

Dec. 22, 1931.

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MANUFACTURE OF PAPER TWINE

Filed Oct. 24, 1925

3 Sheets-Sheet 1

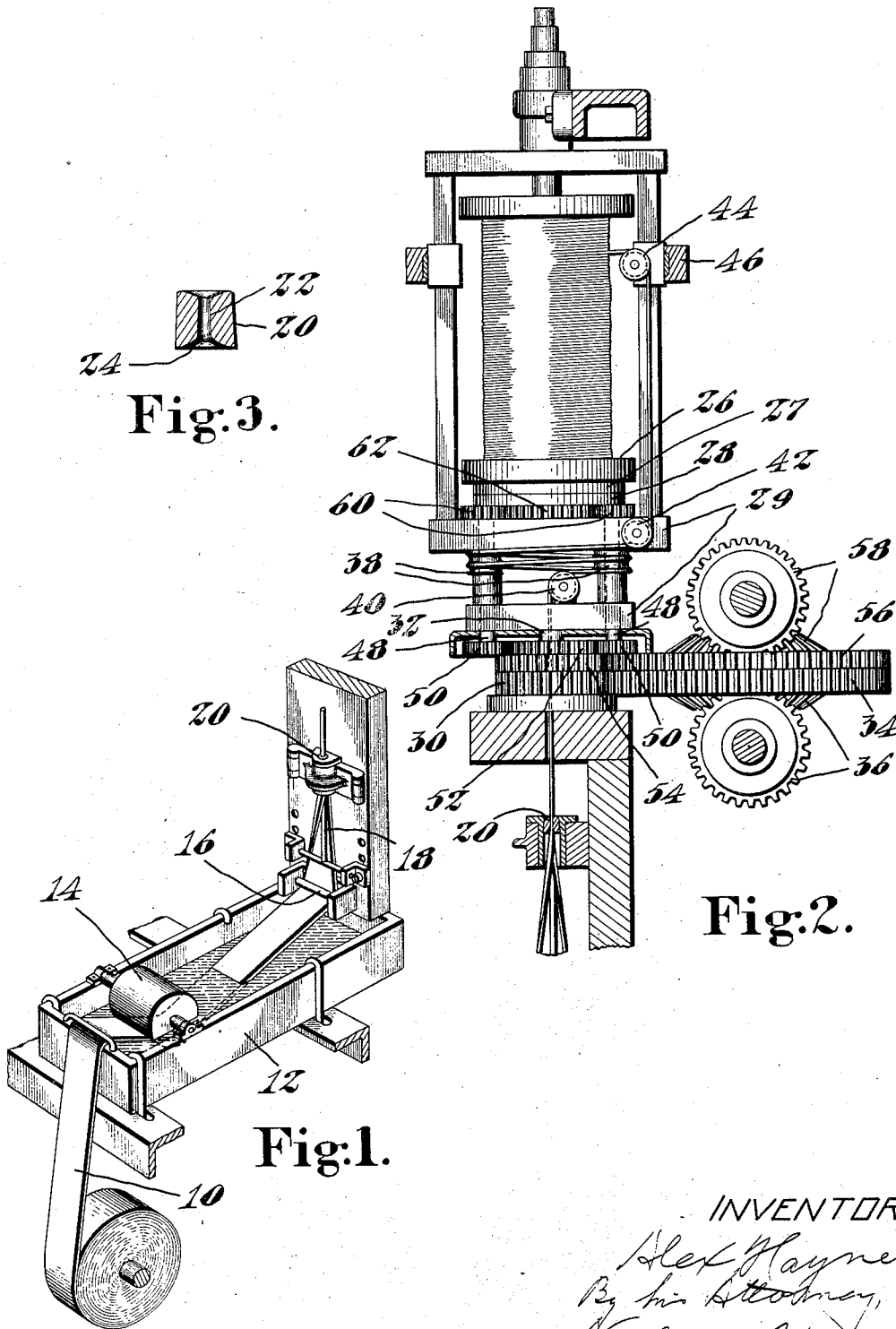


Fig.2.

Fig.1.

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3 Sheets-Sheet 2

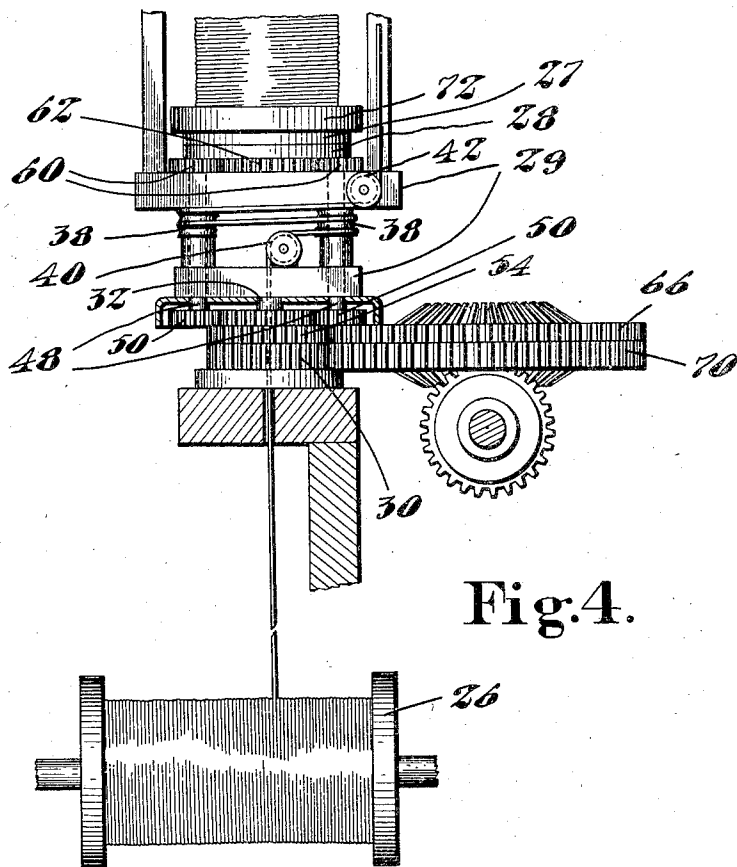


Fig. 4.

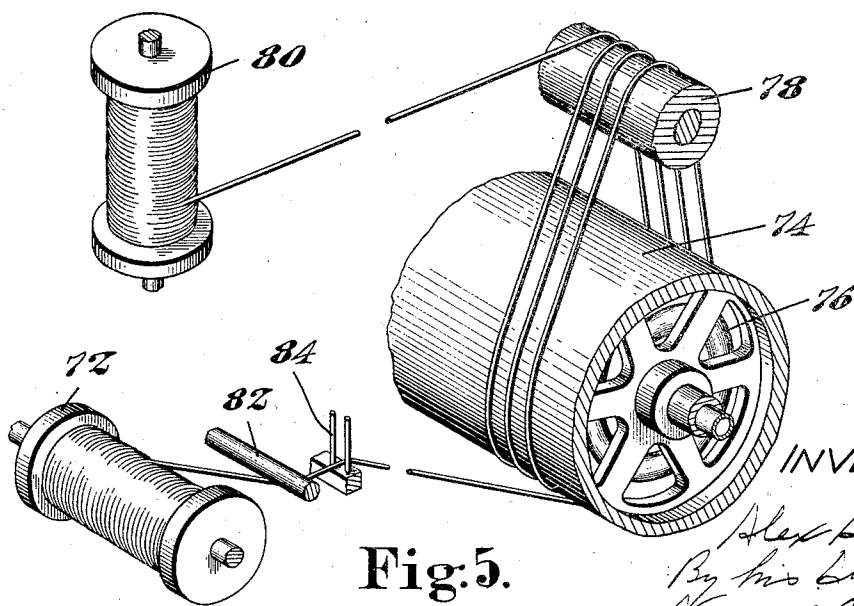


Fig. 5.

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3 Sheets-Sheet 3

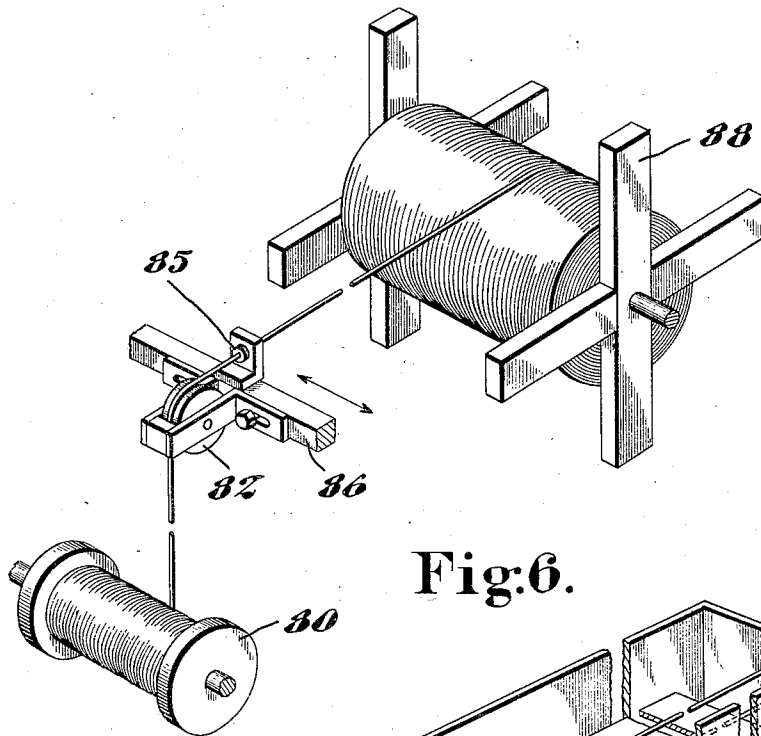


Fig. 6.

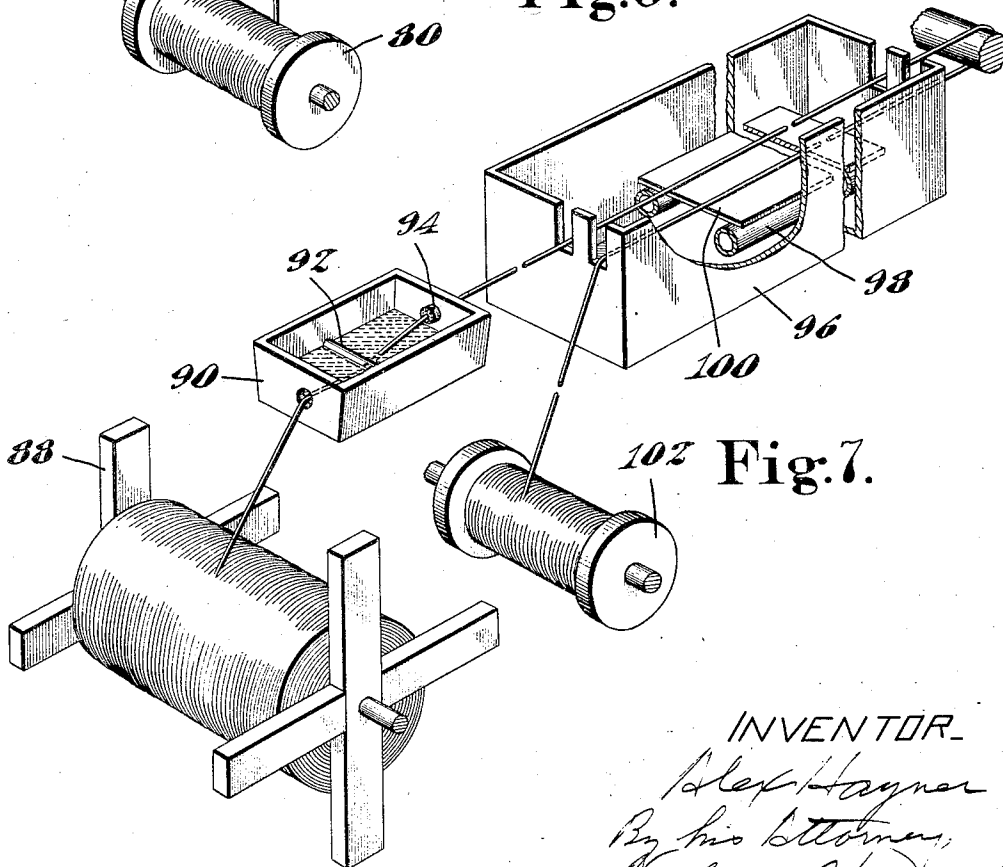


Fig. 7.

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MANUFACTURE OF PAPER TWINE

Application filed October 24, 1925. Serial No. 64,666.

This invention relates to improvements in methods of manufacturing paper twine and is illustrated herein as embodied in an improved method by which paper twine having a high degree of uniformity may be produced.

Paper twine of different sizes and textures has been used in the past on a large scale for such purposes as the manufacture of imitation reed furniture and the manufacture of rugs. It is also used for a variety of lesser purposes, for example as string for tying packages and for handles for paper bags. For these purposes it has not been necessary to produce twine having any great degree of uniformity. Indeed for some purposes, particularly for the manufacture of furniture, a more desirable, because more artistic, result is produced by using twine of a more or less irregular diameter and cross-section. The methods heretofore known and used in the manufacture of paper twine were well adapted to the manufacture of such a comparatively irregular and non-uniform product.

It has recently been proposed to use pegs cut from paper twine as driven fastenings in the manufacture of boots and shoes. This requires a stiff and comparatively hard twine which, for the best results, needs to be much more uniform in diameter and cross-section than the paper twine heretofore manufactured or capable of manufacture by the methods heretofore known.

It is accordingly an object of the present invention to provide an improved method applicable to the making of paper twine of substantially uniform diameter and cross-section.

The paper pegs, referred to above for use in the manufacture of boots and shoes, are driven through a metal driver passage or throat opening which serves to guide the fastenings as they are driven. While the size of this passage will vary according to the size of the peg, which will be varied according to the purpose for which the peg is to be used, nevertheless the size of peg, and of the twine from which it is cut, to be inserted through a given size of driver passage must be sub-

stantially uniform. The peg should pass freely through the driver passage without binding but without capability of lateral play. If it is more than about two-thousandths (.002) of an inch larger than this desired size, it will bind in the driver passage, will block the passage, and will prevent the operation of the machine. On the other hand, if it is more than about two-thousandths (.002) of an inch smaller than this desired size, it is likely to buckle and cannot be depended on to drive properly. My improved method illustrated and claimed herein provides for the manufacture of such substantially uniform paper twine.

Paper twine of the harder and stiffer varieties has heretofore been manufactured by applying sizing to a strip of paper, passing the strip through a die, twisting it, and reeling the twine thus produced. In order to make the twine of greater uniformity, in accordance with the novel method of my invention I give the paper twine thus produced a supplemental twist in the same direction as the original twist while it is still moist. This gives the twine a substantially circular cross-section of greater uniformity than it has previously had and tends also to compact and thereby to harden it. After this the twine is dried, though not to a bone-dry condition, and is passed through a second die. These steps are used in succession to produce the most uniform twine, but under some conditions one of them may be used satisfactorily without the other. After this a supplemental surface coating of sizing is applied to the twine still further to stiffen it and to produce a smooth surface, any excess of sizing being removed by passing the twine through a stripper. The twine is then dried and may be reeled or coiled for shipment.

The words "paper" and "glue" as used in this specification and claims are intended to be taken in their broader senses. By paper is meant any paper-like substance formed in a sheet of the general nature of paper, even though not composed entirely of the cellulose or ligno-cellulose stock from which paper is ordinarily made. Similarly the word "glue" 100

is to be taken as covering any sizing material of a glue-like nature.

With the above and other objects in view, the invention will now be described with reference to the accompanying drawings and pointed out in the claims.

In the drawings,

Fig. 1 illustrates the passing of a strip of paper through a bath of sizing and then through a die in the manufacture of paper twine;

Fig. 2 illustrates the twisting and reeling of the paper twine after it passes from the die of Fig. 1;

Fig. 3 is a view on a larger scale of a die through which the paper strip is passed in Figs. 1 and 2;

Fig. 4 illustrates the giving of a supplemental twist to the paper twine subsequent to the twisting illustrated in Fig. 2;

Fig. 5 illustrates the drying of the twine by passing it around a heated drum;

Fig. 6 illustrates the passing of the dried twine through a second die to make it more uniform in diameter and cross-section; and

Fig. 7 illustrates the application of a surface coating of sizing to the twine and the subsequent drying of the twine.

In the manufacture of paper twine as herein disclosed, a strip of tough, strong paper illustrated at 10 is passed through a bath 12 of sizing, for example a good grade of hide glue, being forced beneath the surface of the sizing by a roll 14. From the bath of glue the sized strip is guided by a rod or roll 16 toward a spindle or plunger 18 about which, when a new strip is being inserted, it is curled manually. Plunger 18 serves to guide the strip to a die 20 (Figs. 1 and 2), and to facilitate its curling, so that it may be passed through the die. Die 20, as shown on a larger scale in Fig. 3, has a passage 22 with a flaring entrance 24 devoid of sharp corners so that the moist curled strip will be compacted without danger of tearing it. The passage 24 through the die tapers somewhat from the entering end to assist in the compacting of the partially formed twine.

From die 20 the strip passes, as shown in Fig. 2, to a spool upon which it is wound, mechanism being provided, however, for twisting the compressed strip before it is wound upon the spool. As illustrated in Fig. 2, a spool 26 is carried on a plate 27 resting on and frictionally carried by a second plate 28 in turn carried by a base 29. Base 29 is rigidly connected to a gear member 30 by a hollow shaft 32, the whole being rotated by a gear 34 driven from any suitable source of power, for instance through bevel gearing 36. In order to feed the twine toward spool 26, base 29 carries a pair of small capstans 38 to which the twine is guided through hollow shaft 32 and about a

pulley 40. From capstans 38 the twine passes about a pulley 42 carried by base 29, upwardly about an idler 44 carried by a traveler 46 reciprocated in any suitable manner and then to spool 26. Capstans 38 are carried by shafts 48 upon which are mounted pinions 50 driven from a gear 52, the latter being rigid with a second gear 54 meshing with still another gear 56. The latter may be driven from any suitable source of power and, as illustrated, is driven by bevel gearing 58. Plates 27 and 28 are rotated relatively to base 29 by gears 60 carried by shafts 48 and meshing with a gear 62 fast to plate 28. The various gears shown are such that the twine is fed by the capstans 38 to spool 26 at a speed which is at all times insufficient to keep up with the speed of rotation of spool 26 and thus causes spool 26 and plate 27 to slip relatively to plate 28 by which they are carried. On the other hand, the frictional engagement of spool 26, plate 27 and plate 28 is sufficient to cause spool 26 to rotate and wind up the twine fed to it by capstans 38. Moreover, base 29 rotates at such a velocity relatively to the rotation of capstans 38 that the twine is given the desired twist as it is fed along by capstans 38. Obviously the twist may be varied by varying the ratio of the velocity of rotation of the capstans to the velocity of rotation of base 29. The most desirable amount of twisting will depend upon various factors, important among which is the diameter of the twine being manufactured. For example, in the manufacture of a high-grade, hard twine of seventy-thousandths (.070) of an inch in diameter, about thirty turns to the foot will be found satisfactory. Speaking generally, from ten to fifty turns to the foot is about the range which is useful.

The twine thus produced and reeled is of a somewhat variable diameter and cross-section due, for example, to irregularities in the paper stock and to deformation as it is wound upon spool 26. In order to render it more uniform, it is given a supplemental twist, as illustrated in Fig. 4. In that figure the twine is passed from spool 26 through a second mechanism substantially like that of Fig. 2 except that the gear ratios are such as to produce a much smaller twist, for example from three to five or six turns per foot. This has the effect not only of compacting the twine but of bringing it back to a circular cross-section, if it has been deformed by the reeling or otherwise. At the time of the second twisting the twine must be mellow and in temper rather than hard, though it may be allowed to stand for a few hours or even over night.

In the twisting device illustrated in Figs. 2 and 4 the ratio of the gearing is such that the small twist given by the mechanism of Fig. 4 is produced by disconnecting the driv-

ing mechanism for the upper gear, numbered 66 in Fig. 4, and securing it against rotation. For purposes of convenience the parts in Fig. 4, other than the gears 66 and 70 and the spool 72 to which the twine is passed, are given the same reference characters as in Fig. 2 for they are, as shown, of identical construction.

After the supplemental twist the twine is passed from the spool 72 (Fig. 5) about a drying drum 74 suitably heated, for example by a steam coil 76. The twine is, as illustrated, passed from drum 74 about an idler roll 78 back and forth several times and then is wound upon a spool 80. The twine is guided from spool 72 to drum 74 in any suitable manner, for example beneath an idler roll 82 and through a traveler 84. The twine is thus rendered substantially dry and hard enough to resist any reasonable handling without deformation but is still somewhat less than bone-dry.

After this drying the twine is passed, as shown in Fig. 6, from spool 80 over an idler 82 and through a second die 85 which may advantageously be of the same construction as die 20. As shown in Fig. 6 die 85 is carried by a traveler 86 and from it the twine passes to a reel 88. Next, as shown in Fig. 7, the twine is passed through a bath of sizing 90, for example glue, being forced beneath the surface of the sizing by a roll 92. Any surplus sizing is removed by passing the twine through a stripper, illustrated, for example, as a piece of rubber 94 with a hole therethrough. This stripper is not intended to act as a die and accordingly is made of yielding material of such a nature that it will wipe off the surplus sizing without further compressing the twine. From the bath of sizing 90 the twine is dried, for example by passing through a drier 96 illustrated as a metal box heated by a steam pipe 98. The twine is passed back and forth through the box and is prevented from getting into direct contact with the steam pipe 98 by a baffle plate 100. The dried twine is then wound upon a spool 102. If desired, the twine may be passed through the sizing bath 90 more than once in order to deposit a thicker surface coating of sizing upon it, being dried after the deposit of each coating.

While the twine, as shown in the accompanying drawings, is wound upon a spool or reel after the performance of a number of the steps of the herein disclosed method, it should be understood that this is largely a matter of convenience and, if desired, the twine may be handled in other ways between the performance of the various steps in its manufacture.

By the use of the herein disclosed method paper twine twisted from a single strand or strip can be manufactured having a much more uniform diameter than any which has

heretofore been made. Prior to the present invention paper twine had never been made having a diameter uniform within anything less than about ten-thousandths (.010) of an inch and in many instances the variation in diameter has been much greater than that. The present method enables the twine to be manufactured with much greater precision, it being possible without difficulty to maintain the diameter within two-thousandths (.002) of an inch or even less in either direction from a set standard. When manufacturing conditions are good, particularly if the highest grade of uniformity is not requisite, the supplemental twisting or the passing of the twine through the second die may be omitted and a considerable portion of the benefits of the invention retained. However, in order to obtain the most uniform product under the varying conditions that will be met with in practice, both of these steps are desirable.

Having described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of strong paper, passing the sized strip through a die and twisting it to form paper twine, and thereafter giving the moist twine a supplemental twist of a much smaller number of turns to the foot than the original twist.

2. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of paper, twisting the sized strip to form paper twine, exposing the twine to the air till it becomes partly dried, and giving the still somewhat moist twine a supplemental twist of several turns to the foot in the same direction as the original twist.

3. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of paper, passing the sized strip through a die and twisting it between ten and fifty turns to the foot, then, while the twine is still moist, giving it a separate supplemental twisting of about three to six turns to the foot.

4. That improvement in methods of manufacturing paper twine which comprises applying sizing to a single strip of paper, passing the paper through a die and twisting it to form approximately cylindrical twine, substantially drying the twine, and thereafter, without the incorporation of additional filaments, passing it through a second die to render it more uniform in cross-section.

5. That improvement in methods of manufacturing paper twine which comprises applying sizing to a single strip of paper, passing the sized strip through a die and twisting it to form paper twine, and thereafter giving the twine a supplemental twist of a

smaller number of turns to the foot than the original twist, all without the addition to the original strip of another strand or other strands.

5 6. That improvement in methods of manufacturing paper twine which comprises curling a strip of paper about an axis extending in the general direction of its length, passing the curled strip through a die to compact it into the form of a solid cylinder, twisting the twine, and thereafter giving it a supplemental twist of a substantially smaller number of turns to the foot than the original twist to give it a truly circular cross section.

10 7. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of strong paper, passing the paper through a die and twisting it to form approximately cylindrical twine, drying the twine somewhat less than bone-dry, and thereafter passing it through a second die to render it more uniform in cross-section.

15 8. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of paper, passing the strip through a die, twisting it to form approximately cylindrical twine, giving the twine a second twist of several turns to the foot in the same direction as the original twist, substantially drying the twine, and passing it through a second die.

20 9. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of paper, passing the strip through a die, twisting it to form approximately cylindrical twine, giving the twine a second twist of a smaller number of turns to the foot than the original twist in the same direction as the original twist, substantially drying the twine, and passing it through a second die.

25 10. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of paper, then passing the strip through a die and twisting it to form an approximately cylindrical twine, thereafter while the twine is still somewhat moist giving it a supplemental twist of a substantially smaller number of turns per unit of length than the original twist in the same direction as the original twist, then substantially drying the twine and passing the substantially dried twine through a second die.

30 11. That improvement in methods of manufacturing twine which comprises applying sizing to a paper strip, passing the strip through a die and twisting it to form approximately cylindrical twine, partially drying the twine, giving the twine a supplemental twist in the same direction as the original twist to render it more compact and to give it a more uniform cross-section, substantially drying the twine, applying a surface coating of sizing, and again drying the twine.

12. That improvement in methods of manufacturing paper twine which comprises applying sizing to a strip of strong paper, passing the sized strip through a die, twisting it to form paper twine, and, after the passage of sufficient time to permit the evaporation of a substantial portion of the liquid which the twine acquired from the sizing, giving the moist twine a substantial twist of a much smaller number of turns to the foot than the original twist, thereby bringing back to a true cylindrical form such portions of the twine as may have been distorted.

13. That improvement in methods of manufacturing paper twine which comprises passing a strip of strong paper through a bath of glue, twisting the strip to form paper twine, and, after the passage of sufficient time to permit evaporation of a substantial proportion of the water which the twine picked up in the glue bath, giving the moist twine a supplemental twist of a few turns to the foot in the same direction as the original twist, thereby bringing back to a true cylindrical form such portions of the twine as may have been distorted.

In testimony whereof I have signed my name to this specification.

ALEX HAYNER.

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