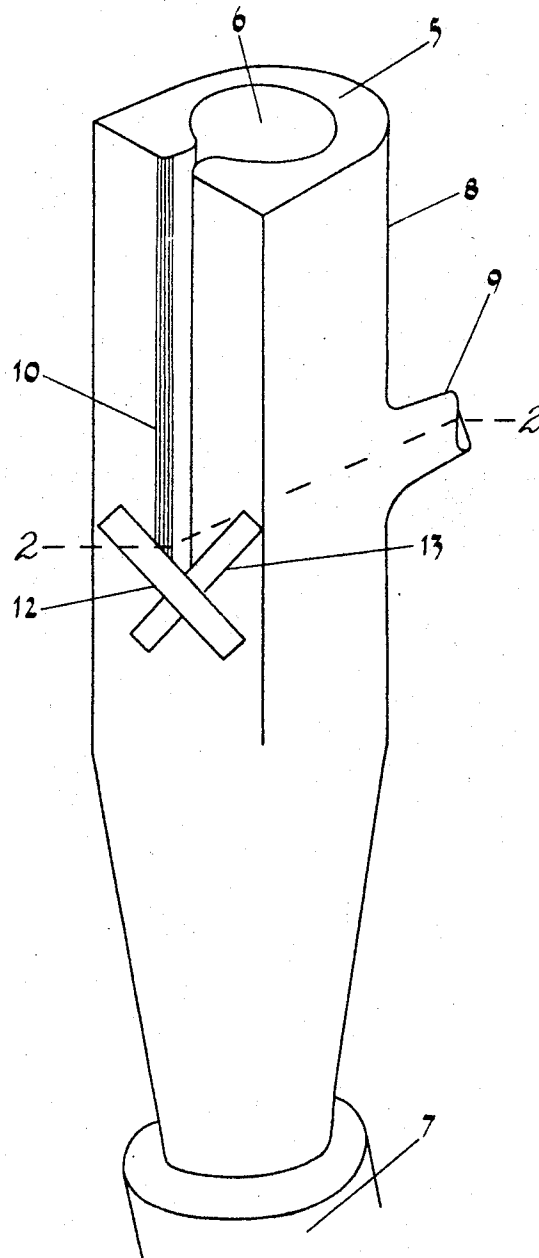


Fig. 1

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Sheet 2 of 2

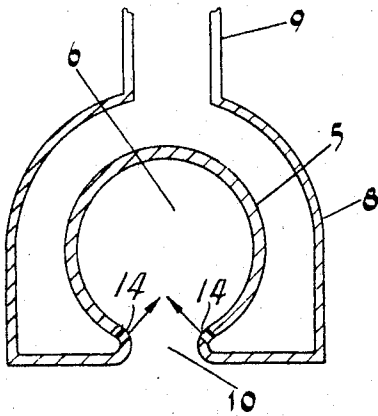


Fig. 2

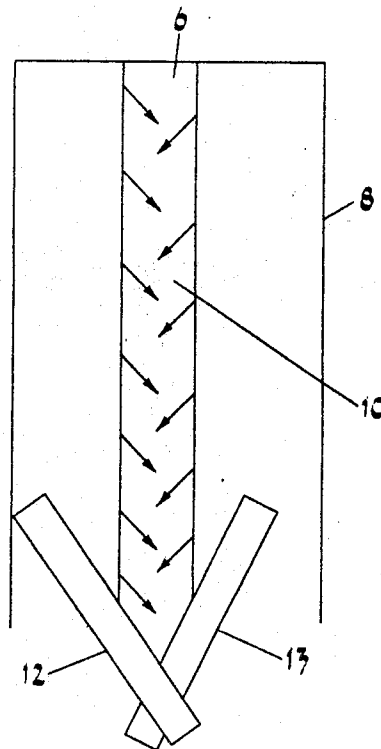


Fig. 3

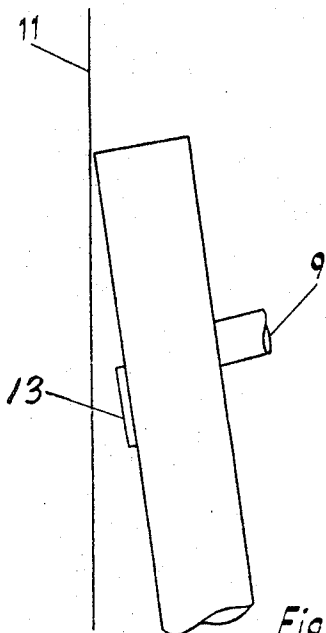


Fig. 4

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DEVICE FOR ENTRAINING AND CUTTING A MOVING THREADLINE

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6 Claims

ABSTRACT OF THE DISCLOSURE

A device for entraining and cutting a threadline comprises a tube having a longitudinal slot in the wall thereof and fluid jet means associated with the slot for creating a stream of fluid which draws the threadline through the slot when the device is brought into proximity with the threadline. The threadline is cut as it is drawn into the slot by a blade disposed so as to be contacted by the threadline, and thereafter the threadline passes into a disposal pipe which is in communication with one end of the tube.

The present invention relates to the entrainment of a threadline away from the position where it is being processed to a waste disposal system.

According to the present invention we provide a filament or yarn entrainment device so designed and constructed that, when proximated to a continuous filament or yarn in lengthwise motion, a portion of the said filament or yarn becomes substantially fully enclosed within a cavity communicating with a disposal pipe the said filament or yarn within the said cavity remaining substantially linearly disposed and the said filament or yarn being, or by alteration of the attitude of the said entrainment device in a predetermined direction subsequently becoming, acted upon by at least one stream of fluid in such a manner as to apply to the said filament or yarn a predetermined force in the direction of motion of the said filament or yarn, the said filament or yarn being simultaneously or subsequently severed and the said filament or yarn being entrained and directed down the said disposal pipe communicating with the said cavity.

According to a further aspect of our invention we provide a filament or yarn entrainment device consisting of a tube, the one end communicating with a disposal pipe for waste filament or yarn and the other end being free, a slot of substantially uniform width extending from the free end and extending substantially the whole length of said tube and being disposed in a substantially parallel manner to the axis of the tube, said slot being of width small in comparison with the inner perimeter of the said tube, the said tube bearing a plurality of apertures communicating with a supply of fluid at greater than atmospheric pressure, said apertures being of such configuration and disposition that the fluid supplied to the said apertures produces jets which are directed away from the free end of the tube and the jets emanating from the said apertures adjacent to the slot being furthermore directed inwards and away from the slot.

By the term "proximated to a continuous filament or yarn" we mean that the device is brought up to the filaments or yarn and made to enclose it without substantially deflecting the filament or yarn from the path which it is following until immediately before the severing of the filaments or yarn takes place.

The action may, for example, be as follows: The entrainment device is held by hand with the side in which the slot is situated being towards the threadline. The

entrainment device is moved towards the threadline (that is the filament or yarn) being maintained substantially parallel to it. At the achievement of a predetermined degree of proximity, sufficient component of force is exerted on the threadline by the flow of air into the slot induced by the jets of gaseous fluid within the slot to exert a force on the threadline drawing it into the slot. As the threadline is drawn towards the slot successive positions in the induced air-flow are reached of progressively higher linear velocity, thus accelerating the threadline. The result is that on attaining the predetermined degree of proximity the threadline is suddenly moved so as to be enclosed completely within the cavity. At the same time the threadline becomes subjected to the flow of air induced along the tube constituting the cavity and in the direction of the disposal pipe. At this stage the still entire threadline will be running freely through the cavity and slightly diverted from its normal path. As soon as this stage is reached, cutting of the threadline can be effected without release of tension upstream of the entrainment device. Normally this will be effected by a cutter associated with the entrainment device in such manner that it comes into effect as soon as the threadline has become enclosed within the cavity. Such a cutter can, for example, consist of a pair of sharpened blades crossed and in contact, similar to a pair of scissors fixed in the open position, and located at the bottom end of the slot, that is the end closer to the disposal pipe.

Since it is required to sever the threadline at a single point along its length, it is desirable that the threadline should be offered to the cutting effect very rapidly so that the time during which the cutter and threadline are in sufficient contact to cause damage to the threadline but not to sever it, is reduced to a minimum. This requirement can more completely be fulfilled if a check action is provided which impedes the progress of the threadline towards the cutter until a predetermined force in the direction of transverse motion of the threadline is substantially in operation, the check action then being overcome by the force urging the threadline onto the cutter or by some separate action and a rapid approach of the threadline to the cutter being thereby caused.

The requirement of a high speed of approach of the threadline to the cutter is also facilitated by a high velocity of the air stream through the slot and the elimination of instability or other considerations which would tend to produce any air flow through or from the slot in an outwards direction. This can be facilitated by known methods such as streamlining.

An alternative method of operation of the entrainment device is to move it towards the threadline with the axis of the cavity in the same plane as the threadline but not parallel to it, the end of the slot more distant from the disposal pipe being closer to the threadline than the remainder of the slot. The entrainment device may then be brought into a position where a portion of the threadline becomes substantially fully enclosed within the cavity, but not within a sufficient length of the cavity for a sufficient length of the threadline to be acted upon by the induced air-flow for the threadline to be diverted at all or significantly from its normal path. The attitude of the entrainment device may then be altered so that the axis of the cavity becomes substantially parallel to the normal path of the threadline. This maneuver is carried out by using as a pivot for the alteration of attitude of the entrainment device a point within the part of the cavity already enclosing the threadline. In this method of operation the cutting of the threadline is arranged to take place approximately as the axis of the cavity becomes parallel to the threadline. The same considerations in respect of speed of cutting also hold in this method.

The induced velocities of air in the vicinity of the slot, through the slot and within the cavity result from the direction, velocity, bore and number of the various jets of fluid in known manner, taking into account the density of the fluid. Following measurement of the tension existing in the threadline on which the device is required to be used, calculation followed possibly by a few trials will result in the desired effect, which is that the force acting on the threadline after cutting, and replacing that existing in the threadline before cutting, should be of a predetermined value, thus maintaining the required conditions upstream of the entrainment device.

The cavity should be such as will conveniently receive the filament or yarn without on the one hand being so narrow that the filament or yarn when within it is restricted in its motion and on the other hand so wide that an excessive volume of air is required to produce the required entrainment force. The cavity should be of sufficient length in relation to the diameter or effective diameter of the filament or yarn, and in relation to the linear flow-rate of the fluid within the cavity so that the required force is exerted along the length of the filament or yarn. We have found that the disposal pipe may be substantially linearly disposed with respect to the cavity or may be at an angle to it. The disposal pipe will normally communicate with a container for the waste filament or yarn.

The jets of fluid referred to in the further aspect of our invention, should be at an angle appreciably less than 90° to the long axis of the cavity. The jets of fluid should preferably be at an angle less than 45° to the long axis, and may be substantially or actually in the direction of the axis of the cavity, so as to facilitate the generation of a fluid flow along the length of the cavity.

By the term "directed inwards and away from the slot" we mean that the jets of fluid should not be directed through the slot away from the cavity.

The severing of the filament or yarn is preferably effected by means of a severing device associated with the disposal device and operating as the entrainment device is proximated to the filament or yarn. This may be of any convenient form. It may, for example, take the form of a fixed sharpened member or pair of sharpened members so designed and disposed as to catch and sever the filament or yarn immediately after it is entrained. In such a severing device, the force required to effect the severing is supplied by the wind-up mechanism and the entrainment action serves only to direct the filament or threadline to the position effective for severing.

An advantage of our invention is that by the use of it an operation involving the linear movement of a filament or yarn, for example from a melt-spinning spinneret to a wind-up device, may be interrupted and the yarn entrained to waste without reduction of the tension operative in the normal process below an acceptable level. This effect is produced in the use of our invention in view of the fact that an appreciable length of the filament or yarn is operated on by the flow of fluid generated within the cavity of the device before the filament or yarn is severed. The level of tension which is acceptable, can easily be determined by observing continuously the tension, for which purpose there are methods known, varying the tension until some criterion, is observed and noting the tension then pertaining. One such criterion is the formation of wraps on a feed roll, which occurs as the tension falls below a certain level controlled by coefficient of friction and feed-roll diameter.

The fluid may suitably be air in view of its cheapness, although any fluid which does not have an adverse effect on the filament or yarn may be used. Examples of other suitable fluids are water and steam; the latter may be dry or contain droplets of water.

In order that our invention may be the more fully understood, we describe hereinafter, by way of example, the form and use of an entrainment device according to

our invention with particular reference to FIGURES 1, 2, 3 and 4.

FIGURE 1 shows an isometric view of an entrainment device.

FIGURE 2 shows a cross-section of the entrainment device of FIGURE 1 through the plane indicated at 2—2.

FIGURE 3 shows a side view of the entrainment device of FIGURE 1 from the side wherein a slot is formed and FIGURE 4 shows the entrainment device in proximity to a filament.

In FIGURES 2 and 3, the slot is exaggerated in order to allow the indication by means of arrows of the direction of air jets.

Referring to FIGURES 1, 2 and 3, a tube 5 of 4 mm. internal diameter is free at one end 6 and communicates at the other end with a flexible rubber pipe 7. A jacket 8 surrounds the tube 5 and extends from the free end 6 to a length of 13 cm. The jacket 8 is sealed except for an air entrance pipe 9 piercing the exterior wall of the jacket 8, and 32 circular apertures 14 of 0.5 mm. diameter. The apertures piercing the tube 5 are located in two rows of 16, equidistantly disposed in each row, a row being disposed along each edge of the slot 10 throughout its length.

Each aperture 14 is so oriented that the air jet from it is directed away from the free end of the tube 5 and makes an angle of 10° with the plane passing through the centre line of the slot 10 and 20° with the axis of the tube 5. The slot 10 is formed in the tube 5 and jacket 8 extending for a distance of 13 cm. from the free end 6 of the tube 5. The width of the slot is 1.5 mm.

In operation, an air-supply at a pressure of about 6 atmospheres is fed to the pipe 9. The resultant jets of air through the various apertures results in a flow of air throughout the cross-section of the tube 5 in the direction from the free end 6 of the tube 5 towards the junction of the tube 5 with the flexible rubber pipe 7. In order to effect the entrainment of the filament or yarn, the entrainment device is moved towards the filament or yarn 11 as shown in FIGURE 4 until a portion of the filament or yarn 11 is enclosed in a portion of the cavity formed by the tube 5 and in altering the attitude of the entrainment device in the direction of coincidence of the axis of the tube 5 with the filament or yarn 11, the latter is suddenly dragged into the slot 10 by the flow of air passing through the slot 10, whereupon sufficient tension is exerted on the filament or yarn 11 by the filament or yarn wind-up mechanism to cause severing of the filament or yarn 11 by the knives 12, 13. At the same time the pull exerted on the filament or yarn by the entrainment device replaces that applied by the wind-up mechanism, so that the tension of the filament or yarn 11 does not at any stage in the action fall below a predetermined, acceptable level.

What is claimed is:

1. A filament or yarn entrainment device consisting of a tube, the one end communicating with a disposal pipe for waste filament or yarn and the other end being free, a slot of substantially uniform width formed in the wall of said tube extending from the free end substantially the whole length of said tube and being disposed in a substantially parallel manner to the axis of the tube, said slot being of width substantially less than the inner perimeter of the said tube, the said tube bearing at least one aperture communicating with a supply of fluid at greater than atmospheric pressure, said aperture being disposed adjacent to said slot and being so adapted and arranged that the fluid supplied to the said aperture produces streams of fluid which are directed away from the free end of the tube, the jets emanating from the said aperture adjacent to the slot being furthermore directed inwards and away from the slot, there being attached to said device near the end of said slot communicating with the disposal pipe a cutting device so adapted and arranged that severing is effected of a yarn

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or filament which passes through the said slot in the said tube.

2. A filament or yarn entrainment device according to claim 1 wherein there is a yarn disposal pipe associated with the tube whereby the yarn or filament after severing is diverted to a waste container.

3. A threadline entrainment device comprising means defining an elongated cavity open to the threadline through a slot extending longitudinally of said cavity; fluid jet means associated with said cavity and slot for suddenly moving the threadline through said slot so as to be fully enclosed by said cavity when said device is brought into proximity with the threadline and for simultaneously applying to the enclosed threadline a predetermined force in the direction of lengthwise motion of the threadline; means for severing the threadline substantially simultaneously with the movement of the threadline into said slot, said means including cutting device attached to said entrainment device in a location to be contacted by the threadline as the latter passes into said slot; and a disposal pipe communicating with said cavity for receiving the threadline after the latter has been severed.

4. A filament or yarn entrainment device according to claim 3 wherein there is further provided a check action preventing contact of the filament or yarn with the cutter

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until a predetermined force urging the threadline onto the cutter is attained.

5. A filament or yarn entrainment device according to claim 3 wherein the stream of fluid is directed at an angle of less than 90° to the long axis of the cavity or tube.

6. A filament or yarn entrainment device according to claim 3 wherein the stream of fluid is directed at an angle of less than 45° to the long axis of the cavity or tube.

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30—133; 57—34.5; 83—177, 402