May 22, 1956 J. D. CUMMINGS 2,746,516

PIPE LINE INSTALLATION EQUIPMENT

Filed May 2, 1955 4 Sheets-Sheet 1

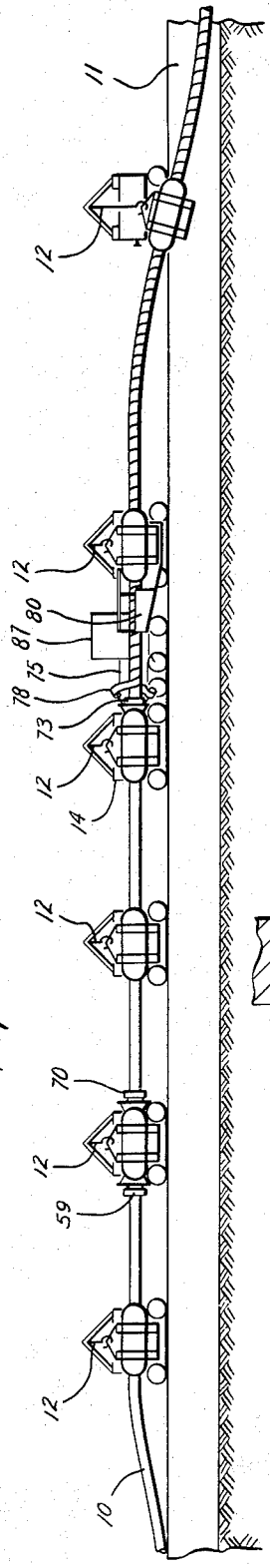


Fig. 1

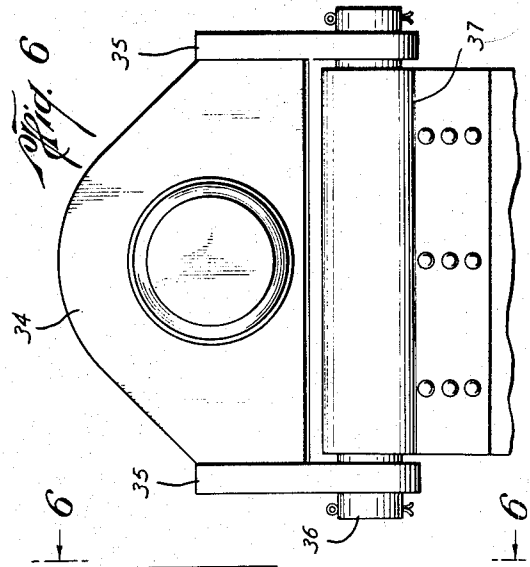


Fig. 6

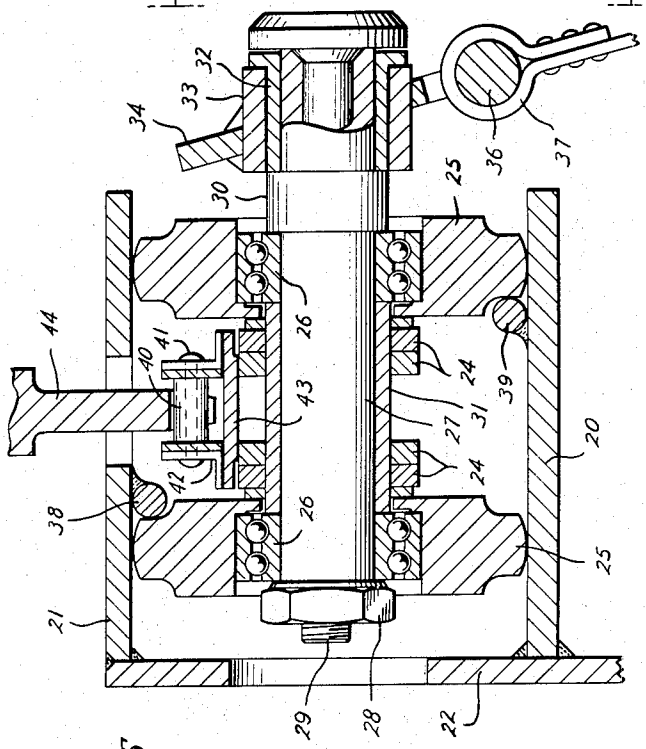


Fig. 5

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PIPE LINE INSTALLATION EQUIPMENT

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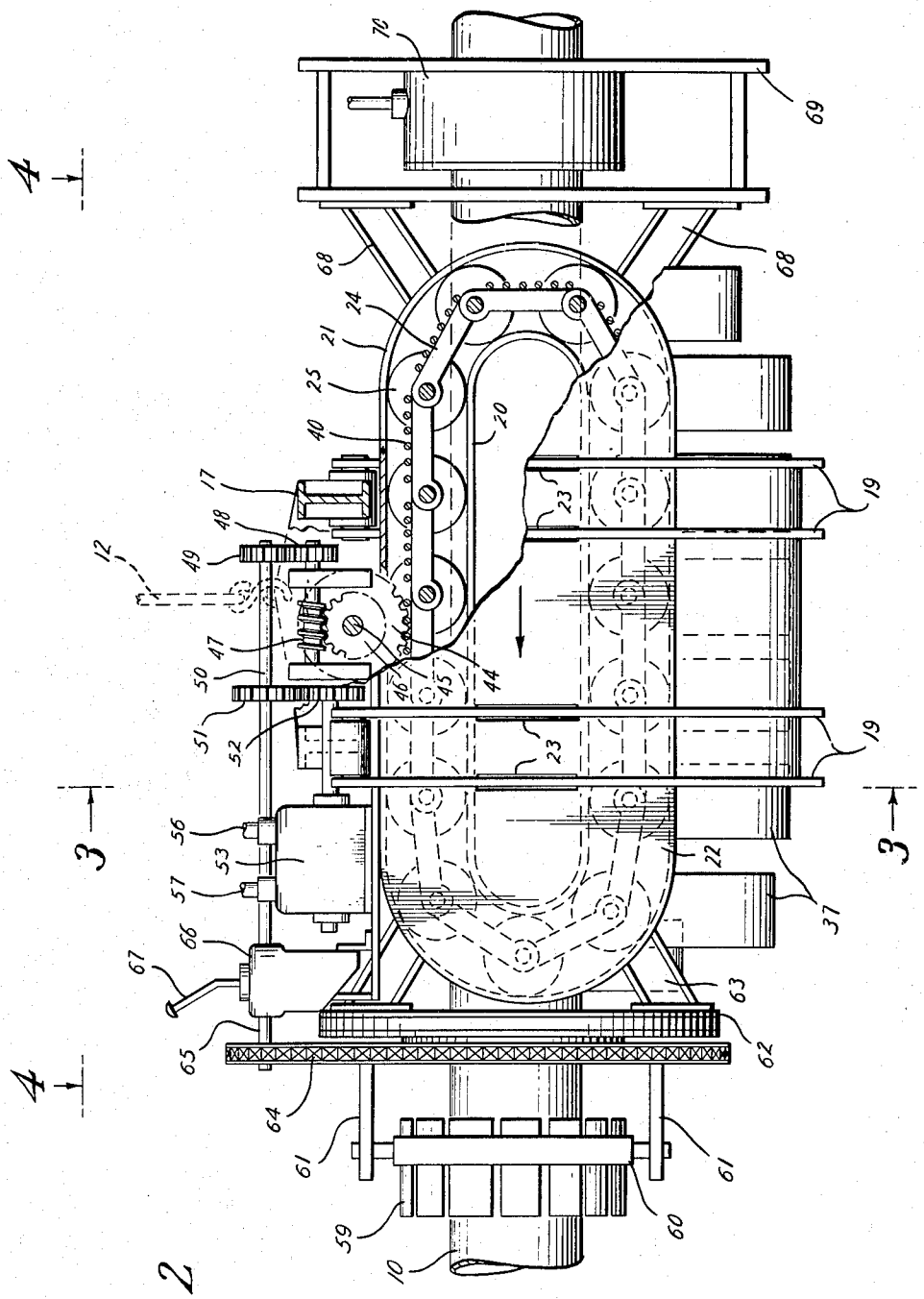


Fig. 2

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PIPE LINE INSTALLATION EQUIPMENT

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Fig. 3

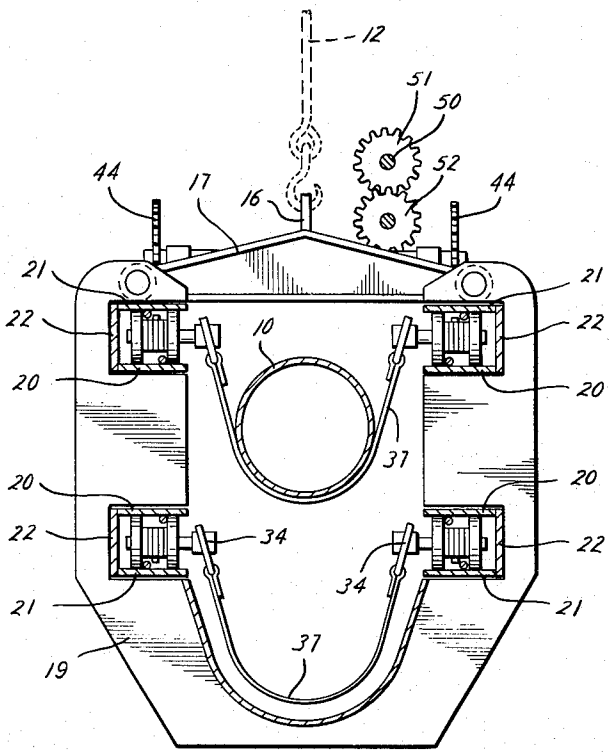
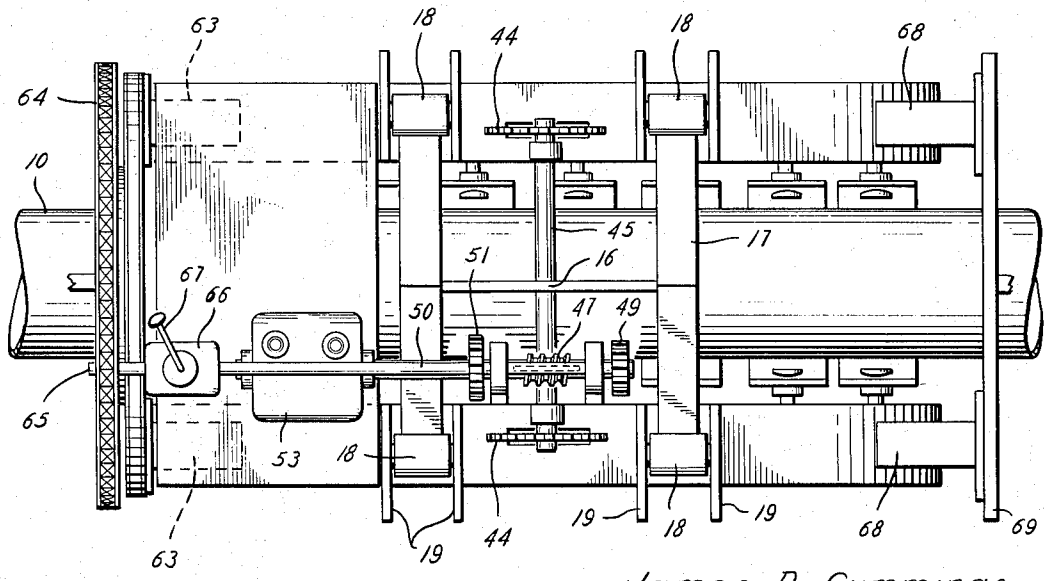


Fig. 4



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PIPE LINE INSTALLATION EQUIPMENT

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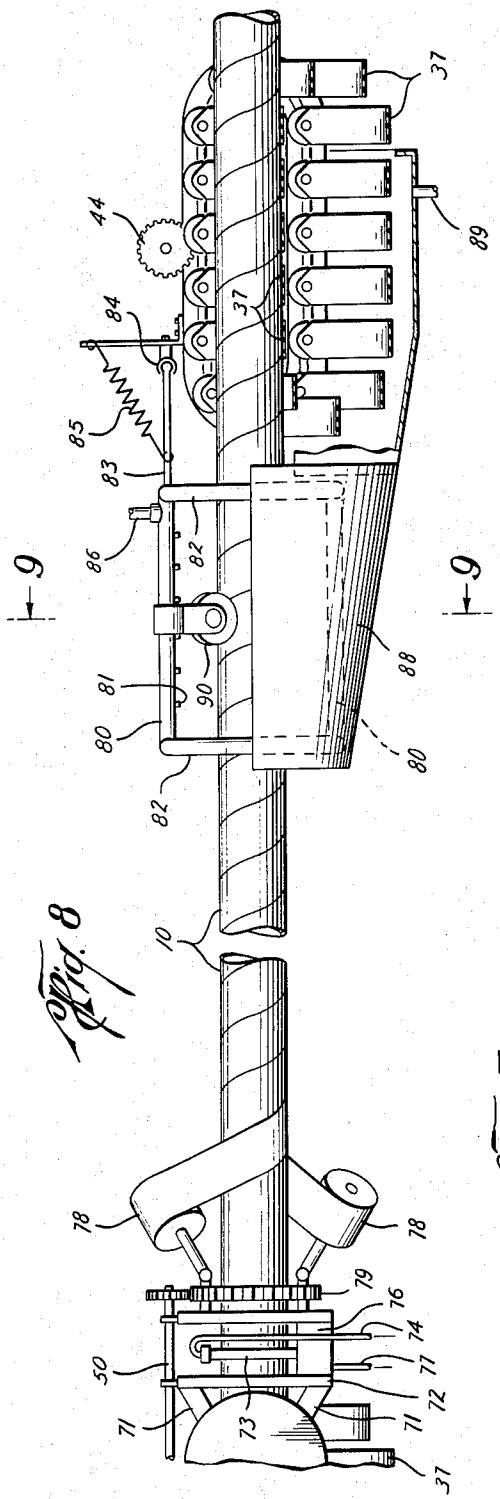


Fig. 8

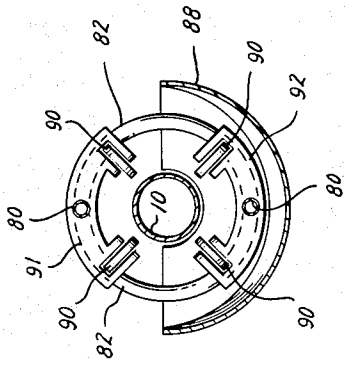


Fig. 9

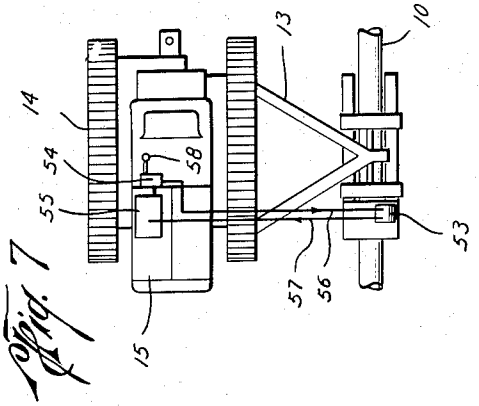


Fig. 7

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United States Patent Office 2,746,516 Patented May 22, 1956

2,746,516

PIPE LINE INSTALLATION EQUIPMENT

James D. Cummings, Houston, Tex., assignor of one-half to Aubrey S. Crutcher, Houston, Tex.

Application May 2, 1955, Serial No. 505,462

17 Claims. (Cl. 154—41)

This invention relates to the preparation, handling, and installation of long distance conduits such as cross-country pipe lines. More particularly, it deals with an improved pipe suspension cradle which accommodates relative travel between the cradle and the supported pipe with an abundance of bearing area for substantially continuous flat contact with a large region of pipe surface without movement of the abutting load transfer surfaces, one on the other, during the relative cradle and pipe travel.

In the installation of a pipe line, the common practice is to joint pipe sections end to end on the ground beside a precut trench and then employ tractor suspended cradles which, as the tractors move forward, lift the pipe for final work performing operations to condition the pipe for subsequent burial. The conditioning may include the customary cleaning, priming, coating, and wrapping operations; and after their performance, the pipe with its hot coating is again rested on the ground until the coating loses its heat and thereby hardens so that later other tractor suspended cradles may again lift the coated pipe and deposit it into the trench.

In a specific embodiment of the present invention the improved cradle structure involves an endless loop circuit of flexible strap slings disposed transversely of the pipe axis in closely spaced longitudinal succession to present a large number of wide bands or slings throughout the loop circuit having opposite return bends joining upper and lower reaches. The several slings in the closed circuit co-operate for a crawler action on the pipe saddled in the slings of the uppermost reach, and the individual slings in succession move upwardly through the foremost return bend at the leading end of the carriage or cradle from the lower reach to the upper reach for an immobile seating with the pipe during relative pipe and carriage travel, and move downwardly through the return bend at the trailing end of the cradle assembly away from pipe engagement in the upper reach and toward the lower reach for recirculation toward the nose of the cradle. An important feature of the arrangement is that each sling is hingedly mounted on its loop carrier to swing individually relative thereto on a transverse pivot axis so that in following the loop circuit its pipe engaging surface always faces upwardly and tends to remain parallel with the pipe axis at all times for insuring a nonangular contact of its wide seating face with the pipe surface, and especially in the approach to and the recession from the pipe surface at the return bend paths. The wide flat face of each sling affords a continuous bearing contact with the underside of the pipe in the direction transversely of the pipe, and since the wide straps are in close succession, they combine to form an almost continuous longitudinal bearing area throughout the length of the upper circuit reach for a maximum load distribution area, both transversely and longitudinally, and a minimum of weight concentration at any point on the pipe underside.

By the use of a crawler sling cradle as herein described, the load is spread and the pipe wall protected from deflection strain. More importantly, it enables a length of pipe

to be raised and supported by a series of cradles in tandem spaced relation for work performing operations on the elevated pipe, including the priming of the pipe surface with a thin film of paint, followed by the application thereto of a thicker protective coating in a hot fluid condition, with any load bearing through the primer film and the coating being such as to reduce objectionable surface injury or appreciable pressure displacement of either.

The improved cradles are readily adapted for stationary installation with traveling pipe, but they will also find great utility for traveling work on stationary pipe to condition it for immediate deposit in a trench. Traveling equipment is here selected for illustration of a specific embodiment of the invention, and in that usage each cradle is suspended from a side boom of a traction vehicle traveling forward on the ground at one side of the preformed trench. To supplement side boom draft on the cradle as supplied by the ground traction vehicle, it will be helpful in many cases to apply power for direct drive of the endless sling carrier for cradle traction on the supported pipe at a rate synchronized with traction vehicle speed. This will be advantageous when operating on hilly and uneven terrain in that it will minimize side boom stress and steering problems by reducing lateral offset drag and vehicle skewing tendency.

For a more detailed description of the structure, reference will be made to the accompanying drawings, wherein Fig. 1 is a somewhat schematic side elevation of equipment wherein a number of traveling tractor suspended cradles hold a pipe during the several work performing operations in conditioning the pipe line conduit for burial; Fig. 2 is a side elevation partly in section, showing a pipe suspending cradle assembly with power drive for both the cradle and one of a pair of work performing mechanisms mounted at the ends of the cradle assembly; Figs. 3 and 4 are, respectively, a transverse section and a side elevation on lines 3—3 and 4—4 of Fig. 2; Figs. 5 and 6 are a detail transverse section and an end view on an enlarged scale, respectively, of the guided carrier and its jointed connection at one end of the pipe cradling strap; Fig. 7 is a top plan view on a small scale showing a ground traction vehicle and a boom suspended cradle powered from the traction vehicle; Fig. 8 is a side elevation showing succeeding cradles with which are associated pipe coating, wrapping, and cooling mechanisms; and Fig. 9 is a transverse section as on line 9—9 of Fig. 8.

Referring first to Fig. 1, there is illustrated one arrangement suitable for handling steel pipe of about twelve inches in diameter with a wall thickness of about one-third of an inch, but the equipment can be adapted for use with pipe of other dimensions as regularly employed. Such pipe in a continuing length, indicated at **10**, is to be treated and deposited in a ditch or trench **11**, and that operation may call for as many as six tractor suspended cradles traveling along the length of the pipe. Thus, in succession, the first traveling cradle serves to raise the pipe from the ground; the second cradle suspends the pipe and also mounts forward cleaning brushes and an aft priming mechanism; the third cradle suspends cleaned and primed pipe against sagging in the interval between the second and fourth cradles for allowing drying of the priming paint; the fourth cradle suspends the primed pipe, as well as pipe coating and wrapping mechanisms in trailing relation to the pipe area being suspended. The next cradle mounts a forwardly projecting cooling spray structure for extracting heat from the wrapped coating to a substantially nonfluid temperature, and also cradles the pipe through the coating which has just been hardened, and the final cradle in the line receives the fully treated pipe for lowering it into the trench **11**. A greater or lesser number of cradles may be called for, depending upon the size and weight of the pipe and the

number of operations to be performed. For example, on small and clean pipe the specifications may omit the cleaning and priming operations and demand only the coating and wrapping cradle and the cooling cradle for the complete operation of lifting, treating, and lowering.

The several carriages or cradle assemblies may be duplicates of one another in so far as concerns the pipe cradling slings, their endless carriers, and the main frames which contain loop guides for the endless carriers. Each carriage has at its top and in substantially vertical alignment with the center of gravity of the assembly a suspension eye for pivotally receiving a detachable hook on the end of a winding drum cable **12** dependent from the side boom arms **13** (see Fig. 7) of a traction vehicle **14**, to operate on the right-hand side of the ditch **11**. Such side boom vehicle is a conventional ground engaging tractor having endless tracks powered by an internal combustion engine **15** under manual control of an operator who rides the vehicle.

The suspension eye just referred to is indicated by the reference character **16** and is located centrally of an H-shaped casting **17** which is best seen in Fig. 4. The opposite terminal ends of both legs of the H-shaped casting **17** have apertured heads **18—18** to receive pins or bolts which extend through the upper ends of a set of four flat plates which extend in transverse planes and are arranged in two longitudinally spaced pairs so that each pair has corresponding upper ends pinned to the same head **18** of the uppermost H-shaped casting **17**, as is best evident from Fig. 4. The bottom bars of the U-shaped plates **19** extend across from one side to the other of the cradle, and in co-operation with the spaced side legs and the upper casting **17** afford a central opening through which the pipe **10** extends during normal use of the machine.

Each side leg of the plates **19** has a pair of vertically spaced and inward opening cut-off portions to receive guide tracks comprising a pair of vertically spaced flat straps **20** and **21**. The lowermost strap **20** of the upper straps, as seen in Fig. 3, and the uppermost strap **20** of the lowermost set of straps may be considered as following an endless loop in the longitudinal direction of the machine, as evident by comparison with Fig. 2. Similarly, the outermost straps **21—21** in Fig. 3 appear in Fig. 2 as an endless loop guide extending in the longitudinal direction. The two co-operating guide straps could each be a single loop of strap material, but more conveniently they are formed from a number of separate pieces joined together, and the joining lines conveniently are located at each of the opposite return bends of the loops. To close the outermost sides of the guideways, and more particularly to lend strength and locating support for the loop straps **20** and **21**, a pair of outer vertical plates **22—22** extend throughout the length of each guideway and are joined to the outer edges of the straps **20** and **21**, as by welding. As shown at **23—23**, each side plate **22** has vertical slots for the projection therethrough of the adjacent portions of the four frame plates **19**.

In each of the endless looped guideways afforded between the vertically spaced straps or runways **20** and **21** is located an endless carrier in the form of a succession of interpivoted chain links **24** joined in succession by pivot pins, each of which carries wheels or rollers **25** to ride in the endless loop trackway. The link pivot and roller arrangement is shown in detail in Fig. 5, wherein it will be seen that a pair of transversely spaced rollers or wheels **25** have their hubs mounted on antifriction ball bearings **26** fitted to a sleeve **27** held between a nut **28** on a fastening pin **29** and a spacer collar **30** co-operating with the head of the fastening pin **29**. A spacer sleeve **31** between the innermost races of the bearings **26** surrounds the sleeve **27** and affords a pivot bearing for the adjoining, overlapping ends of the co-operating pairs of chain links **24**. Interposed between the head of the fastening bolt **29** and the spacer collar **30** is a tubular bearing sleeve **32** which provides a transverse pivot mounting for a bearing collar **33** which has welded to it a strap **34** which may be of substantially triangular shape, as seen in Fig. 6. Welded to and projecting downwardly from opposite side edges of the pipe **24** are a pair of ears **35—35** which are apertured to mount therein a crosspin **36** suitably retained in place, as by means of cotter pins or the like.

Each of the pivotally mounted plates **34** suspends one end of a sling strap **37**, preferably formed of a flexible fabric material and whose opposite end is joined to a like mounting plate **34** of a carrier in the guideway on the opposite side of the main frame, as seen in Fig. 3. Such straps, when they are in the uppermost reach of the loop circuit, can receive the pipe **10** therein and accommodate themselves to various diameters of pipe, and also to bends in the pipe. That is to say, lateral bends in the pipe may result in a relative sidewise swinging of the straps **37** as the carriage travels along the axis of the pipe. As best seen in Fig. 3, substantially more than half of the underside of the pipe is in seating engagement with the flexible sling which conforms itself to the pipe circumference for an arcuate extent approximately between one hundred fifty and one hundred seventy-five degrees for a given pipe diameter with respect to which a particular sling design has been selected. Thus a six-inch wide sling for a twelve inch pipe will afford a bearing face area on the order of one hundred square inches and a cradle assembly having five slings engaging the pipe at all times, presents a support area of around five hundred square inches. These illustrative dimensions will of course vary with sling width and design and the diameter of the pipe being operated upon.

The transverse pivotal connections for the straps afforded by their bearing members **32** and **33** will insure that the straps will always hang downwardly by gravity, so that their bearing faces in longitudinal planes tend always to remain parallel to the surface of the pipe with which they engage. Thus, as seen in Figs. 2 and 8 in particular, the direction of relative carrier travel may be considered as being toward the left, so that the straps at the trailing end of the carrier will drop downwardly away from the pipe surface as their supporting rollers **25** negotiate the return bend for forward travel through the lower reach to the foremost return bend when the straps are elevated in succession with their faces remaining in a horizontal plane, so that as the supporting pivot pins reach the level of the uppermost reach the strap faces come into nonscraping, flat and nonangular seating relation with the pipe surface or surface of the coating thereon and thereafter remain in stationary or nonscraping seating contact with the pipe as the carrier moves forward with the tracks riding on the roller wheels **25—25**.

In connection with the support of the load at the innermost end of the pivot pin assembly, there will be a tendency for the innermost roller **25**, as seen in Fig. 5, to bear downwardly on the guide plate **20** while the outermost roller **25** bears upwardly and rides on the undersurface of the plate **21**. For restraining any rocking or tilting reaction of the wheel and pivot assembly and for retaining these parts in position, a circular wire or rod **38** is welded on the underside of the track **21** for a lateral bearing against the outermost wheel **25**, and a similar wire or rod **39** is welded to the upper side of the track **20**, as seen in Fig. 5, to resist outward force on the innermost wheel **25**.

The draft transmitted to the cradle frame through the side boom of the tractor will pull the cradle assembly along the pipe with the slings in the upper reach of the loop circuit suspending the pipe, and as the movement proceeds, the slings in succession drop away from the pipe at the trailing end of the loop as the endless link chain and supporting rollers travel in the reverse bend to the lower reach and forwardly in the lower reach

guideway to the leading end of the machine, where the rollers are guided upwardly into the upper reach and the slings again seat on the pipe as the cradle advances. Because of the transverse pivotal mounting of the opposite ends of each sling, they will always tend to hang downwardly with their bearing faces in horizontal planes, so that as the slings move through both of the reverse bends, their seating faces move into and out of engagement with the pipe in parallelism with the pipe surface. The slings are preferably constructed so that in the transverse direction, as seen in Fig. 3, their pipe seating engagement is throughout the entire underside of the pipe **10** and the width of the slings, as seen in Figs. 2 and 8, is greater than the longitudinal spacing between the slings, and the number of slings in the horizontal reaches of the loop oval affords a large longitudinal length of bearing support, so that the pipe load is uniformly distributed over a maximum of bearing area.

In many cases, and especially when the cradles are conveniently employed for supporting mechanism for performing work on the pipe, it will be advisable to supplement the forward draft of the tractor boom by a positive drive of the endless sling carrier. For that purpose, a motor may be mounted on the main frame of the cradle with its power output geared to the carrier chain. Rack teeth can conveniently be formed on the chain links for sprocket engagement, and for reducing friction in the drive the teeth can be in the form of spaced roller sleeves. The rollers or rack teeth **40** are indicated generally in Fig. 2, and in greater detail in Fig. 5. Referring to Fig. 5, the rollers **40** are mounted on studs or rivets **41** between a pair of angle brackets **42—42** welded to a plate **43** which bridges and is secured, as by welding, to a pair of co-operating chain links **24**. Each succeeding pair of chain links **24** carries a similar mounting plate **43** for a succession of equally spaced rollers **40**, and the latter are for engagement by the teeth of a drive sprocket **44**, the lower portion of which projects downwardly through a slot in the upper reach of the guide track **21**. The carrier chains on both sides of the machine are similarly equipped with the drive sprocket arrangement for operation in unison, and Fig. 4 shows the drive sprockets **44** fixed to a transverse drive shaft **45** mounted on a transverse axis in suitable bearings on the main frame. The shaft **45** also has fixed to it a worm wheel **46** (Fig. 2) in mesh with a worm **47** whose shaft is driven through gears **48** and **49** from a power shaft **50**. This shaft in turn is driven through gears **51** and **52** from a motor **53**.

A motor especially adapted for use with the equipment here involved is of the hydraulic type for response to liquid flow in a circulating system which also includes a pump **54**. This pump **54** (see Fig. 7) is mounted on the tractor **14** and is driven through the usual power take-off mechanism from the tractor engine **15**. The pump withdraws hydraulic liquid, such as thin oil, from a sump or supply tank **55** and supplies it through a suitable control valve, through a flexible hose **56** leading to the inlet of the motor **53**. The motor outlet is connected by a flexible hose **57** for liquid return to the sump **55**. The control valve referred to is under manual control of the tractor operator by means of a hand lever **58**, so that the operator can at all times regulate the speed of operation of the drive motor **53** to co-ordinate or synchronize the travel of the pipe supporting cradle with the rate of tractor advance. By relieving the tractor of side pull through the lateral boom, the problems of tractor steering are greatly reduced and a straight ahead direction of tractor travel is facilitated.

The same source of power is utilized for driving accessory equipment forming a part of certain of the succession of cradles. Thus the cradle which is shown second in line in Fig. 1 and in more detail in the enlarged view, Fig. 2, includes a circular succession of cleaning brushes **59** which are to rotate around the axis of the pipe **10** to brush and scrape dirt and corrosion from the pipe surface. The brushes are mounted in an annular frame **60** carried by forwardly projecting arms **61** rotatably mounted in a supporting head **62** at the front of the cradle. Connecting brackets or supporting arms **63** detachably secure the mounting head **62** to the main frame of the cradle, and the rotatable ring which carries the arms **61** is geared or connected by a driving chain **64** with a drive sprocket on the forward end of a driven shaft **65** which is to be connected with the power shaft **50** through a conventional change speed gear box **66** having a manual control lever **67** by which drive gear ratios are selected The change speed box **66** enables a range of speed ratios for rotating the cleaning brushes **59** at selected rates in relation to the rate of forward travel in accordance with the work to be done, inasmuch as some pipe surfaces may require more or less cleaning and scraping than other pipe surfaces.

The same cradle which supports the driven rotary brushes can be utilized for supporting the conventional priming mechanism at the trailing end of the cradle. Thus Fig. 2 shows rearwardly projecting supporting brackets **68** on the cradle main frame for carrying an annular pipe surrounding frame **69** and the housing **70**, containing the mechanism for applying and spreading a thin film of primer paint on the surface of the pipe, as is customary in the practice of coating pipe lines.

There is contemplated the use of a priming paint which is fairly fast drying, and the drying time interval will dictate the space between the priming machine and the thick coating machine. That space may be on the order of one hundred feet or even as much as two hundred feet, and when heavy pipe is being conditioned it may be desirable to insert a carrying cradle in the space between the priming machine and the coating machine, as indicated in Fig. 1. This carrying cradle, when constructed as previously described, will contact the primed pipe surface without harm to the surface, inasmuch as no point on the priming film will have a heavy load concentrated on it, as would be the case with the use of roller cradles of the type heretofore employed. Such conventional rollers have concave treads of increasing diameter outwardly from their middle and the variations in circular dimensions of said spaced portions result in different circumferential velocities across the tread and cause a scrubbing or abrasive scraping on at least some part of the pipe surface engaged. No such scraping occurs with the present strap slings and the large area of bearing surface afforded by the strap slings crawling along on the pipe surface supports the pipe without abrasion over a maximum bearing area, and the reduction in the likelihood of injury makes feasible the use of a load carrying cradle in the space between the priming and coating operations to better insure the suspension of the pipe on a straight line throughout its length of elevation.

The pipe coating and wrapping mechanisms may be of well known conventional types and are supported by brackets or arms **71** in trailing relation with a pipe supporting cradle, as in Fig. 8. A supporting frame **72** consists of a pair of longitudinally spaced annular rings, and between them is mounted a dope applying shoe **73** which surrounds the pipe **10** for spreading thereon a thick layer of hot asphaltum. Preferably, the supply of hot coating material is pumped directly to the shoe **73** without appreciable heat loss from a tar kettle and through a delivery pipe **74**, which includes a flexible conduit or hose connecting the shoe with the tar kettle, shown schematically at **75** in Fig. 1 in trailing relation with the tractor from which the cradle is suspended. The tar kettle stores and heats the coating material which is fed as a fluid having a temperature of around four hundred fifty degrees Fahreheit directly to the shoe in an amount related to the surface area to be covered and the machine travel rate to keep down oversupply and heat loss, as occurs when hot dope does not go directly to the applying shoe but

rather to the conventional machine carried, large capacity sump from which it is then circulated over the pipe in excess quantity, with the excess dropping back to the sump for recirculation. With the direct feed of hot fluid to the shoe, only a small drip pan **76** carried by the frame **72** beneath the shoe is required. A pump return connection **77** to the kettle is indicated in Fig. 8. Also mounted on the frame **72** and rearwardly of the dope applying shoe **73** are a pair of wrapping rolls **78** carried by a rotatable ring **79**. The rotatable ring **79** is mounted in the frame **72** and is geared for rotation from the power supply shaft **50**, which in this case extends rearwardly from the motor driven gearing **51** and **52** previously referred to in connection with Fig. 2. As the machine travels forward and applies a protective coating on the pipe, the rolls **78** rotate about the axis of the pipe and pay out ribbons, either paper or felt, in spiral courses to protectively cover the hot tar, and, among other things, the paper coating tends to prevent the hot tar from dripping and protectively envelops the tacky surface.

To insure uniformity of coating thickness entirely around the pipe and to minimize the tendency of the hot fluid to run or sag from the top and sides to the bottom of the pipe, it is proposed to quench the coating or cause it to give up its heat and fluidity immediately following its application to the pipe. For that purpose and which also enables the hardened coated pipe to be deposited at once in the trench without the setting up period which heretofore has been deemed necessary, a spray cooling arrangement is provided for a quick temperature drop or extraction of heat from the coating and in advance of that pipe supporting cradle next following the coating operation. Water may be employed as the cooling medium, and its delivery to the coated pipe may be by one or more longitudinally extending pipes **80**, each provided with a series of spray nozzles **81** for directing a copious supply of water onto the coated pipe. As seen in Fig. 8, the spray pipe arrangement includes an upper and a lower spray pipe **80**, connected at axially spaced intervals by arcuate or annular pipes **82** for communicating the spray pipes with one another. The uppermost spray pipe **80** has a rearwardly extending arm **83** which is universally connected by a ball and socket joint **84** to a frame mounting bracket which locates the spray frame but allows a certain relative movement in all directions about the ball and socket joint **84**. A load supporting spring **85** has one end secured to the arm **83** ahead of the ball joint **84**, and has its opposite end joined by an adjustable attachment stud to a frame bracket so that the adjustable connection will enable the position of the spray frame to be adjusted. Normally the adjusted position will set the pipes **80—80** on lines parallel to the pipe axis.

Cooling water enters the spray frame at the inlet connection **86**, which is joined by a flexible hose to a supply pump forming a part of a vehicular cooling tower **87** (see Fig. 1) which may trail behind the tar kettle **75**. After the water has contacted with and extracted heat from the coated pipe, it will drain into a catch basin, shown in Fig. 8 as including a flexible waterproof canvas trap **88** whose sides are secured at their upper ends to approximately the midheight of the annular connecting pipes **82—82** and whose bottom wall is inclined rearwardly and is connected to the bottom of the main frame, as a sump. From the sump there leads a pump suction line **89** which includes a flexible hose running back to the cooling tower vehicle **87**, where the heat is extracted from the liquid for recirculation in the cooling system.

The universally jointed mounting for the cooling frame is a feature which will find utility in the event the pipe line has bends in it, inasmuch as the forwardly projecting cooling frame may tend to follow the bend by a swivel movement at the joint and a yielding of the load carrying spring, accommodating the bend regardless of the direction of the bend. As a guide for the swivel movement, four rollers **90** having soft rubber treads are provided at circumferentially spaced locations about the pipe and forwardly at some distance ahead of the universal joint **84** and preferably behind the nose or leading end of the spray frame (see Fig. 8). The rollers **90** are arranged in upper and lower pairs, with the upper pair secured in a bracket **91** carried by the pipe **80** and the lower rollers mounted in a bracket **92** carried by the lowermost pipe **80**. In normal operation the treads of the rollers are all spaced from the pipe surface so as to be out of engagement therewith, with the axis of each roller tangentially related to the pipe axis. As will be seen in Fig. 9, if the pipe bends in any direction, its surface will be engaged by one or the other of the rollers **90** and the spray frame swings around the pivot **84**, keeping the frame and particularly the nozzles away from any sliding or scraping action on the pipe coating. Since the greatest temperature drop is from the hottest coating area and at the very start of cooling from the foremost sprays, there will have occurred a substantial cooling of the coating layer before any rearwardly disposed guide wheel **90** can roll on the cooled outer crust of the coating. By the time the completely sprayed and cooled coating is reached by and rested in the trailing load suspending slings, its temperature will have been lowered to approach hardened solidity, and especially because of the wide bearing area referred to heretofore, there will be little likelihood of pressure deflection of the coating material. Because of the cooling action of the water spray, the corrosion protection of the steel pipe is immediately secure and with the absence of load concentration, any residual plasticity inwardly of the hard crust will be of insignificant consequence as not to shift or permit harmful displacement of the protective sheath.

Accordingly, the cooled, coated pipe may be deposited immediately into the ditch **11** without the customary time delay and additional installation work heretofore practiced. For facilitating the lowering in of the pipe and eliminating abruptness of bends as the pipe descends into the ditch, one or more cradles will be used to support the pipe after it leaves the water cooling equipment, as indicated in Fig. 1, and the pipe will be ready for the backfilling operation by which it is buried in the open trench.

A noteworthy advantage of the working equipment here described is that the pipe walls are free from imposition thereon of the heavy weight of the equipment. The entire load is carried by the frame of the pipe cradle as distinguished from the heretofore practice of mounting each of the cleaning, priming, coating and wrapping mechanisms on the pipe itself with the load carrying rollers tracking and bearing on the pipe walls. By relieving the pipe walls of the machine loads, there will be an absence of wall wrinkling and distortion to make feasible the use of thinner pipe walls than otherwise would be required, and thereby enable important cost savings in material for distance pipe lines.

The tar kettle and the cooling tower may be parts of a single vehicle, and the tar and water pumps can be driven from the same power source such as an internal combustion engine. If desired, that engine instead of a tractor engine as before described, may be employed for operating the hydraulic power transmitting system which operates the driven carriers of the pipe supporting slings.

While the foregoing description has been directed primarily to the preferred embodiment of the invention, it is to be understood that various modifications are contemplated as within the scope of the appended claims.

What is claimed is:

1. Pipe cradling mechanism, including a power driven, ground engaging vehicle, a pipe cradling structure carried by said power driven vehicle for travel along the length of pipe, said cradling structure including an endless carrier movably mounted for travel in a longitudinally extending loop circuit, pipe engaging slings pivotally con-

nected to said carrier on transverse swing axes for cradling engagement with the pipe, a motor drive connected with the carrier and effecting circuit travel thereof, and means controlling said motor and regulating the speed of driven carrier travel to match the speed of travel of said power driven vehicle.

2. The structure of claim 1 wherein said vehicle includes a side boom through which the cradle structure is adjustably suspended in laterally offset relation with the vehicle and a power supply for said motor includes a a power delivery unit mounted on said vehicle and driven from the vehicle power plant and a flexible power conductor joins the power delivery unit with the motor and flexibly accommodates position changes of the adjustably suspended cradle structure relative to said vehicle.

3. Pipe cradling mechanism, comprising a longitudinal succession of transversely extending pipe cradling slings, an endless looped carrier supporting said slings, each on a transverse pivot axis acommodating individual swing action thereof to maintain its pipe engaging face parallel with the pipe surface during loop travel of the carrier, a power motor drive connected with the carrier to effect travel thereof and a crawler engagement of the slings with the cradled pipe.

4. The structure of claim 3 wherein the carrier is comprised of a pair of transversely spaced, interpivoted link chains and drive transmitting gearing connects the motor with both chains and compels their unison travel.

5. A pipe supporting cradle to be mounted for travel along the length of a pipe, comprising a main frame having transversely spaced side structures receiving the pipe therebetween and carrying transversely aligned guides affording longitudinally extending loop circuits for endless chains, endless chains mounted by said guides of both side structures for loop circuit travel relative thereto, pipe cradling straps having opposite ends supported by said chains, and power drive means operatively drive connected with said chains for the circulation of the chains and the crawler engagement of said straps with a cradled pipe.

6. A pipe supporting cradle to be mounted for travel along the length of a pipe, comprising a main frame having transversely spaced side structures receiving the pipe therebetween and carrying transversely aligned guides affording longitudinally extending loop circuits for endless chains, endless chains mounted by said guides of both side structures for loop circuit travel relative thereto, and a longitudinal succession of flexible flat straps bridging the pipe receiving space and being pivotally joined at opposite ends to said chains on transverse axes so that their pipe engaging faces remain uppermost through the chain loop circuit travel, said straps being longitudinally spaced apart for distances less than their widths.

7. In a pipe cradle of the character described, a pair of transversely spaced endless chains supported in longitudinally extending parallel loop circuits on opposite sides of a pipe to be cradled, and each comprising a succession of interpivoted links and link connecting pivot pins which project inwardly beyond the chain links and in substantially axial alignment with the pivot pins of the other chain, and a succession of flat, flexible straps bridging the transverse space between said chains for cradling a pipe by the straps in the upper reaches of the circuits and each connected at opposite ends to the inner ends of axially aligned link connecting pivot pins of the pair of chains, said connection accommodating free rocking of the straps relative to the chains to present the pipe engaging face of each strap uppermost in the chain circuits.

8. In a pipe supporting cradle of the character described, a pair of transversely spaced endless carriers arranged in an elongated loop circuit having upper and lower reaches and return bends joining said reaches and a series of pipe cradling straps projected transversely across said space and joined at opposite ends to said carriers by connections constraining the several straps to swing on transverse axes and relative to the carriers in their paths through the return bends of the loop circuit and thereby presenting the straps in planes parallel and nonangularly related to flat seat contact with the surface of a pipe cradled in the upper reach of the loop circuit.

9. In a conduit supporting cradle wherein an endless carrier is mounted in a loop circuit having upper and lower reaches and return bends joining said reaches, a succession of slings extending transversely of said carrier and presenting conduit receiving cradles in the upper reach of said loop circuit and pivot connections between the carrier and each of said slings mounting the slings for individual rocking action on axes transverse to the longitudinal extent of said carrier loop circuit.

10. In a conduit supporting cradle, a series of conduit suspending slings, each comprising a transversely extending flat strap, an endless carrier suspending each transverse strap in close succession to one another in the direction of the length of the conduit, a support mounting said endless carrier for travel through a loop circuit including upper and lower reaches and opposite end returns with the upper reach containing a large number of said straps for simultaneous load bearing contact with the conduit, and connections between the carrier and the several straps to present the straps parallel to one another in all positions throughout the loop circuit.

11. For conduit installation, a ground engaging vehicle having a source of power, a conduit suspending cradle carried by said vehicle for travel along the length of the conduit with vehicle travel and provided with power driven conduit engaging bearing members, power delivery means having drive transmitting connections with said bearing members and driving the same in conduit traction engagement and power take-off mechanism joining said vehicle power source with said power delivery means and imparting movement through said drive transmitting connections to said bearing members.

12. For conduit installation, a ground engaging vehicle having an engine power take-off device, a conduit suspending cradle carried by said vehicle and including power driven conduit bearing members arranged for traction drive on the conduit concurrently with vehicle travel, power transmitting drive connections between said vehicle power take-off device and said bearing members for driving said conduit engaging bearing members in the propulsion of said conduit suspending cradle, work performing means mounted on said vehicle carried cradle for operation on a conduit coincidentally with forward traction drive thereon by said power driven bearing members, and operating means adjoining said power transmitting drive connections which drive the conduit bearing members and said work performing means to actuate the same.

13. In conduit installation, a ground engaging vehicle having a power take-off device, a conduit supporting cradle suspended from said vehicle for travel with the vehicle and provided with conduit cradling and traction members for drive transmitting connection with said vehicle power take-off device for supplementing vehicle draft on the cradle, and a cooling liquid spray head mounted on the cradle and positioned at the forward end thereof for directing cooling liquid in heat exchange relation to the conduit in advance of conduit engagement by said traction members.

14. For the cooling of a hot fluid coating on a conduit, a ground engaging vehicle, a conduit supporting cradle carried by the vehicle for movement therewith along the length of the conduit and provided with conduit bearing members, a cooling liquid delivery pipe positioned ahead of said bearing members, a pivoted mounting between said pipe and said cradle, resilient load carrying connections between the delivery pipe and the cradle arranged to enable the pipe to swing about said pivot mounting and yieldably maintain the pipe in substantial parallelism with

the direction of cradle travel, and a normally inactive spacer on the delivery pipe in forwardly spaced relation to said pivot mounting for temporary buffer engagement with the conduit at those portions in the length thereof which bend or are laterally deflected from any portions instantaneously engaged by said bearing members as the cradle advances.

15. Means for cradling a pipe and for crawler engagement therewith comprising, in combination, a pair of sling carriers for receiving the pipe therebetween, support means for said sling carriers arranged for relative movement between the same and the pipe along the longitudinal extent of the pipe, and a plurality of slings rockably supported by said carriers for successively engaging and disengaging the under side of the pipe and for supporting the same in the relative movement therealong of said support means and the pipe.

16. Means for cradling a pipe and for crawler engagement therewith comprising, in combination, a pair of sling carriers for receiving the pipe therebetween, support means for said sling carriers arranged for relative movement between the same and the pipe along the longitudinal extent of the pipe, and a plurality of relatively wide slings rockably supported in their uppermost position about axes located transversely to the longitudinal axis of the pipe for successively engaging the principal portion of the under side of the pipe, said slings having relatively narrow clearance space between adjoining transverse edges of successive slings and being many times wider than the intervening clearance space for large area contact as said support means and pipe move relative to one another.

17. A pipe supporting cradle comprising a pair of transversely spaced supports arranged to receive a pipe in the space therebetween and for the relative travel of the pipe and supports in the direction of the axis of the pipe, a pair of endless carriers mounted by said supports for travel relative thereto through a circuit parallel to the pipe axis, a succession of transversely disposed flexible sling straps suspended in substantially U-shape from said carriers for ascent to the upper portion of said circuit and pipe seating engagement without movement on the pipe surface engaged thereby and for descent away from the pipe to the lower portion of said circuit, and swivel means swinging said straps on the carriers on axes transverse to the pipe axis for dependent suspension of the U-shaped straps and the swinging thereof to present their wide seating surfaces in planes parallel to the pipe surface throughout their circuit travel.

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