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BALING TWINE

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Fig. 1.

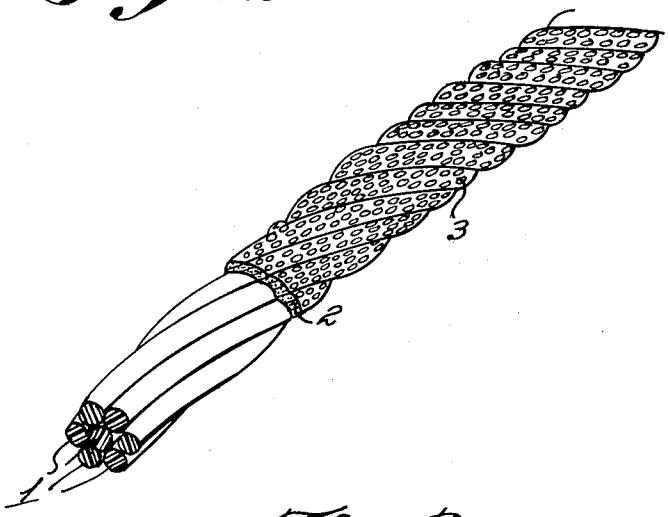
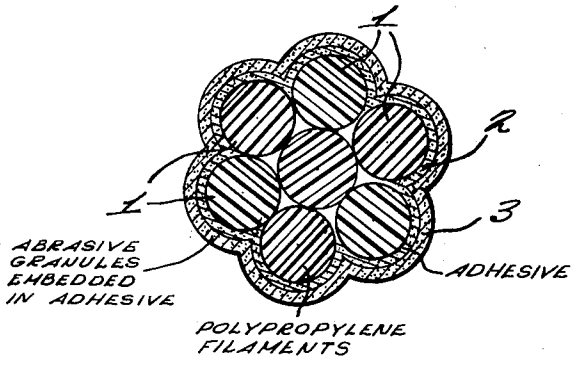


Fig. 2.



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BALING TWINE

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This invention relates to a twine and more particularly to a twine made from a synthetic or artificial material and to a method of producing it.

The synthetic twine of the invention is particularly intended for use in baling machines. In the past, the twine used in these machines has been made from natural fiber. Efforts have been made to substitute synthetic twine, but these have been generally unsuccessful. The difficulty has been that ordinary synthetic twines slip against themselves when tied in the kind of knots made by conventional baling machines. The single loop knots made by the machines will hold tight with natural fiber twines, but ordinary synthetic twines have a tendency to slippage or runback when they are tied in single loop knots, and they have been generally rejected for use in baling machines.

The object of the present invention is to so manufacture a twine from synthetic thermoplastic materials that the slip and runback problem is avoided. This and other objects which will be apparent from the following detailed description are achieved, in accordance with the invention, by forming a twine with an unbalanced surface, and, in accordance with a preferred embodiment, the application of friction-inducing materials to the surface of the twine.

The twine may be made with a single strand or a plurality of strands. When making the single strand twine, a plurality of thermoplastic filaments are twisted together and the strand is subjected to a combined stretching and heat setting operation. To achieve the best results in terms of an unbalanced surface the filaments are of different sizes, such as in the range of 5–20 mils diameter. A smaller range of diameters may be used, and it is possible, in accordance with certain embodiments to use a single size of filaments. The strands are twisted together with a low order of twist, generally up to about 5 turns per inch. For example, the twist may be 1.5, 1.75 or 3 turns per inch. The total number of strands and their sizes are chosen so that the tensile strength of the twine will be at least about 180 pounds.

After the twisting operation, the twine is given a slight stretch, up to about 10%, and, while under tension, is heat set. Preferably the heat setting and stretching operations take place simultaneously.

When a multi-strand twine is to be made, two or more strands, each composed of filaments of the type and size described above, are made and twisted. Each strand will have a different number of turns per inch or twist differential, and the resulting strands are then twisted together with an opposite twist of a higher or lower order of turns per inch than the separate strands, so as to produce an increased unevenness. Combined, the sizes of the filaments and strands are such that the tensile strength will be at least 180 pounds. The resultant twine is then subjected to the heat setting and stretching operation described above. This procedure results in a compacting of the structure.

Upon completion of the heat setting operation, the twine is preferably coated or impregnated on its surface with an adhesive, preferably one based on a synthetic rubber-resin, mixed with a sanding material. This treatment produces a rough surface on the twine which improves its resistance to slipping in single loop knots.

The synthetic thermoplastic resins preferred, in accordance with the invention, are polyethylene and polypropylene. The polyethylene used is preferably a so-called "high density" polyethylene, such as is described in Peters 2,692,259 or as is obtained by the "Ziegler" process. These high-density polyethylenes have extremely good tensile strength. Other types of polyethylene may also be used, provided a sufficient number of strands of suitable size is used to give an over-all tensile strength of about 180 pounds or more. The polypropylenes include those developed by Natta which were originally described in the Journal of the American Chemical Society, vol. 77, page 1708–10 (1955), and have more recently been described in greater detail. These and other suitable thermoplastic polyolefins and other resins may be treated with carbon black or antioxidant to increase their resistance to light or atmospheric agents, preferably before the thermoplastic is spun into fibers.

The following examples illustrate the practice of the invention.

Example I

A single strand yarn is manufactured by twisting together 30 polyethylene filaments of different sizes in the range of 5–20 mils diameter, to give a twine of a tensile strength of about 180 pounds. The filaments are given a twist of 2 turns per inch or stretch about 5% and heat set, causing, subsequently, the effect of shrinkage and compacting of the structure. The twine is then coated on its surface with a synthetic rubber resin-based adhesive mixed with sanding material. It was found that this twine held firmly in single loop knots.

Example II

A multi-strand twine was made as follows:

One strand was made of 20 filaments of different sizes in the range of 5–20 mils diameter, twisted 1.5 turns per inch.

A second strand was made of 10 filaments of different sizes in the range of 5–20 mils diameter, twisted 1.25 turns per inch.

The two strands were then twisted together in the opposite direction with 2.5 turns per inch. The twisted twine was then subjected to heat setting with a stretch of about 5% with the subsequent effect of shrinkage and compacting the structure. The twine is then coated on its surface with an adhesive, mixed with sanding materials, to produce an unbalanced and rough surface on the twine.

The invention is illustrated by the accompanying drawing, in which:

FIGURE 1 shows a twisted baling twine in accordance with the invention, in perspective; and

FIGURE 2 is a cross-section schematically showing the twine.

In the drawings, 1 represents strands of polypropylene twisted together, 2 is an adhesive coating and 3 represents granules of abrasive such as sand.

While the above detailed description has referred to the use of specific materials and structural details, it will be understood that the invention is subject to certain variations, and is limited only as defined in the claims.

I claim:

1. A synthetic baling twine suitable for forming non-slipping single loop knots in a baling machine comprising at least one strand, each strand having a plurality of filaments of a thermoplastic synthetic resin selected from the group consisting of polyethylene and polypropylene, said twine being heat set under tension to compact the structure, and said twine having a surface coating of an adhesive and granules of an abrasive material embedded in the adhesive.

2. A synthetic baling twine as set forth in claim 1 in which the filaments of each of said strands are twisted together prior to heat setting.

3. A synthetic twine as set forth in claim 2 in which the number of turns in the twisted strand is up to five turns per inch.

4. A method of making a synthetic baling twine suitable for forming non-slipping single loop knots in a baling machine comprising forming a twine from a plurality of filaments of a thermoplastic synthetic resin selected from the group consisting of polyethylene and polypropylene, heat setting said twine under tension to compact the structure, applying a surface coating of an adhesive to the twine and embedding granules of an abrasive material in the adhesive.

5. A method of making a synthetic baling twine as set forth in claim 4 in which said filaments are twisted together to form the twine prior to heat setting.

6. A method as set forth in claim 5 in which the

number of turns in twisting the filaments together is up to five turns per inch.

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