

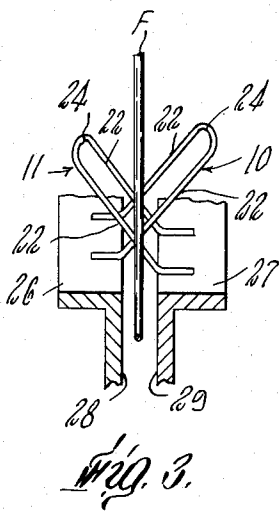
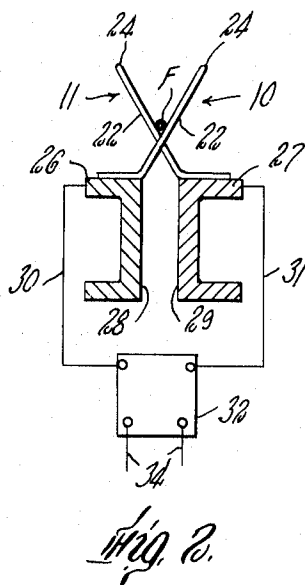
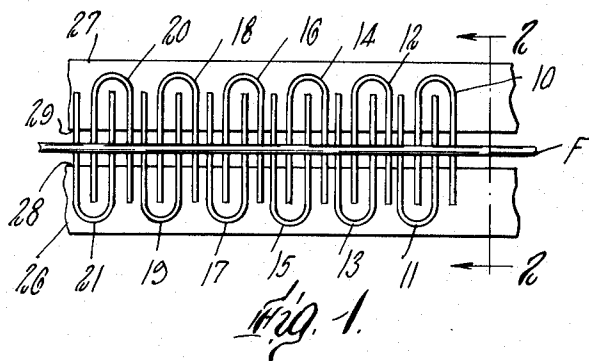
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TEXTILE THREAD HEATING APPARATUS

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TEXTILE THREAD HEATING APPARATUS
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2 Claims. (Cl. 219—10.61)

This invention relates to apparatus for continuous heat treatment of an elongated moving textile filament or thread by means of a radio frequency field. Throughout this specification, the terms "thread" and "filament" will be used interchangeably and are intended to include textile monofilament as well as roving, yarn, or thread composed of natural or artificial fibers. Particularly, this invention relates to the heating of textile threads such as rayon, nylon and the like by a high frequency electric field, continuously as the threads are produced or processed and moved longitudinally, and is concerned with improved elements for applying the field to the moving thread.

One object of the invention is to provide such a heater with elements that may serve as guides and supports for the textile filament and that will not impede free longitudinal movement of the thread at usual production or processing speeds. Incidentally such freedom of movement will allow the thread to expand or contract during heating.

A further object is to provide a heater of the character described that is easy to make, economical to operate and desirably uniform in its heating action on the moving thread or filament.

Still another object of the invention is to provide, for a continuously moving filament, a radio frequency heater with electrodes that are largely free from any tendency to produce arcs or corona discharge.

These and other objects of the invention are met by providing one or more aligned pairs of thread guiding and supporting inverted U-shaped alternately oppositely directed round wire electrodes, the legs of one U in each pair being connected to one side of a radio frequency oscillating circuit, the legs of the other U in the pair being connected to the other side of the radio frequency oscillator. These thread guiding and supporting electrodes are physically arranged with one leg of each U intermeshing or alternating with one leg of the other U in a pair, and the U-pieces are also positioned with their legs and bent ends extending upwardly in planes crossing each other to form an X when viewed from one direction, edgewise of the pair of electrodes. The moving thread or filament to be heated lies within and may be supported and guided across the pair of crossed electrodes at or close to the crotch or cross-over point of the X, passing close to first one leg of a first electrode, then one leg of the second electrode, then the other leg of the first electrode and finally the other leg of the second electrode in each pair. Beyond a first pair of electrodes, further pairs of identical electrodes may be mounted in horizontally aligned relation so that the thread travels past and is in close proximity alternately and successively to a multiplicity of electrodes of different polarities.

Other objects and further details of that which is believed to be novel and included in this invention will be clear from the following description and claims, taken with the accompanying drawing in which is illustrated an example of textile thread or filament heater embodying the present invention and incorporating pairs of criss-crossed U-shaped thread guiding and supporting electrodes described generally above.

In the drawings:

FIG. 1 is a top plan view of a section of a thread guiding, supporting and heating assembly according to this invention;

FIG. 2 is a transverse vertical sectional view there-through substantially on the line and in the direction of the arrows 2—2 of FIG. 1, showing diagrammatically certain electrical connections that may be made thereto, and

FIG. 3 is an endwise top perspective view of one pair of the thread heating electrodes showing how a textile thread or filament is guided and supported therein.

In carrying out the objects of this invention, in one embodiment thereof, radio frequency current is imposed on and induced in a longitudinally moving filament F by traversing the filament continuously over and near to or in contact with a series of electrodes that may support and guide the filament. The particular design, arrangement and mounting of these thread heating electrodes are the characteristic features of this invention.

Accordingly, a V-shaped skeleton trough is made up of one or more pairs of cross-wise arranged inverted U-shaped round wire pieces. These pieces are intended as paired electrodes indicated by the numbers 10 and 11 through 20 and 21 inclusive, the even numbers representing electrodes of one polarity and the odd numbers indicating electrodes of opposite polarity as will later appear. Each of these rounded wire electrode pieces is substantially identical with all others, and to form the U, each includes parallel leg portions 22 joined at one end by a semi-circular bight or bend 24.

Considering a single pair of electrodes, because they are arranged in identical sets of pairs, the even-numbered electrode is suitably secured mechanically and electrically at the ends of both its legs to an elongated feeder strip or bus bar 26, and the odd-numbered electrode of each pair is similarly secured in any suitable fashion to an opposing feeder strip or bus bar 27, these bus bars preferably being given a channel shape as indicated in FIG. 2 of the drawing and having parallel closely spaced longitudinal facing walls 28 and 29 as shown in that figure.

The bent ends of the electrodes of each pair are extended upwardly from their respective supporting feeder strips, as shown, and at an angle to each other so that the legs of the pieces cross and form an X as seen in end view, FIG. 2. One leg of each U-piece in each pair is located between and spaced equally from the legs of the other U-piece of the pair, looking downwardly as in FIG. 1.

Electrical connections are made through the bus bars 26 and 27 to the respective electrodes in each pair, the bus bar 26 being connected to one output side 30 of a radio frequency oscillator 32 and the other bus bar 27 being connected to the other output side 31 of the oscillator. As an example of frequencies found useful, but not limiting the invention in any sense, the oscillator may operate in the range of from 10 to 100 megacycles and upwards.

Suitable driving power source connections are provided for the oscillator through leads such as 34 in a customary fashion.

To extend the heating area a multiplicity of pairs of the crossed, U-shaped electrodes are mounted on the bus bars in alignment horizontally, at such spacing that the outermost leg of any crossed pair is spaced approximately the same distance from the outermost leg of an adjacent pair as the crossed legs of each individual pair are spaced from each other. Therefore, as long as the assembly of electrodes may extend, the moving filament or thread will contact electrically or be influenced by first an electrode of one polarity and then an electrode of

opposite polarity at equally spaced points. The arrangement is such that a radio frequency field is created between the crossed legs of adjacent electrodes within each pair and between pairs, this field having its highest intensity in the spaces between the electrodes where the legs cross each other. Because the thread or filament is moving lengthwise within the skeleton trough formed by the crossing of the legs of the electrodes it is located and traveling in the field virtually entirely in the area of highest intensity. By thus arranging a number of electrode pairs seriatim with their crossing points aligned horizontally, the efficiency of the individual guiding and supporting electrode pairs is increased or improved.

Speaking geometrically, the pairs of electrodes may be described as comprising two identically formed members, each having two straight, elongated, spaced legs defining a plane, joined together by a curved portion at one end spanning the space between the legs, said members being oriented relative to each other so that a leg of each one passes centrally between both legs of the other and so that the planes defined by the legs of the members intersect, preferably at about 90 degrees one from the other, in a single line of intersection passing through both legs of both members of the pair. The line of intersection of the legs of the crossed members includes the points where electrodes of one polarity most closely approach those of the opposite polarity and therefore is the line or center of highest intensity of the radio frequency field between the electrodes. If the crossing of electrodes is made to depart substantially from the preferred 90 degrees mentioned above, the field between adjacent electrode members of differing polarity may become undesirably dispersed or spread over a larger area and its effect therefore weakened accordingly.

The heating effect and efficiency of the apparatus is further benefitted by the close and parallel spacing of the opposed walls 28 and 29 of the feeder members, these creating a condenser action immediately below the moving thread which adds to the capacitance of the load. The length of the bus bar or feeder members may be extended and the number of pairs of the U-shaped intermeshed electrodes multiplied to obtain any desired elongation of the heating area.

Because the electrodes support and guide the thread at frequent and regular horizontal intervals, tension on the thread may be kept as small as possible and still allow it to keep moving, thus permitting the material of the thread to contract freely during heating. The round cross-section of the wires forming the electrodes offers no resistance to movement of the filament thereover, and will not snag or catch on the moving thread even though this may be of a roughened or irregular conformation or texture on its outer surfaces.

Each individual wire piece serves as two electrodes of the same polarity because of the alternating crossed-over legs of each pair of electrodes. The tendency for arcs to be thrown from the electrodes is reduced to a minimum because the rounded cross-section of the wires and the curved or bent semi-circular end of each electrode piece provide no sharp points from which such arcs may start. If desired, any sharp corners on the edges of the opposed faces of the feeder bus bars may also be rounded to reduce possible arcing.

With the electrode mounting arrangement here shown and described it is also possible to use the feeder bus and electrode assembly as its own oscillating tank or radio frequency resonant circuit for example, in a manner according to my United States patent application, Serial No. 275,417, filed April 24, 1963.

As will be evident from the foregoing description, certain aspects of this invention are not limited to the particular details set forth as an example, and it is contemplated that various and other modifications and applications of the invention will occur to those skilled in the art. It is therefore, intended that the appended claims shall

cover such modifications and applications as do not depart from the true spirit and scope of the invention.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. Apparatus for supporting, guiding and heating a lengthwise moving textile filament comprising a pair of spaced parallel feeder members, a multiplicity of spaced pairs of identical wire elements supported by said feeder members, each element consisting of

two straight, elongated, spaced leg portions defining a plane and

an integral portion joining said leg portions at one end, spanning the space between said legs, said leg portions terminating free of each other at the other end,

said wire elements in each pair oriented each relative to the other so that

a leg of each element passes centrally between both legs of the other element and so that

the planes defined by the legs of each element are at an angle one to the other and cross in a single line of intersection passing through both said legs of both said elements in each pair, the line of intersection of each pair being aligned with the line of intersection of all other pairs,

whereby a textile filament is adapted to be supported and guided in lengthwise movement on said elements adjacent said line of intersection in proximity to both legs of both elements in each pair,

one said feeder member secured to and supporting the free ends of the leg portions of one of said wire elements in each pair and connected to

means providing the feeder member and the legs of one wire element in each pair with a radio frequency of one polarity,

the other said feeder member secured to and supporting the free ends of the leg portions of the other said wire element in each pair and connected to means providing the other feeder member and the legs of the other wire element in each pair with the same radio frequency of opposite polarity,

whereby a radio frequency field is produced between said wire elements at the aforesaid line of intersection for heating a textile filament moving therealong.

2. Apparatus for supporting, guiding and heating a lengthwise moving textile thread comprising

a pair of straight, elongated, spaced horizontal and parallel bus bars,

a multiplicity of identical pairs of round wire elements, each element of each pair consisting of

two straight, elongated, spaced parallel leg portions defining a plane and

an integral semi-circular curved portion joining said leg portions at one end, spanning the space between said legs,

said leg portions of each element terminating free of each other at the other end and secured to one of said bus bars, the leg portions of the other element of each pair being secured to the other of said bus bars,

said wire elements of each pair oriented each relative to the other so that

a leg of each element passes centrally between both legs of the other element and so that

the planes defined by the legs of each element are at an angle one to the other and cross in a single line of intersection passing through both said legs of both said elements in a pair,

said pairs of elements being mounted in longitudinally spaced relation on said bus bars with their lines of intersection aligned,

whereby a textile thread is adapted to be supported and guided on said multiplicity of pairs of elements

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for lengthwise movement substantially along said lines of intersection in proximity alternately to legs of the elements in all pairs,
 means providing one bus bar and the legs of one element of each pair with a radio frequency of one polarity, and means providing the other bus bar and the alternating legs of the other elements of the pairs with the same radio frequency, but of opposite polarity,
 whereby a radio frequency field is produced at the aforesaid line of intersection between said elements in each pair and between adjacent pairs of ele-

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ments in said multiplicity of spaced pairs, for heating a textile thread moving in proximity to the said aligned pairs of elements.

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