Sept. 7, 1926. 1,598,872

C. PALMER

FLEXIBLE METAL LINED TUBE

Filed May 3, 1923 2 Sheets-Sheet 1

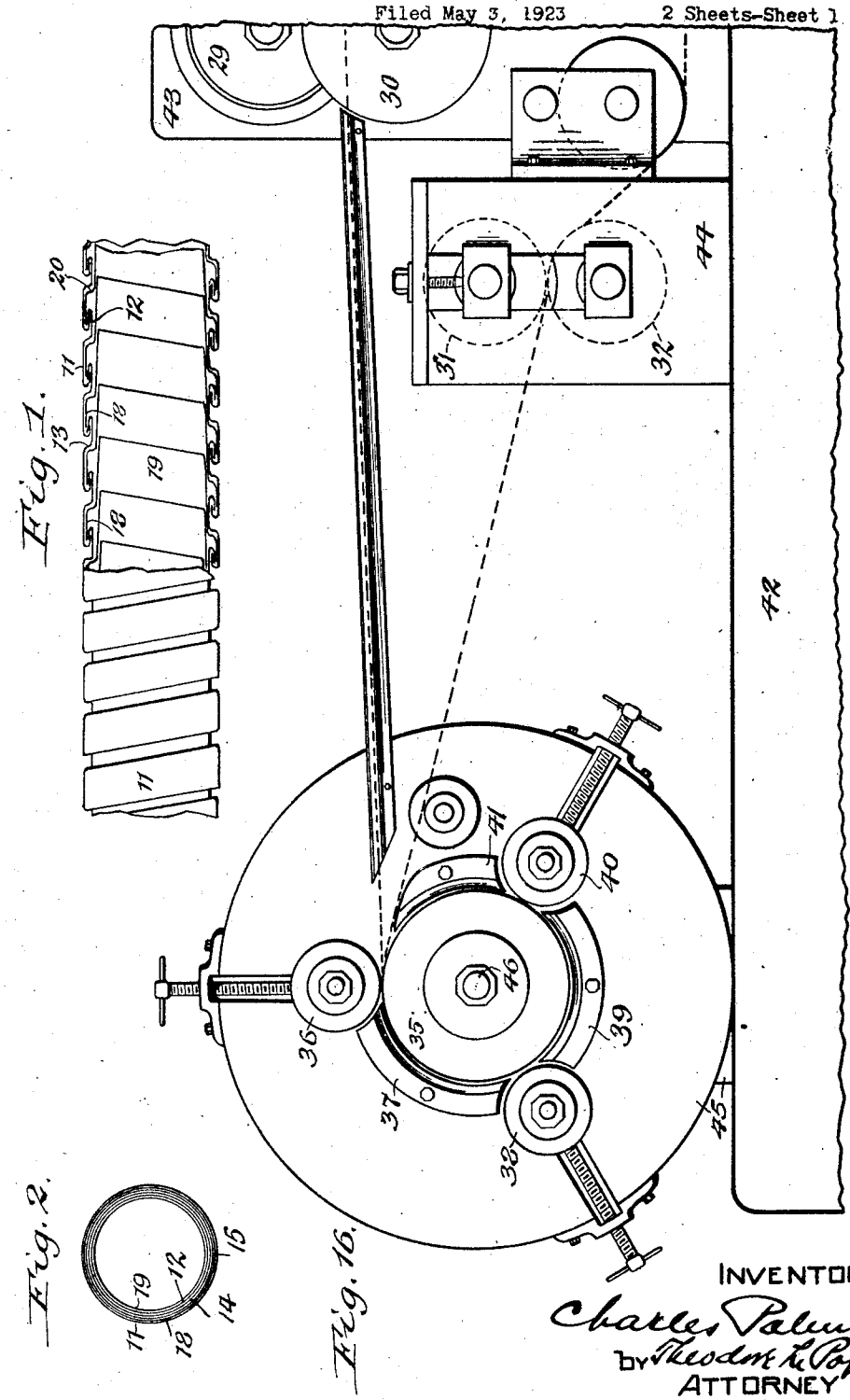


Fig. 1.

Fig. 2.

Fig. 16.

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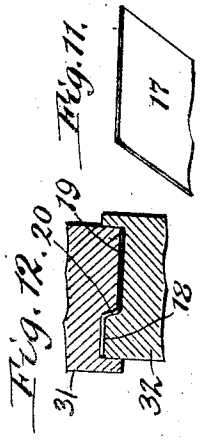
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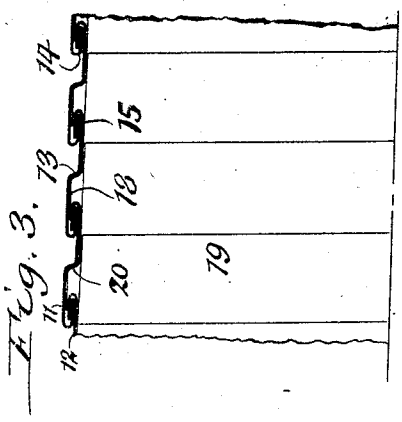
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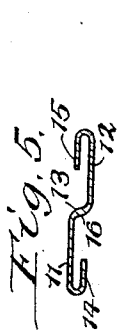
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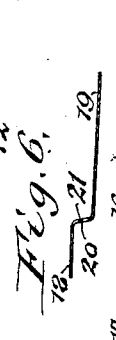
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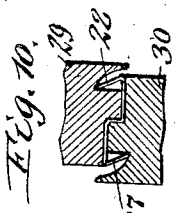




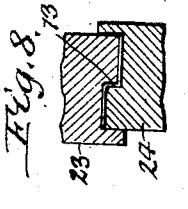


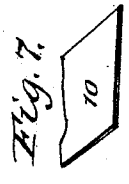


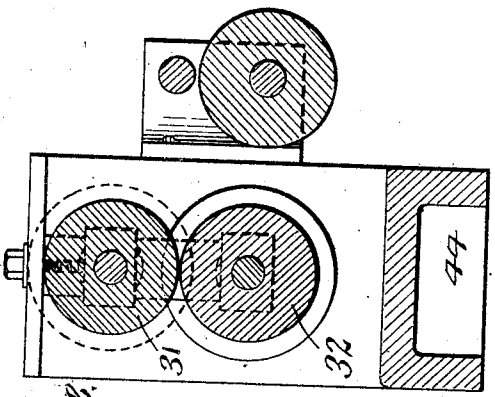


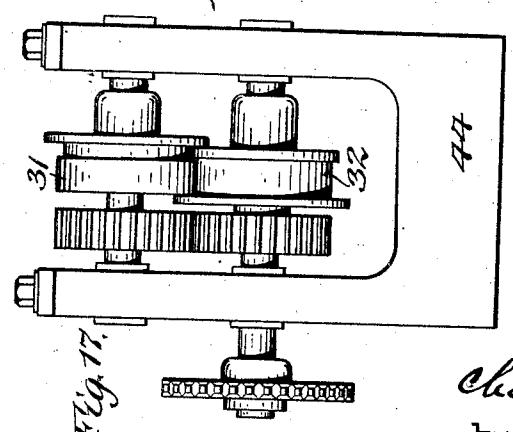


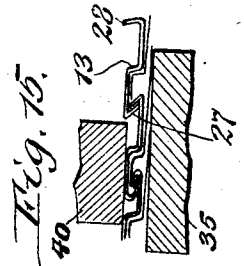


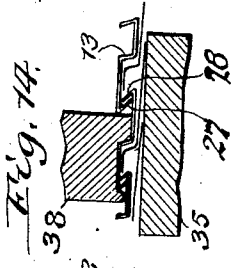


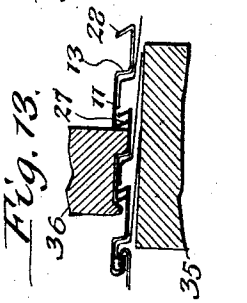












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Patented Sept. 7, 1926.

1,598,872

UNITED STATES PATENT OFFICE.

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FLEXIBLE METAL-LINED TUBE.

Application filed May 3, 1923. Serial No. 636,441.

The object of this invention is to provide a flexible metal tube or hose having a lining forming a smooth bore in the same.

In the accompanying drawings: Figure 1 is a fragmentary longitudinal sectional elevation of a flexible metal tube or hose of comparatively small diameter embodying my invention. Figure 2 is a cross section of the same. Figure 3 is a fragmentary longitudinal section showing a tube of larger diameter containing my improvements. Figure 4 is a fragmentary longitudinal section, on an enlarged scale, showing the formation of the sheathing and lining and the manner of interlocking the same in accordance with my invention. Figure 5 is a sectional view of the completed sheathing strip. Figure 6 is a similar view of the lining strip. Figure 7 is a perspective view of the strip from which the sheathing is made. Figures 8, 9 and 10 are fragmentary sectional views showing successive stages in the preliminary formation of the sheathing strip by means of profiling rolls. Figure 11 is a perspective view of the strip from which the lining is made. Figure 12 is a sectional view showing the manner of profiling the lining strip preparatory to assembling the same with the sheathing strip. Figures 13, 14 and 15 are fragmentary sectional views showing successive stages in the operation of assembling the sheathing and lining strips and interlocking the same into a completed tube. Figure 16 is a front elevation of an apparatus adapted for producing the flexible metal tube with smooth bore lining of my invention. Figure 17 is a front elevation of that part of the apparatus which profiles the lining strip before the same is assembled with the sheathing. Figure 18 is a longitudinal section of the same.

Similar characters of reference indicate corresponding parts throughout the several views.

In its general organization, the sheathing of the flexible metal tube or hose which contains my improvements is constructed of a strip 10 of pliable sheet metal which is wound spirally so that the front edge 11 of each convolution or turn overlaps the rear edge 12 of the preceding convolution. The several convolutions of the strip which thus form the sheathing of the tube are interlocked with each other so that the tube is flexible, yet will not pull apart under normal conditions, by offsetting the front and rear edge portions of the strip so as to form a longitudinal web 13 between them and providing the front edge portion of each convolution with an inwardly projecting hook-shaped flange 14 which interlocks with an outwardly-projecting hook-shaped flange 15 on the rear edge portion of the next preceding convolution of the sheathing strip, as shown in Figs. 1, 3 and 4.

By forming the sheathing strip in which the front hook flange is offset outwardly and the rear hook flange offset inwardly, the web on the central part of this strip forms a forwardly facing internal shoulder 16 between these hook flanges.

The lining is constructed from a strip 17 of pliable meet metal which is wound spirally in the same direction as the sheathing, so that each successive convolution of the same overlaps the outer side of the next preceding convolution thereof. The cross section of the lining strip is such that its front edge portion 18 is offset outwardly and the rear edge portion 19 of the same is offset inwardly and between these offset parts the lining strip is provided with a transverse web 20 which connects the offset parts of the strip and produces an external rearwardly facing shoulder 21 on the same. When the sheathing and lining are assembled, the front portion of each convolution of the lining is arranged between the outward turned hook flange of the next forward convolution of the sheathing, its rearwardly facing shoulder 21 is adapted to bear against the forwardly facing shoulder of the corresponding convolution of the sheathing and its rear portion engages with the inwardly offset rear portion of the respective sheathing convolution and extends across the groove, recess or gap 22 between the corresponding and the next following convolutions of the sheathing while its rear extremity engages with the inner side of the rear part of the next following lining convolution, as best shown in Fig. 4.

By this means, a lining is provided which produces a practically smooth bore on the inner side of the sheathing and renders the same particularly desirable for conducting granular or semi-solid materials, for in-

stance, flax seed and other grains inasmuch as this construction prevents the material from lodging in the gaps between the convolutions of the sheathing and instead causes the same to flow freely through the tube with a minimum of friction and resistance. Furthermore, by thus lining the sheathing the tube as a whole is much lighter and tighter than a tube made up of one sheathing within another for producing what has been known theretofore as a double armored hose which last mentioned construction was objectionable on account of weight and the piling up or lodging of material in the joints or corrugations which decreased the internal diameter of the tube, prevented free flow of the material and substantially lengthened the time required to load or discharge a specified amount of material.

The preferred means and method of procedure for manufacturing this lined metal flexible tube in accordance with my invention are as follows:

A strip 10 of pliable sheet metal of a suitable width, as for example that shown in Fig. 7, is first passed between a pair of offsetting profiling rolls 23, 24 the co-operating peripheral surfaces of which are adapted upon engaging opposite sides of the strip blank to offset the two edge portions of the strip relatively to each other and form a longitudinal web 13 which connects the inner opposing parts of these offsets, as shown in Fig. 8. This strip is next passed between two flanging profiling rollers 25, 26, which are constructed and operate to form flanges 27, 28 which project in opposite directions on the front and rear longitudinal edges of the strip and are arranged at right angles thereto, as shown in Fig. 9. This strip is next operated upon by the opposing surfaces of a pair of upsetting profile rollers 29, 30 which are constructed to bend the two flanges 27, 28 slightly inwardly, so as to form oblique angles with the body of the strip, as shown in Fig. 10.

At the same time that the sheathing strip is being thus profiled into the preliminary cross sectional shape, the strip of sheet metal 17 is passed between a pair of co-operating offsetting profiling rolls 31, 32, which operate to bend the lining strip, as shown in Fig. 12, to produce the outwardly offset portion 18 on the front longitudinal edge of this strip which is comparatively narrow and the inwardly offset portion 19 on the rear longitudinal edge of this strip, which front and rear offset strip portions are connected by the web 20.

After the sheathing and lining strips have been thus profiled, the same are fed together with the sheathing strip on the outer side and the lining strip on the inner side, to a rotary mandrel 35 in such manner that these strips wind spirally around this mandrel and the inwardly turned up-set flange 27 at the front or advancing longitudinal edge of the sheathing strip to engage with the outwardly projecting upset flange 28 at the rear or trailing longitudinal edge of the last turn or convolution of the sheathing strip and the co-operating flanges of the adjacent overlying parts of the sheathing strip which have just been assembled to be partially set down or pressed closer together between the periphery of the mandrel and an initial setting down roll 36 arranged above the mandrel, whereby the hook formation of the flanges on the sheathing strip is increased and these flanges are partially interlocked, as shown in Figs. 13 and 16, and prevented from becoming disengaged.

While the co-operating flanges of two sheathing convolutions are being thus partially set down the outwardly offset front portion of the lining strip is arranged on the underside of the outwardly offset front portion of the corresponding convolution of the sheathing strip, as shown in Fig. 13.

After the partially interlocked hook shaped flanges on adjacent convolutions of the sheathing strip have been acted on by the mandrel and initial setting down roll, this strip, with its flanges still in the same condition, descends on one side of the mandrel and these flanges are retained in this position by the first section 37 of a guiding die, as shown in Fig. 16. After leaving the first section of the guiding die, the assembled sheathing and lining strips pass between the periphery of the mandrel and an intermediate setting down roll 38, as shown in Fig. 16, whereby the setting down of the co-operating flanges of the sheathing strip may either be maintained to the same extent as effected in Fig. 13, or the intermediate setting down roll may be so constructed as to progressively increase the angularity or inward bend of the co-operating flanges of the sheathing strip and also confine the outwardly offset front portion of the respective lining convolution within the corresponding sheathing convolution to a greater extent, as shown in Fig. 14. As the sheathing and lining strips continue their rotary motion with the mandrel, they next pass between the same and the second section 39 of the guiding die and then the co-operating flanges of adjacent convolutions of the sheathing strip are acted upon by a final setting down roll 40 between which and the periphery of the mandrel the assembled strips pass, as shown in Fig. 16. The result is that the final setting down roll completes the closing or pressing together of the hook shaped flanges of adjacent convolutions of the sheathing strip and finishes the bending of these flanges, so that they are arranged parallel with, or substantially parallel with the axis of the tube, as shown in Figs. 1, 4

and 15, whereby these flanges are fully interlocked and incapable of being separated or unhooked under normal conditions.

In addition to completing the setting down of the co-operating hook flanges of adjacent sheathing convolutions, these flanges are bent or doubled in such manner as to extend along the inner side of the outwardly offset front part of the respective lining convolution and thereby interlock the same with the corresponding sheathing convolution, as best shown in Figs. 4 and 15. After the final setting down roll has operated on the assembled sheathing and lining strips, the same pass between the mandrel and the third or final section 41 of the guiding die and then leave the mandrel as finished parts of the lined flexible metal tubing.

A machine organized for producing the several operations above described may be constructed as follows:

42 represents the main frame of the machine which may be of any suitable construction. On the rear part of this frame is mounted a standard 43 upon which are mounted the sheathing strip upsetting rolls 29, 30, and additional standards of the same character being provided for similarly mounting the flanging rolls 25, 26 and offsetting rolls 23, 24. These offsetting rolls, flanging rolls and upsetting rolls may be rotated by power in any suitable manner. On the rear part of the main frame is also arranged a standard 44 upon which are journaled the lining strip offsetting rolls 31, 32 which latter may also be turned by power in any approved manner.

45 represents a standard arranged on the front part of the main frame and provided centrally with a main horizontal driving shaft 46 which carries the mandrel 35. The initial setting down roll 36 is pivotally mounted on the upper part of the standard 45 and co-operates with the top of the mandrel and the intermediate and final setting down rolls 38 and 40 engage with opposite sides of the lower part of the mandrel and are pivotally mounted on the adjacent parts of the front standard 45. The several sections of the guiding die are mounted on the front standard and alternate with the setting down rolls. Any desired means may be employed for rotating the mandrel and the setting down rolls co-operating therewith.

As the sheathing strip issues from the upset profiling rolls and the lining strip issues from its offset profiling rolls the same together pass between the mandrel and the several setting down rolls for interlocking these strips and then continuously discharging the finished product from the machine.

I claim as my invention:

A flexible metal tube having a helical sheathing and a lining, the sheathing consisting of a strip of metal which in cross section has two parallel longitudinal body sections, the opposing inner edges of which are off-set from each other and connected by a web and the outer longitudinal edges of which are provided with hooks which are reversely bent along opposite sides of the respective body sections, and the hook on one edge of one convolution interlocking with the hook on the opposite edge of the next convolution, and said lining consisting of a strip of metal which in cross section has two parallel body sections which are off-set and a web connecting the inner longitudinal edges of said off-set sections of the lining body and said lining having its web engaging the web of the sheathing and the front longitudinal edge of the lining being arranged between the body section of one convolution and the rear hook on the rear edge of the preceding convolution and the rear longitudinal edge of the lining being arranged between the inner side of the rear body section of the respective sheathing convolution and the rear edge of the preceding lining convolution and also engaging with the inner side of the rear part of the next following convolution of the lining.

CHARLES PALMER.