Nov. 13, 1956 E. L. MYRICK 2,770,284

PIPELINE COATING AND WRAPPING MACHINE

Filed Jan. 25, 1954 5 Sheets-Sheet 1

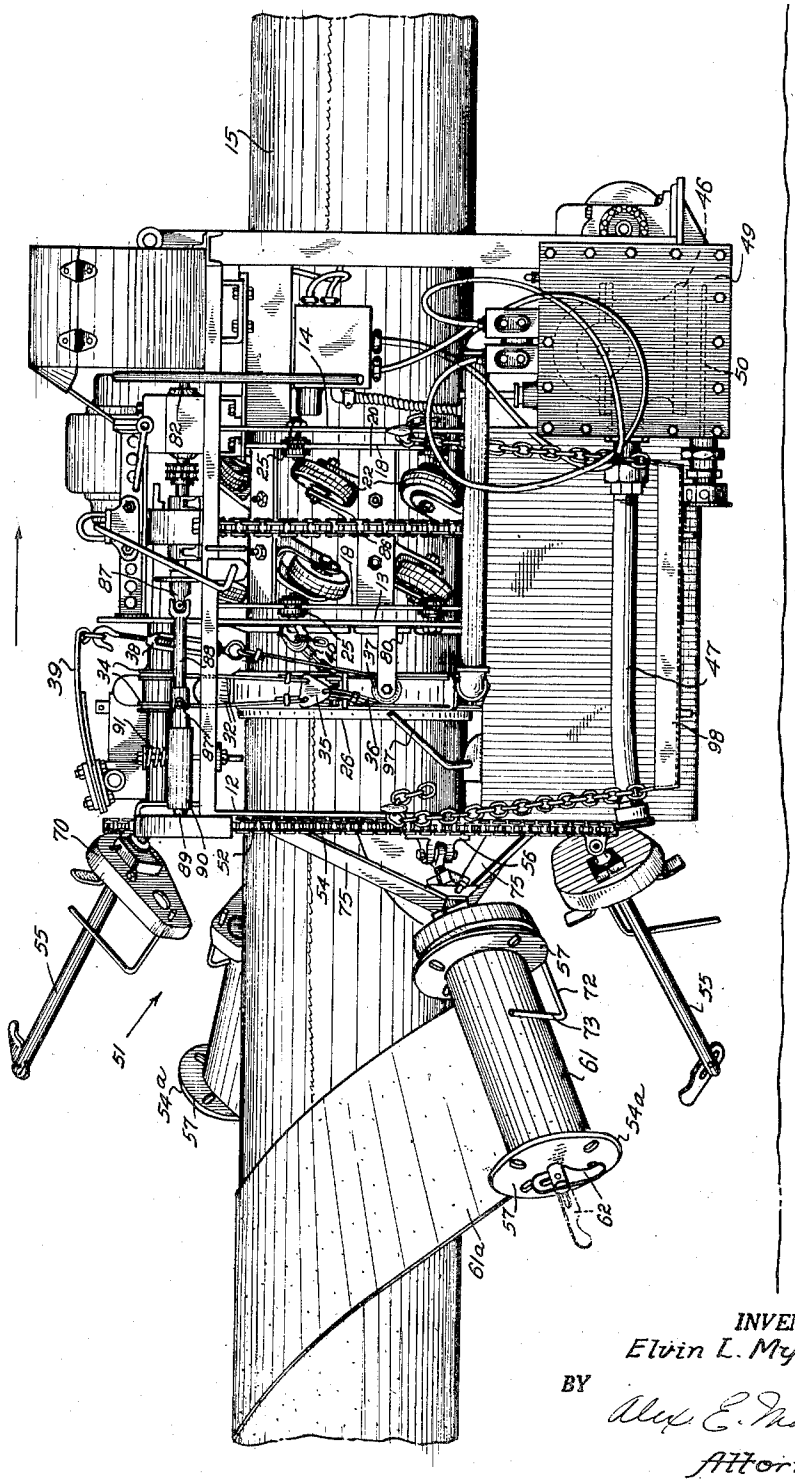


Fig. 1.

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PIPELINE COATING AND WRAPPING MACHINE

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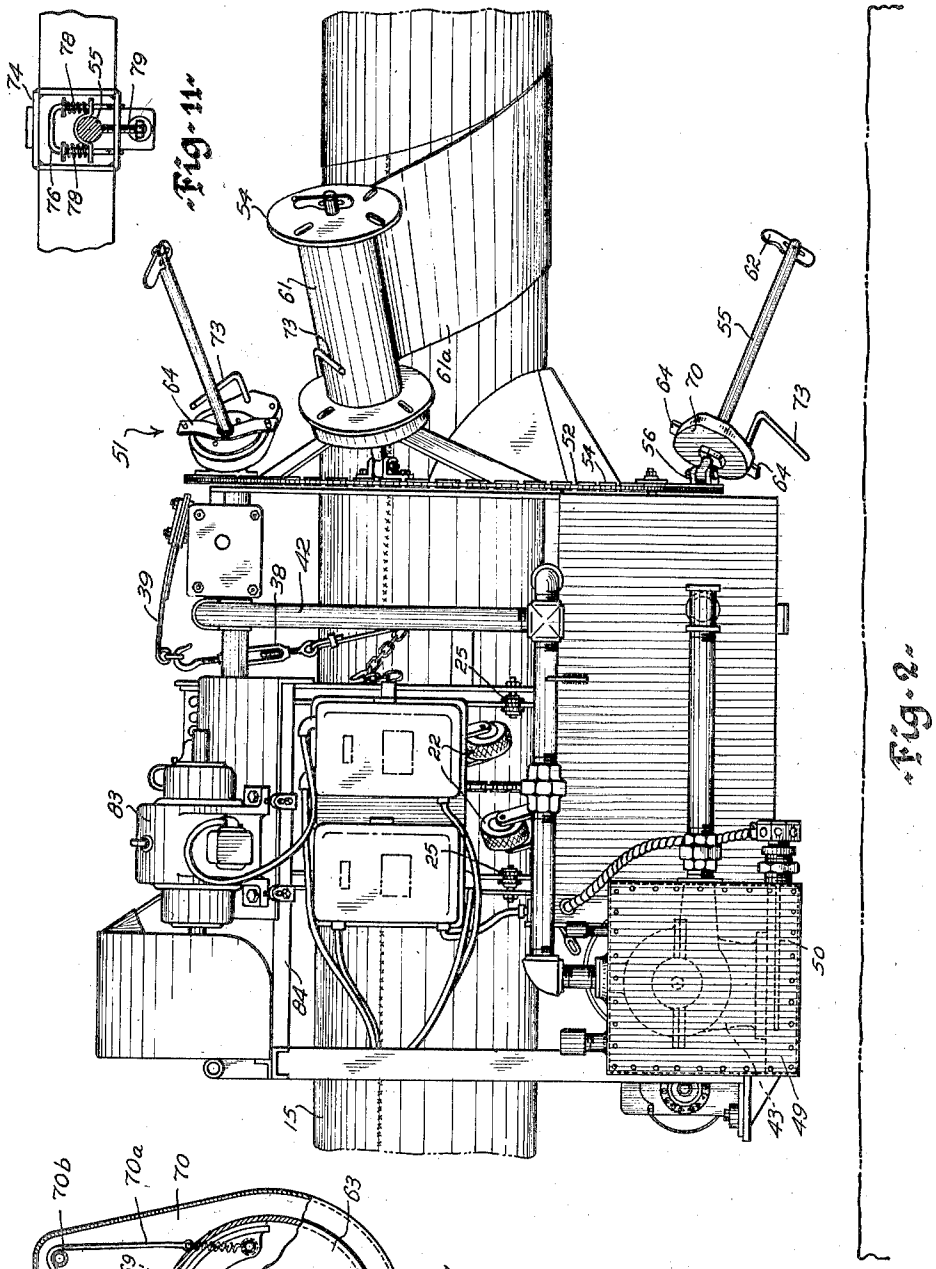



Fig. 11.

Fig. 2.

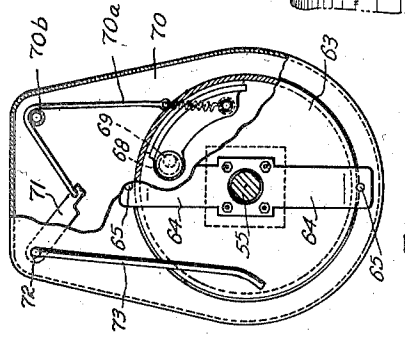



Fig. 10.

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PIPELINE COATING AND WRAPPING MACHINE

Filed Jan. 25, 1954 5 Sheets-Sheet 3

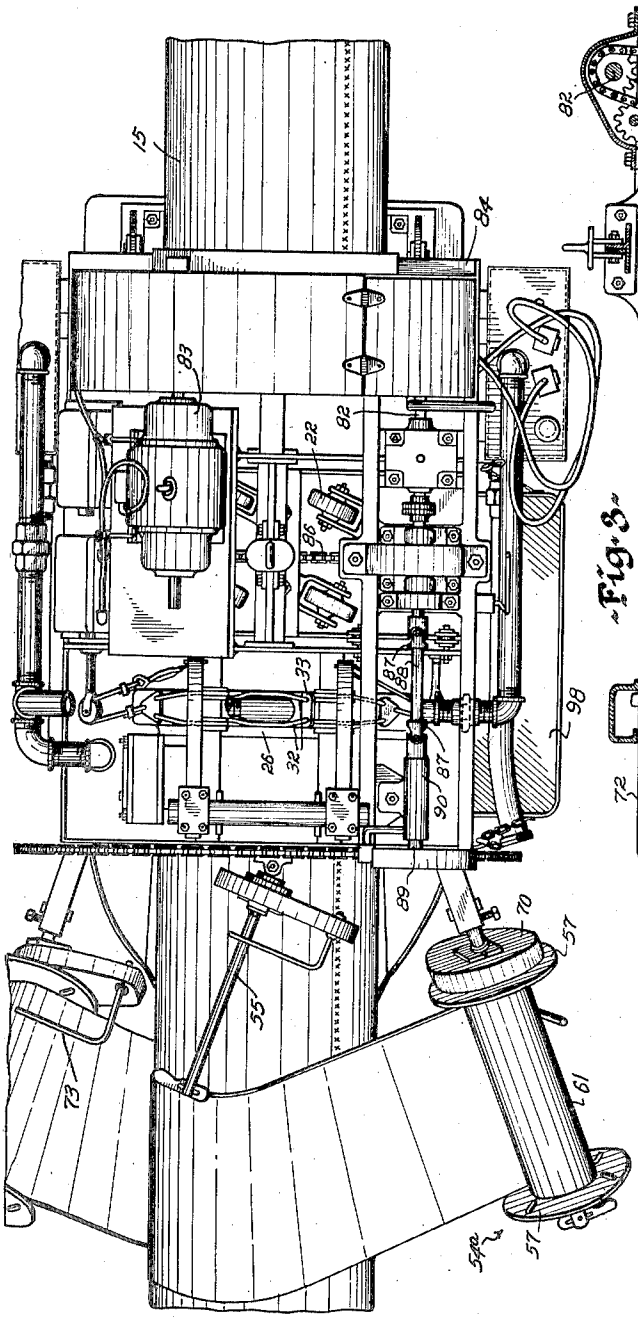


Fig. 3.

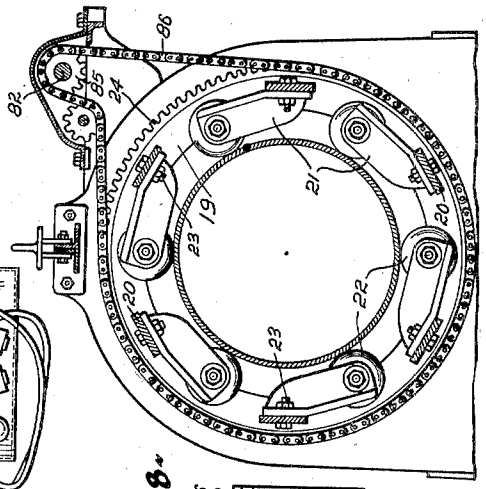


Fig. 4.

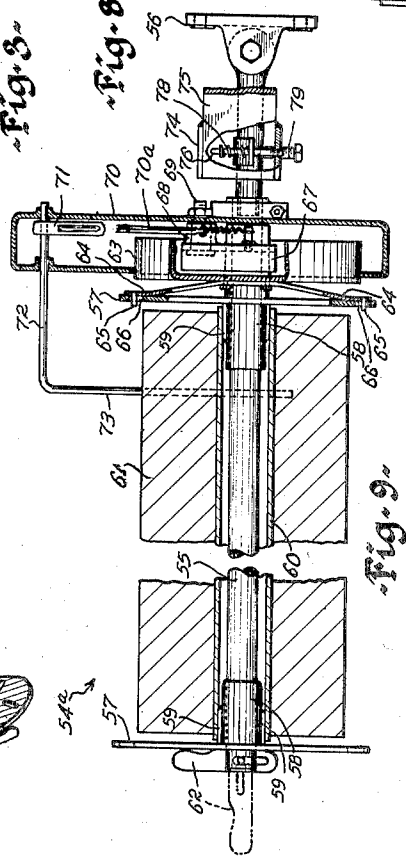


Fig. 2.

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PIPELINE COATING AND WRAPPING MACHINE

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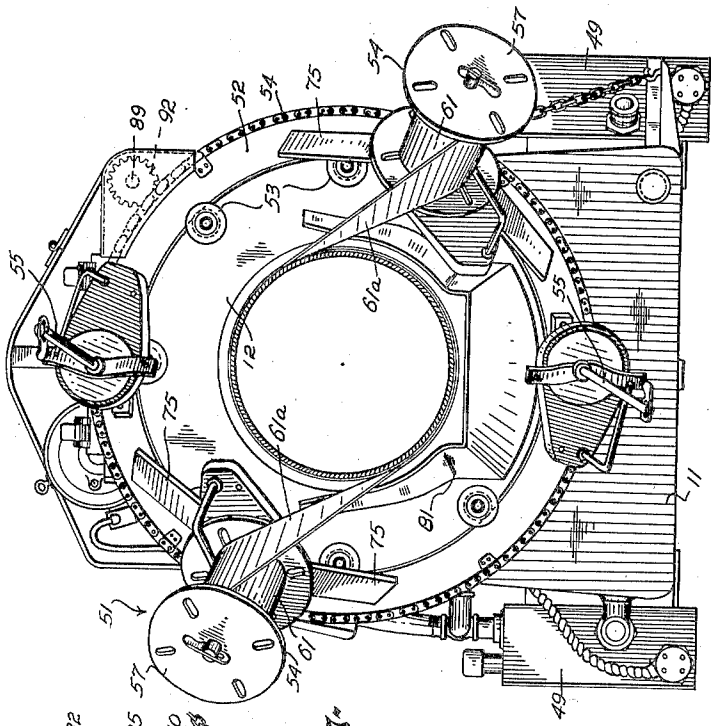


Fig. 4.

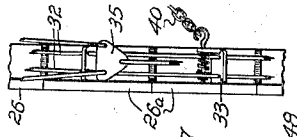


Fig. 7.

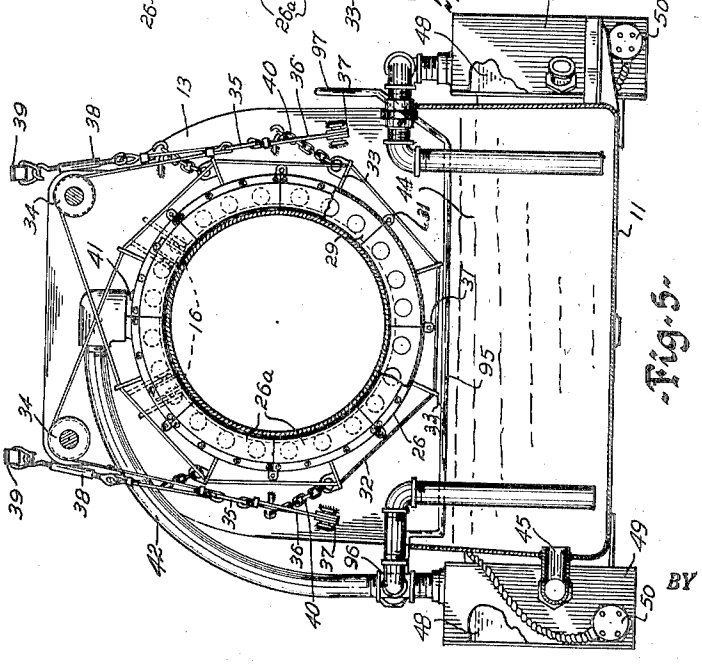


Fig. 5.

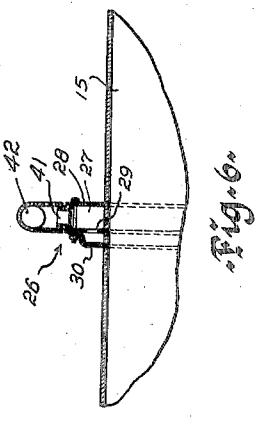


Fig. 6.

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PIPELINE COATING AND WRAPPING MACHINE

Filed Jan. 25, 1954 5 Sheets-Sheet 5

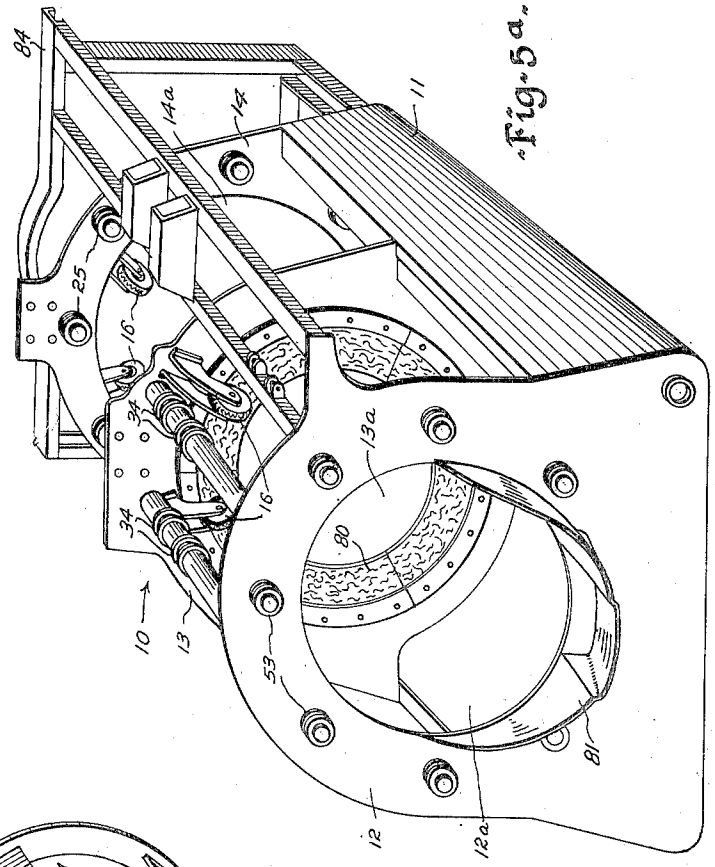



Fig. 5a.

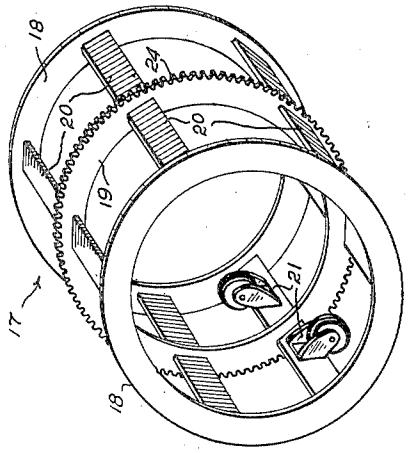



Fig. 5b

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United States Patent Office

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Patented Nov. 13, 1956



2,770,284

# PIPELINE COATING AND WRAPPING MACHINE

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Application January 25, 1954, Serial No. 405,939

6 Claims. (Cl. 154—41)

This invention relates to machines for coating and wrapping cross country pipelines.

Many machines for this purpose have heretofore been proposed. Such a machine usually includes crawler means for propelling it forwardly along the pipeline, means for applying a corrosion resistant coating of specified thickness to the pipeline, and means for spirally wrapping one or more layers of protective strip material over the coating. However, because of the many problems to be solved in producing a machine of satisfactory and effective operation, many available machines are subject to disadvantages.

It will be apparent, for instance, that operation of the crawler means and the wrapping means should be so synchronized that a correct ratio between the pitch of the spirally wrapped material and the distance the machine travels during each revolution of the wrapping means will be maintained. It is also highly desirable that no slippage of the crawler means occur since any such slippage will upset such ratio. However, it is very difficult to guard against slippage, especially since pipelines freely travel over rough and uneven terrain with long steep grades. Another requirement which is difficult to attain is that the wrapping material must be applied at a uniform tension.

An object of the present invention is to provide a pipeline coating and wrapping machine having a crawler means adapted to produce several times the tractive power of presently available machines whereby the machine is capable of travelling without slippage over terrain of substantially any roughness that may be encountered and including grades at least as steep as 45 degrees.

Another object is to provide a machine of this type wherein the drive of the crawler means and wrapping means is so coupled that the correct ratio between the pitch of the spirally wrapped material and the distance that the machine travels during each revolution of the wrapping means is positively maintained.

Another object is to provide braking means for continuoously and accurately controlling the tension at which the wrapping material is applied.

Another object is to provide means for mounting the wrapper spool arms whereby such arms may withstand shocks and automatically return to their correct position following dislodgment therefrom.

Another object is to provide means for automatically bringing working parts up to operating temperature and for controlling that temperature within fixed limits.

Another object is to provide increased machine stability whereby no external force is required to balance the machine.

Other objects include reduction of the number of machine parts to achieve greater simplicity of construction, reduced cost of manufacture and greatly reduced overall weight.

These and other objects, details and advantages will become apparent as this description proceeds with particular reference to the accompanying drawings in which



Figure 1 is an elevation of one side of a machine in accordance with the invention,

Figure 2 is an elevation of another side of the machine,

Figure 3 is a plan view of the machine,

Figure 4 is an elevation of one end of the machine,

Figure 5 is an elevation of the other end of the machine,

Figure 5*a* is a perspective view of the main frame of the machine,

Figure 5*b* is a perspective view of the crawler carriage, a number of the wheels thereof being omittted for simplification of illustration,

Figure 6 is a partial sectional view of the coating shoe,

Figure 7 is a partial elevational view of a detail of the coating shoe,

Figure 8 is a sectional transverse elevation of the crawler means,

Figure 9 is a longitudinal sectional view of a wrapper spool and supporting arm,

Figure 10 is a transverse sectional view of the wrapper spool, and

Figure 11 is a sectional detail view of the spool supporting arm and related mounting means.

Referring to the drawings, the machine comprises a main frame **10** which is preferably fabricated as a unit and which includes a storage tank **11** for coating material and three spaced frame members **12**, **13** and **14** extending upwardly therefrom and each having a respective, aligned opening **12***a*, **13***a*, **14***a* therein for passage therethrough of a pipeline indicated at **15**. The frame **10** is supported on the pipe by means of a pair of rollers **16** on each of members **13** and **14**, such rollers serving to carry the weight of the machine and to hold the latter in alignment on the pipe.

The machine is adapted to travel in the direction of the arrow shown in Figure 1, and thus ring **14** is the forward or leading portion of the frame and ring **12** the rearward or trailing portion of the frame. Furthermore, for the purpose of the ensuing description, the terms "forward" and "rearward" will be employed to indicate positions with respect to the direction of travel of the machine.

The crawler carriage is indicated at **17** and comprises a pair of annular end plates or rings **18** and an intermediate or center ring **19** connected together by a plurality of longitudinally extending bars **20**. On each of the interior surfaces of each bar between each adjacent pair of rings **18** and **19** is mounted a bracket **21** in which is journalled a rubber-tired wheel **22**. Each bracket is preferably connected to a bar **20** by means of a single bolt **23** whereby its angularity (and that of its wheel **22**) may be adjusted with respect to the bar **20**. Thereafter the brackets are rigidly locked in place as by a tack weld or the like. As shown in Figure 8, the wheels **22** project inwardly from the rings **18** and **19** to frictionally engage the surface of pipe **15**. In the structure described, 16 wheels **22** are provided and it will be apparent that they provide great tractive power. While the number of wheels **22** may vary, it is preferable that not less than 12 be employed in order to achieve the desired tractive power. The periphery of the center ring **19** is provided with teeth **24** to constitute a drive sprocket for the carriage.

The carriage **17** is revolvably mounted in the main frame **10** between members **13** and **14** by means of a plurality of rollers **25** rotatably mounted on each of frame members **13** and **14**. Each roller **25** has a grooved periphery engaging the periphery of a respective end ring **18**. It will be apparent that revolution of the carriage will propel it and the frame **10** along the pipeline by reason of the angular disposition of the wheels **22**. Means

for applying a corrosion resistant coating to the pipe comprises a coating shoe 26 consisting of an annular container 27 having an imperforate forward wall 28 and a perforate rearward wall 29, the inner peripheries of which walls are arranged to engage the surface of pipe 15. Fixed to container 27 and spaced rearwardly therefrom is a material spreading ring 30, the periphery of which is spaced from the surface of pipe 15 a predetermined distance. The shoe 26 is positioned between frame members 12 and 13 in adjacent spaced relation to member 13. In order that the shoe may be held in close but yieldable engagement with the pipe, it is preferably formed of a plurality of segments 26*a* hinged together at 31 and resiliently suspended from the frame by means of a pair of cables or the like 32 which extend through an outwardly extending lug 33 on each segment 26*a*.

As shown in Figure 5, the end portions of the cables 32, following passage through lugs 33, cross each other above the shoe and extend over grooved pulleys 34 and downwardly, each pair of ends being fastened to a link 35. Each link 35 is in turn connected to one end of a short length of cable 36 which extends over a pulley 37 and has its other end connected through a turnbuckle 38 to a flat spring 39 mounted on the main frame. It will thus be apparent that a spring loading is imposed on cables 32 to ensure that the walls 28 and 29 engage the pipe at all times. Drag chains 40 connect each side of the shoe 26 to frame member 13 to pull it forward with the frame as it travels forward on the pipeline.

Coating material is supplied to the annular container 27 of the shoe 26 through an inlet 41 at the top thereof and by means of a pipe 42 leading from a flow pump 43, which in turn pumps liquid material 44 from tank 11 through pipe connection 45. Pump 43 is controllable in the usual manner to supply coating liquid to the shoe 26 in any desired volume. Thus, a valve 96 may be provided in the pump connection to pipe 42, such valve being operable by a lever 95, extending across the tank 11 and having a handle 97 readily accessible to an operator on the operator's stand 98.

It will be apparent that, with the container 27 filled with coating liquid, a complete bath of such liquid surrounds and engages the pipeline in this area. The liquid flows through perforate wall 29 and out of the clearance space between ring 30 and the pipeline thus leaving a film of coating material on the pipeline after the shoe 26 has passed on. Excess coating material flows back into the tank 11 but coating material is supplied to the shoe at a rate slightly in excess of that at which it can escape from the trailing ring 30.

A supply of coating material is maintained in tank 11 at any desired level by means of an intake pump 46 mounted on the tank, such pump being provided with a pipe or hose connection 47 leading to a source of supply (not shown).

It will be apparent that the thickness of the coating applied to the pipeline will depend upon the temperature of the coating material (and, therefore, its viscosity) as it is applied to the pipeline. In order to bring working parts up to operating temperature and control such temperature, each pump 43 and 46 is preferably immersed in a bath 48 of heat transfer oil or the like provided in an enclosing container 49. Each bath 48 is maintained at any desired temperature by a conventional thermostatically controlled immersion heater 50. It will thus be apparent that the temperature of the coating liquid may be quickly brought up to the desired operating degree and maintained at any such desired temperature by circulation through the pump. It will be apparent that the heat transfer bath may be extended to include portions of the coating shoe to provide additional means for bringing such parts up to operating temperature.

The wrapping mechanism is generally indicated at 51 and comprises an annular wheel or ring 52 rotatably mounted on frame member 12 by means of rollers 53



which engage the inner periphery of wheel 52. Suitable driving sprocket means such as a chain 54 is mounted on the outer periphery of wheel 52. The wrapper wheel carries one to four wrapper arm assemblies 54*a*, as required. Each assembly 54*a* comprises a central arm 55 one end of which is pivotally mounted on the wheel 52 by means of the bracket 56. Rotatably mounted on the arm 55 is a wrapper roll receiving spool comprising a pair of end discs 57 each having an axial hub 58 sleeved upon the arm. Each hub 58 has external ribs 59 adapted to engage the core 60 of a roll 61 of paper or like wrapping material and to prevent relative turning movement of the roll. It will be apparent that the roll 61 is thereby rotatably mounted on the arm 55. A latch 62 is provided on the free end of arm 55 to lock the outer disc 57 and roll 61 in place on the arm.

Braking means for the rotatably mounted roll is provided and, as shown in Figures 9 and 10, comprises a brake drum 63 journalled on the arm 55 adjacent the inner disc 57. Fixed to the lateral surface of the drum are a pair of radially extending spring fingers 64, each of which carries a dog 65 for engagementt with respective openings 66 in the inner disc 57, thereby connecting the drum to the roll 61 for rotation therewith. A brake shoe 67 is pivotally mounted on an eccentric portion 68 of a pin 69 carried by a brake cover 70 also journalled on the arm 55. The shoe 67 is engageable with the brake drum flange in the usual manner to apply braking pressure thereon. It will be apparent that initial adjustment of the shoe with respect to the flange may be made by rotation of the brake shoe pin 69, the eccentric portion 68 thereof acting to adjust its position with respect to the flange.

Means for actuating the shoe 67 to apply braking pressure to the drum comprises a spring-loaded link such as a flexible cable 70*a* connected to the free end of the shoe and extending over a roller 70*b* to an operating lever 71 pivoted to the brake cover. Fixed to the lever 71 and swingable therewith is a rod 72 having an angular portion 73 arranged to ride lightly upon the outer surface of the roll 61, as shown. It will be apparent that, with a full roll of paper on the arm 55, the rider rod 72 will exert through lever 71 and linkage 70 a predetermined maximum degree of braking pressure on the drum 63. As the roll unwinds and the diameter thereof decreases, less braking action is needed to maintain the same tension on the wrapping web indicated at 61*a*. The roll rider 72, held in contact with the outer surface of the roll by the spring-loaded link 70, swings down towards the arm 55 and the tension in the link 70 is gradually released. This action relieves the pressure of the brake shoe on the drum in proportion to the decrease in the diameter of the roll 61. Uniform tension is thus automatically maintained at all times on the web 61*a*.

Means for setting and maintaining the wrapper arms and rolls at a desired angle to the wrapper wheel is provided and comprises, for each arm, a bracket 74 carried by supporting straps 75 fixed to wheel 52. The bracket carries a V-shaped rod 76 which embraces a portion of arm 55 adjacent its pivoted ends and constitutes a guide therefor. A plate 77 slidably carried by rod 76 is resiliently urged into engagement with one side of arm 55 by means of springs 78 also carried by rod 76. A set screw 79 carried by bracket 74 engages the opposite side of arm 55. It will be apparent that the set screw 79 may be adjusted to vary the angularity of arm 55 (and roll 61). Moreover, the springs 78 constitute means for absorbing shocks which may be applied to the arm 55 and for permitting the arm to move out of position when it encounters obstruction, while ensuring automatic return of the arm to its proper position.

A seal ring 80 is carried by frame member 13 and engages the pipe to protect the carriage from coating material applied by the coating shoe. Frame member 12 is preferably provided with a trailing scoop 81 which

assists in directing excess coating material back into the tank.

Driving means for the machine includes a driven shaft **82**, which is driven from any suitable source of power, such as a motor **83**, and which is mounted on an auxiliary frame **84** carried by the main frame **10**. Shaft **82** has fixed thereto a sprocket **85** connected by chain **86** to the carriage sprocket **24**. Shaft **82** is connected through a pair of universal joints **87** and an expansion shaft **88** to a shaft **89**. Shaft **89** passes through a pivoted bearing stand **90** which is spring-loaded at **91**. Fixed to shaft **89** is a sprocket **92** which meshes with wrapper wheel sprocket **54** to drive the latter. The mounting described imposes a resilient pressure on sprocket **85** to maintain it in mesh while permitting it to move out of mesh with chain **86** should the wrapper wheel **52** lock. The mounting thus provides a form of clutch which renders it possible to change sprocket **85** in a rapid and convenient manner.

In operation, one or more rolls of paper or like wrapping material are mounted on respective arms **55**, such arms being loaded and adjusted to (1) single wrap with one roll, (2) single wrap with two rolls, (3) double wrap with two rolls, (4) double wrap with four rolls.

The wrapping material may be several different types. Each type usually has a different tensile strength and, for most efficient use, should be wrapped on the pipeline at a tension near the breaking point. The roll braking means described makes it possible to readily and quickly adjust the tension of the wrapping web.

It will be observed that, with the machine mounted on pipeline **15**, the latter passes through the crawler carriage, coating shoe, and wrapper wheel, and that rotation of the shafts **82** and **89** will revolve the crawler carriage and wrapper wheel. The crawler carriage, due to the inclined mounting of its traction wheels **22**, will propel the machine along the pipeline at a predetermined rate dependent upon the angle of setting of the wheels **22**. The coating shoe applies a coating of desired thickness in the manner described, and following application of the coating, webs of wrapping material are trained about the coated pipeline and helically wrapped thereon.

It will be apparent that all wheels **22** are set at the same predetermined angle. It will also be apparent that, when the carriage is revolved, it travels forward a distance equal to the circumference of the pipe multiplied by the tangent of the wheel angle.

In order that the wrapping material be applied neatly, with the correct degree of overlap, several factors are involved, namely:

(1) Wheel angle of the crawler carriage $\theta$.

(2) Ratio of the number of teeth in the crawler drive sprocket **85** ($S_1$) and in the crawler carriage sprocket **24** ($S_2$).

(3) Ratio of the number of teeth in the wrapper wheel drive sprocket **92** ($S_3$) and the number of chain links in the wrapper wheel sprocket **54** ($S_4$).

(4) Pitch of the helical pattern formed by the path of the rolls **61** when the wrapping web **61***a* is spiral wrapped on the pipeline with the correct amount of overlap ($P_2$).

(5) Pitch of the helical pattern formed by the path of the crawler carriage **17** ($P_1$).

(6) Circumference of the pipeline **15** (C).

Thus, having determined the pitch of the wrapping web **61***a*, the number of teeth in the various sprockets and the angle of the wheels **52** may be computed in accordance with the following formula:

$$P_2=\frac{(S_4)(S_1)\tan\theta(C)}{(S_3)(S_2)}$$

Ordinarily, the number of teeth in the crawler carriage sprocket **24** and the number of links in the wrapper wheel sprocket **54** will be fixed. The correct ratio can then be obtained by employing sprockets **85** and **92** with the required number of teeth to provide the correct ratio and, if necessary, varying slightly the angle of wheels **22**.

For the wrapper web **61***a* to be applied neatly, the angle between the axis of the wrapper arm **55** and the axis of the pipeline **15** is computed as follows:

$$\text{Tangent }\theta=\frac{P_2}{C}$$

It will be apparent that there has been provided a self-contained compact machine having sufficient tractive power to satisfactorily meet all operating conditions and adapted to provide the desired coating and wrapping in a neat, efficient and wholly satisfactory manner. Moreover, the described arrangement of elements results in a substantial reduction in the number of parts and overall weight. It will also be apparent that the machine, having a low center of gravity, possesses fully self-contained stability. Since the crawler carriage is roller mounted, it is impossible for the machine to upset while on the pipeline.

I claim:

1. In a pipeline coating and wrapping machine, a frame, and a crawler carriage comprising a pair of axially aligned end rings, a third ring in spaced axial alignment between said end rings and substantially equidistantly spaced therefrom, supporting plates connecting said rings, said rings providing a passage through the carriage for reception of a pipeline, said frame having a plurality of series of rollers each engaging the periphery of a respective one of said end rings to revolvably support the carriage in the frame, and a series of traction wheels mounted on said plates between each said end ring and third ring, each said wheel having a tractive periphery extending into said passage for engagement with said pipeline, and being angularly disposed with respect to the lateral faces of said rings to permit circumferential traversal of said pipeline, said third ring having a driving sprocket on the periphery thereof.

2. In a pipeline coating and wrapping machine, a frame, and wrapping mechanism revolvably carried by said frame and comprising a revolvable ring, at least one wrapper roll arm carried by said ring in angular relation thereto, a spool rotatably carried by said arm, and braking means carried by the arm and engaging said spool, said braking means comprising a brake drum and a brake cover journalled on said arm, a shoe pivotally carried by the drum, a lever for actuating the shoe pivoted to said cover and having a flexible, resilient connection with said shoe, and a rod fixed to the lever for operating said lever, said rod having an angular portion arranged to ride upon a roll carried by said spool.

3. In a pipeline coating and wrapping machine, a frame, and wrapping mechanism revolvably carried by said frame and comprising a revolvable ring, a wrapper roll arm pivotally carried by said ring in angular relation thereto, a spool rotatably carried by said arm, braking means carried by the arm and engaging said spool, and means for resiliently and adjustably retaining said arm in said angular relation comprising a bracket fixed to the ring, a guide rod fixed to the bracket and supporting said arm, resilient means on the guide rod urging the arm in one direction, and an adjustable rigid member fixed to the bracket and engaging the arm to limit its movement in said direction.

4. In a pipeline coating and wrapping machine, a frame, coating mechanism mounted in the frame and comprising a pair of rings forming an annular container having an inner diameter approximately equal to the external diameter of said pipeline, one of said rings being perforate and the other being imperforate, and a third ring in spaced adjacent relation to said perforate ring, said third ring having an inner diameter greater than that of said first rings, and means for delivering coating liquid to said container.

5. In a pipeline coating and wrapping machine, a frame, coating mechanism comprising a storage tank for

coating liquid suspended from said frame, a coating shoe carried by the frame and having an annular container arranged to communicate with said pipeline, said shoe comprising a plurality of segments hingedly secured together, cables connecting said segments to hold the same in engagement with said pipeline, and resilient means suspending said cables from the frame, a conduit for delivering coating liquid from said tank to said container, a pump in said conduit, a second pump mounted on the frame for supplying coating liquid to said tank, each said pump having an enclosing casing, a heat transfer liquid in each said casing and having said pump immersed thereon, and means for heating said heat transfer liquid.

6. In a pipeline coating and wrapping machine, a frame, a coating shoe carried by the frame and comprising an annular container having an imperforate forward wall and a perforate rearward wall, each said wall consisting of a plurality of segments hingedly secured together, and a spreading ring carried by said container and



disposed in spaced adjacent relation to said perforate wall, said spreading ring having an internal diameter greater than that of said container walls, means for delivering coating liquid to said container, and means for holding the inner peripheries of said container walls in close, yieldable engagement with said pipeline comprising a cable having a loop connecting said segments, and resilient means applying tension to said cable.

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