APPARATUS FOR RUNNING PIPE

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ABSTRACT OF THE DISCLOSURE

Substantially inflexible pipe is run into a well with apparatus embodying a powered grooved drum and a powered reel for spoiling the pipe, a loop of the pipe being held on the grooved drum by a continuous holding means, such as a chain provided with pressure blocks, which is coextensive with and conforms to the pipe loop and allows sufficient force to be exerted on the pipe by the drum to maintain the pipe on the drum to cause it to pass under sufficient tension, the apparatus being provided with guide means for the pipe between the drum and reel and a telescopic guide means for guiding the pipe into the well.

The present invention is directed to apparatus for running pipe. More particularly, the invention is directed to running a continuous length of pipe into and out of a well. In its more specific aspects, the invention is concerned with running a substantially inflexible length of pipe into a well.

The present invention may be briefly described as apparatus for running a continuous length of pipe into and out of a well. The apparatus comprises a powered, grooved wheel adapted to receive the pipe on the groove of the wheel. A continuous means is operatively arranged adjacent the wheel for movement relative to a major portion of the circumferential surface of the wheel substantially coextensive with the pipe in the groove of the wheel. This continuous means is preferably a chain. Carried on the continuous means, such as the chain, is a plurality of grooved means which are pivoted on the continuous means and which are adapted to maintain peripheral contact with the pipe received in the groove of the wheel. The continuous means, such as the chain, is provided with means operatively connected to the continuous means for adjusting the contact of the grooved means with the pipe. This means may suitably be a hydraulically-operated means which may be spring loaded for adjusting the contact of grooved means with the pipe.

A pipe straightening means is provided and positioned adjacent the point where the grooved means moves out of contact with the pipe and the pipe leaves the groove of the wheel. This straightening means includes two opposing wheel members, one being biased by pressure against the pipe just before it leaves the wheel and the other a fixed rotatable wheel contacting the pipe just after it leaves the wheel. A pipe guide means is positioned just below the straightening means and consists of a series of concentric telescoping sleeves, adjustable in height so as to guide the pipe from the point it passes through the straightening means to the point it passes into the well or wellhead assembly. The apparatus may optionally include slip means, arranged below the telescoping guide means and attached to the top of the wellhead apparatus, adapted to carry the weight of the pipe in the well. The slip means is preferred to hold and support the pipe when necessary without requiring the holding power of the grooved wheel.

The wellhead apparatus includes a pipe stripper and a set of rams positioned on top of the wellhead. The set of rams preferably includes a set of blank rams, cutter rams, pipe slip rams and pipe rams. Such an arrangement permits the pipe to be held at the wellhead, cut off above the slip rams, packed off around the pipe and closed above the cut pipe so that the well can be brought under control without delay when an emergency arises as the well begins to flow.

The invention also comprises in combination with the pipe running apparatus a spoiling device which is operably connected through a hydraulic system to the running apparatus so as to operate in conjunction therewith. The spoiling device suitably comprises a pipe reel means mounted on a rotatable shaft means, the shaft means having a passageway for fluid formed therein and power means for rotating said shaft and said reel means. Pipe connecting means are carried by the reel means for connecting the pipe to the reel means and to the passageways in the shaft means. The spoiling device also includes a level winding apparatus adapted to keep the pipe snugly wound on the drum at all times.

The apparatus for running the pipe is suitably carried on a frame which is pivotally mounted on a support means or member. The frame member and the support member are interconnected by a dual hinging arrangement at the two points farthest from the point where the pipe is run into a well. A weight indicator means connects the frame member and support member at the points nearest to the point where pipe is run into a well. The weight indicator indicates weight by the measure of pressure applied at these two points with very little relative movement between the frame and support members, if any.

The present invention will be further illustrated by reference to the drawing in which:

FIG. 1 is a view in profile of the apparatus for running the pipe into the well or removing it from the well;
FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1, with parts omitted for reasons of clarity;
FIG. 3 is a fragmentary view in profile of the braking device of FIGS. 1 and 2;
FIG. 4 is a schematic fragmentary view showing how the pipe is guided onto and held against the running wheel;
FIG. 4A is a view similar to FIG. 4 showing an alternate means for guiding the pipe in conjunction with the running wheel;
FIG. 4B is a sectional view taken along the line 4B—4B of FIG. 4A;
FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 4.
FIG. 6 is a schematic view taken along the line 6—6 of FIG. 4 to illustrate the path in which the pipe is guided in conjunction with the running wheel;
FIG. 7 is a view in profile of the spoiling device used in conjunction with the running wheel;
FIG. 8 is a plan view of the device of FIG. 7;
FIG. 9 is a detail view, partly in section, of the pipe guide means of FIG. 1;
FIG. 10 is a schematic flow diagram of the hydraulic system incorporated to connect and operate in conjunction with each other, the running and spoiling apparatus.

Referring now to the drawing which sets forth a best embodiment, and in which identical numerals will designate identical parts, numeral 11 designates a frame member suitably constructed of metallic stanchions which may be cross-braced, such as with cross-brace 12, and numeral 13 designates a support or base member for the frame member 11. The support member 13 may suitably be mounted on skids, such as 14. The frame member and the support member 13 may be considered as an integral piece of equipment. The frame member is connected to the support member through a pivot connecting means 15 which may suitably be a hinge member. The
frame member 11 and base member 13 are also interconnected by hydraulically operated weight indicator means 17 which includes a pair of piston cylinder assemblies bolted to the frame member 11 with pistons 39 and pistons 40 extended through and hinging against the base member 13. The pressure side of each cylinder is interconnected to a common conduit which is operably connected to a weight indicator (not shown). Hydraulic pressure is applied to the cylinders in a sufficient amount to raise the frame assembly a desired distance off the base member 13. The weight indicator would then indicate the weight of the entire frame assembly when the wheel is empty or no pipe is wound thereon. The indicator is then "zeroed in" and closed in by closing suitable valves. As weight is added by virtue of pipe being run into the well, the additional weight will exert more pressure on the cylinders and will therefore indicate in calibrated pounds on the weight indicator in view of the operator. Relative movement of the frame 11 to the base member 13 is very slight. The weight indicator means 17, incorporated in the present invention, is used solely as a weight indicator. However, it is obvious that such a means could be incorporated to act as an automatic safety feature to cut off power means, engage braking mechanisms or operate the wellhead ram assemblies in case of emergencies such as when an obstruction is encountered when running pipe or when pipe sticks when being removed.</p>

As a continuous length of pipe 42 is carried between spring loaded grooved guide wheels 43A, 43B, 43C, 43D, 43E, and 43F. Thus, the pipe 42 is guided into the groove 47 of the grooved wheel 20. The fragmentary view of FIG. 6 illustrates the angle of the path the pipe 42 follows by means of the guide rollers 43A-43F. Roller assembly 42E has been omitted from FIGS. 4 and 6 for reasons of clarification. Pressure blocks 48 carried by the continuous chain member or means 31 are provided with grooves 49 (see FIG. 5) designed to embrace the pipe 42 in the groove 47. These pressure blocks are pivotally carried on the chain 31 and maintain peripheral contact with the pipe 42 in the groove 47.

As an alternative to the spring loaded, grooved guide wheels 43A-43F, a more desirable embodiment, as shown in FIGS. 4A and 4B, provides for the continuous length of pipe 42 to be carried in a guide tube 44 instead of between the spring loaded grooved guide wheels 43A to 43F. Guide tube 44 may be formed from a 2½" outside diameter by 1½" inside diameter steel tube 45 that has a 1½" outside diameter by 1½" inside diameter brass tube 46 pressed into the steel tube 45. The tubular unit comprising the tubes 45 and 46 has been rolled into a 180° arc of a 58" diameter circle. The guide tube 44 is scarred on the lower end thereof to allow the tube to fit the grooved wheel 20. The end of the guide tube 44 next to the reeling mechanism may have a machined bell 44A, such as a brass bell, brazed to it. The guide tube 44 may be set in place to guide properly the tubing, and may be welded to the supports which are then welded to the frame as shown. Guide tube 44 directs the pipe 42 through the same path as do the guide rollers 43A-43F, of FIGS. 4 and 6. A spring loaded guide wheel is mounted on the tube 44 and expands into a slot in tube 44 to center and guide the pipe in the tube.

Fluid pressure (which may be liquid or gasiform) loaded grooved wheel 50 maintains the pipe 42 in the groove 47 by means of piston cylinder means 50A (see FIG. 4). Pressure loading is through a piston cylinder arrangement 51 connected by piston arm 52 to a member 53 to which the grooved wheel 50 is attached by shaft 54. Although not shown in FIG. 4A, the pipe 42 is held against the wheel 20 by the pressure block chain 31.

Spaced below the grooved wheel 50 is a grooved pipe straightening wheel 55 and a fixed radius guide wheel 56. This wheel works in conjunction with the wheel 50 to comprise the pipe straightening means. As the pipe 42 comes off of the grooved wheel 20, and passes wheel 50, it almost immediately passes through a telescope pipe guide 57 and then into the well through the slip member 58, thus providing for a fixed radius guide wheel 56. The several elements 57, 58, 59 and 60 are interconnected by suitably flanged connection means with the whole stack being arranged on the wellhead 61. Conduits 62, controlled by valves 63, lend into the blowout preventer 69 while a conduit 64 controlled by valve 65 connects into the annulus between the continuous pipe 42 and the walls of the well (not shown).
which suitably may be cased. It is to be understood, how-
never, that the conduits 62 and valves 63 may be replaced
by a single conduit and valve below the blank rams but
above the control of the well.

The slip member 58 suitably may be a Regan Unit
which has two sets of slips which are hydraulically set
and held in both directions. A description of such a unit
may be found on page 4034 of the 1964-1965 Compos-
site Catalog of Oil Field & Pipeline Equipment. The blowlou-
ner mounted on the wellhead as described before. The ram assembly 60
consists of a stack of rams, including blank rams, cutter rams, slip rams and pipe rams for closing off around the
tubing 42.

While a brake drum has been described on the grooved
wheel 20, the brake drum may suitably be dispensed with
since a fluid system, such as a hydraulic system, may
employ positive displacement pumps and motor and thereby
the movement of the grooved wheel 20 may be locked.
While the brake drum and its brake band may be omitted,
with a different power system, a brake assembly may be designed.

Referring now to FIGS. 7 and 8, a frame member 70
mounted on skid 71 is provided with a cross-brace 72 on
which is arranged journals 73 carrying a shaft 74. Ar-
anged on the shaft 74 is a reel drum 75 on which the pipe
42 is spaced out and about the sleeve pipe 76 to a point
77 which in turn connects by a con-

nector joint 78 to a passageway 79 in the shaft 74.
One end of shaft 74 extends beyond journal 73 and is
enclosed and rotates in a seal member 79B to which a
hose or other conduit means may be attached. The seal
member 79B may be bolted to the frame member 70 or
the journal 73. The seal acts as a swivel connection
for introducing fluids into the pipe 42 through passageway 79.

A hydraulic motor 80 is suitably attached to the frame
70 and through a drive train, including sprockets 82, 82A,
83, 83A and 84, and their interconnecting sprocket chain,
provides the drive power for rotating the reel drum and
reel 75 with sprocket 84 being directly connected to the
shaft 74 and drum 75.

A plurality of rollers 88 are spaced around the periph-
ery of the drum 75 to maintain the pipe 42 on the reel
should it become loosened thereon.
The rollers 88 are only necessary when certain types
of pipe are employed. When longer, stronger, or stiffer
pipe is used, the rollers 88 may perform a desirable func-
tion. Actually safety may dictate the emloyment of the
rollers 88 when a loose end of pipe or one relatively short
is moving around the grooved wheel 20.
A chain drive mechanism, including a sprocket 89 driven
by a chain 90 from sprocket 91 on shaft 74, suitably
drives a spooling or level winding mechanism through sprocket 92 and chain 93, and sprocket 94 and chain 95
which extends around the sprocket 96. The sprocket 96
is mounted on yoke 97 and rotates a multiple return rod
108 (see FIG. 8) having two-way threads formed thereon.
The rod 108 is journaled at each end to a pair of yoke
members 97 which extend slightly above reel 75 and are
pivotally mounted just above the shaft 74 on the same
shaft to which sprocket 94 is attached. The pair of yoke
members 97 have connected therebetween a double track
97A (see FIG. 8) which extends laterally across the reel
75. The yoke members 97 are pivotally adjustable relative
to the outer periphery of the drum 75 by moving the con-
necting bolts 98 to space them in any of the holes 99 in
the cross member 99 of the level winding apparatus 101.
Also provides a sleeve member 109 which is slidably
mounted on the rod 108. A follower lug or pawl 109A is
threaded into sleeve 109 and extends into the grooves
or threads of the rod 108. The sleeve is adapted to slide
back and forth on the track 97 and driven by the rod
108. Above the sleeve 109 are a pair of journal plates which carry pipe guide rollers 102 and
104. As shown in FIG. 7, the pipe 42 passes between

the rollers 102 and 104. Each of the rollers 102 are car-
ried in a slot and are spring-biased against the pipe by
spring members 103. The linear movement of the roller
by hydraulic motor 105 mounted on one of the plates.
The motor is operably connected to the rollers by drive
chains 106 and 107. Additional rollers 104 may be added
or deleted as desired. As shown, the level wind, generally
designated as 101 is driven back and forth across the
drum 75 by the motor 80, while the guide wheels are
driven by the motor 105. Thus, the horizontal movement
of the level wind unit 101 is coordinated with the reel
drum 75 so that each successive wrap of pipe on the drum
lays snugly against the previously laid wrap. This is clear-
ly illustrated in FIG. 8.
The yoke member 97 may be removed and the level
wind unit mechanism may be set in fixed journals on
the frame 70 above or in front of the reel 75. However,
in many instances, the use of the yoke mounting such
as 97 may be quite desirable.
The guide rollers need not be power driven and the drive
chains 106 and 107 with motor 105 may be omitted
if desired. The power-driven wheels are shown only as
an alternate tension device for maintaining a certain
amount of drag or tension on the pipe between the rollers
and the drum either when spooling or unspooling the
pipe on the drum, whereby each layer of pipe is assured
of being wound tightly on the drum 75. However, the
hydraulic system, later to be described, which coordinates
the running device with the spooling apparatus provides
the tension qualities for correctly winding and unwinding
the pipe in relation to the reel drum.

Referring now to FIGURE 9, the telescopic pipe guide
57 is suitably bolted to the slips 58 by flange 110 and
is comprised of a plurality of telescopic members 111, 112,
113, 114, 115 and 116 as may be desired. The upper
member 116 may be provided with a flange 117 to which a
stuffing box (not shown) may be attached. Each of the
members 111, 112, 113, 114, 115 and 116 is provided with
a shoulder 118, 119, 120, 121 and 122 which is designed
to rest against a shoulder 123, 124, 125, 126 and 127, re-
spectively, to prevent the several members 111, 112, 113,
114, 115 and 116 from being pulled out of the next lower-
most member. Each of the telescoping members, except
116, has threadedly attached into its lower end spacer or
guide rings 130 having various outside diameters, but hav-
ing a common I.D. which is slightly larger than the O.D.
of the pipe 42. The member 116 provides its own correct
I.D. The guide member 57 serves to maintain the pipe
around the pipe 42 as it is forced into the well from the
grooved drum 20. The pipe guide may be comprised of 3
or 4 or more telescopic members which may be about 9
inches in length attached to a length of 2" or 2 1/4" pipe.
It is to be understood, however, that while an example has
been given with respect to the telescopic members, these
specific examples are illustrative and should not be con-
strued as limiting the length of the telescopic members to
9" nor to the size of pipe to which they are attached.
The guide and the attached pipe may be any size with an In-
side diameter larger than the outside diameter of the pipe
and couplings being run. A total of 2 to 3 feet of adjust-
able length may be suitable for most conditions depending
on the distance the apparatus of the present invention is
disposed or located relative to the wellhead. The tele-
scop ing members are extended the correct length above
the slips means 58 and are held in position by nuts threaded
to the mounting bolts supporting the guide members or
slip means. The top of the guide means 57 is positioned
as close as possible beneath the straighening wheel 55 so
that pipe is sufficiently guided until it enters the wellhead
apparatus. This prevents buckling of the pipe prior to en-
tering the wellhead.
The apparatus of the present invention may suitably be
used for introducing a continuous length of substantially
flexible pipe into a well drilled to penetrate one or more
hydrocarbon productive strata. By substantially flexible
is meant that the pipe 42 has sufficient strength to support itself. Substantially inflexible does not mean, however, that the pipe has no flexibility, but rather means that continuous lengths of such pipe may have a substantial amount of flexibility in that it may have rather large radius bends. The pipe has sufficient flexibility that it may be shaped and reeled or unreeled and shaped to be inserted into a well.

Referring now to FIG. 10, the hydraulic control system incorporated to drive and control the operation of the present invention will now be described. A power unit A, including an engine 209 drives a hydraulic pump 201 and a small air compressor 206. The output of pump 201 is connected through a relief valve 283 and filter 284 to a reservoir tank 285 which is in turn fluidly connected to the intake of the pump 201. The compressor 206 supplies air to pressure tank 207 which provides air pressure to a control panel 209 by way of conduit 205. Power unit A is provided with a power fluid output line 211 and a fluid return line 212. Line 211 connects at junction 210 to branch lines 213, 214 and 215. Line 215 supplies power fluid to main control valve 216 which is a 4-way (spring-centered to a no-flow position) throttle valve which is remotely operated from the control panel 209 by way of air line 217. In the position shown, fluid is throttled through valve 216, line 218, pressure reducing valve 219, check valve 220 (bypassing flow control valve 211 to one side of hydraulic motor 21) which drives the running unit or wheel 20. The power fluid rotatably drives motor 21 with the fluid returning as shown through line 221, flow control valve 222, check valve 223, line 224, main control valve 216, line 225, check valve 226 to junction 227 of the fluid return line 212 and back to the reservoir tank through filter 204. For purpose of example, the fluid flow as described causes the motor 21 to rotate in a clockwise direction, therefore rotating through mechanical linkage a variable positive displacement pump 228 which is fluidly connected to drive the hydraulic motor 80 to drive the reel assembly C. Hydraulic fluid is supplied to pump 228 by way of line 229 (which connects to line 225) check valve 230 and line 231. Rotation of pump 228 (also main mounted on the running assembly) causes output power fluid to flow through line 235, check valve 233 to drive reel motor 80. Fluid output flow from pump 228 through line 234 and check valve 235 through relief valve 236 which is preset, for example at 1500 lbs, line 237 to the junction 227 of return line 212. Rotational drive of motors 21 and 80 in the opposite direction (counterclockwise, as viewed) is caused by rotating valve 216 whereby power fluid is flowed by way of line 213 and valve 216 through line 224, pressure reducing valve 238, check valve 239 and line 221 to motor 21, with the return fluid passing through motor 21, flow control valve 211, check valve 240, line 218, main valve 216, line 225, check valve 226 and back to the return line 212 by way of junction 227. Rotation of motor 21 in a counterclockwise direction causes rotation of the variable P. D. pump 228, with power fluid being supplied by way of line 229, check valve 241, and line 242 through P. D. pump 228, line 231, and line 234 through hydraulic motor 80, line 235, pressure relief valve 243 (preset at 1000 lbs, for example) line 244 back to return line junction 227.

With the flow pattern described, it can be seen that a hydraulically powered connection is maintained between the main drive B (which represents the pipe drive mechanism) and the spooling device or reel assembly C. With proper control of the various components, including the P. D. pump 228, and the main relief valves 236 and 243 any desired speed relation between the drive wheel 20 and reel drum 75 can be maintained.

For example, when removing pipe, such as from the well and spooling it onto reel 75, it is desirable to always have tension on the pipe especially between the level wind mechanism 101 and the drum. This is allowed by causing the drum to try to out-run the drive mechanism. This is accomplished by setting the drum speed at maximum rotational speed (for example, a speed sufficient with an empty drum or no pipe wound thereon). From there on, as pipe is wound onto the drum, the tension or drag is automatically afforded. This allows the pipe to be at all times snugly wrapped about the drum and also held in such a fashion that when the device is stopped for one reason or another.

When running pipe into a well or unspooling from drum 75, it is also necessary to maintain a certain amount of drag or tension on the pipe as it comes off the reel 75. This is also afforded by allowing the drum 75 to try to run behind the speed of the running wheel 20. This provides the tension required to keep the pipe from expanding on the reel and be at all times in tension so as to keep the pipe snugly wrapped.

The alternate tension device, when not being used, is closed off from the system by closing valves 246 and 247 in lines 244 and 245, respectively. However, with fluid being trapped in the alternate device, it is necessary to allow this fluid to circulate since the motor will be rotated by means of the pipe rotating the guide rollers 102 and therefore motor 105. This is accomplished by opening circulating valve 248 and allowing the fluid to freely circulate without causing any drag to the guide rollers 102 or the motor 105.

Power fluid to the alternate tension device D is supplied through line 245 to either of branch lines 249 and 250, depending on which direction it is desired to rotate. Either of the outlet fluids from motor 105 is forced through relief valve 251 into line 244 which ties into junction 227 of return line 212. However, as stated previously, it is not always necessary to use this device in the system since, as explained hereinbefore, the system may provide its own tension producing qualities.

A brake cylinder E which operates to set or release a band on brake drum 67 is tied into the power fluid system through branch line 213. The brake remains released by means of hydraulic pressure below the piston and is only released to allow the biasing spring to set the brake in case of power failure such as a broken line where the power fluid would be released. This brake is only added as a safety feature and it is not usually needed in normal operation. In the event of the system going out of pressure holding power by means of the fluid being locked in when the "spring-biased to off position valve 216" is released by the operator.

At times, it may be desirable to operate the reel assembly exclusive of the running wheel 20. For this purpose, a valve 260, also controlled from panel 209, is connected into the system and motor 80 by power line 214 and line 261.

Valve 216 which is spring-biased to a center or no flow position is operated by a "spring-biased to center position" piston cylinder assembly (not shown) which is in turn operated by air pressure in line 217 which is supplied through control valve 209A of the panel 209. This control valve 209A is also spring-biased to an off position and always assumes this position when the handle is released by the operator. Any time a malfunction of the apparatus occurs, the operator has only to release the handle of valve 209A and the entire system is stopped with all moving parts locked against movement by means of the locked-in fluid.

The present invention is quite useful in that it may be used for running a continuous length of pipe into a well where the well is long enough to extend at least 3000 feet. The system avoids the necessity of handling and hoisting very long lengths of pipe at one time. One very long system may be connected between the two ends by a convenient connector and the entire system and even several units may be set up at a time and the entire operation may be handled by a relatively small crew of men. While a specific embodiment has been shown and described it will be apparent to those skilled in the art that other configurations, operations and combinations of elements may be made in accordance with the teachings herein and without departing from the spirit and scope of the invention.
The apparatus of the present invention provides a sufficient bearing area on the pipe 42 by the grooved wheel 20 to support a free hanging length of the entire pipe string and is capable of holding the pipe 42 with enough tensile force to pass the pipe if the pipe should become lodged or cemented in the well. The apparatus of the present invention shapes the pipe to the desired form as it is reeled into or out of the hole. The apparatus has means for pumping into the pipe as it is being reeled into or out of the well, such means including the connection to the reel drum shaft 74 to which a connection may be made to a source of fluid for introduction into a well or to storage for removal from the well. Besides the particular apparatus, accessory wellhead equipment serves to prevent blowout and loss of the pipe string. Means are also provided for injecting heavy mud or other drilling fluid to prevent a blowout.

In employing the present invention, referring now back to the drawing, the pipe 42 may be reeled from the drum 75 and passed between the guide wheels 43A to 43F and into the groove 47 of the grooved wheel 20 and thence down through the telescopic pipe guide 57, the slips 58, the follower 59 and through the blowout preventer stack 60 into the well. Should the pipe 42 become stuck in the well and it is desired to part it, a cut-off device incorporated in the blowout preventer stack 60 may be operated to cut the pipe. The slips would be released to hold the pipe. Under these conditions, the weight indicators would show that the slips were holding the pipe. The operation of the pipe cut-off device and its details have been described hereinbefore and will not be repeated.

The operation of the device should be understandable from the description taken with the drawing.

1. Apparatus for running a continuous length of substantially inflexible pipe into and out of a well which comprises a powered, grooved wheel adapted to receive said pipe on the groove of said wheel, a loop of said pipe being adapted to be placed around the wheel in said groove, a continuous holding means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with and conforming to said pipe loop in the groove of said wheel adapted to maintain positional contact with said pipe received in the groove of said wheel and to hold said pipe on said wheel, and means operatively connected to said continuous means for adjusting peripheral contact with said pipe.

2. Apparatus in accordance with claim 1 in which an adjustable pressure maintenance means in contact with said pipe is provided at a point adjacent the point where said grooved means moves out of contact with said pipe and said pipe leaves the groove of said wheel.

3. Apparatus for running a continuous length of substantially inflexible pipe into and out of a well which comprises a powered, grooved wheel adapted to receive said pipe on the groove of said wheel, a loop of said pipe being adapted to be placed around the wheel in said groove, a continuous holding means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with and conforming to said pipe loop in the groove of said wheel and to hold said pipe on said wheel, a plurality of means pivotally carried by said continuous means and adapted to maintain peripheral contact with pipe received in the groove of said wheel and means operatively connected to said continuous means for adjusting the peripheral contact of said means with said pipe.

4. Apparatus for running a continuous length of substantially inflexible pipe into and out of a well which comprises a frame member, a powered, grooved wheel adapted to receive said pipe on the groove of said wheel mounted in said frame member, a loop of said pipe being adapted to be placed around the wheel in said groove, a continuous holding means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with and conforming to said pipe loop in the groove of said wheel and to hold said pipe on said wheel, a plurality of means pivotally carried by said continuous means and adapted to maintain peripheral contact with pipe received in the groove of said wheel and means operatively connected to said continuous means for adjusting the peripheral contact of said means with said pipe.

5. Apparatus in accordance with claim 4 in which the frame member is pivotally mounted on a support member for measurement of pressure applied on the frame member and in which weight indicator means connects said frame and support members for indicating said pressure as weight is imposed by said pipe on said grooved wheel.

6. Apparatus for running a continuous length of substantially inflexible pipe into and out of a well which comprises a powered, grooved wheel adapted to receive said pipe on the groove of said wheel, a loop of said pipe being adapted to be placed around the wheel in said groove, a continuous holding means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with and conforming to said pipe loop in the groove of said wheel and to hold said pipe on said wheel, and means operatively connected to said continuous means for adjusting peripheral contact with said pipe, and roll means for said continuous length of pipe operatively disposed relative to said groove wheel and said apparatus being provided with means for guiding said pipe between said grooved wheel and said roll means.
Apparatus in accordance with claim 6 in which the means for guiding said pipe between the grooved wheel and the reel means are guide wheels carried adjacent said grooved wheel.

Apparatus in accordance with claim 6 in which the means for guiding said pipe between the grooved wheel and the reel means is a tubular guide means carried adjacent said grooved wheel.

Apparatus in accordance with claim 6 in which the reel means is provided with means for compactly spooling said pipe on said reel means.

Apparatus for running a continuous length of pipe into and out of a well which comprises a powered, grooved wheel adapted to receive said pipe on the groove of said wheel, continuous means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with said pipe in the groove of said wheel adapted to maintain peripheral contact with pipe received in the groove of said wheel, means operatively connected to said continuous means for adjusting peripheral contact with said pipe, and telescopic pipe guide means arranged for guiding said pipe into said well.

Apparatus for running a continuous length of pipe into and out of a well which comprises a powered grooved wheel and the reel means for holding said pipe on the groove of said wheel, continuous means operatively arranged adjacent said wheel for movement relative to the circumferential surface of said wheel substantially coextensive with said pipe in the groove of said wheel, grooved means carried by said continuous means adapted to maintain peripheral contact with pipe received in the groove of said wheel, means operatively connected to said continuous means for adjusting the peripheral contact of said grooved means with said pipe, and telescopic pipe guide means arranged for guiding said pipe into said well.

Apparatus in accordance with claim 9 in which slip means are arranged below said telescopic pipe guide means for carrying the weight of said pipe in said well.

Apparatus for running a continuous length of substantially inflexible pipe into a well which comprises, in combination, powered drum means for injecting said pipe into a well, a loop of said pipe being adapted to be placed around said powered drum, a continuous holding means operatively arranged adjacent said powered drum means substantially coextensive with and conforming to said pipe loop for maintaining said pipe on said powered drum means and for holding said pipe on said powered drum means, and means for spooling said continuous length of pipe comprising a rotatable shaft means having a passageway for fluid formed therein, powered reel means mounted on said shaft means, means carried by said reel means for connecting said pipe to said reel means, said connection means fluidly connecting to said passageway in said shaft means, means for maintaining said pipe on said reel means, and means for compactly spooling said pipe on said reel means.

Apparatus in accordance with claim 13 in which means are provided for guiding said pipe between said powered drum means and said powered reel means.

Apparatus in accordance with claim 13 in which guide wheels are provided on said powered drum means for guiding said pipe between said powered drum means and said powered reel means.

Apparatus in accordance with claim 13 in which tubular guide means is provided on said powered drum means for guiding said pipe between said powered drum means and said powered reel means.

Apparatus for running a continuous length of substantially inflexible pipe into a well which comprises, in combination, powered drum means for injecting said pipe into a well and powered reel means for spooling said pipe to and from said powered drum means, a loop of said pipe being adapted to be placed around said powered drum, a continuous holding means adjacent said powered drum means substantially coextensive with and conforming to said pipe loop for holding and maintaining said pipe on said drum means, means connected to said drum means and to said reel means for supplying power to said drum means and to said reel means and controlling the speed of rotation of said drum means relative to said reel means.

Apparatus in accordance with claim 17 in which the means for supplying power to and controlling the speed of rotation of said drum means and said reel means is hydraulically powered.

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JAMES A. LEPINK, Primary Examiner.