

Feb. 11, 1941.

R. C. NEWMAN ET AL

2,231,815

FIBROUS ARTICLE

Original Filed Aug. 25, 1937 2 Sheets-Sheet 1

*Fig. 1*

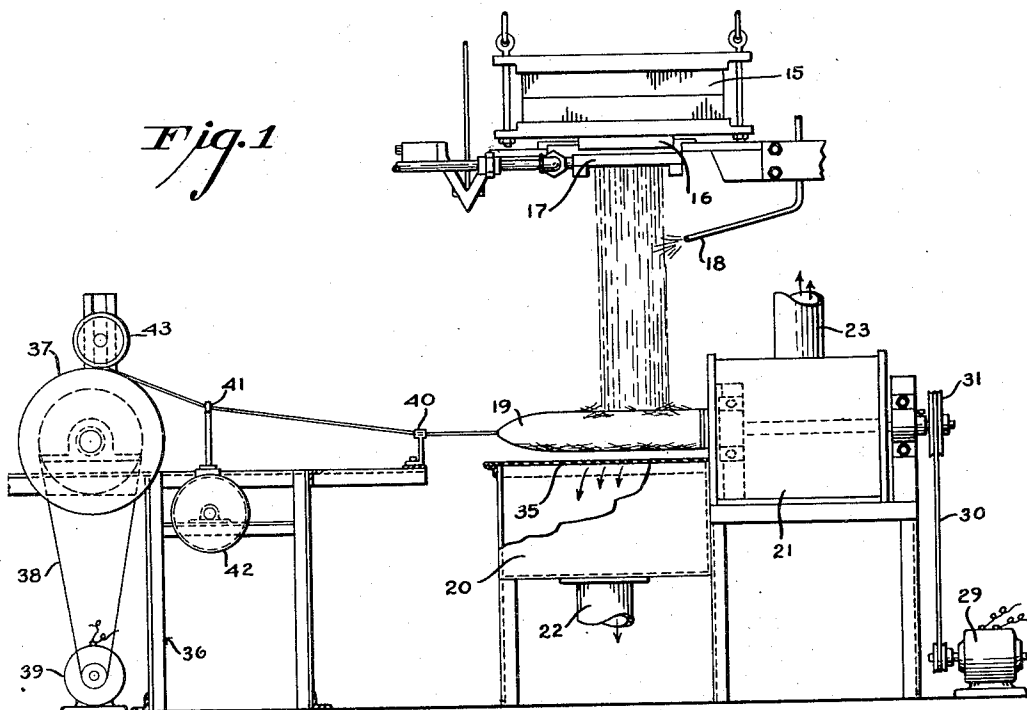


*Fig. 2*

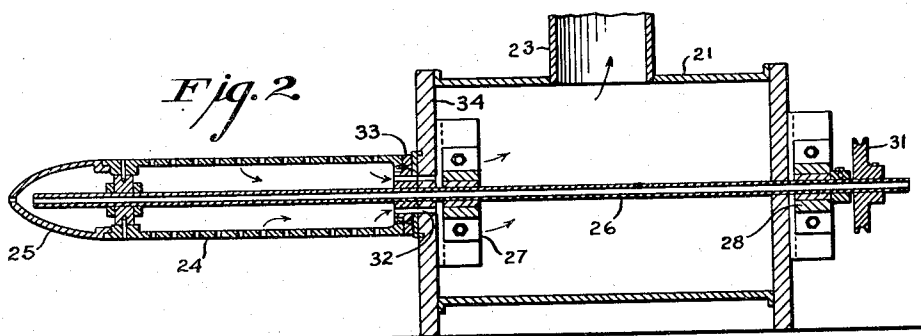


*Fig. 3*



*Fig. 4*



INVENTORS.  
RALPH C. NEWMAN  
AND JOHN W. ROMIG  
BY *J. H. Knight*  
ATTORNEY.

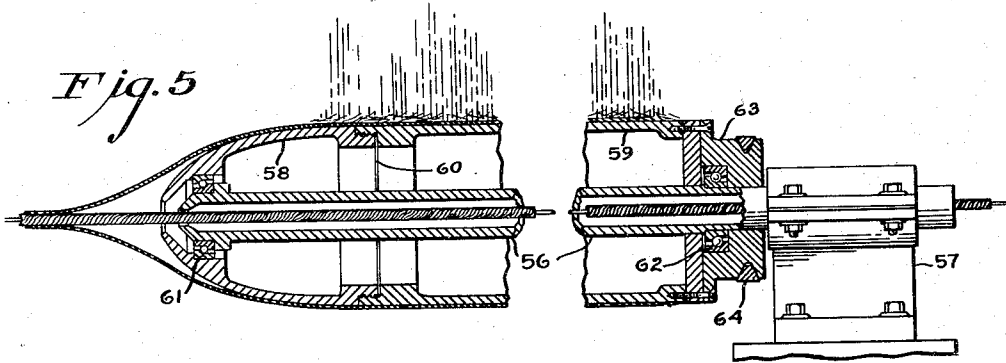
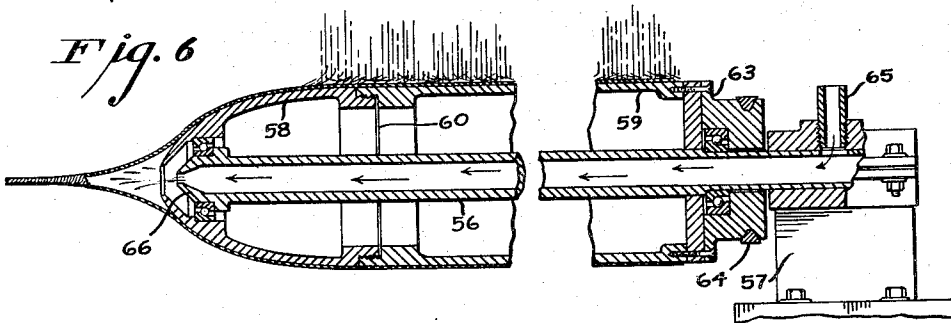
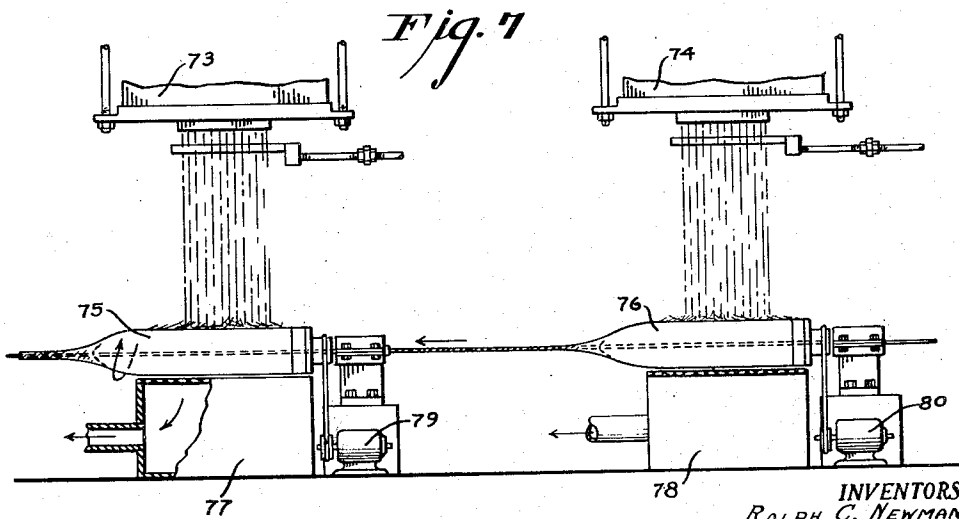
Feb. 11, 1941.

R. C. NEWMAN ET AL

2,231,815

FIBROUS ARTICLE

Original Filed Aug. 25, 1937 2 Sheets-Sheet 2



INVENTORS.  
RALPH C. NEWMAN  
AND JOHN W. ROMIG  
BY *F. H. Knight*  
ATTORNEY.

## UNITED STATES PATENT OFFICE

2,231,815

## FIBROUS ARTICLE

Ralph C. Newman, Corning, N. Y., and John W. Romig, Rumford, R. I., assignors, by means assignments to Owens-Corning Fiberglass Corporation, Toledo, Ohio, a corporation of Delaware

Original application August 25, 1937, Serial No. 160,908. Divided and this application October 26, 1939, Serial No. 301,500

6 Claims. (Cl. 57-144)

This invention relates to fibrous articles and has for its object yarns, rovings and similar articles of improved structure.

The principal feature of this invention is an improved form of fibrous article such as a yarn or roving in which at least a part of the article is composed of a generally tubular mass of interlaced and twisted fibres.

A further feature of the invention is a yarn or roving composed of two or more concentric tubular masses of interlaced fibres, adjacent layers of fibres being twisted in opposite directions.

A still further feature of the invention is a fibrous structure in which a generally tubular mass of interlaced fibres is twisted tightly about a centrally located core.

In the accompanying drawings are disclosed a structure capable of fabricating the fibrous articles of the invention and representations of such articles.

In the accompanying drawings:

Fig. 1 is a vertical elevation of one type of forming device including a fibre forming unit, a spinning mandrel and a take-off mechanism

Fig. 2 is a vertical section through the spinning mandrel of Fig. 1;

Fig. 3 is an enlarged perspective view of a single yarn having the structure of the present invention;

Fig. 4 is an enlarged perspective view of a two-layer yarn having the structure of the present invention;

Fig. 5 is an elevation, partially in section, of a spinning mandrel of somewhat different design especially adapted for the manufacture of multiple layer yarns and the like;

Fig. 6 is a sectional view of the mandrel of Fig. 5 modified to provide for application of various treating fluids to the fibrous materials being fabricated; and

Fig. 7 is an elevation showing a pair of spinning mandrels arranged in series.

While the structure of the present invention may be formed of natural fibres such as cotton, silk and wool and from the cellulose compounds commonly known as artificial silk, the present disclosure illustrates their manufacture from fine filaments of thermoplastic substances such as glass, resins and the like.

The structure disclosed in detail is particularly designed to produce filaments of glass, commonly known as glass wool, although this structure may be operated with equal efficiency in the production of fibres of any other thermoplastic substance normally solid at moderate temperatures.

In this device the thermoplastic substance is melted electrically and divided mechanically into fine streams, which are in turn drawn into filaments of exceedingly fine diameter by a jet of gas issuing at high speed from a blower surrounding the streams. It has been found possible to collect these fine fibres immediately after their production on a rotating body placed in their path. In the accompanying drawings, this rotating body is disclosed as a generally cylindrical mandrel placed with its axis of rotation at right angles to the path of the newly formed fibres which are directed adjacent to its surface by a draft of air being drawn into an adjacent vacuum chest. As the fibres are deposited in a heterogeneous, interlaced manner, layer on layer, a felted mass of fibres is built up about the surface of the mandrel.

If the fibres constituting the edge of the felted mass are gathered together and drawn off over the end of the mandrel, it will be found that they will in turn pull adjacent fibres with them and thus apply a tractive effort which promotes gradual movement of the entire mass toward the end of the mandrel. If the rate of lineal movement of the withdrawn fibres is properly regulated with respect to the rate at which additional fibres are being deposited on the mandrel, the felted mass will remain substantially constant as to the area and volume, fibres being withdrawn and the felted mass being replenished continuously over an indefinite period.

In withdrawing fibres from the felted mass, it has been found advisable to move the fibres in a straight line along the axis of rotation of the mandrel for an appreciable distance after which they may be diverted as desired. No rotation is imparted to the withdrawn fibres so the continuous rotation of the mandrel will produce relative rotation between the withdrawn fibres and the felted mass from which they are withdrawn. Thus, what would otherwise be a cylinder of interlaced fibres of the same diameter as the mandrel is spun down into a twisted yarn whose weight and degree of twist are determined by the rate of production of the fibres, the speed of draw and the speed of rotation of the mandrel. However, on examination of the resulting yarn it will be found to retain an essentially tubular construction.

The fibre forming device and winding mechanism which are shown in the drawings are of standard manufacture while the novel collecting and spinning mechanism cooperating therewith forms the subject matter of our co-pending application, Serial Number 160,908, filed August 25,

1937, now matured into U. S. Patent No. 2,202,118 of which this application is a division. This mechanism consists essentially of a hollow mandrel, suitable means for driving this mandrel at various speeds and suction means to aid in the collection of fibres about the surface of the mandrel. In general, it has been found that a single suction chest placed beneath the mandrel and having a perforate upper surface closely adjacent thereto is ample to effect collection of the fibres as desired. Such a suction chest draws a considerable volume of air about the mandrel and the fibres, borne in this body of air, are brought into close proximity to the mandrel. It has been found that the fibres will collect in a uniform felted mass about the mandrel without any mechanical means attracting them thereto, but it is advantageous in certain instances to perforate the surface of the mandrel and evacuate its interior, thereby drawing the fibres down into contact therewith. However, this may result in the fibres wrapping so tightly about the mandrel that they are not easily withdrawn. Since the mandrel rotates at a considerable speed, there is a tendency for the fibres to pull away therefrom under the influence of centrifugal force. It has been found possible to control the cohesion between the mandrel and fibres by regulating the applied suction or by placing a baffle plate or plates within the mandrel thereby limiting the application of suction to a portion only of the surface of the mandrel.

When it is desired to form multilayer yarns or rovings, a battery of spinning mandrels may be set up to operate one after another, subsequent mandrels spinning a series of concentric coverings upon the yarn or roving produced on the first mandrel. In such an arrangement, adjacent mandrels are rotated in opposite directions to produce opposite twists in adjacent layers. In this manner a yarn will be produced having a core twisted in one direction and a seamless outer layer or layers twisted in the other direction. Since the twists of adjacent layers oppose each other, the yarn has no tendency to twist on itself and kink.

Referring in more detail to the specific apparatus disclosed in Fig. 1, there is disclosed diagrammatically a fibre forming mechanism such as is shown in detail in the Slayter and Thomas U. S. Patent No. 2,133,236. In such a structure the thermoplastic material from which the fibres are to be formed is melted in a refractory container 15 and issues from the bottom thereof through openings in an electrically heated bushing plate 16. The issuing streams of thermoplastic material are cooled and attenuated to filaments of minute diameter by the action of a jet of gas issuing at high velocity from a blower 17 of suitable design located immediately below the bushing. As these filaments pass downwardly from the blower, they may be sprayed with a suitable conditioning fluid issuing from the pipe 18.

Directly beneath the bushing is positioned a spinning unit which consists of a rotatable hollow mandrel 19 and associated vacuum chests 20 and 21 which are connected with a suitable suction device by ducts 22 and 23. As shown in more detail in Fig. 2, the mandrel 19 consists of a perforate cylindrical metal shell 24 and tapered head 25 mounted upon the shaft 26. This shaft is journaled in bearings 27 and 28 and may be rotated at any desired speed by the variable speed electric motor 29 operating through belt 30 and pulley 31. A series of registering holes 32 in the end plate 33 of the mandrel and the adjacent wall 34

of the vacuum chest 21 permit partial evacuation of the mandrel.

As the newly formed fibres pass downwardly from the blower they are caught in the current of air being drawn into the vacuum chest 20 through its upper surface 35 which may be made of wire mesh or other perforate material. This vacuum chest is so positioned and shaped with respect to its surface 35 that it directs the fibres about the rapidly rotating mandrel where they are deposited and formed into a felted sheath-like layer. This layer is continuously withdrawn from the end of the mandrel by the adjacent winding mechanism designated generally at 36. This mechanism may be of any desired type, but as shown consists of a friction drum 37 driven by belt 38 at the desired speed by a variable speed motor 39. The withdrawn fibres are spun down into a yarn or conductor covering adjacent the nose of the mandrel which passes through a fixed guide 40, located in axial alignment therewith, and the eye 41 of a conventional traverse mechanism 42. The finished material is wound about the cylinder 43 due to frictional contact with drum 37.

While it has been found that the descending fibres will wrap themselves about the mandrel in a satisfactory manner solely under the action of the vacuum chest 20, it has been found desirable, in certain instances, to at least partially offset the centrifugal force acting on the fibres due to the high speed of rotation of the mandrel. This may be accomplished by developing a partial vacuum in the mandrel through communication with the vacuum chest 21 in the manner described above. The degree of suction which is applied to the mandrel may be controlled by suitable valves or dampers or by baffles properly positioned within the mandrel.

As has been stated above, thoroughly satisfactory results have been obtained without evacuation of the mandrel and it is this mode of operation which permits the use of a variety of mandrel designs each particularly adapted for a different function. The hollow rotating shaft of Fig. 1 is satisfactory when a single yarn is formed, but when it is desired to supply consecutive layers of fibres as in the case of multilayer, it has been found desirable to provide a central conduit through the mandrel which will not rotate with respect to the preformed yarn. Such a structure is shown with various modifications in Figs. 5 and 6. In Fig. 5, the hollow central shaft 56 of this structure is rigidly clamped in a supporting bracket 57. In this design the mandrel is made up in two sections 58 and 59 threaded together at 60. Ball bearing assemblies 61 and 62 carried in these sections of the mandrel permit it to rotate as desired about shaft 56. The heavy hub 63 within which bearing 62 is positioned is grooved to accommodate a V-type belt connected to any suitable prime mover.

Fig. 6 discloses slight variations in the above structure. By providing a connection 65 with a source of supply and a spray head 66, shaft 56 becomes a spraying device. If it is desired to guide a yarn or conductor through the mandrel as shown in Fig. 5 while spraying an adhesive or impregnant, a central aperture may be provided to support and center the conductor while lateral openings direct a spray of the desired material against the interior of the cone of fibres.

In Fig. 7 are shown a plurality of devices of this nature arranged in series for the application of successive layers of fibres, one outside the other, as a straight line operation. The type of mandrel which has been used in this instance

is the same as that disclosed in Figs. 5 and 6. The illustrated structure consists of fibre forming units designated generally as 73 and 74, mandrels 75 and 76 and suction chests 77 and 78.

5 The mandrels are mounted in substantial axial alignment and are rotated from reversible electric motors 79 and 80 so that they may be rotated in the same or opposite directions. A suitable device for withdrawing the spun fibres is, of course, included in the working assembly, but this mechanism has not been illustrated in Fig. 7. An insulated conductor provided with a fibre coating in this manner is shown passing through the second mandrel in Fig. 5.

15 While this invention has been disclosed primarily with respect to a structure in which fibres are artificially formed and are immediately collected on the spinning mandrel, it has been found that satisfactory results will be obtained when natural fibres are employed and are delivered to the spinning mandrel from the usual carding, picking and stapling machines commonly employed in fibre preparation in the textile art and various rotating bodies of different configuration may be substituted for the specific mandrel disclosed.

This specific disclosure is by way of illustration and the invention is to be limited only by the scope of the appended claims.

30 What is claimed is:

1. As a new article of manufacture, a yarn

comprising a twisted core of intermingled fibres, said core having an annular cross section, and a seamless external coating of intermingled fibres.

2. As a new article of manufacture, a yarn comprising a twisted core of intermingled fibres, said core having an annular cross section, and a seamless external coating of intermingled fibres, said external coating being twisted in the opposite direction from the twist of the core. 5

3. As a new article of manufacture, a fibrous article comprising a core and a seamless, generally tubular mass of interlaced fibres twisted about said core. 10

4. As a new article of manufacture, a yarn comprising a twisted core of intermingled fine glass fibres, said core having an annular cross-section, and a seamless external coating of intermingled fine glass fibres. 15

5. As a new article of manufacture, a yarn comprising a twisted core of intermingled fibres, said core having an annular cross-section, and a seamless external coating of intermingled fine glass fibres, said external coating being twisted in the opposite direction from the twist of the core. 20 25

6. As a new article of manufacture, a fibrous glass article comprising a core and a seamless generally tubular mass of interlaced glass fibres twisted about said core.

RALPH C. NEWMAN. 30  
JOHN W. ROMIG.