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PREPARATION OF TOW FROM FILAMENTS OF ACRYLONITRILE POLYMERS

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Fig. 1.

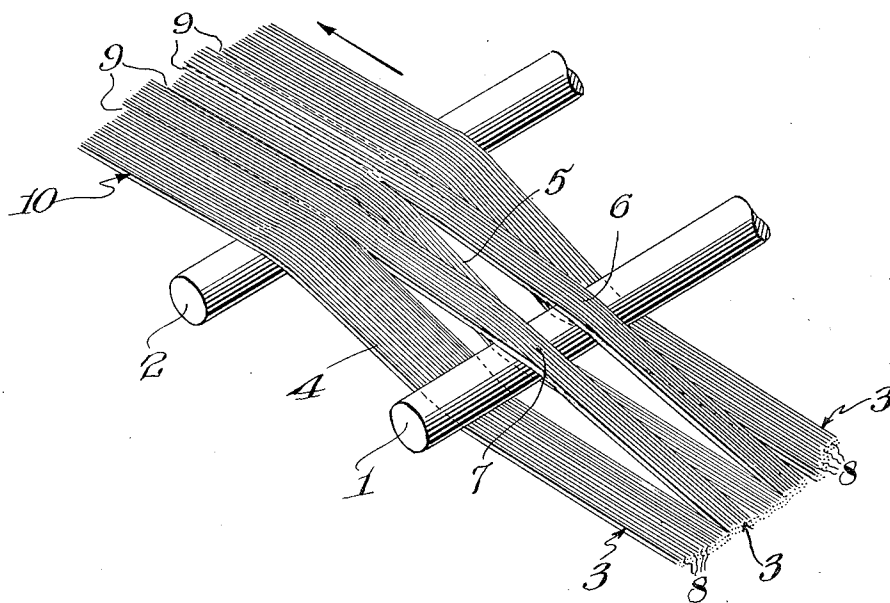
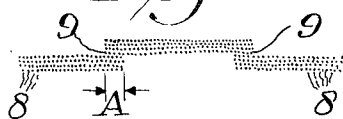


Fig. 2.



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PREPARATION OF TOW FROM FILAMENTS OF
ACRYLONITRILE POLYMERS

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2 Claims. (Cl. 28—78)

This invention relates to an improved guiding arrange-
ment for bringing together a plurality of filament bundles
to form a larger composite bundle or tow.

In the manufacture of staple and tow of continuous
crimped filaments, such as those of polyacrylonitrile and
copolymers of acrylonitrile containing not less than 35%
acrylonitrile, the filament bundles from each spinning ma-
chine or from a group of spinning machines are washed
and drawn and then, before being subjected to crimping
and/or drying, several moist ribbons of filaments are
combined to form a very large denier tow. Heretofore,
the several smaller bundles after passing through a pin
or comb guide were brought together over a bar guide
where the individual bundles flattened out and widened
perceptibly so that they continued on as a single wide
ribbon to the crimper. This combined tow of crimped
filaments tended to split when subjected to cutting or
during drying prior to their sale as a continuous filament
tow, and in the customers' mills the tow of continuous
crimped filaments caused trouble by splitting into the
several smaller bundles. Tow which splits in any of the
processing steps causes excessive "downtime" and waste
due to tangling; costs increase and the quality of the final
product is lowered.

It is, therefore, an object of this invention to provide
an improved process for overcoming this defect. Another
object of this invention is to prepare a tow of continuous
filaments comprised of a plurality of smaller tows that
have been overlapped so as to resist splitting. Still an-
other object of this invention is to provide an improved
guiding arrangement for producing an overlapped tow.
Other objects will be apparent from the description of
the invention that follows.

The objects of this invention are accomplished by
means of guide bars placed substantially parallel and
spaced several inches apart. The several individual moist
ribbons of filaments, which have been washed and drawn
and kept segregated during these processing steps, are
delivered, usually through a pin or comb guide, to the
first of the bar guides. As can be observed from Figure
I, the ribbons are brought over the first bar guide by
passing alternate preliminary tows over and under the
first bar guide and then all go over the second guide. The
individual elemental tows spread during and after contact
with the bar and since there is no interference with ad-
jacent tows, a certain amount of overlapping results by
the time all of them pass over the second guide bar. It
is this overlapping of the preliminary tows that effectively
binds the final tow into a unitary bundle that very greatly
improves subsequent processing or conversion into a fin-
ished product.

In previous handling the individual ribbons were passed
over the first bar and over the second as one wide ribbon.
In this arrangement there was, of course, contact of a
ribbon with the edges of its adjacent ribbons, but this
contact was insufficient to prevent the adverse splitting.
In the present handling, there is overlapping and a well-
bound tow results.

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Figure I shows the arrangement of the guide and tow
and Figure II shows, in an end view, the nature of the
overlap.

In Figure I guide bar 1 and guide bar 2 are located in
a substantially parallel arrangement. A plurality of
moist ribbons 3 come from a source to guide bar 1 and
here they are passed alternately over and under guide
bar or cylinder 1. For example, ribbons 4 and 5 are
shown going under guide bar 1, while ribbons 6 and 7
are shown going over. Each ribbon is, of course, made
up of a plurality of filaments 8. They are joined as they
go over bar 2 and the overlaps 9 result so that the final
product is a unitary tow 10 comprised of a plurality of
individual tows adjacently overlapped with each other.
This overlap 9 need not be extensive and is generally of
a small magnitude, being about 20% of the total width
of the single ribbons, although the overlap may vary from
about 10% to about 40%.

In Figure II it can be seen that the individual filaments
8 are retained substantially in their respective ribbons and
that the overlap is formed chiefly by the contact of a por-
tion of the bottom of one ribbon with a portion of the
top of another, adjacent ribbon. The extent of the over-
lap is designated at A in Figure II. There may be some
intermingling or intermeshing of filaments from the dif-
ferent contacting tows but generally the amount of such
positioning is very small. With the contact as shown very
good binding occurs with many types of filaments such
as those prepared from polyacrylonitriles, polyesters,
polyamides and cellulose materials.

The guiding means are preferably cylindrical although
other shapes, such as substantially rectangular or oval
shapes can be used. They are made preferably of stain-
less steel or other non-corrodible, wear-resistant ma-
terials. Plastic, glass and ceramic materials may also be
used. Other means may be devised for producing an
overlapped tow as above described and combinations of
crowned rolls or bent bars may produce even greater
spreading and overlapping of tows which may be de-
sirable under certain conditions.

The following example is given to illustrate the sur-
prising improvement in running continuity and quality of
the resulting crimped tow for sale to converters.

Over a given unit of time production was followed
for off-quality material and for operating efficiency, using
the normal non-overlap producing procedure. In this
test, 31.1% of the production was not first-quality and
operating efficiency was only 57%. In other tests using
the principles of this invention, the off-quality material
was reduced considerably to a low level of about 7%
and operating efficiency, measured on a relative basis, was
increased to 100%. These results are shown in the
table below:

	Percent Off- Quality	Percent Operating Efficiency
Old Guide.....	31.1	57
Overlap Guide.....	7.4	62
	7.7	92
	6.5	100

Another advantage provided by this invention is that
the amount of first grade material produced in a unit
time can be substantially increased, since the operation is
more efficient and less downtime is experienced. The
very substantial improvement in quality and the much
improved continuity of operation lowered costs of produc-
tion. Furthermore, mill converters of this improved or
overlapped crimped filament tow report their operating
efficiencies are substantially increased and in one case
nearly doubled.

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It is indeed surprising that the simple expedient above described consolidates the elemental filament bundles and provides sufficient cohesion through the slight overlap to keep the resulting tow intact during subsequent operations. This overlapped tow is crimped in a "stuffer box" type crimper such as described in Hitt U. S. Patent 2,311,174 more uniformly and with noticeable improved efficiency. The crimped overlapped tow is cut into staple more effectively, that is, the "downtime" and waste are reduced. The overlapped tow of crimped continuous filaments sold as such to converters is of improved quality as is evidenced by improved efficiency in converting this tow to top due to reduction in tow splitting and breaks in the tow.

Any departure from the above description which conforms to the present invention is intended to be included within the scope of the claims.

I claim:

1. A composite tow comprising a plurality of tow

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ribbons consisting substantially of parallel longitudinally disposed continuous filaments of a polymer of acrylonitrile, each of said tow ribbons overlapping its adjacent ribbon from 10% to 40% of its width in lightly bound relationship.

2. The tow of claim 1 in which the overlap is about 20%.

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