

[54] **LINER INSERTING MACHINE FOR PIPELINES**

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[58] Field of Search..... 29/234, 237, 244, 29/252; 61/43, 72.5, 72.7; 166/50, 77; 254/29 R

[56] **References Cited**

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[57] **ABSTRACT**

It is a known practice to recondition long, straight runs of a large diameter, underground pipeline—as in an irrigation or sewer system—by inserting a liner pipe in each such run. This is accomplished by successively thrusting liner pipe sections into the run from an end thereof which has previously been opened for the purpose. The present disclosure is of an improved machine to accomplish such result; the machine including a frame adapted to be prepositioned in an excavation adjacent the open end of said run of the pipeline, and the frame supporting a power-actuated, reciprocable pusher head disposed—when the frame is in place in the excavation—in axial alignment with said open end of such run and operative to successively, forcefully thrust liner pipe sections, in end-coupled relation, thereto.

8 Claims, 6 Drawing Figures

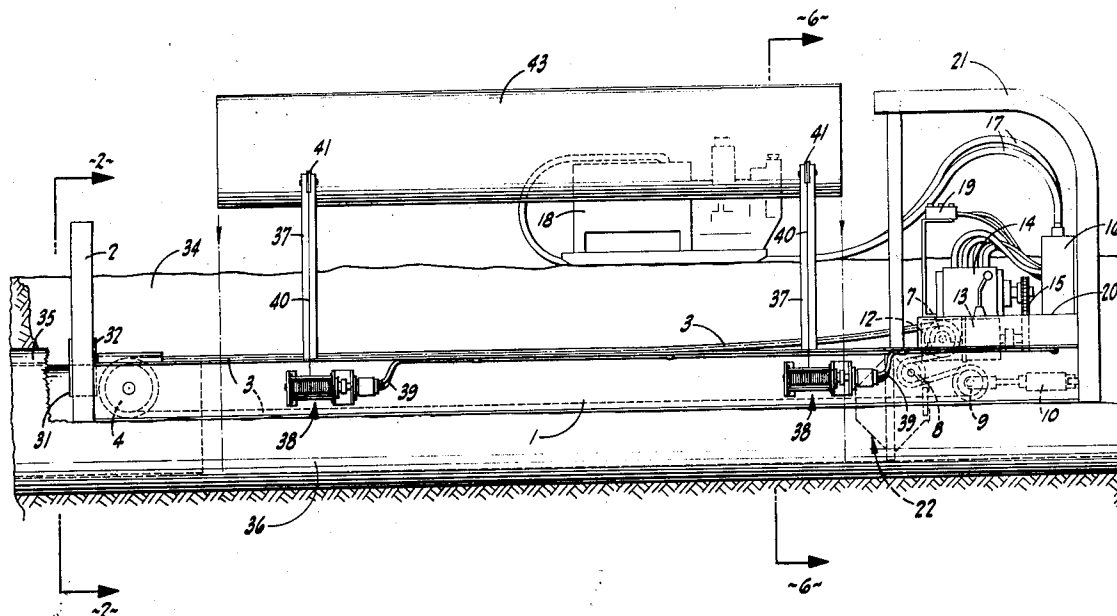
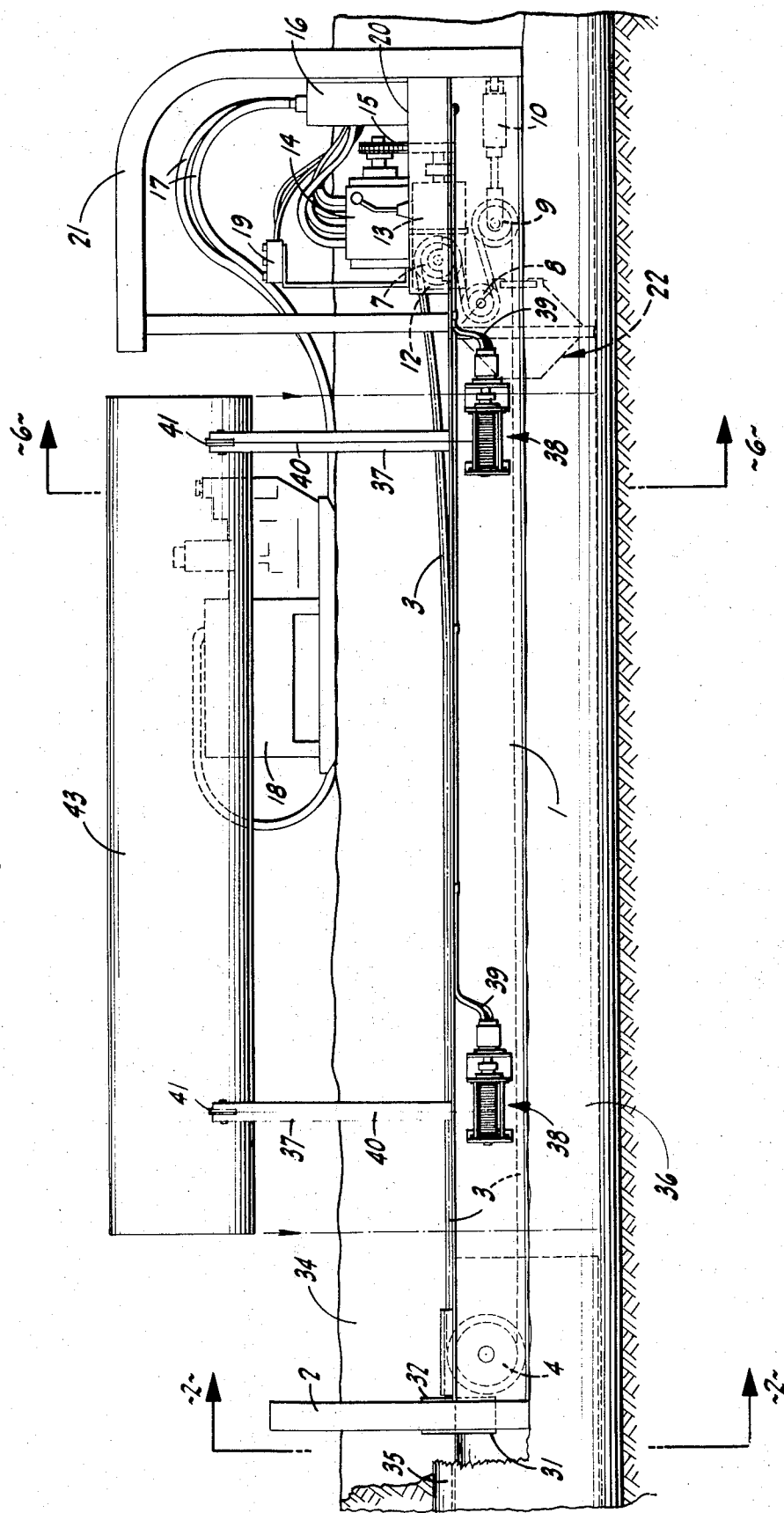


FIG-1



4 Sheets-Sheet 2

FIG-2

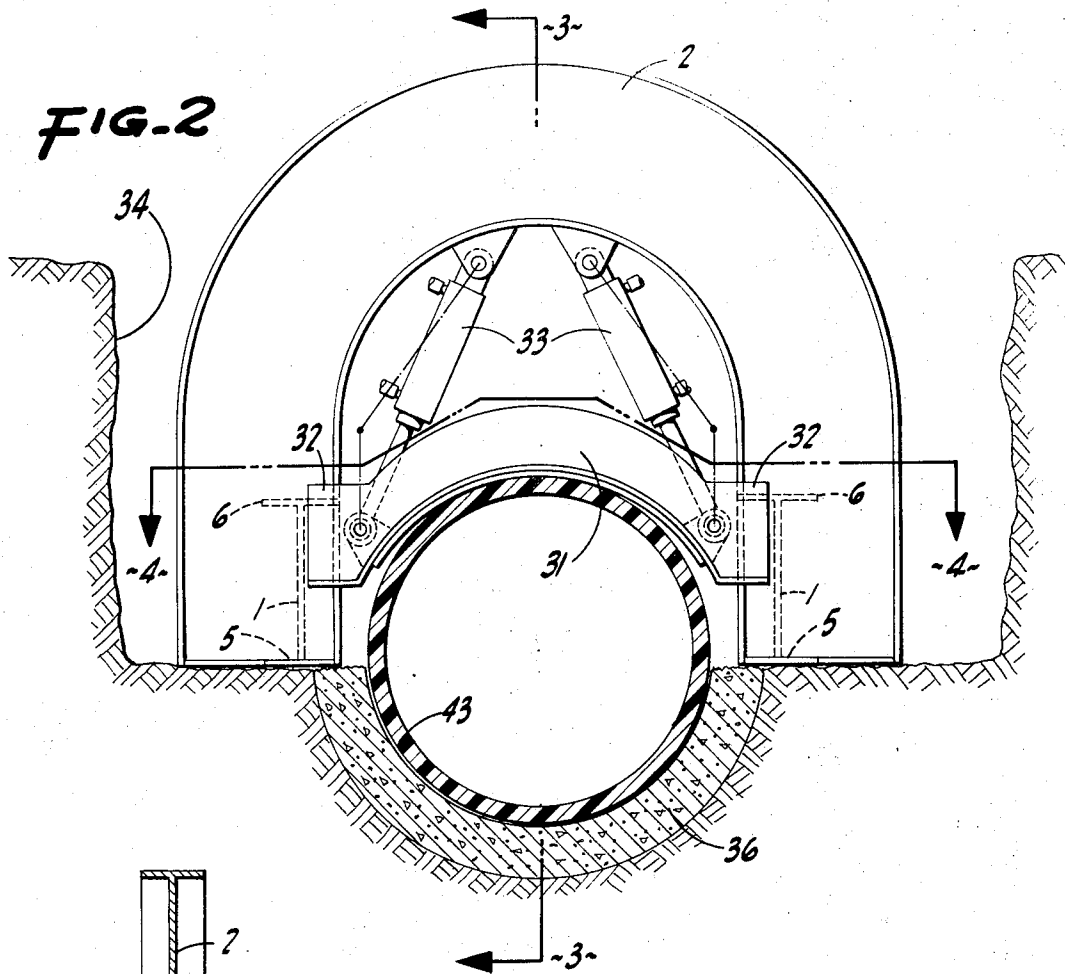
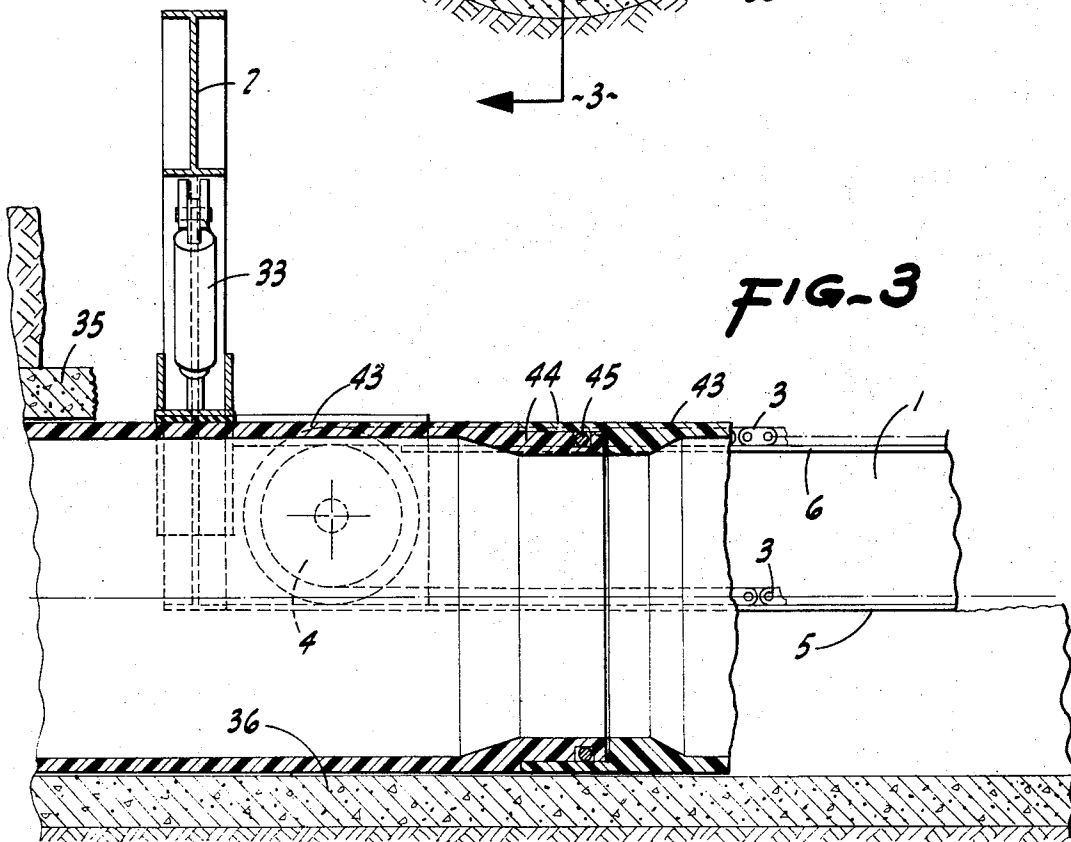
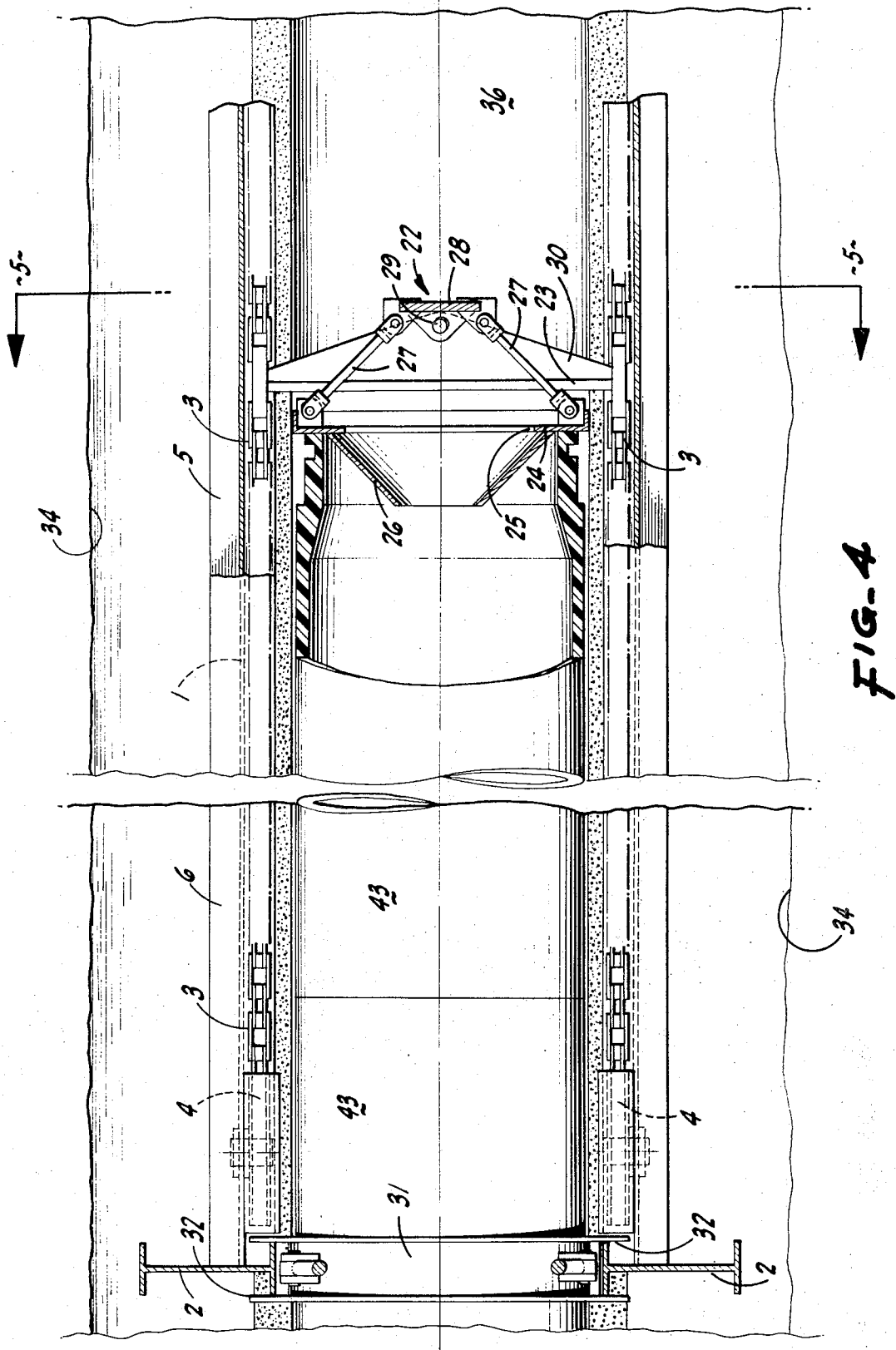
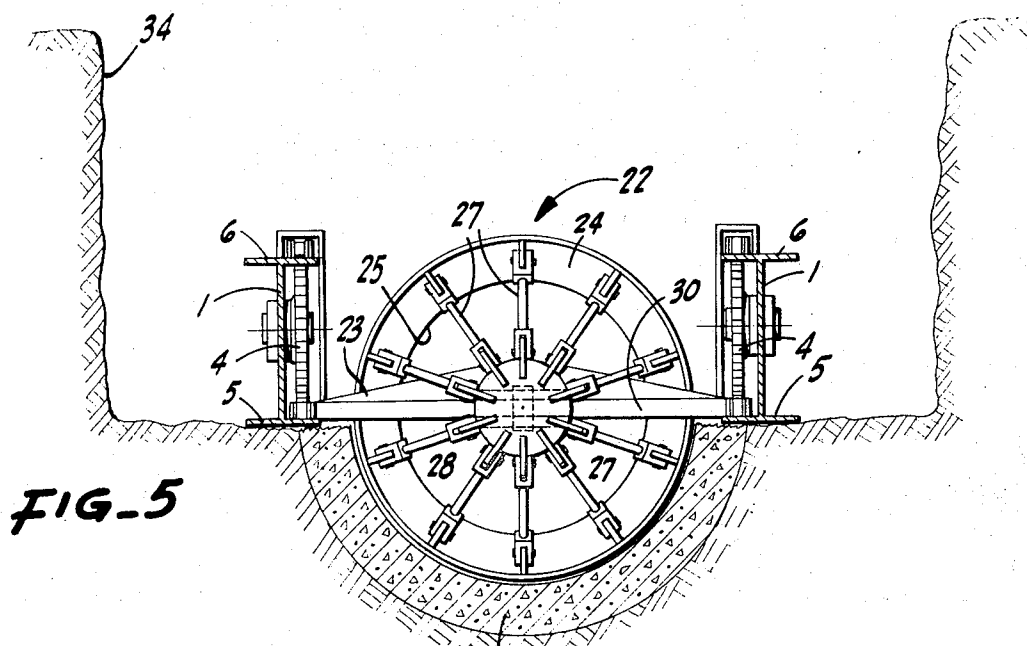
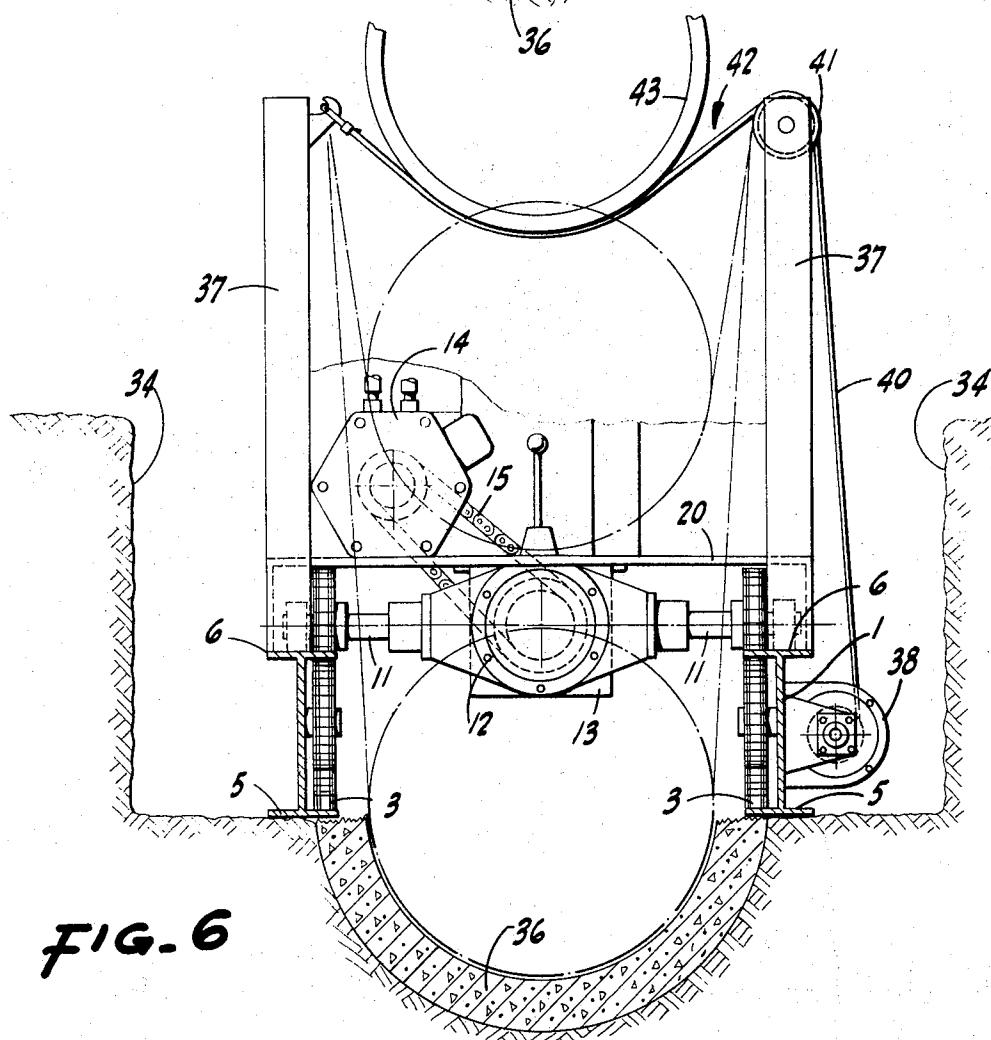


FIG-3







LINER INSERTING MACHINE FOR PIPELINES

BACKGROUND OF THE INVENTION

The insertion of liner pipe in an underground pipeline, for the purpose of reconditioning the latter, has heretofore been accomplished by machines of sundry forms, but none thereof has performed the task in as effective and expeditious manner as might be desired. The present machine was conceived in an effort to provide a liner-inserting machine of improved construction and function relative to those heretofore known.

SUMMARY OF THE INVENTION

The present invention provides, as a major object, a machine for inserting liner pipe—section by section, and in end-coupled relation—into a straight run of an existing, large diameter underground pipeline as, for example, in an irrigation or sewer system; the machine including a frame adapted to be prepositioned in an excavation adjacent an open end of the run of the pipeline, and the frame supporting a power-actuated reciprocable pusher head disposed—when the frame is in place in the excavation—in axial alinement with said open end of such run and operative to successively, forcefully thrust liner pipe sections, in said end-coupled relation, thereinto.

The present invention provides, as another important object, a machine, as in the preceding paragraph, which includes transversely spaced simultaneously driven endless chains which travel in the same direction, such chains including corresponding courses having a cross bar connected therebetween; the pusher head being mounted on such cross bar, and such corresponding courses of the chains resting on and being guided by transversely spaced, longitudinal beams of the frame.

The present invention provides, as still another important object, a machine, as above, which includes an actuating mechanism for the chains comprised of a fluid-motor-driven gear box mounted in connection with the frame; fluid pressure for the motor being fed through a conduit which leads into the excavation from a fluid pressure supply unit supported at ground level adjacent but spaced from such excavation. This arrangement permits the essential assembly of the machine to be more compact than would otherwise be the case and which would require an excavation of greater dimensions.

The present invention provides, as an additional important object, a pusher head of novel construction and function.

The present invention provides, as a further object, a liner inserting machine for pipelines which is designed for ease and economy of manufacture.

The present invention provides, as a still further object, a practical, reliable, and durable liner inserting machine for pipelines, and one which is exceedingly effective for the purpose for which it is designed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the machine as disposed in an excavation for use; the pusher head being retracted, and the next-to-be-pushed section of liner pipe being shown on the cable slings preparatory to lowering into position for pushing into the pipeline being reconditioned.

FIG. 2 is an enlarged transverse sectional elevation on line 2—2 of FIG. 1; the view showing the front end of the machine with the clamp lowered into engagement with the section of liner pipe just previously pushed into the pipeline.

FIG. 3 is a fragmentary, longitudinal sectional elevation on line 3—3 of FIG. 2; the view showing the next section of liner pipe as pushed into coupling engagement with said clamp-engaged section.

FIG. 4 is a fragmentary, longitudinal sectional plan on line 4—4 of FIG. 2; the view showing the manner of engagement of the pusher head with the section of liner pipe being pushed.

FIG. 5 is a transverse sectional elevation on line 5—5 of FIG. 4; the view showing the pusher head in rear-end elevation.

FIG. 6 is an enlarged transverse sectional elevation on line 6—6 of FIG. 1; the view showing the chain-driving mechanism in front elevation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings and to the characters of reference marked thereon, the machine comprises a pair of elongated, transversely spaced, parallel frame beams 1 suitably rigidly connected together at the ends; the connection at the forward ends of said beams being an arch 2. The frame beams 1 are of I-form, and an endless chain 3 extends along each such beam; each chain turning at the front about an idler sprocket 4, and thence extending rearwardly with the lower and advancing course of the chain riding the inside bottom flange 5 of the related beam, while the upper and returning course of the chain rides the inside top flange 6 of said beam.

At the rear end, and relative to the direction of travel, each chain first passes rearwardly about a drive sprocket 7, thence forwardly about a direction-changing sprocket 8, and finally rearwardly about another direction-changing and chain-tightening sprocket 9; the latter being mounted in connection with a chain-tightening power cylinder 10.

The sprockets 7 are simultaneously driven in the same direction and at the same speed (to likewise advance the lower courses of the chains 3) by means of opposed output shafts 11 of a gear box 12 actuated by a transmission 13 powered by a reversible hydraulic motor 14 through the medium of a sprocket and chain drive 15. Hydraulic pressure is delivered to motor 14 by conduits leading from a control valve unit 16 fed—in turn—by flexible conduits 17 extending from a remotely disposed engine-driven hydraulic pump unit 18. The control valve unit 16 is responsive to and regulated from a console 19 supported from a rear, operator's deck 20; the operator, by manipulation of the console 19, causing the chains 3 to be simultaneously run in one direction or the other. A cab 21 provides overhead protection for the operator.

A pusher head—indicated generally at 22, and hereinafter described in detail—is disposed between the frame beams 1 in forwardly facing, normally retracted position as shown in FIG. 1. The pusher head is mounted centrally on and supported by a cross bar 23 which spans between and is secured, at its ends, to the chains 3; the pusher head being disposed in front of said cross bar 23.

The forwardly-facing pusher head 22 is symmetrically disposed relative to the cross bar 23 and comprises an annular plate 24 whose opening 25 is surrounded by a forwardly extending, frusto-conical guide 26; the plate 24—which lies ahead of cross bar 23—being of a diameter such that it projects radially beyond the rear end of said guide 26. A plurality of circumferentially spaced, radial thrust arms 27 are pivoted to the back side of annular plate 24 adjacent its periphery and thence slope inwardly to pivotal connection with a circular attachment disc 28 disposed rearwardly of cross bar 23. In turn, the disc 28 is vertically pivoted, as at 29, to a reinforcing web 30 on the rear of said cross bar 23. As so mounted, the pusher head 22 is effectively disposed for forceful advance by the chains 3 from initially retracted position, while capable of some lateral play about pivot 29 as an axis.

At the front end of the machine, the arch 2 is provided—within its confines—with a normally raised, downwardly movable clamp 31 of arcuate, downwardly facing form; such clamp having saddle-type guides 32 at the ends, and which guides slidably ride adjacent legs of the arch 2. The clamp 31 is normally raised but is adapted to be lowered by upwardly converging, normally retracted, double-acting power cylinders 33 pivotally connected between the end portions of said clamp and the top portion of the arch 2.

For use of the machine, an elongated, trench-like excavation 34 is first made over the end portion of a straight run of an existing pipeline 35; such excavation being of a length and width to receive the machine therein, and of a depth such that the bottom of the excavation is in substantially the midplane of the pipeline transversely thereof. This exposes the upper half of such end portion of said run of the pipeline, and which upper half is then cut away to form, from the lower half, an elongated, substantially half-circle cradle 36 extending from end to end of the excavation 34.

Nextly, the machine is lowered—as by a crane—into the excavation 34, with the arch 2 adjacent the then-open end of said straight run of the pipeline, and until the frame beams 1 rest on the bottom of the excavation on opposite sides of said cradle 36. When the machine is thus supported in the excavation, the lower half of the pusher head 22 occupies a symmetrical position in said cradle 36 and for advance therealong.

When the machine is disposed in working position in excavation 34, the hydraulic pump unit 18 remains on the ground to one side of said excavation; the conduits 17 then leading down into such excavation and to the machine.

A pair of posts 37 upstands, in longitudinally spaced relation, from each frame beam 1, and corresponding posts of such pairs are transversely aligned. A pair of hydraulic power winches 38 are mounted exteriorly on the outside of one frame beam 1, and conduits 39 lead from such winches to the control valve unit 16, and whereby the winches can be controlled from console 19. The winches 38 are aligned with the posts on the corresponding frame beam 1, and a cable 40 leads upwardly from each winch, thence passes over a direction-changing sheave 41 on the upper end of said aligned posts, and then spans—as a sling 42—to the top of the corresponding post on the other frame beam 1. An elongated section 43 of liner pipe, of an outside diameter slightly less than the inside diameter of pipeline 35, is placed—by suitable means—in the slings 41, and—by

operation of winches 38 to pay-out cables 40—is lowered thereby downwardly into the cradle 36 formed by the above-described cut-away of an end portion of a straight run of the pipeline 35. This is followed by withdrawal of the cables 40 from beneath said section 43. The initially retracted pusher head 22 is then slidably advanced by simultaneous operation of the chains 3, and with their lower courses moving forward. As the pusher head 22 advances, it engages the near end of the section 43 of liner pipe lying in cradle 36 and pushes such section forwardly into the pipeline 35 from its adjacent open end and until only a short trailing portion of such section remains exposed in the cradle and beneath the then-raised clamp 31.

Upon such advance of the pusher head, and at the time of its initial engagement with the section 43, the frusto-conical guide 26 enters said section to properly locate the pivotally mounted pusher head and assure that the adjacent end of such section 43 is flush-engaged by the annular plate 24. The circumferentially spaced thrust arms 27 assure of equal distribution of the pushing force applied to annular plate 24 and the engaged end of section 43.

As the plate 24 is annular and hence centrally open, and as the guide 26 is frusto-conical and open end to end, any water which may be flowing in the cradle 36 passes through the pusher head without obstruction.

After a section 43 of liner pipe has been pushed into pipeline 35 with only a short trailing portion of said section remaining exposed, the clamp 31 is lowered by power cylinders 33 into clamping engagement with said trailing portion (see FIG. 2); the purpose of such operation being to hold the clamp-engaged section 43 stationary until the next section of liner pipe is pushed, by pusher head 22, forwardly in cradle 36 and a male-female coupling 44—which includes an O-ring 45—is engaged between adjacent ends of said sections (see FIG. 3), and which requires a forceful thrust. Otherwise, there is a tendency to slide the lead section 43 ahead in pipeline 35 without the coupling 44 being properly engaged.

As soon as the coupling 44 is engaged, the clamp 31 is released by raising the same, and then the pusher head 22 is further advanced to push said next section into the pipeline 35 and again stopping with only a short trailing portion remaining exposed for the above-described reason.

The foregoing operations are conducted successively, and—as each section 43 of liner pipe is pushed into the pipeline 35—all of the sections 43 previously pushed thereinto (in end-coupled relation) are advanced as a continuous string thereof. In this manner, a long, straight run of a pipeline can be effectively and expeditiously reconditioned by placement of liner pipe therein.

With respect to the clamp 31, its use can be discontinued when enough sections have been pushed into the pipeline to create a sufficient resistance to forward motion so that each coupling 44 can thereafter be engaged before the string of sections starts to move in said pipeline.

From the foregoing description, it will be readily seen that there has been produced such a liner inserting machine for pipelines as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the liner inserting

machine for pipelines, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention as defined by the appended claims.

I claim:

1. A machine for push-inserting liner pipe sections into a straight run of an existing pipeline from an open end of such run; the machine including a longitudinal frame adapted to be positioned adjacent and extending lengthwise away from the open end of the run, a pusher head adapted for engagement with an end of a section of liner pipe, means mounting the pusher head on the frame for powered advancing movement from an initially retracted position toward the open end of the run, there being a section of liner pipe prepositioned lengthwise adjacent the frame forwardly of the pusher head in its retracted position and in alinement with the open end of the run, the pusher head as power-advanced engaging the adjacent end of said section of liner pipe and push-inserting the same for a substantial part of its length into the run from said open end thereof, the mounting means for the pusher head including longitudinally extending endless chains supported by the frame, a power mechanism connected to the chains to simultaneously actuate them at like speed, and a cross bar secured to and spanning between corresponding courses of such chains; the pusher head being attached to the cross bar and including a circular, forwardly facing plate, a plurality of circumferentially spaced thrust arms connected to the plate adjacent its periphery and extending rearwardly in converging relation, a disc to which the thrust arms are connected at their rear ends, and means securing the disc to the cross bar.

2. A machine, as in claim 1, in which the circular plate is disposed forwardly of the cross bar and the disc rearwardly thereof; and the disc-securing means including a pivotal connection.

3. A machine for push-inserting liner pipe sections into a straight run of an existing pipeline from an open end of such run; the machine including a longitudinal frame adapted to be positioned adjacent and extending lengthwise away from the open end of the run, a pusher head adapted for engagement with an end of a section of liner pipe, means mounting the pusher head on the frame for powered advancing movement from an initially retracted position toward the open end of the run, there being a section of liner pipe prepositioned lengthwise adjacent the frame forwardly of the pusher head in its retracted position and in alinement with the open end of the run, the pusher head as power-advanced engaging the adjacent end of said section of liner pipe and push-inserting the same for a substantial part of its length into the run from said open end thereof, the mounting means for the pusher head including longitudinally extending endless chains supported by the frame, a power mechanism connected to the chains to simultaneously actuate them at like speed, and a cross bar secured to and spanning between corresponding courses of such chains; the pusher head being attached to the cross bar; the frame including transversely spaced frame beams, and the chains being supported between their ends by corresponding beams.

4. A machine, as in claim 3, in which the frame beams include laterally inwardly extending flanges, and the latter supporting the courses of the chains between which the cross bar spans.

5. A machine for push-inserting liner pipe sections into a straight run of an existing pipeline from an open end of such run; the machine including a longitudinal frame adapted to be positioned adjacent and extending lengthwise away from the open end of the run, a pusher head adapted for engagement with an end of a section of liner pipe, means mounting the pusher head on the frame for powered advancing movement from an initially retracted position toward the open end of the run, there being a section of liner pipe prepositioned lengthwise adjacent the frame forwardly of the pusher head in its retracted position and in alinement with the open end of the run, the pusher head as power-advanced engaging the adjacent end of said section of liner pipe and push-inserting the same for a substantial part of its length into the run from said open end thereof; the machine being adapted for use in a trench-like excavation which exposes a portion of the pipeline and the top half of which portion is cut away to form said open end of the run and define a longitudinal cradle therebeyond, the frame being disposed in the excavation longitudinally of and adjacent the cradle, said frame including transversely spaced longitudinal frame beams located on opposite sides of the cradle, the section of liner pipe being prepositioned in the cradle between said frame beams, the pusher head being disposed in part in the cradle for advance therein, an arch affixedly connected between the frame beams at the forward end thereof, said arch being adapted to span over a trailing and exposed portion of the section of liner pipe as so push-inserted, and an initially raised clamp mounted in the arch for powered lowering movement into engagement with said trailing and exposed portion of the push-inserted section of liner pipe.

6. A machine for push-inserting liner pipe sections into a straight run of an existing pipeline from an open end of such run; the machine including a longitudinal frame adapted to be positioned adjacent and extending lengthwise away from the open end of the run, said frame having transversely spaced longitudinal frame beams, a pusher head adapted for engagement with an end of a section of liner pipe, means mounting the pusher head on the frame for powered advancing movement from an initially retracted position toward the open end of the run, there being a section of liner pipe prepositioned lengthwise adjacent the frame forwardly of the pusher head in its retracted position and in alinement with the open end of the run, the pusher head as power-advanced engaging the adjacent end of said section of liner pipe and push-inserting the same for a substantial part of its length into the run from said open end thereof, the mounting means for the pusher head including longitudinally extending endless chains supported by the frame, a power mechanism connected to the chains to simultaneously actuate them at like speed, a cross bar secured to and spanning between corresponding courses of such chains, the pusher head being attached to the cross bar, a rigid arch connecting the frame beams at their forward ends, a clamp vertically slidably mounted in the arch and operative upon lowering from an initially raised position to engage a trailing portion of the push-inserted section remaining exposed beyond the open end of said run, the clamp as so engaged preventing forward movement of said push-inserted section during end-coupling thereto of the next prepositioned section of liner pipe when first ad-

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vanced by the pusher head, and power means between the arch and clamp operative to so lower the latter.

7. A machine, as in claim 6, adapted for use in a trench-like excavation which exposes a portion of the pipeline and the top half of which portion is cut away to form said open end of the run and define a longitudinal cradle therebeyond; the frame being disposed in the excavation longitudinally of and adjacent the cradle, and the pusher head being circular and disposed so that the lower part thereof is received in and moves forwardly in the cradle when said pusher head is ad-

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vanced; the section of liner pipe being prepositioned in the cradle.

8. A machine, as in claim 6, in which the transversely spaced frame beams rest on the bottom of the excavation on opposite sides of the cradle; there being frame-mounted power-operated sling means adapted to receive a section of liner pipe in an elevated position and to then lower such section between the frame beams and thence into said cradle to so preposition such section forwardly of the initially retracted pusher head.

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