June 9, 1942. C. MOSIER ET AL 2,285,755

METHOD OF MAKING INSULATING TAPE

Filed Nov. 1, 1938 3 Sheets-Sheet 1

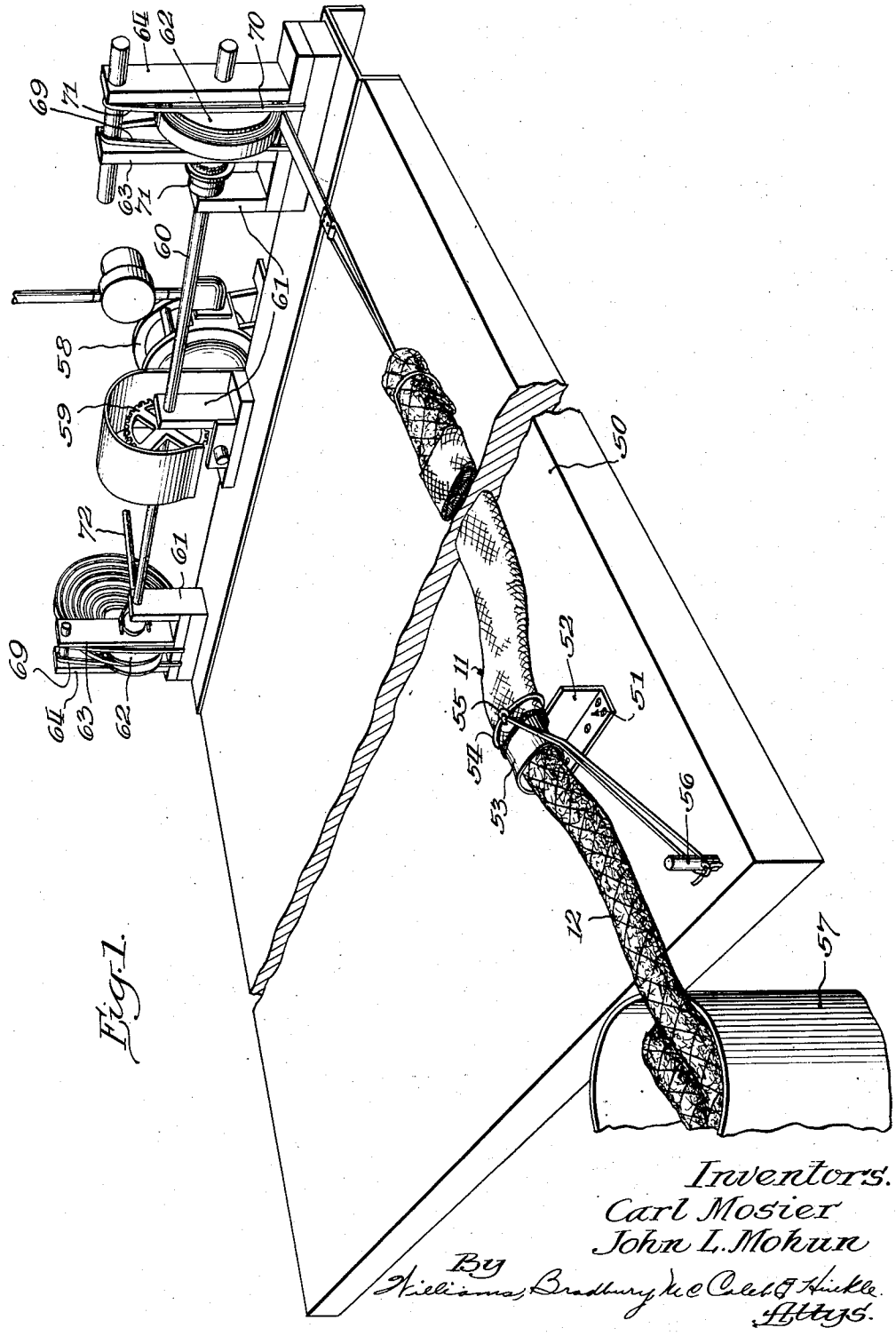


Fig. 1.

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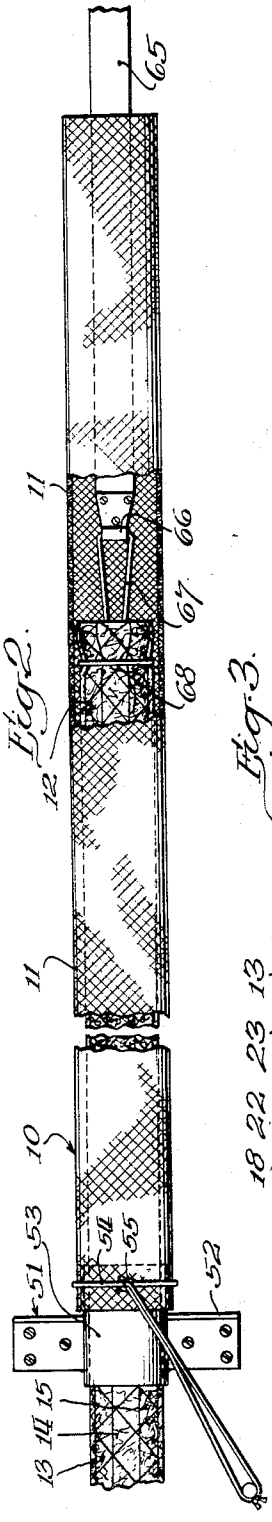


Fig. 2.

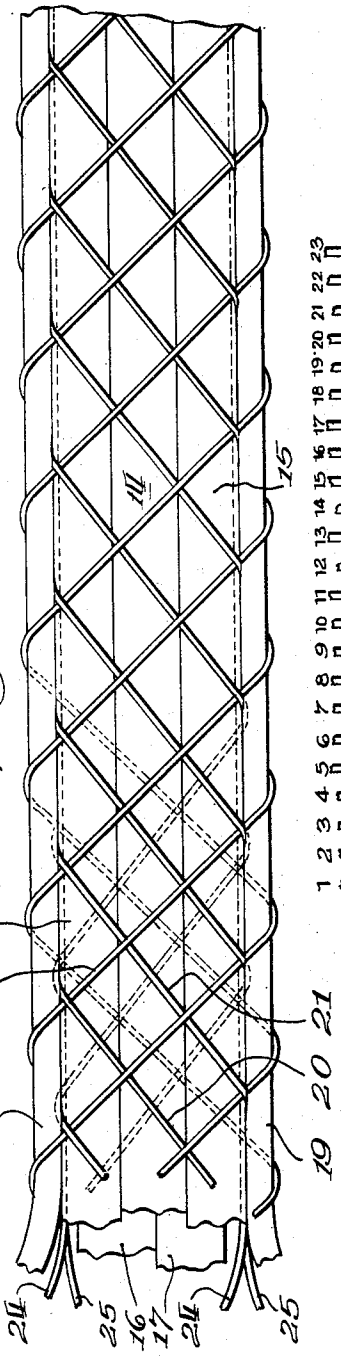


Fig. 3.

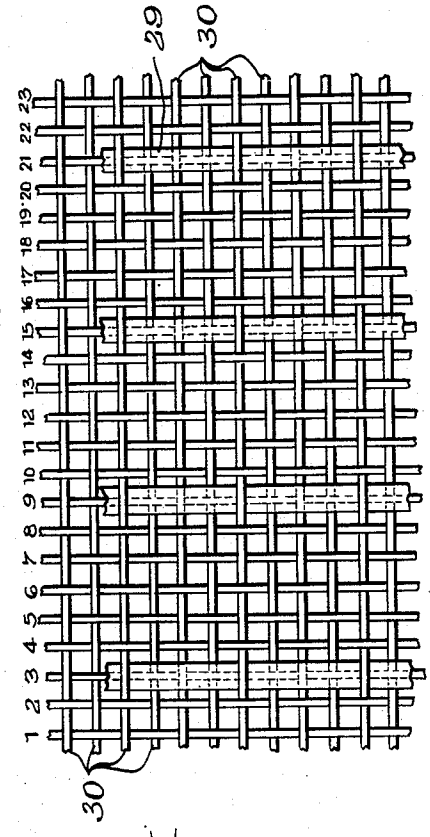


Fig. 4.

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Fig. 5.

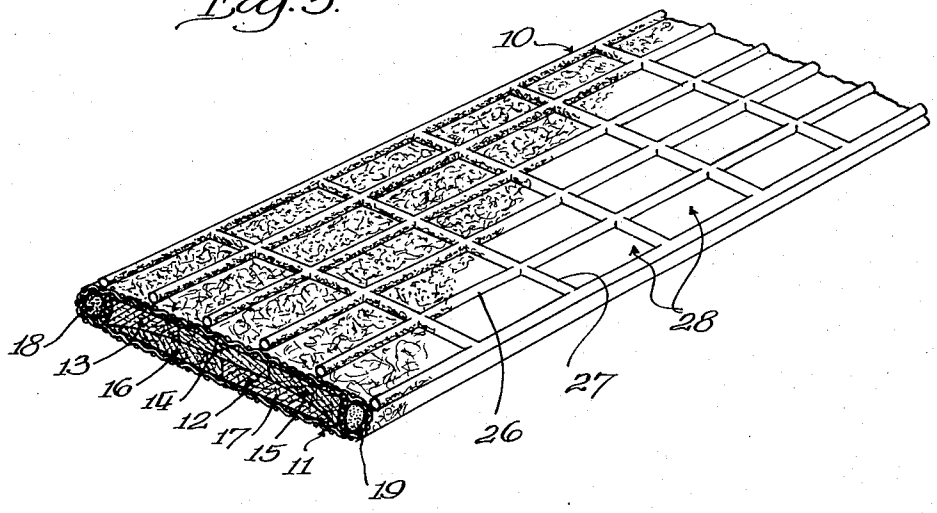
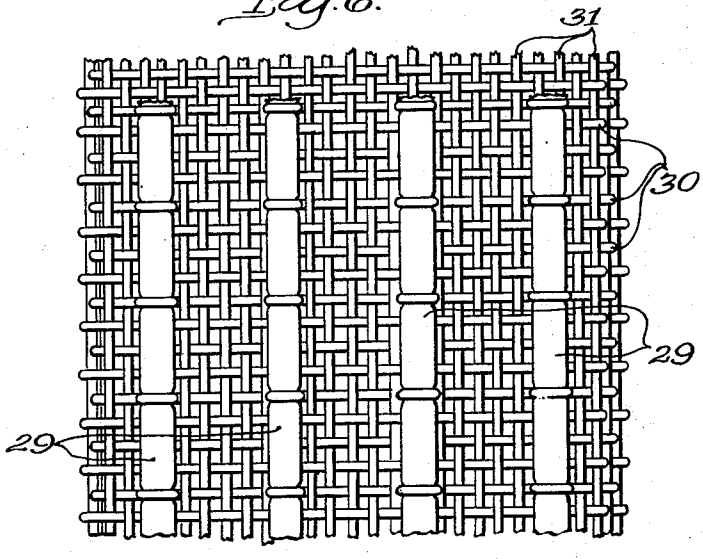


Fig. 6.



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2,285,755

METHOD OF MAKING INSULATING TAPE

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Application November 1, 1938, Serial No. 238,204

6 Claims. (Cl. 154—28)

The present invention relates to a method for making insulating tape, and is particularly concerned with insulating tape of the type having a woven sheath and insulating filler.

The present application is a continuation-in-part of our prior applications, Serial Nos. 108,170, filed October 29, 1936, for Insulating tape and methods of making the same; and 199,752, filed April 4, 1938, for Method and apparatus for making insulating tape.

One of the objects of the invention is the provision of an improved insulating tape and method of making the same, which includes a structure that is adapted to entrap air between the tape and the pipe in dead air spaces, to increase the insulating value of the tape.

Another object of the invention is the provision of an improved filler structure which is adapted to be drawn into an insulating tape sheath with greater facility by virtue of its improved structure, which gives it greater tensile strength, and which tends to cause the filler to contract into a smaller space while the filler is being drawn into the sheath.

Another object of the invention is the provision of an improved method of manufacturing insulating tape of the class described, by means of which a more simple and effective insulating tape may be constructed.

Another object of the invention is the provision of an improved machine whereby the insulating filler is adapted to be placed within a previously constructed woven sheath.

Another object is the provision of an improved machine for use in making insulating tape which is adapted to draw the insulating filler into the tape in such manner as to insure the construction of a relatively flat continuous insulating tape of uniform insulating characteristics.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the three sheets of drawings:

Fig. 1 is a view in perspective of a machine for drawing an insulating filler into an insulating sheath, in the manufacture of the insulating tape;

Fig. 2 is a top plan view of a portion of the machine of Fig. 1 showing additional details of construction with the filler and sheath as they appear at the beginning of the operation of drawing the filler into the sheath;

Fig. 3 is a diagrammatic fragmentary plan view of a portion of an insulating filler constructed according to the present invention;

Fig. 4 is a fragmentary plan view of a portion of the insulating sheath constructed according to present invention;

Fig. 5 is a fragmentary view in perspective of an insulating tape constructed according to present invention, that side of the tape which is to be adjacent to the article to be insulated uppermost.

Fig. 6 is an enlarged diagrammatic plan view of the upper side of the insulating sheath of Fig. 5 showing the details of its construction.

Referring to Fig. 5, the present insulating tape, which is indicated in its entirety by the numeral 10, preferably comprises a woven insulating sheath 11, which is tubular in shape, and which is provided with an insulating filler, indicated in its entirety by the numeral 12.

The filler preferably consists of a plurality of large loose and soft rovings of asbestos fibers, the rovings being indicated by the numerals 13, 14, 15, 16 and 17.

These rovings may be made of relatively long fibers or short fibers, and in some cases other insulating fibers, such as vegetable or animal fibers, may be used. In the preferred embodiment of the invention the rovings have very little or practically no tensile strength, although a slight amount of vegetable fibers may be included to increase the tensile strength of the rovings to facilitate handling of the rovings during the manufacture of the filler 12.

These rovings are preferably so arranged that they overlap each other; that is, the rovings 16 and 17 are disposed over the crack between the rovings 12 and 13 and 14 and 15 respectively. When the filler is complete, the rovings flatten out to an elongated structure, which may be substantially rectangular in cross section.

The filler 12 also preferably includes at each edge an asbestos rope 18, 19, which comprises asbestos or other fibers tightly twisted together, for the purpose of giving the filler a greater tensile strength.

Referring to Fig. 3, the rovings 13 to 17 may be secured together by a plurality of threads 20, 21 and others extending spirally around the assembly 12—17 in a left hand direction as viewed in Fig. 9, and by a plurality of other threads 22, 23, and others which extend spirally around the assembly 13—19 in the oppsite or right hand direction. These spiral threads 20—23 and others form a basket weave about the rovings and ropes and hold the parts of the filler together. When

the spirally extending threads 20—23 are subjected to longitudinal tension with the rest of the filler, they tend to cause the filler to contract into a smaller space so that it can be more readily inserted in its sheath.

The ropes 18, 19, give the filler a tensile strength which enables it to be drawn into the sheath 11 in substantial lengths, such as, for example, fifty feet, more or less. In addition to the threads 20—23, other longitudinally extending threads 24, 25 may be arranged at the edges of the rovings to increase the tensile strength of the assembly. It should be understood that any number of rovings may be used, and rovings are preferably used in the preferred form of the invention. In some embodiments of the invention, however, other forms of flat fillers of less insulating value might be used with the improved sheath.

Referring to Fig. 5, this shows the outside of an improved form of sheath or of a tape which has on its rear side, that is, the side which is innermost to the pipe when the tape is spirally wound on a pipe, a plurality of insulating ropes or large threads 26 extending longitudinally of the sheath, and a plurality of relatively large thread formations 27 extending transversely of the sheath and intersecting the thread formations which extend longitudinally thereof.

This forms depressed rectangular spaces 28 between the thread formations 26, 27, and the depressions 28 are adapted to entrap air between the sheath and the pipe when the sheath is spirally wound on a pipe or when it is applied to any other surface. This greatly increases the insulating value of the sheath and causes this increase at a slight additional cost, which is not proportionate to the increased value of the tape.

The structure of Fig. 5 may be accomplished in different ways, one example being the addition to the sheath of longitudinally and transversely extending relatively large threads or ropes of asbestos.

In the embodiment of Fig. 1, however, additional longitudinally extending large threads or ropes 29 have been used, located on the lower outside of the sheath and equally spaced from each other. Referring to Fig. 4 and Fig. 6, in this embodiment 30 indicates the weft threads and 31 the warp threads. Every fourth weft thread extends over the large thread or rope 29 and binds it to the woven assembly. Thus, for example, the large thread or rope 29 in Fig. 4 is secured by the weft thread 30 at the bottom, the woven thread 30 at the middle of the figure, and left thread 30 at the top.

The weft threads 30 may be drawn so tightly in the weaving that they cause the portions 27 of the warp threads 31 to project outward above the rest of the surface of the weave. In other words, the thread portions 27 project outward substantially as much as the ropes 29. This gives the appearance of the sheath on that side a waffle-like formation, as shown in Fig. 5, the transverse ridges being formed by the outwardly projecting portions 27 of the warp threads 31.

The arrangement of the weave may be seen in greater detail with reference to Fig. 4, in which the warp threads have been numbered 1 to 23. The ropes or large threads 29 have been arranged in the figure on top of the warp threads 3, 9, 15 and 21, and they are secured by engagement with the weft threads 30.

Referring to Figs. 1 and 2, these are diagrammatic illustrations of a part of the apparatus used in the manufacture of the insulating tape previously described. In Fig. 1, 50 indicates a table top which may be slightly longer than the longest length of sheath which is intended to be filled by one operation of drawing the filler into the tape; for example, if the tape is to be made in fifty-foot lengths, the table may be 55 or 60 feet long, so as to leave sufficient space on the table for work at each end of the tape.

The table 50 is provided at one end, the left end, in Fig. 1 with a sheath-holding fixture 51 that may comprise an angle iron member 52, provided with a relatively flat tubular member 53. The horizontal flange of the iron 52 is secured to the table 50 by a plurality of screws, bolts, or other fastening means, and the vertical flange of the iron 52 carries the flat or oval tubular member 53.

The tubular member 53 is constructed of metal and it is of sufficient size, with respect to the sheath 11, so that the sheath 11 is rather tightly stretched when it is placed upon the tubular member 53, as shown in Fig. 1.

In order to insure the securement of the sheath 11 on the tubular member 53, the apparatus may be provided with a cord having a loop 54, embracing the sheath and tubular member 53, and drawn tight by means of a slip knot 55, the end of the cord being tied to a peg 56 in the table 50.

The shape of the tubular member 53 in elevation approximates the shape of a flat tubular sheath 11, with which it is used. The tubular member 53 is adapted to serve as a rigid and fixed eye for the end opening of the woven sheath 11 and also for securing the sheath 11 in place, while the filler 12 is drawn into the sheath.

The filler 12 may be as shown in Fig. 3 and may be provided in suitable lengths to correspond to the length of the sheath 11, and is stored in coils in a suitable barrel 57.

It should be understood that the table 50 may be provided with any number of different apparatus, including the fixture 51 and the machinery for drawing filler into a multiplicity of sheaths at the same time.

The apparatus for drawing the filler into the sheath is mounted at the right hand end of the table in Fig. 1, and it comprises a suitable electric motor 58, provided with worm gear for driving the gear wheel 59, which is mounted upon a horizontal shaft, 60. The shaft 60 is rotatably mounted in bearings carried by the brackets 61, and it is provided with one or more drums, 62, which may be located between the vertical guides 63, 64.

Each drum 62 has secured to its periphery a tension member 65, which may consist of a length of flexible steel strap. The strap 65 of spring steel is longer than the length of the table 50 so that it may extend, when unwrapped from the drum, to a point beyond the fixture 51, where it may be secured to the filler 12. At its free end, the steel strap is provided with a U-shaped metal member 66, secured thereto by rivets or other fastening means and having a loop for receiving a cord 67. The cord 67 may have a slip knot formed in its opposite end and may be looped around the end of the filler 12 at 68.

In order to insure the wrapping of the strap 65 upon the relatively narrow drum 62, additional guide members 69 and 70 are provided on each side of the drum 62 for slidably engaging the edges of the strap 65 and confining it to the drum 62. Any number of drums in 62 may be employed upon the same shaft 60, depending

upon the size of the motor, the length of the sheath into which the filler is to be drawn, and the resistance encountered.

We have found it convenient to use a pair of drums on the same shaft and same table, but it is not necessary to use both drums at the same time. The sheath is secured to the tubular member **53** at one end and is laid out on the table **50** in approximately a straight line and extending toward the drum **62**. Each drum **62** is preferably loosely mounted on the shaft **60** and its connection to the shaft **60** is controlled by a clutch **71**, the clutch being actuated by a lever **72**. The operation of the machine will be apparent from the foregoing description.

The spring steel strap **65** is sufficiently stiff so that it can be threaded or inserted into the sheath **11**, beginning at the right hand end **13**. The natural shape of the strap is straight so that it will lie flatly on the table and so that it can be pushed into the sheath **11** until it emerges from the tubular member **53**.

The operator may then grasp the cord **67** and place the loop **68** about the end of the filler **12**. The loop **68** should not only embrace the rovings **13—18**, but it should also embrace the ropes **18**, **19** and embrace threads **21—23** of the filler. The loop **68** should also be arranged as close to the end of the filler as it can, while also making a secure connection between the cord **67** and the filler **12**.

We find that one good way to accomplish this result is to double over the end of the filler and arrange the loop **68**, embracing the double portion of the filler. The head **74** of the filler is thus formed by a doubled or bent over portion, which is less apt to be disintegrated during its passage through the sheath **11**. The slip knot of the cord **67** is adapted to compress this doubled head so that it does not form an obstruction to the drawing of the filler **12** into the sheath **11**.

The motor **58** may then be started and the drum **62** will wind up the strap **65** and draw the filler **12** into the sheath **11**, until it emerges at the end **73**. Thereafter the excess portions of filler **12** are cut off and the sheath is detached from the tubular member **53**. The filler is, of course, detached from the strap **65**. Care must be taken during the drawing in of the filler to see that it lies flat and does not become twisted and the sheath **11** must, of course, be laid out flat without any twists.

The nature of the basket weave of the enclosing threads **21—23** is such that a tension on these threads tends to cause the filler to contract, whereby it may be more easily drawn into the sheath.

Our method of the manufacture of insulating tape may be outlined briefly as follows:

The woven sheath is constructed as a unit and woven by a weaving machine into tubular form, the threads being composed mainly of asbestos. In many cases a small percentage of cotton may be interwoven with the asbestos for the purpose of increasing its tensile strength, and if desired, fine metal wires may also be included.

The filler **12** may be assembled as shown in Fig. 3 and embracing threads **21—23**, may be wrapped spirally in both directions about the filler and the edge ropes **18** and **19**. The filler is coiled in a barrel or other container **57**, so that it may be freely withdrawn from the container when it is to be assembled with the sheath.

The sheath is cut into predetermined lengths and laid out flat upon the table, one end of the sheath being secured to a tubular member. A relatively stiff tension member is threaded through the sheath from the opposite end until it emerges at the tubular member, whereupon the tension member is secured to one end of the filler; thereafter, the filler is drawn into the sheath by means of the tension member, the act of drawing this member, causing the embracing threads on the filler to contract the filler into a smaller space for facilitating its entry into the sheath. The filler is carefully guided and fed into the tubular member and sheath without twisting, so that it will lie flat within the sheath.

The excess of filler at each end of the sheath is then cut off and the insulating tape is then adapted to be used by being wrapped spirally about a pipe or other object.

In certain embodiments of the invention the sheath will be provided with a dead air space **28** on Fig. 5, by means of the longitudinally and transversely extending ridges **26** and **27** which are formed in the operation of the weaving of the sheath.

The side of the sheath, or the side opposite to the dead air spaces, **18**, is also preferably provided with a waterproof covering which may be applied by means of rollers, the lowermost of which dips into a container of waterproofing and impregnating compound, such as a compound including a rubber latex and an evaporating solvent. The waterproof compound preferably extends to the ends of the sheath and over the rear side of the sheath, that is, toward the uppermost side in Fig. 5, so that the article which is waterproofed covers enough of the tape so that the waterproofed edges may engage each other when the tape is spirally wrapped upon a pipe.

It will thus be observed that we have invented an improved machine for use in the manufacture of insulating tape and improved methods of manufacture of insulating tape by means of which the tape may be covered with a previously woven asbestos sheath. It is not necessary to turn the sheath inside out to fill it according to the present methods, nor is it necessary to stitch the edges of the sheath together after the filler has been placed in it, and the insulating tape is constructed with the present apparatus according to the present methods of substantially uniform heat insulating characteristics and may be manufactured more cheaply than the insulation of the prior art, having equivalent insulating value.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

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

1. The method of making insulating tape which comprises holding a tubular fabric sheath of insulating material, assembling a plurality of large, loose, soft rovings of insulating material in overlapping relation to form a filler for said sheath, with reinforcing ropes extending longitudinally of said filler, and drawing said filler into said sheath to form the tape.

2. The method of making insulating tape which comprises weaving a tubular fabric sheath of threads comprising asbestos fibers, said sheath including warp and weft threads of substan-

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tially the same size and also including a plurality of warp threads of substantially larger size, the latter larger warp threads being located in spaced relation to each other on the outside of the sheath and extending longitudinally thereof and being secured thereto by a plurality of regularly spaced weft threads, said latter predetermined weft threads being drawn more tightly than the warp threads which they engage for the purpose of providing transversely extending ridges on the same side of said sheath as said larger warp threads, placing said sheath upon a support and securing one end to said support, threading a straight and resiliently bendable tension member through said sheath, securing said tension member to one end of a filler and drawing said filler into said sheath by means of said tension member.

3. The method of making insulating tape which comprises weaving a tubular fabric sheath of threads comprising asbestos fibers, said sheath including warp and weft threads of substantially the same size and also including a plurality of warp threads of substantially larger size, the latter larger warp threads being located in spaced relation to each other on the outside of the sheath and extending longitudinally thereof and being secured thereto by a plurality of regularly spaced weft threads, said latter predetermined weft threads being drawn more tightly than the warp threads which they engage for the purpose of providing transversely extending ridges on the same side of said sheath as said larger warp threads threading a straight and resiliently bendable tensioning member through said sheath and attaching it to said filler, and drawing a filler into said sheath.

4. The method of making insulating tape which comprises weaving a tubular fabric sheath of threads comprising asbestos fibers, said sheath including warp and weft threads of substantially the same size and also including a plurality of warp threads of substantially larger size, the latter larger warp threads being located in spaced relation to each other on the outside of the sheath and extending longitudinally thereof and being secured thereto by a plurality of regularly spaced weft threads, said latter predetermined weft threads being drawn more tightly than the warp threads which they engage for the purpose of providing transversely extending ridges on the same side of said sheath as said larger warp threads, assembling a filler comprising a plurality of large, loose, soft rovings with left hand and right hand spirally extending threads, attaching a tension member to said filler, and subjecting said filler to tension to contract the filler, while drawing the filler into said sheath.

5. The method of making insulating tape which comprises weaving a tubular fabric sheath of insulating material, said fabric sheath having a plurality of longitudinally extending ropes interwoven therewith, said ropes being adapted to prevent the contraction of the sheath under tension, assembling the plurality of insulating fillers in overlapping relation to form a composite filler for said sheath with reinforcing threads extending spirally about said filler, tensioning said filler, and reinforcing threads, whereby the filler is caused to contract, and drawing said filler into said sheath to form the tape.

6. The method of making insulating tape which comprises weaving a tubular fabric sheath of insulating material, said fabric sheath having a plurality of longitudinally extending ropes interwoven therewith, said ropes being adapted to prevent contraction of the sheath under tension, assembling a plurality of insulating filler members to form a composite filler for said sheath with reinforcing threads extending spirally about said filler whereby the filler is caused to contract into smaller size when subjected to tension, laying said sheath in a straight line, and securing one end of said sheath to a fixed support, threading a relatively stiff, yet bendable and resilient, member through said sheath, and attaching it to one end of said filler adjacent the secured end of said sheath and wrapping the other end of said tension member spirally about a support to draw the tension member and filler through said sheath and locate the filler in said sheath.

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