

Sept. 30, 1958

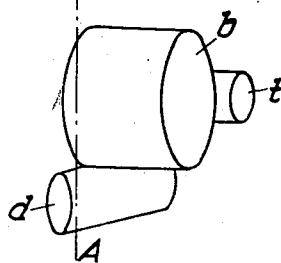
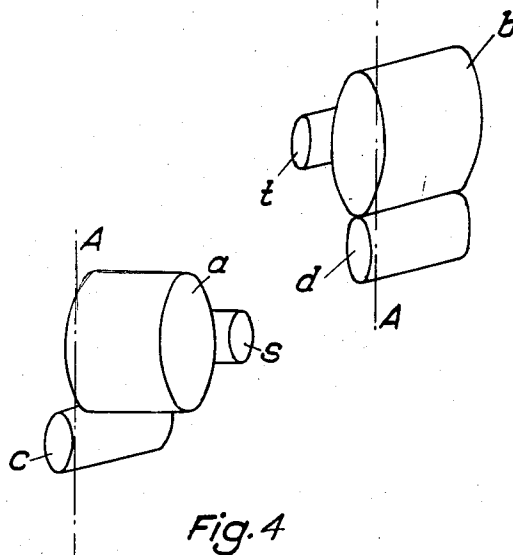
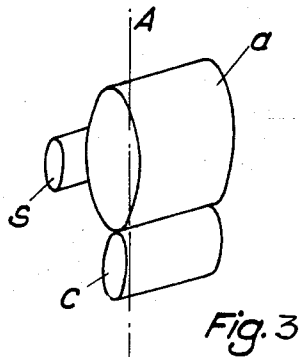
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2,853,738

APPARATUS FOR DRAWING OF SYNTHETIC FIBRES

Filed Jan. 23, 1953

4 Sheets-Sheet 1



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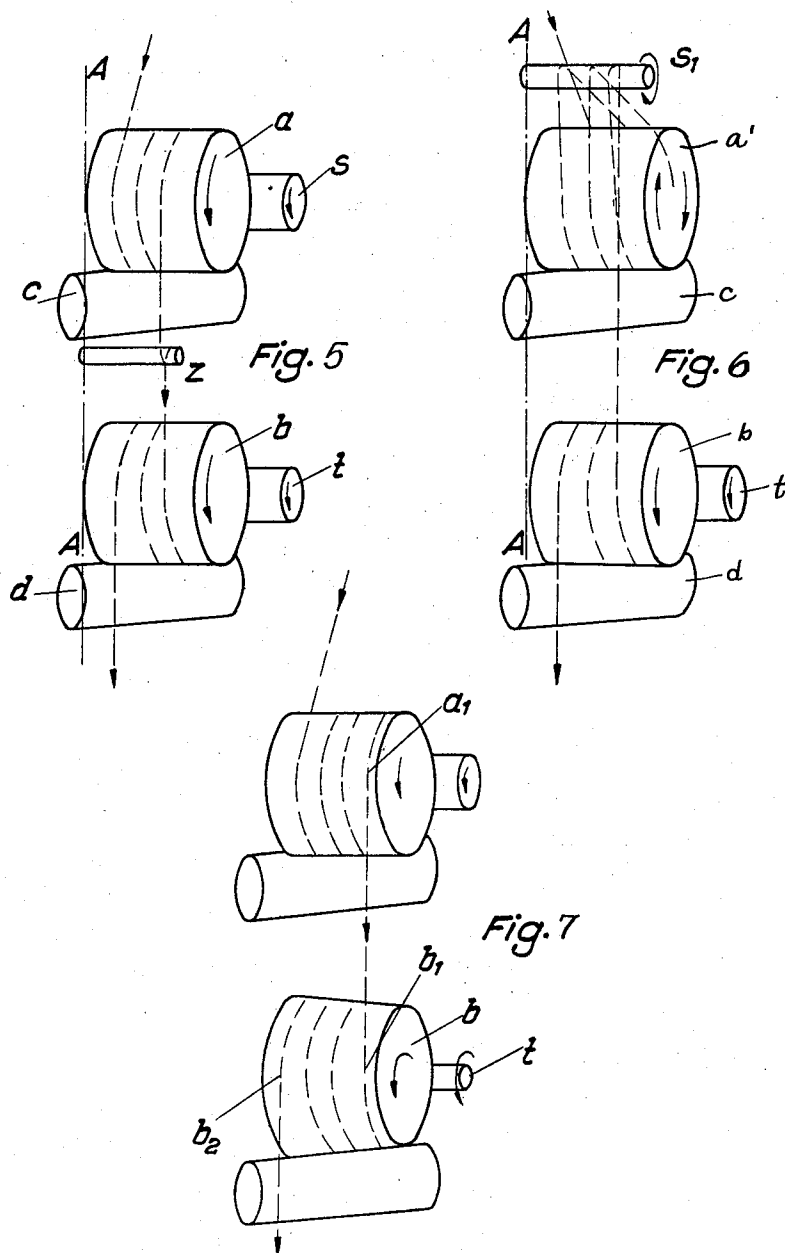
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APPARATUS FOR DRAWING OF SYNTHETIC FIBRES

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APPARATUS FOR DRAWING OF SYNTHETIC FIBRES

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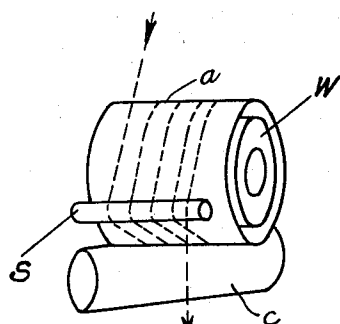


Fig. 8

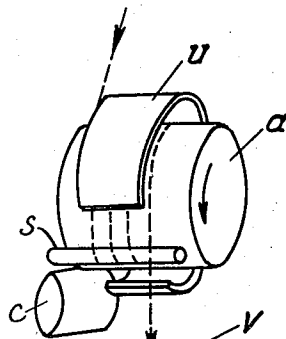


Fig. 9

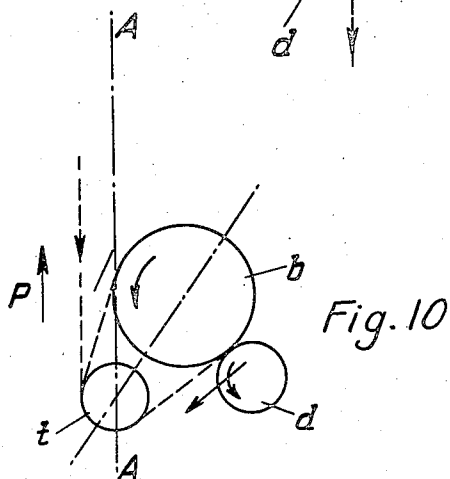
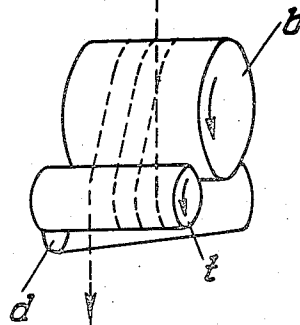
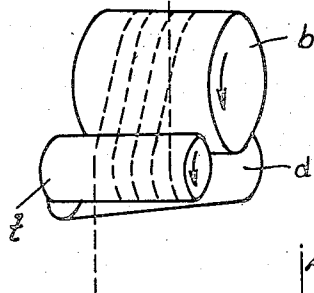


Fig. 10

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APPARATUS FOR DRAWING OF SYNTHETIC FIBRES

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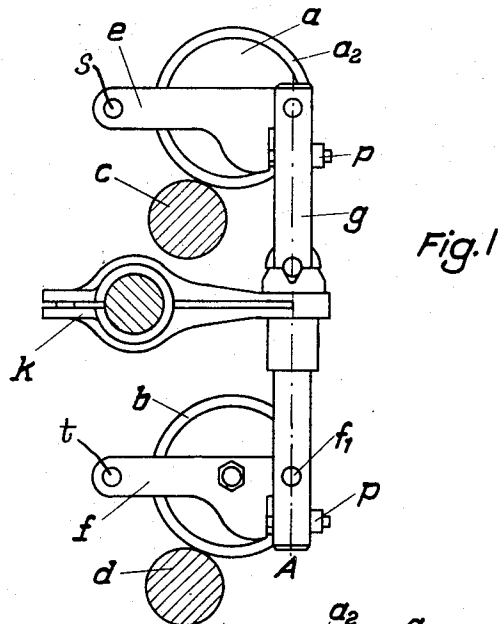


Fig. 1

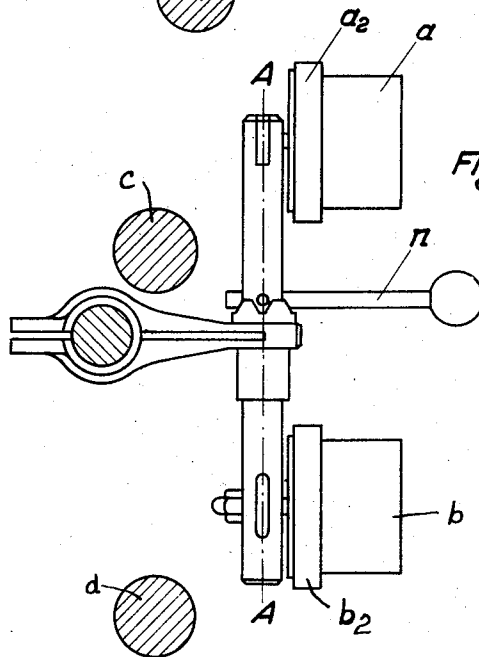


Fig. 2

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APPARATUS FOR DRAWING OF SYNTHETIC FIBRES

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4 Claims. (Cl. 18—8)

This invention relates to an arrangement for drawing (cold or hot drawing) synthetic fibres, such as, mesomeric chain polymers (Terylenes, Perlon U, L and T, Nylon), polymeric hydrocarbons and their derivatives, polystyrol, polyvinyl chloride, polyacrylic compounds (Orlon and so forth), and all substances of similar physical characteristics.

It has been found that the known drawing processes employing an agate pin, have the disadvantage of being subject to certain limitations with respect to the speed of drawing. Since the thread to be drawn clings to the agate pin, during the running, there is developed, with increasing speed, a progressively increasing frictional heat, which ultimately leads to breakage of the thread, and is synonymous with the limitation of the speed of drawing. The friction of the thread on the agate pin also leads to many capillary thread breakages.

Substantially better results are achieved when the arrangement for drawing according to the invention is employed. This arrangement is fundamentally suitable both for cold drawing and for hot drawing. An important feature of the invention consists in that two drawing rollers, located with their axes in a plane, are provided with deflecting rollers, and that the drawing rollers, by frictional engagement with two driving rollers, can be driven to correspond to the draft ratio. Such an arrangement largely counteracts the tendency that is characteristic of customary processes to form constrictions during the drawing process, and with such an arrangement of the drawing elements practically the same results are attainable as regards uniformity of the titre, elastic elongation and so forth, as are expected when employing the customary agate pin.

A further distinctive feature of this invention is that the said drawing rollers, and also the deflecting rollers, are mounted on swingable levers, which are collectively pivoted to a vertical shaft (rotatable column), and can be rotated with the rotatable column about a definite axis, whereby the revolving elements of the drawing arrangement are disconnected from the drive and stopped. For the invention still further details are important, which will be hereinafter described. For instance, a conical or stepped construction of the lower drawing roller is contemplated, in which case the diameter of the deflecting roller or deflecting pin is to be maintained as small as possible.

For all the arrangements according to the invention, the following may be set forth as important advantages:

(1) Slight gripping or special stressing of the thread through friction by drawing rollers or thread brakes at any stage of the drawing process;

(2) For piecing the broken end after breakage of thread, all the drawing elements are at rest;

(3) Substantially higher drawing speeds, and therefore substantially higher doffing speeds than are attained with the arrangements hitherto known, are yielded by (1) and (2).

By way of illustrating the arrangement according to

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the invention, various constructions are diagrammatically represented in the accompanying drawings, in which:

Fig. 1 is a side elevational of the rotatable column, with certain of the components in cross-section.

Fig. 2 is a view similar to Fig. 1 with the rollers in the swung-off position.

Figs. 3 to 9 inclusive are diagrammatic representations of means for practicing the invention, with the components in the inoperative position, and

Fig. 10 is a diagrammatic view showing the path of forces of the thread loops about the roller *b* of Fig. 9.

In Figs. 1 and 2, the drawing assembly includes drawing rollers *a* and *b*, deflecting rollers *s* and *t*, and friction driving rollers *c* and *d*, respectively. The rollers *a*, *s* and *b*, *t* are carried by swing levers *e* and *f*, respectively which levers in turn are mounted on a rotatable column *g*. Setting screws *p* function as stops for limiting the swing stroke of the levers *e* and *f* and *n* denotes a hand grip operatively connected with the column *g* to facilitate the rotation of the column.

The rollers *a* and *b* support rubber rings *a*² and *b*², respectively serving to increase the friction on the rollers *c* and *d* (Fig. 1).

In Figures 3 and 4, merely diagrammatic arrangements are illustrated which are in line with the invention. The drawing rollers *a* and *b* lying in one plane, the deflecting rollers *s* and *t*, and finally the driving rollers *c* and *d*, which drive the rollers *a* and *b* by friction, will be seen.

Figure 5 likewise shows fundamentally the arrangement described in connection with Fig. 3, but with the addition of an agate pin. This indication is given for the purpose of indicating how wide a range the applicability of the arrangement according to the invention is available.

Figure 6 illustrates a somewhat modified arrangement, which however likewise corresponds to the basic structure of the arrangement of the invention. According to this form, the deflecting roller *s*¹ of the feed roller *a*¹ is so supported on the appropriately constructed swing lever that the issuing of the thread from the deflecting roller in question is effected with a suitable direction of rotation of the roller *a*¹ and corresponding guidance of the thread.

This arrangement counteracts to a great extent the tendency to form constrictions during the drawing process, and is likewise suitable for the cold drawing of mesomeric chain polymers.

A similar effect is obtained with the arrangement according to Figure 7, this being on the basis of the conical or stepped formation of the lower drawing roller *b*. The diameter of the deflecting roller *t* (or of the pin) is kept small. Owing to this conical formation of the drawing roller *b* the drawing procedure is separated into two continuously successive operations, 80 percent of the draft being generally effected on the portion *a*¹ to *b*¹ and 20 percent of the draft in the form of afterdrawing within the individual loopings of the thread around the lower conical drawing roller *b* during the passage of the thread from *b*¹ to *b*². This arrangement has proven particularly advantageous also for the reduction of the residual elastic elongation of the drawn yarn, which is generally very undesirable. This is especially the case when the after-drawing is effected under the influence of a definite temperature.

The shaping of the polymeric hydrocarbons and their derivatives can only be effected under the influence of a definite heat, the temperature of which lies generally between 180° and 220° C. According to the process hitherto known the procedure was to guide the thread during the drawing over a heated plate or profile body

or through a heated tube or similar device. This arrangement has been found to have the serious disadvantage that for the attainment of a proper doffing speed, either the temperature of the heated body that effects the warming of the thread had to be higher than the temperature that is in itself necessary for the elastic deformation of the thread or substance in question, or else the heating body had to be very large or very long in order to give the thread time enough, during its passage through or over the heating body, to become warmed to the temperature of elastic deformation. The arrangements hitherto known therefore constitute in general a compromise between a structurally more or less advantageous construction and as high a delivery or doffing speed as possible; and here the question of easy operation in the event of breakage of thread, or in setting or starting the operation of the machine as a whole, is of the utmost importance. An excessive temperature, which lies even only a few degrees above the temperature at which elastic deformation of the substance in question begins, has been found to be particularly disadvantageous, since the joining of the ends after breakage of thread is in particular hereby rendered exceedingly difficult; for a contact, lasting even a few seconds, of the heating body with the thread not yet running, leads to the thread sticking to the heating body or to breakage of thread.

All these circumstances are taken into consideration by the structure illustrated in Figure 8, owing to the fact that the deflecting rollers *s* and *t* are differently arranged, and that the upper feed roller is heated internally, and, it may be, also heated externally, as in Figure 9.

For yarns of a general nature the internal heating of the upper feed roller *a* by means of a heating body *w*, stationary or revolving with the roller, in the interior of the roller *a*, as shown in Figure 8, is quite sufficient. With this arrangement delivery or doffing speeds are attained which are much greater than those hitherto known.

For yarns or fibre bunches of great thickness, supplementary heating by means of an annular heating body *u* surrounding the upper feed roller *a* at a certain distance, as shown in Figure 9, has been found advantageous. With this arrangement also the known doffing speeds for the yarns or fibres in question are greatly exceeded.

As a special feature of the novel action of this device for warming the thread or substance to be drawn, the following is set forth:

(1) A gradual warming of the thread up to the temperature of elastic deformation by means of multiple turns around a heated roller *a* (see Figure 8, the temperature of which is approximately equal to the temperature of elastic deformation of the substance to be drawn. Here the gradual warming of the thread can be regulated by more or less turns according to the thickness of the thread and the speed of doffing. The same applies in the case of supplementary heating by an encircling annularly constructed heating body.

(2) Moreover a relatively long stoppage of the rollers, with threads looped around the roller *a*, does not lead to the thread sticking to the heated surface of the roller and to consequent breakages of thread, as the temperature is not higher than the temperature necessary for the elastic deformation of the substance to be drawn.

The high stresses occurring in the thread in the hot drawing of the thick threads or fibre bunches are important for the proper driving of the lower drawing roller *b* on a basis of friction by the lower driving shaft *d*. By

a special arrangement of the deflecting roller *t* (see Figure 9) the result is obtained that the stresses occurring in the thread work out in part as application pressure of the roller *b* upon the shaft *d*, this pressure depending upon the number of loops of thread passing around the roller *b* and the deflecting roller *t*. Due to the fact that the tension in the thread, during the drawing process to the individual loops of thread surrounding the roller *b* and the deflecting roller *t*, it will be noted that the sum of all these tensions attempts to press the roller *b* in the direction towards the roller *t*. While a portion of this sum of thread tensions is taken off by the bearing of the roller *t* and over the lever *f* ultimately by the column *g*, the component vertical to this first mentioned portion of the sum of thread tensions comes into action as supplementary pressure between the roller *b* and the lower driving shaft *d*, as can be seen from Fig. 10.

As a feature of special effect there may be added for this arrangement the fact that an application pressure, in addition to the intrinsic weight of the roller *b* and the swing lever *f*, acting upon the driving shaft *d*, is effected owing to the thread tension produced between the two rollers *a* and *b* by the drawing process, and rises or falls proportionally with this thread tension.

We claim:

1. An apparatus for the hot or cold drawing of stretchable full synthetic threads of thermoplastic high polymers comprising a feeding roller, a drawing roller, a corresponding deflecting roller for each of the feeding and drawing rollers, drive means frictionally engaging said feeding and drawing rollers to impart movement to the same, swing levers, means mounting the feeding roller and its deflecting roller on one of the swing levers, means mounting the drawing roller and its reversing roller on another of the swing levers, a vertical shaft, and means pivotally mounting each swing lever to the vertical shaft whereby said feeding and drawing rollers are both swingable about the axis of the vertical shaft to a degree to disconnect the feeding and drawing rollers from the drive means and render said feeding and drawing rollers inoperative.

2. An apparatus for the drawing of synthetic threads as claimed in claim 1, characterized by the feature that the movement of each swing lever upon the rotation of the vertical shaft is limited in one direction by a projection on the lever and a set screw on the shaft thereby insuring simultaneous starting of the feeding and drawing rollers.

3. An apparatus for the drawing of synthetic thread as claimed in claim 1, characterized by the feature that the deflecting roller associated with the feeding roller is journaled on the correspondingly constructed swingable lever, whereby, with a corresponding direction of rotation of the said feeding roller, the thread-guiding can be so effected that the delivery of the thread is effected from the deflecting roller in question.

4. An apparatus for the drawing of synthetic threads as claimed in claim 1, characterized by the feature that the lower drawing roller is of conical formation, and that the thread runs on at the smaller diameter and runs off at the larger diameter of this roller.

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