This invention pertains to a textile strand, to a process of making the same, and to apparatus useful in practicing this process. During the manufacture of textile and allied fabrics and in making such materials into garments or other useful articles, a certain amount of waste is always produced, which, in the aggregate, is very large in quantity, consisting of short or damaged lengths of woven, knitted, or felted fabrics, or trimmings resulting from the cuttings of such materials into definite shapes. While such waste fabricated material, hereafter referred to as "rag," is of utility as a paper stock, it must be sold for this purpose in competition with raw paper materials and thus whatever labor is represented in the fabrication of the textile rag from the raw material is a total loss. In accordance with the present invention, I convert short pieces of textile rag, which may comprise lengths of fabric differing in thickness, material, color, texture, etc., and of short or long lengths, into a strand of unlimited length useful and valuable as a basis for making certain textile materials and in which the structural characteristics of the textile rag are of high utility.

For example, such rag material, consisting of textile fibre which has undergone the usual steps involved in the preparation of a textile fabric, is far stronger, more durable and more flexible than similar lengths of grass, straw, hair or other unfinished fibres, and the strand made from such rag material is thus very desirable for purposes for which grass, straw or hair strands would be wholly unsuited.

While the strand thus prepared from rag stock is of utility for a variety of purposes for which usual textile materials are employed, it is especially desirable as a material for making carpets, rugs or similar heavy fabrics. For such use, the strand may well consist, as described above, of united lengths of rag of different colors, material, etc., since the variegated non-uniform strand when used for this purpose, either as warp or weft, produces an artistically pleasing effect in the finished article. However, for some purposes, for example, in the production of distinct patterns, I contemplate that it is within the scope of my invention to sort the rag, bleach it, dye it, if necessary, or otherwise subject it to a preliminary treatment so as to produce a strand of substantially uniform color, texture, or weight per unit of length.

I am aware that a continuous strand material has heretofore been made from rag stock by sewing rags together in series, but this mode of manufacture is unsatisfactory because of the slow rate of production and consequent high cost of labor, and further because the strand thus produced is substantially flat and presents substantially continuous raw edges. In accordance with my present process a strand is produced continuously at high speed and at a minimum labor cost, while the completed strand is of more or less circular contour in transverse section and the raw edges of the rag material are to a large extent bound in and confined. This strand, thus manufactured, is more like usual textile strands than the flat ribbon-like strand produced by sewing or otherwise, and is easier to manipulate in weaving or subsequent operations. Furthermore, the resultant fabric has a more finished and pleasing appearance than when woven from a flat strip having raw and exposed edges.

When prepared in accordance with my preferred process, the completed strand comprises relatively short lengths of rag in which the rag is twisted with or about a core of thread or cord consisting of any desired material, for example, cotton, jute, wire, or the like and which is adapted to impart a certain degree of longitudinal strength to the strand. The completed strand is also provided with an outer helical wrapping or binding of thread or cord which may be of the same or different material from the core thread. The ends of adjacent pieces of rug are preferably overlapped and twisted together, the individual lengths of rag being twisted not only at their ends but throughout their lengths, and preferably the direction of twist of the rug material is opposite to the direction of the
outer helix of wrapping or binding thread. Single rags arranged in series with their ends overlapping may constitute the strand, or if desired all portions of the strand may comprise a plurality of twisted rags.

In accordance with my preferred process, lengths of rag stock (either single or consisting of a plurality of parallel individual pieces) are placed with their ends in overlapping relation and twisted, preferably together with a core thread, as above described, and a wrapping or binding thread is wrapped around the twisted material to retain the twist. As a preliminary step in the process, the rag stock may be sorted, bleached, dyed, etc., and after the strand has been twisted and wrapped it may be wound to form a package of desired character or delivered into a textile “can” or other receptacle for use in winding woof bobbins or in the preparation of weaving warps, or for braiding, knitting or the like.

While my process may be carried out by hand, I prefer to employ mechanism for the purpose, and I have devised a desirable form of mechanism comprising in general a twisting device, means for presenting the rag to the twisting device, and means for delivering a core thread with the rag material to the twisting device. The apparatus also comprises a rotating flyer or its equivalent for wrapping a binder thread around the twisted material, together with means for drawing off or tensioning the completed strand and for delivering it to the desired point. The machine is preferably fed by hand, although I contemplate the provision of automatic feeding means as within the purview of the invention, and the machine may be provided with a suitable stop motion of any usual type, if desired, to stop the machine whenever the core or wrapping thread breaks or becomes exhausted.

In the accompanying drawings, I have illustrated one desirable embodiment of mechanism for use in the practice of my process together with the completed strand resulting from the practice of my process, it being understood that the mechanism shown in but one example of means suitable for the purpose, and that the process here described may be carried out by hand and may be varied as, for example, by changing the order of steps, by the omission of certain steps, or by the substitution of equivalent steps without departing from the spirit of the invention.

In the accompanying drawings:

- Fig. 1 is an elevation illustrating a fragmentary portion of a strand formed in accordance with my present process and by hand or by the apparatus here disclosed;
- Fig. 2 is a transverse section of such a strand substantially on a line 2—2 of Fig. 1;
- Fig. 3 is a similar section illustrating a modification;
- Fig. 4 is a fragmentary plan view of apparatus designed for making the strand of Fig. 1;
- Fig. 5 is a front elevation of such apparatus, certain parts being broken away;
- Fig. 6 is an elevation from the left-hand side of Fig. 5;
- Fig. 7 is a fragmentary section on the line 7—7 of Fig. 5;
- Fig. 8 is a vertical section on the line 8—8 of Fig. 5;
- Fig. 9 is a fragmentary plan view illustrating a typical piece of rag material employed in making my improved strand; and
- Fig. 10 is a fragmentary plan view illustrating one of the steps of the process.

Referring to the drawings the numeral 1 designates a typical piece of rag material which, as indicated in Fig. 9, is of woven fabric having the raw or torn edges 2 and 3. While woven material may be employed, it is within the scope of the invention to employ materials made by knitting, braiding or felting and all such material may be formed into rags or narrow strips in any suitable manner preparatory to the present process. For some purposes it may be desirable to sort the rag material for uniformity of color, weight, etc., or to bleach it or dye it particularly when it is to be used in making patterned fabrics.

The rag material is stretched out longitudinally and, as indicated in Fig. 10, one end of the piece 1 is lapped over the end 4 of a second piece and the material is then twisted so as to produce a strand 5, of more or less circular contour in cross section (see Fig. 2). Preferably, in order to impart additional longitudinal strength to the strand I lay a continuous core thread 6 in contact with the rag material prior to twisting. This core thread extends longitudinally of each piece of rag material and across the joint between adjacent pieces and thus to some extent at least sustains longitudinal stress to which the strand may be subjected. As indicated in Fig. 2, the core 6 will usually lie at substantially the center of the strand 5, although due to the twisting action it may at times be displaced toward one side or the other or in some cases taken up a more or less spiral course. Having thus twisted two sections of rag material together, a third piece is placed in overlapping relation to the free end of the piece 1 and is twisted together with the latter, and this process continues indefinitely by the addition of further pieces of rag so that a continuous strand of any desired length may be formed from relatively short sections of rag material, it being understood that the core thread extends throughout the entire length of the completed strand.

During the twisting of the rag material,
or subsequently thereto, I prefer to wrap a binder thread around the strand in the form of an open helix. This thread binds in the exposed edges of the rag material and tends further to reduce the strand to a circular cross section. It prevents untwisting of the strand and thus strengthens the joints between adjacent rags. Preferably this binder 7 is wrapped around the strand in a helix whose pitch is opposite to the twist of the rag material. When thus wound the binder assists very materially in preventing untwisting of the rag material when the completed strand is subjected to longitudinal tension.

Under such circumstances the rag material tends to untwist while the helix tends to move in the opposite direction and these forces thus balance each other. In Fig. 3 I have shown a strap 58 having a binder 7 but omitting the core 6, but I prefer as shown in Figs. 1 and 2 to provide both core and binder.

While the above process may be carried out by hand, I prefer to employ mechanical means for the purpose and in the accompanying drawings have shown one desirable mechanism for use in the practice of this process.

This mechanism preferably comprises a work table 8 of substantial area and of sufficient length to permit the longest section of rag to be extended thereon. At the forward edge of this table I provide a trough-like structure comprising the bottom 9 (Fig. 7) and the rear and front walls 11 and 12 respectively. The bottom 9 of this trough furnishes a support for the upper run 13 of an endless feed belt. This belt passes about an idler pulley 14 (Fig. 5)—mounted in suitable bearings at the right hand portion of the table, and at its other end passes about a driving pulley 15 mounted upon a shaft 16. This shaft turns in suitable bearings carried by the frame of the machine and is provided at its rear end with a pinion (not shown) meshing with a pinion upon a vertical shaft 18 provided with a gear 19 meshing with a pinion 20 on the main drive shaft 21. The shaft 21 is mounted in suitable bearings in the machine frame and is provided with disengageable driving clutch mechanism 22 and receives its motion through a reduction gearing 23 from an electric motor 24 mounted upon the machine frame. Obviously any other suitable source of power may be employed.

At a point near the left hand end of the table 8 the guide trough is furnished with bearings for an idler roll 25 (Fig. 5). A roll 26 is disposed directly above the roll 25. The roll 26 is mounted on a shaft journaled in bearings carried by a lever 27 pivoted to turn about an axis 28. This lever is furnished with a weight supporting arm 29 carrying an adjustable weight 30 by means of which the pressure of the roll 26 in a downward direction may be regulated. An endless belt 31 passes around the rolls 25 and 26. The left hand portion at least of the lower run of this belt normally contacts with the upper run 13 of the feed belt above described. As the guide roll 26 is movable upwardly and downwardly, the left end of the belt 31 may rise slightly from the belt 13, but it is pressed downwardly thereagainst by the action of the weight 30.

At a suitable point a bracket 33 is connected to the table and this bracket carries a spindle 34 upon which may be mounted a spool or thread mass 35. This thread mass furnishes the core thread 6 which passes from the spool or mass through a guide 36 and thence down between the belts 13 and 31.

A bracket 37 (Fig. 4) extends to the left from the table 8 and this bracket carries spaced bearings 38 and 39 which receive a rotary twister 40 (Fig. 5). This twister preferably comprises a pulley having the flanges 42 and is adapted to receive a belt 43 which passes around a pulley 44 on the shaft 21. The twister also comprises an elongate sleeve member 45 and is provided with a passage 46 extending longitudinally through it from one end to the other. This passage 46 is preferably angular in cross section, or eccentric with reference to the axis of the twister, or both, and is adapted to receive the rag material and to impart a twist thereto as the material passes longitudinally through the rotating twister.

The machine frame is provided with an upright 47 which supports a fixed substantially horizontal and tubular bearing member upon which is mounted a rotary sleeve 48 forming the body portion of a flyer. The sleeve 48 is provided with a plurality of radial arms 49, two such arms being here shown, and each arm is furnished with a spindle for receiving a thread mass 50. These thread masses are adapted to supply the binding thread 7 and from each thread mass the thread passes over a suitable guide 52 carried by an arm 51 mounted on the sleeve 48. If desired a thread may be fed simultaneously from each of the thread masses 50, but ordinarily only one of these thread masses is active at any one time, the other merely constituting a reserve and acting as a counterbalance for the other. If desired a suitable stop motion (not shown) of any usual type may be added for detecting the breakage or failure of each of the threads 6 or 7 and for automatically stopping the machine on such occurrence.

The sleeve 48 is furnished with a driving pulley 53 which is engaged by a drive belt 54 passing around a driving pulley 55 on the shaft 21 and also about a pulley 56 fixed to a shaft 57 journalled at the upper end of the member 47. The shaft 57 carries a pulley 59 for a purpose hereinafter described.
A tension or pull-off roll 60 is mounted in fixed bearings carried by the upright 47 and the shaft which supports this roll is furnished with a bevel pinion 61 (Fig. 6) meshing with a pinion upon a shaft 62 provided at its lower end with a gear 63 meshing with a gear 46 on the shaft 21. A second pull-off roll 65 is mounted directly above the roll 60. The roll 65 is journaled in bearings carried by a lever arm 66 fulcrumed at 67 and provided with an adjustable weight 68 which tends to press the roll 65 downwardly into engagement with the roll 60. The axis of the twister, the axis of the flyer sleeve 48, and the bight of the rolls 60 and 65 are all in substantial alignment with the upper run of the belt 13.

In the operation of the mechanism above described, the core thread 6 is first threaded through the guide 36 and then passed between the belts 13 and 31, through the passage 46 in the twister, through the hollow shaft upon which the flyer is mounted, and between the rolls 60 and 65. When the machine is started into operation the movement of the rolls 60 and 65 as well as the movement of the belts 13 and 31 draws off this core thread 6 from the mass 35 and delivers it continuously at the left hand end of the machine. This thread is now passed up over the pulley 59 and may be led to any suitable form of winding mechanism or into a textile can 69 shown in Fig. 6.

The operator now selects rags from the supply and lays them one after another upon the upper surface of the belt 13 within the guide trough, disposing the end of each rag or bundle of rags in overlapping relation upon the end portion of the preceding rag or rags. Conveniently, for the purpose of speeding up the operation, the operator may straighten out the individual rags and lay them in more or less parallel relation upon the upper surface of the table 8, as indicated in Fig. 4 so that as the end of a rag approaches the roller 25 another rag may be ready to be placed in overlapping relation upon the first rag. The movement of the core thread 6 assists in moving the rags between the bight of the belts 13 and 31 and to direct them from between the belts into the passage 46 of the twister. As the rag material is gripped firmly between the belts, the rotating twister imparts a substantially uniform twist per unit of length to the rag material, and during this twisting the core thread 6 is twisted into the rag material. From the left hand end of the sleeve 45 of the twister the twisted material emerges and passes into the hollow shaft which supports the flyer sleeve 48. At the point where the twisted material is thus exposed, the binder thread 7 is engaged therewith and as the twister is rotating rapidly the binder is wrapped in a tight helix about the twisted rag material. The guide roll 59 may be provided with friction means or other suitable tension element so that the binder is applied subjected to the desired tension as it is wrapped about the rag. Preferably, as above stated, the flyer turns in a direction opposite to the direction of rotation of the twister so that the binder helix is of opposite pitch to the twist of the rag material itself. However, it is not necessary to employ this opposite twist and the flyer and twister may be turned in the same direction if desired. After twisting and wrapping with the binder, the completed strand passes out between the pull-off rolls 60 and 65 and thence up over the pulley 59 to the point of delivery. As shown in Fig. 6 the completed material is coiled in a cam 69 from whence it may be drawn and wound upon a weaving bobbin or otherwise prepared for use.

The strand thus formed may be made continuous in any desired length, the raw or free edges of the rag material are bound in firmly, the individual rags are firmly united and the joints between them are substantially smooth and scarcely perceptible. This strand is particularly well suited in use for making rag rugs or carpets, and may be employed either as a warp or weft for this purpose. Obviously, by varying the width of the rags employed in making this strand, the diameter of the strand may be varied so that the strand will be found useful for many purposes for which strands of more usual type are employed.

While I have set forth a certain desirable sequence of steps as constituting my process and have indicated a desirable mechanism for use in practicing such process, I wish it to be understood that the invention is not limited to the details herein described except as defined by the appended claims.

I claim:

1. Apparatus of the class described comprising a rotary twister, a pair of moving endless belts adapted to grip a rag between them and advance it toward the twister, means for rotating, the twister, and means for winding a binder thread helically around the twisted rag delivered from the twister.

2. Apparatus of the class described comprising a rotary twister having a passage therethrough, an endless feed belt having an upper run substantially aligned with the axis of rotation of the twister, a second endless belt having a run substantially parallel with and above the upper run of the feed belt, means tending to press the second belt against the feed belt whereby to grip a rag resting upon the feed belt, means for moving the opposed runs of the belts in the same direction, means for rotating the twister, and means for wrapping a binder thread around the material delivered by the twister.

3. Apparatus of the class described comprising a rotary twister having a passage therethrough, an endless feed belt having an upper substantially horizontal run aligned
with the axis of rotation of the twister, means for pressing a rag into contact with said horizontal run of the belt, means for moving the belt and for rotating the twister, means for delivering a core thread in a position to be gripped between the horizontal run of the belt and said pressing means, and means for wrapping a binder thread around the material delivered from the twister.

4. Apparatus of the class described comprising a rotary twister, means for feeding rag material to the twister and for drawing the twisted material from the twister, means for rotating the twister, a rotary flyer coaxial with the twister, said flyer having a support for a thread mass and means for guiding the thread into a position to wind about the material delivered by the twister, and means for rotating the flyer.

5. Apparatus of the class described comprising a rotary twister, means for feeding rag material to the twister and for drawing the twisted material from the twister, means for rotating the twister, a rotary flyer coaxial with the twister, said flyer comprising a plurality of symmetrically disposed supports for thread supply masses, a guide corresponding to each support, and means for rotating the twister whereby to wrap thread from at least one of said supplies about the twisted rag material delivered by the twister.

6. Apparatus of the class described comprising a rotary twister, means for gripping a rag and advancing it toward the twister, means for rotating the twister to twist the rag, a rotary flyer for winding a binder thread helically around the twisted rag, means for rotating the flyer oppositely to the twister, and means for applying tension to the twisted material.

7. Apparatus of the class described comprising a rotary twister having an eccentric passage for the material to be twisted, means for gripping a rag and advancing it toward the passage in the twister, means for rotating the twister to twist a rag extending through the passage therein, and means for wrapping a binding thread helically around the twisted rag.

8. Apparatus for use in preparing textile weft strand from rags of fabricated textile material, said apparatus comprising a rotary twister having a passage therethrough for the rags, means for rotating the twister, a feed belt for delivering rags to the twister, a second belt for pressing the rags into contact with the feed belt, means for loading the second belt to provide the desired pressure, means for driving the feed belt, means for delivering a core thread to the bight of the belts, a rotary flyer having means for supporting a supply of binder thread, a pair of draw-off rolls for pulling the twisted rag material from the twister, and means for rotating the flyer to wrap binding thread around the twisted material delivered by the twister.

Signed by me at Lowell, Massachusetts, this 28th day of January, 1928.

JOHN C. CORAM.