Dec. 15, 1936. L. I. WHITLOCK 2,063,966

TWINE

Filed Feb. 3, 1934

Fig. 1.

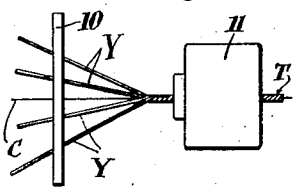


Fig. 1a.

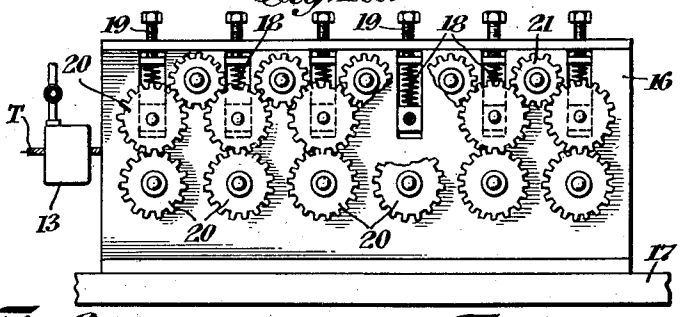


Fig. 8.



Fig. 3.



Fig. 10.



Fig. 2.

Fig. 2a.

Fig. 4.

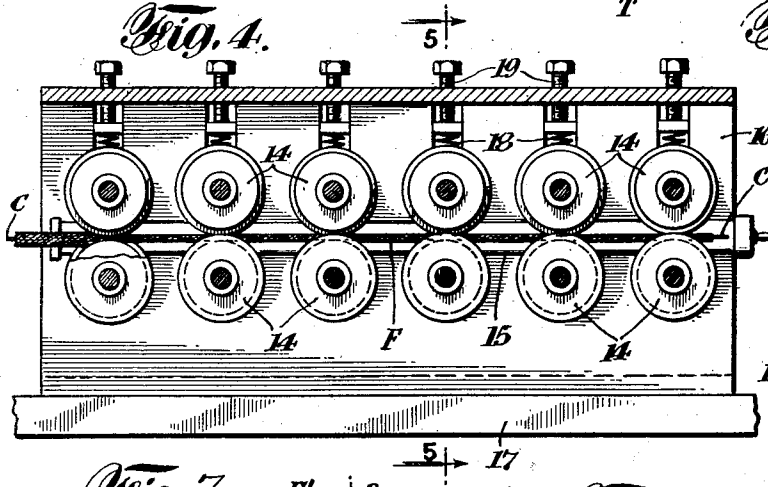


Fig. 5.

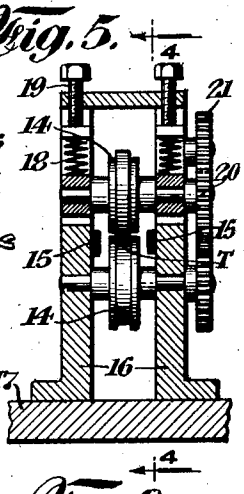


Fig. 7.



Fig. 6.

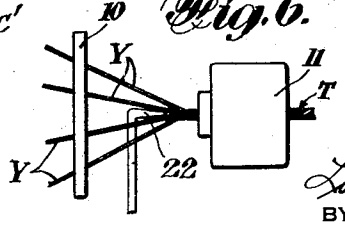
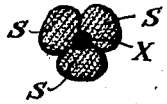


Fig. 9.



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Patented Dec. 15, 1936 2,063,966

UNITED STATES PATENT OFFICE

2,063,966

TWINE

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Application February 3, 1934, Serial No. 709,570

6 Claims. (Cl. 117—2)

This invention relates to twine and more especially to twine suitable for use in tying up bundles, packages and the like.

Heretofore, twine has been of generally circular cross-section and has the undesirable characteristic of forming depressions or grooves in articles, bundles or packages tied therewith. The tension applied to the twine to draw it tight has caused the twine to bite into such articles, bundles or packages. Also, packages or the like tied with such twine, if packed in tiers, may be undesirably grooved or otherwise injured by the twine because of the weight of the superposed packages and in addition the twine spaces superposed bundles or the like so that the surface cannot contact throughout, thus causing relative tilting of packages or bundles in a tier. In order to avoid formation of grooves or depressions in articles, packages or bundles and to facilitate stacking of the same in tiers, use has heretofore been made of fabric, paper or metal tape which, by reason of its wide faces, distributes the pressure applied by it to packages and the like over a much wider surface than does round twine, and by reason of its thinness does not space the adjacent faces of articles, etc. stacked in tiers. Such tapes are more expensive than twine of equal strength and so result in higher cost to the user.

In the co-pending application of Brown and Farrell, Serial No. 707,892 filed Jan. 23, 1934 there is described and claimed a flat twine which avoids the objectionable characteristics of round twine and is less expensive than tapes of equal strength. The twine covered by the above-mentioned application comprises yarns such, for example, as fibre yarns inter-twisted with each other and pressed into flat configuration or a single yarn pressed into flat configuration.

An object of the present invention is to improve such multi-ply flat twine by sticking together the various yarns of which it is composed, thereby opposing separation of the yarns and to improve such single yarn twine by sticking the fibres together, thereby retaining the twine in flat configuration.

In the manufacture of flat fibre twine embodying the present invention, a regular soft twist twine may first be made up from a plurality of yarns in the well-known manner with binding material arranged centrally of the yarns to cause such yarns to adhere to each other. A string impregnated with a volatile solution of the binder may be introduced into the twine as a core as the yarns are twisted together or a volatile solution of the binder may be extruded axially of the twine between the yarns. Preferably, the twist in the yarn should be as slight as is practically possible so as to prevent fibre breakage in the subsequent compression operation. The twine is then subjected to pressure by being passed between a pair or successive pairs of pressure rollers which apply progressively increasing pressure, the pressure applied by the rollers being dependent upon the size of the twine. During the compression operation, heat may be applied to the twine to facilitate the flattening operation and to drive off the binder solvent. Each yarn of the twine as well as the whole mass of twine is flattened during the compressing operation. If desired, the twine may be moistened before being compressed and steam or water may be used for this purpose or starch solution may be used for moistening as well as for the purpose of giving a finished appearance to the twine. If the twine is moistened prior to the compression operation, the moisture may be driven out during the compressing operation by heat applied thereto during such operation. Also, a single yarn may be spun from a fibre sliver and a binder introduced into the yarn either by means of a core or by extrusion as in the case of the ply twine. The yarn may be moistened with starch solution or other suitable liquid and reduced to flat configuration by compression.

In the ply yarn twine, separation of the yarns is opposed by the adhesive and in the single yarn twine, the adhesive holds the fibres together to retain the yarn in flat configuration.

Any binder may be used which is flexible and remains flexible, does not discolor or stain and is easily gotten into liquid condition. Latex and other combinations of rubber solution, resinous binders, soluble gums, a mixture of latex and glue and vulcanizable compounds have been found satisfactory.

In a typical four-ply flat twine, each yarn runs approximately 750 feet to the pound and each yarn is spun with twelve turns to the foot while the yarns are twisted together with nine turns to the foot. The twisting together of the yarns to form the twine untwists the yarns so that the twist of each yarn is very materially reduced. A typical single yarn twine will run approximately 250 feet to the pound and is spun with seven turns to the foot. In the flattening operation, the applied pressure may be of the order of 400 pounds if a single pair of rollers is used or may start with approximately 100 pounds at the first pair of rollers and may be increased to approximately 300 pounds at the last pair of rollers if a series of rollers is employed.

The flattened twine above described is not limited to use as a tying medium, but may be used for weaving rugs or other fabrics or for binding books or other articles. A rug woven from such twine is highly durable and wear-resisting. The flattened configuration of the twine gives a large contact surface for a given weight of material.

This invention is also applicable to round ply twine and has as a further object to improve twine of any cross-section and composed of any number of yarns by sticking together the yarns to thereby oppose separation of the yarns.

Furthermore, the invention is of utility in connection with single yarn round twine and has as a still further object to improve such twine by providing adhesive centrally of the twine to prevent loosening of the fibre or untwisting of the yarn.

Other objects, novel features and advantages of this invention will be apparent from the following specification and accompanying drawing, wherein:

Figs. 1 and 1a illustrate apparatus for producing one form of flat twine;

Fig. 2 illustrates the twine in its several stages of formation, the twine in this figure being shown on a larger scale than in the other figures;

Fig. 2a is a plan view of the finished twine;

Fig. 3 is an enlarged section on the line 3—3 of Fig. 2;

Fig. 4 is a longitudinal section of the flattening apparatus substantially on the line 4—4 of Fig. 5;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 illustrates apparatus for producing a modified form of twine;

Fig. 7 illustrates a single yarn twine;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a section through a three-ply round twine having the yarns held together in accordance with the invention; and

Fig. 10 is a section on an enlarged scale through a single yarn round twine embodying the invention;

In the drawing, 10 is a guide plate having holes (not shown) through which yarns Y are fed to the die 11 of a standard twisting machine from which the twine T passes to a standard wind-up reel (not shown). A string or other suitable core C impregnated with binding material is fed into the twisting die 11 together with the yarns Y and in the twine T the yarns are twisted about the core C.

Preferably, the yarns Y are soft-twisted so that in the twine T, the twist in the yarns approaches as nearly as possible to zero. There is thus formed a soft twist round twine which is next subjected to compression in order to convert it into flat configuration. The twine may be conditioned for the flattening operation by passage through a suitable moistening device 13 in which the twine is thoroughly moistened or it may be compressed without being moistened. The twine is flattened by being fed through a succession of pressure rollers 14 which are so adjusted that the twine is subjected to progressively increasing pressures. During its passage through the compressing apparatus, the twine may be heated to facilitate the compression operation and to drive off the binder solvent, the heat being supplied by means of heaters 15 extending lontudinally of the compression apparatus at opposite sides of the pressure rollers. The heat thus supplied will also drive out the contained moisture if the twine has been moistened.

Figs. 2 and 2a disclose the twine in various stages of its formation. As shown in these figures, the soft twist yarns Y are twisted together around the core C to form the round twine T, the direction of twist of the yarns in the twine being opposite to the direction of twist in the individual yarns and the twist in the individual yarns being less in the finished twine than in the yarns before being twisted into the twine. The yarns Y are of such twist before being twisted together that in the twine, the twist in the individual yarns as nearly as practical approaches zero. The fibres of the yarn therefore extend nearly longitudinally of the twine and fibre breakage in the compression operation is reduced to the minimum and loss of strength in the compression operation by fibre breakage is substantially avoided. The twine emerges from the compression operation in flat configuration as shown at F, each of the yarns Y being individually flattened as shown in Fig. 3, and being held together by the adhesive carried by the core C.

The rollers 14 are journalled between vertical plates 16 mounted on a suitable base 17. The lower rollers 14 are grooved to receive ribs provided on the upper rollers, thus providing a rectangular space within which the twine T is confined and shaped. The journals of the upper rollers are mounted for vertical movement and springs 18 are provided for pressing the upper rollers against the lower rollers. Adjusting screws 19 provide means for adjusting the pressure exerted by the springs 18 on the twine passing between the rollers. Gears 20 and 21 are provided for supplying driving power to the pressure rollers 14.

The twine T may be moistened with a starch solution prior to its passage between the compression rollers to give a finished appearance to the ultimate flat twine. The pressure applied to the twine by the rollers 14 varies according to the size of the twine and also according to the character of fibre used in the twine.

Instead of introducing the binder by means of a string or other suitable core impregnated with the binder, a volatile solution of the binder may be squirted on to the yarns Y just before they enter the twister die. An apparatus for thus applying the binder is shown in Fig. 6, the binder solution being extruded from the nozzle 22 into contact with the yarns.

As shown in Figs. 7 and 8, the twine may be made from a single round yarn. A round yarn Y' may be spun with an adhesive impregnated core arranged centrally or adhesive may be extruded centrally of the yarn while it is being spun. The yarn is then passed through the compression apparatus shown in Figs. 4 and 5 to reduce it to flat configuration resulting in the flat twine F'. If desired, the yarn may be conditioned for the compression operation by being moistened with starch solution or other suitable fluid. The edges of the finished single yarn twine are slightly curved, but the twine is of generally flat configuration and the adhesive serves to hold the fibres together and to maintain flat configuration.

In Fig. 9, there is shown a cross-section of three-ply round twine R composed of round yarns S bound together by adhesive carried by the central core X. The core is inserted into the twine at the time that the yarns are twisted together to form the twine and the adhesive acts to oppose separation of the yarns. Also, the ad-

hesive may be extruded or squirted between the yarns as previously described.

The twine shown in Fig. 10 comprises a single round yarn S' centrally of which there is provided a core X' impregnated with a binder and inserted into the yarn at the time the yarn was spun. Instead of a core, the binder may be extruded into the yarn at the time of spinning as above described. The adhesive opposes loosening of the fibres or untwisting of the yarn.

The adhesive is localized at the center of the yarn or twine and this arrangement results in effectively opposing separation of the fibres or yarns with the minimum amount of adhesive and the adhesive is completely covered by the fibres or yarns so that the surface of the yarn or twine as well as the major portion of the yarn or twine is free of adhesive. Previously, it has been suggested to completely impregnate yarn with finishing material such as starch or other material having adhesive qualities so that in the finished product, the finishing material permeated the entire structure and formed an enclosing casing or film as well as serving as an adhesive to hold together the fibres or yarns. The present invention does not contemplate any such arrangement of adhesive, but contemplates rather strict localization of the adhesive centrally of the yarn or twine to keep down to the minimum the amount of adhesive required to oppose separation of the fibres or yarns and to avoid having the yarn or yarns permeated with or enclosed by the adhesive.

It is to be understood that any yarns, i. e. of fibre, paper, combinations thereof, cellulosic material or other suitable material may be used; that different varieties of twist of the yarns and of the twine i. e. right or left turns, hard or soft twist and all combinations of the same may be used; and that the invention is not limited to the embodiment herein specifically described, but that various modifications may be made without in any way departing from the spirit of the invention as defined in the appended claims. For example, yarns (or units) of two or more plies may be substituted for the single yarns herein shown, and in twine of any configuration or number of yarns, the yarns are held together by suitable adhesive to prevent separation of the yarns.

I claim:

1. The process of manufacturing flat twine which comprises twisting together a plurality of yarns to form round twine, introducing a core impregnated with binding material into the twine during the twisting operation and compressing the round twine into flat configuration.

2. As a new article of manufacture, flat twine composed of a plurality of individually spun soft twist yarns intertwisted with one another and pressed into flat configuration, said yarns being joined together with an adhesive binder.

3. As a new article of manufacture, flat twine composed of a plurality of individually spun soft twist yarns intertwisted with one another and pressed into flat configuration and a central core impregnated with an adhesive binder for holding the yarns together.

4. As a new article of manufacture, flat twine composed of a plurality of yarns spun in the same direction and intertwisted with one another in the opposite direction, said yarns being joined together with an adhesive binder and pressed into flat configuration.

5. As a new article of manufacture, flat twine composed of a plurality of yarns spun in the same direction and intertwisted with one another in the opposite direction, and a center core impregnated with an adhesive binder for holding the yarns together, the intertwisted yarns with impregnated center core being pressed into flat configuration.

6. The process of manufacture flat twine which comprises twisting together a plurality of individually spun soft twist yarns to form round twine, introducing adhesive centrally of said round twine during the twisting operation and pressing the round twine into flat configuration.

LOUIS I. WHITLOCK.