Dec. 20, 1966 J. L. McELVANY 3,292,379

PIPE LAYING APPARATUS

Filed March 5, 1962 2 Sheets-Sheet 1

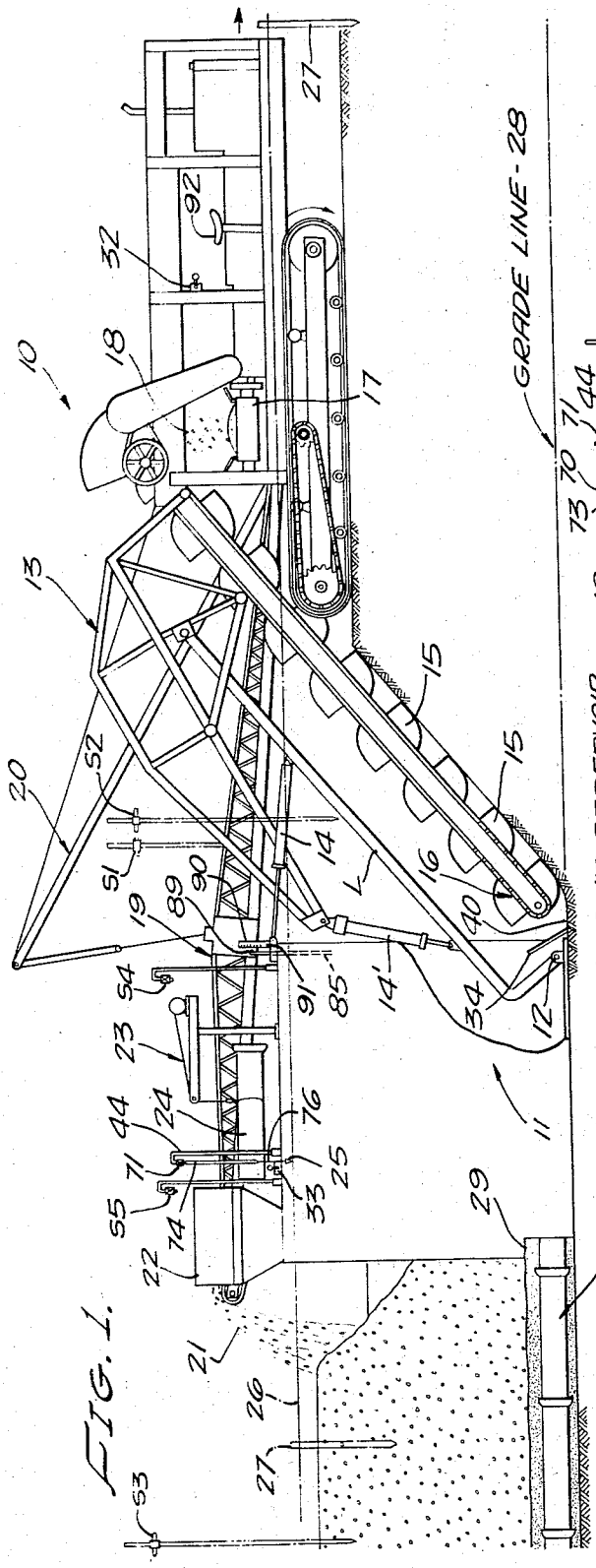

FIG. 1.

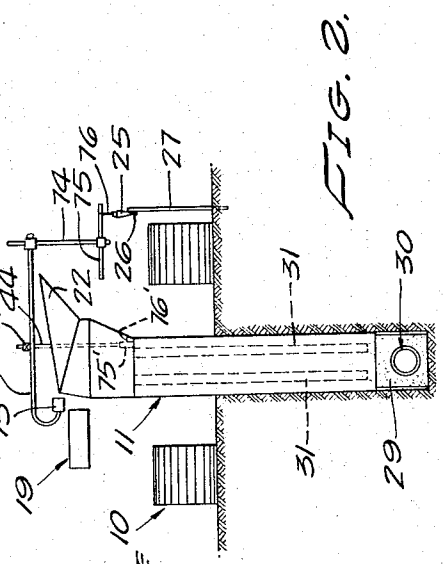

FIG. 2.

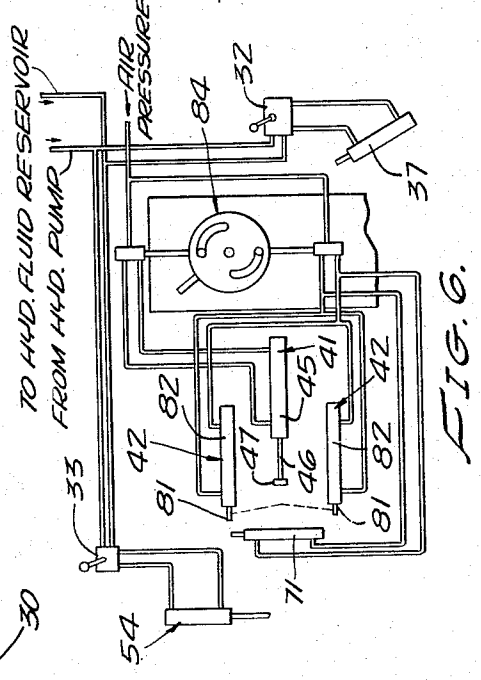

FIG. 6.

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Filed March 5, 1962 2 Sheets-Sheet 2

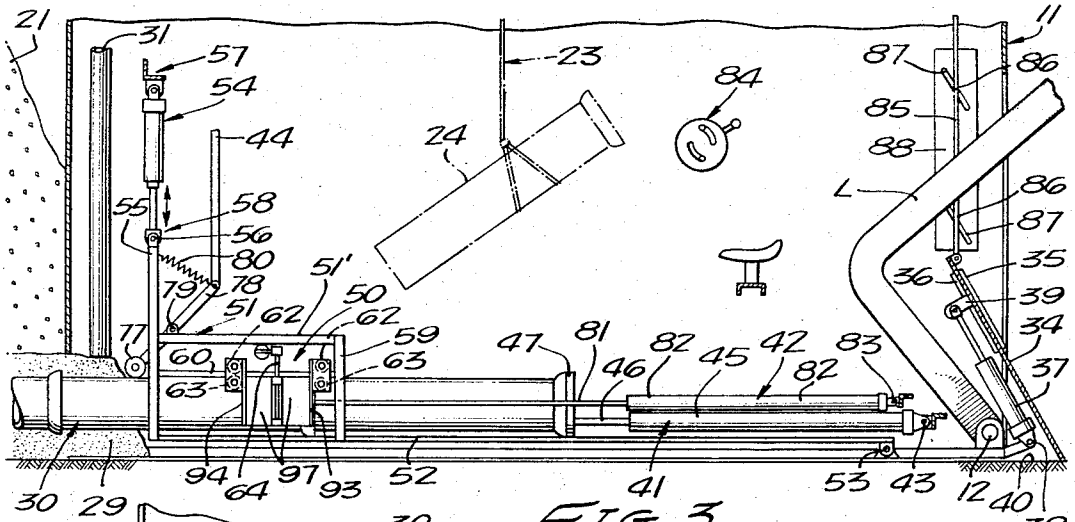

FIG. 3.

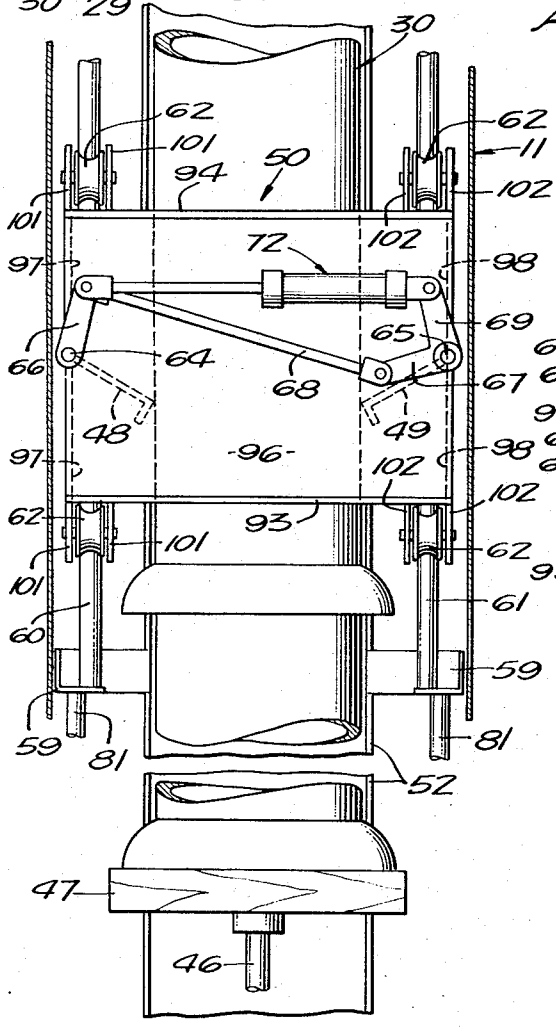

FIG. 4.

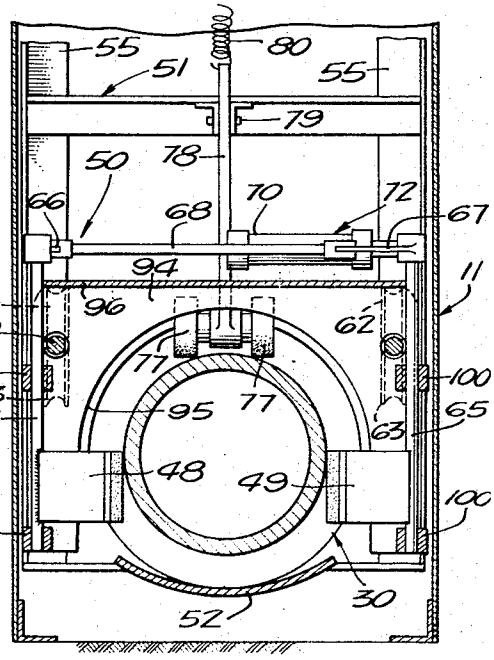

FIG. 5.

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PIPE LAYING APPARATUS

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9 Claims. (Cl. 61—72.5)

This invention relates to devices for laying underground pipe lines, and more particularly to equipment for laying pipe to grade, i.e. accurately along a prescribed grade line.

In the past, the laying of pipe to grade, e.g. to within a fraction of an inch, has been difficult if not impossible to achieve under many different sets of conditions.

The apparatus of the present invention overcomes this and other disadvantages of the prior art by providing means to orient the pipe or the pipe laying apparatus itself, or both of them. Thus, rapid and accurate corrections may be made and pipe thereby laid to grade.

In accordance with a feature of the present invention, a construction is provided in pipe laying apparatus including a trench digging machine or trencher and a pipe laying crib to follow in the trench dug by the machine. To enable the crib to follow the machine within a close tolerance of grade, adjustment of the angular position of the crib is made by a pivotal connection of the crib with the trenching machine. The position of the crib is determined by the use of sight bars mounted at each end of the crib, which bars are aligned with stationary sights set to project the prescribed grade line. Thus, the floor of the crib is held parallel to a prescribed grade.

Notwithstanding that such sight bars may be employed, a difficulty in laying pipe to grade may still be encountered because dirt from the earth moving parts or bucket line of the trencher will feed under the crib when the front end thereof is tilted upwardly in an attitude at an angle relative to a prescribed grade line. In such a case, a simple angular adjustment of the crib position will not compensate for any error in the average vertical height of the crib unless the dirt collected under the front end of the crib is removed therefrom. That is, the entire crib will ride up on this dirt to a height well above the prescribed grade line since the crib can only follow the trencher in and rest on the bottom of the excavated ditch even if the ditch effectively bottoms on top of the mound of dirt under the front end of the crib.

In order to overcome the problem of the crib riding up over the top of the dirt mound dropped by the bucket line and in order to hold the crib otherwise parallel to a prescribed grade line during cave-ins and operations in materials having other irregularities, in accordance with the present invention a plow blade mounted on the crib at the forward lower end thereof may be employed to overcome this difficulty. In such a case, the lower end of the blade may be located in a position projecting exteriorly of the crib. Means for adjusting the vertical position of the blade may also be provided. Such means, in turn, can thereby control the position of the crib in the trench within narrow vertical limits. In this case, the crib may be adjusted to a position parallel to a grade line by plowing the bottom of the trench, as required.

In accordance with a feature of the present invention, another construction may be provided in addition to or in lieu of that described above including reciprocable means in the crib for engaging the end of a pipeline to

2

maintain the same longitudinal compression, and elevator means in the crib for adjusting the vertical position of the reciprocable means in the crib. Thus, the position of the pipe in the crib may be adjusted to within narrow limits in a manner similar to that in which the pipe may be laid to grade within narrow limits by adjusting the vertical position of the blade as the crib follows the trench digging machine in the trench.

The above described and other advantages of the present invention will be better understood from the following description when considered in connection with the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 is a side elevational view of pipe laying apparatus constructed in accordance with the present invention;

FIG. 2 is a rear elevational view of the apparatus shown in FIG. 1;

FIG. 3 is a longitudinal sectional view of a pipe laying crib;

FIG. 4 is a longitudinal sectional view of the rearward portion of the crib shown in FIG. 3 at the left end thereof as viewed in FIG. 3;

FIG. 5 is a transverse sectional view of the crib shown in FIG. 3 looking rearwardly therein; and

FIG. 6 is a schematic diagram of air and hydraulic systems which may be employed with the embodiment of the invention illustrated in FIGS. 1 to 5 inclusive.

In the drawings in FIG. 1, a trench digging machine is indicated generally at **10** connected to which is a pipe laying crib **11**, crib **11** being pivoted at a horizontal pin **12** from a set of beams **13** which forms a part of the machine **10**. Crib **11** is pivoted about pin **12** by a pair of hydraulic rams **14** extending from the set of beams **13** to the top of the crib **11**. Except for the pivotal connection at **12** and the hydraulic rams **14** and one at **14'** to move a linkage L, trench digging machine **10** may be conventional.

Machine **10** digs a trench by the use of buckets **15** which are carried by a chain and sprocket drive assembly **16** to a position overlying a transverse conveyor belt **17**. Conveyor belt **17** transfers earth at **18** to a longitudinal conveyor belt, not shown, in an assembly **19** supported by a boom **20** on machine **10**. Earth **18** is then eventually dumped into the trench behind crib **11** as at **21**, from the left end of assembly **19** as viewed in FIG. 1.

Beams **13** may be provided at each side of crib **11** and welded together. Cross beams, not shown, may connect each identical set **13** at any point of intersection with any one of the beams with another.

The apparatus contained in crib **11** other than the improvements of the present invention operates in a manner similar to that disclosed in U.S. Patent No. 2,830,548. Some of the apparatus exterior of crib **11**, shown in FIG. 1, also may be similar to and have a similar function to that disclosed in the said patent. In particular, a hopper **22** is shown in FIG. 1 which may perform the same function as hopper **41** shown in FIG. 1 of said patent. A cable assembly may be provided as indicated at **23** above crib **11** to lower pipe sections such as pipe section **24** shown in FIG. 1 downwardly inside crib **11**.

To lay pipe to grade, a trench is excavated by machine **10** by using a digging sight **S1**. The trench, as nearly as it is possible to do so, is excavated parallel to a prescribed

grade line. Sight S1 which is shown in FIG. 1, is aligned with grade projected by stationary sights S2 and S3. The crib **11** follows machine **10** closely in the trench with sights S and S aligned with sights S2 and S3. With this method, it is possible to lay pipe to grade and with an error not exceeding ±.05 foot. In order to lay pipe to grade, a comparison of a marker **25** fixed to crib **11** is also made to the position of a string **26** on stakes **27**, which string is pulled tightly parallel to a prescribed grade line as indicated at **28**. The function of marker **25** is likewise illustrated in FIG. 2.

Further, accurate indication of the height of pipe line **30** and the trench excavated by machine **10** is made by connection of a linkage **44** shown in FIG. 3 connected to an arm **70** to be described hereinafter. The upper end of linkage **44** is shown in FIG. 2. A cross arm **70** is connected to linkage **44** at a universal joint **71**. Cross arm **70** is provided with a counterweight **73** at its left end. Cross arm **70** is provided with a vertical bar **74** and a horizontal bar **75** fixedly connected thereto, plumb bob **25** being suspended from horizontal bar **75** on a string **76**. Their use of universal joint **71** makes the indication of the height of lower end of plumb bob **25** above string **26** accurate within a few hundredths of a foot, even though crib **11** may be inclined to the left or to the right as viewed in FIG. 2. Linkage **44** is vertically slidable in a tube **75'** that, in turn, is pivoted about a horizontal axis **76'** through crib **11**.

As gravel is located at **21** in FIG. 1 of said patent, so gravel **29** is located around pipeline **30** as shown in FIG. 1, gravel being deposited in hopper **22** and falling through conduits **31** therefrom as shown in FIGS. 2 and 3 to a position overlying the pipeline **30**.

As has been explained, the invention includes the alternative or simultaneous use of a plow blade and a vertical adjustment of pipeline compression sustaining means. Both of these functions are performed by apparatus actuable through the operation of valves **32** and **33** shown in FIGS. 1 and 6.

The plow blade of the present invention is illustrated at **34** in FIG. 3 slidably supported between plates **35** and **36** fixed with crib **11**. The vertical position of plow blade **34** is adjusted by a ram **37** operated by means of valve **32**. Ram **37** is pivoted at its lower end **38** to crib **11** and at its upper end to an ear **39** fixed with blade **34**. It can be seen that the level of the earth in the trench dug by machine **10** and **40** is determined by the vertical adjustment of blade **34** in conjunction with the angular position of the crib.

As shown in FIG. 3, a linkage **85** is connected from the upper end of blade **34** and is guided for movement in a vertical plane parallel to the front of crib **11** by pins **86** extending therethrough and into slots **87** in a bracket **88** fixed to a side wall of crib **11**. The upper end of linkage **85** is shown in FIG. 1 having an index at **89** thereon for comparison with indicia **90** on a strip **91** fixed to crib **11** in order for an operator seated at **92** on machine **10** to determine the position of blade **34** relative to crib **11**.

When crib **11** follows machine **10** in the trench, pipeline **30** is maintained continuously in compression. This is done by a centrally located ram **41** and by a pair of rams **42**, each of the rams **42** being positioned adjacent the longitudinal walls of the crib **11**. Ram **41** is supported at **43** in a substantially fixed position relative to crib **11**, ram **41** including a cylinder **45** containing a piston, not shown, and a piston rod **46** connected to the piston, a plate **47**, in turn, being connected to piston rod **46** to bear against the end of the pipeline **30**.

A section of pipe is placed at approximately the right end of the pipeline **30** in FIG. 3 when the crib **11** is in approximately the position shown therein relative to the section of pipe at the right end of the line **30**. Crib **11** then moves to the right relative to ground level and when crib **11** moves to the right a distance approximately equal to the length of the section of the pipe. A pair of arms indicated at **48** and **49** shown in FIGS. 4 and 5 are actuated from a position spaced from the exterior wall of a pipe section adjacent thereto to a position in frictional engagement therewith, as shown in FIG. 4. Thus, while an additional pipe section is inserted between the end of the pipeline **30** and the plate **47**, the pipeline **30** is maintained continuously in compression by forcing arms **48** and **49** against the exterior of the pipe wall adjacent thereto. Arms **48** and **49** are fixed with support means **50** that are moved rearwardly in a framework **51** by means of rams **42**.

Pipeline **30** is supported in crib **11** by a beam **52** which is pivoted at **53** to the bottom of crib **11**. Beam **53** is arcuate in shape as indicated in FIG. 5. The rearward end of beam **52** is supported by a hydraulic ram **54**. Ram **54** lifts beam **52** by connection with a pair of rear posts **55** through which cylindrical shaft **56** projects. Ram **54** is connected to crib **11** at **57** and to shaft **56** at **58**. Framework **51** is not only provided with rear posts **55**, but also with a pair of forward posts **59** shown in both FIGS. 3 and 4, each of which posts has an L-shaped cross section. Framework **51** also includes two rods **60** and **61** of circular cross section above and below which two pairs of upper and lower rollers **62** and **63** respectively fit to guide longitudinal movement of support means **50** in framework **51**. Rods **60** and **61** and rollers **62** and **63** are perhaps best shown in FIG. 5. Framework **51** is further rigidly held together by a pair of horizontal angle irons **51'** connected from front posts **59** to rear posts **55**.

Support means **50** includes end plates **93** and **94** of a front elevational shape indicated at **94** shown in FIG. 5. In particular, end plates **93** and **94** have an arcuate slot **95** cut therethrough to receive the bell end of a section of pipe. A top plate **96** is fixed relative to end plates **93** and **94**. A pair of side plates **97** are fixed relative to end plates **93** and **94** and top plate **96**. The same is true of a pair of side plates **98**. Support means **50** is provided with a pair of bearings **99**. A shaft **64** is rotatable in these bearings **99**. Bearings **99** are preferably welded in between side plates **97**. A similar pair of bearings **100** are fixed relative to and in between side plates **98**, bearings **100** being provided for a vertical cylindrical shaft **65**.

Rollers **62** and **63** are respectively supported on steel plates **101** and **102** welded to end plates **93** and **94**. It is a feature of the present invention that the rollers **62** and **63** have a concave curvature, as shown in FIGS. 4 and 5, to fit the cylindrical surface of rods **60** and **61**. In particular, such an arrangement prevents rollers **62** and **63** from binding upon rods **60** and **61**, should framework **51** twist to the left or to the right as viewed from the right end thereof in FIG. 3 when pipeline **30** is being held in compression.

Arms **48** and **49** are rotatable by shafts **64** and **65** respectively to which crank arms **66** and **67** respectively are connected. Crank arms **67** and **69** are fixed relative to each other. Crank arms **66** and **67** are connected by a linkage **68** as shown in FIG. 4. A ram **72** is connected from crank arm **66** to crank arm **69**.

A pair of spring biased rollers **77** carried by an arm **78** ride on top of the pipeline **30**, arm **78** being pivoted at **79** as shown in FIG. 3 and biased in a counterclockwise direction by a spring **80**. Support means **50** is forced rearwardly in crib **11** by the operation of rams **42** including piston rods **81** fixed to pistons, not shown, in cylinders **82** of rams **42**. Rams **42** are connected at their forward ends **83** to crib **11**.

From the foregoing, it will be appreciated that support **43** for ram **41** need not be fixed to crib **11** but may be fixed to beam **52**.

The operation of rams **37**, **41**, **42**, **54** and **72** is perhaps best illustrated in FIG. 6.

All the rams may be operated by single control indicated at **84** in both FIGS. 3 and 6 with the exception of rams **37** and **54**. Control **84** may be a multiposition control similar to that disclosed in said patent. In general, control **84** operates rams **41**, **42** and **72** in a manner such

that pipeline **30** is placed in compression by the force of plate **47** thereagainst. After crib **11** has moved a distance from that shown in FIG. 3, rams **42** and **72** are operated to cause arms **48** and **49** to bear against the exterior surface of a pipe section adjacent thereto and to force support means **50** rearwardly in crib **11**. Next, piston rod **46** is withdrawn to the position shown in FIG. 3 or to a position farther to the right as viewed in FIG. 3, and a pipe section is placed between the end of pipeline **30** and plate **47**. Ram **41** is again actuated to place pipeline **30** in compression by pressure of plate **47** thereagainst. After pipeline **30** is placed in compression by actuation of ram **41**, rams **42** and **72** then may be operated to release arms **48** and **49** from the pipeline and to withdraw support means **50** to its forward limit of travel within framework **51**. The operation just described is then repeated until the pipeline is completed.

While the trench digging machine **10** and the pipe laying apparatus in crib **11** are operated, valves **32** and **33** may be operated, whereby pipeline **30** may be layed to grade. In particular, note will be taken that the operation of rams **14** and the operation of ram **37** may be employed to control the orientation of crib **11**. In addition, the orientation of pipeline **30** in crib **11** may be controlled by adjustment of valve **33**. Rapid and accurate corrections to an erroneous pipe or crib position may thus be made. Although it is not necessarily the case, both rams **37** and **54** may be hydraulically rather than pneumatically operated.

Only one specific embodiment of the invention has been shown and described. However, many changes and modifications thereof will of course suggest themselves to those skilled in the art. The invention is thus not to be limited to the embodiment disclosed herein, since the embodiment selected for disclosure has been only for the purpose of illustration, the true scope of the invention being defined only in the appended claims.

What is claimed is:

1. In pipe laying apparatus including a trench digging machine, the combination comprising: a pipe laying crib; a substantially flat rectangular blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said blade projects exteriorly of said crib; and a fluid pressure actuable ram for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits.

2. Pipe laying apparatus comprising: a trench digging machine; a pipe laying crib pivoted to the rearward end of said machine; means to adjust the angular position of said crib about said pivot; a substantially flat rectangular blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said blade projects exteriorly of said crib; and a fluid pressure actuable ram for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits.

3. In pipe laying apparatus including a trench digging machine, the combination comprising: a pipe laying crib; a beam positioned longitudinally along the bottom of said crib to support pipe sections, said beam being pivoted about a horizontal axis at its forward end; a framework fixed to the rearward end of said beam in a position thereover; support means movable rearwardly on said framework; selectively actuable means fixed with said support means for engaging a section of pipe; power means for moving said support means rearwardly in said crib to force a section of pipe against the end of an established pipeline to maintain the same in longitudinal compression; and means to adjust the vertical position of said framework relative to the crib.

4. In pipe laying apparatus including a trench digging machine, the combination comprising: pipe laying crib; reciprocable means in said crib for engaging the end of a pipeline to maintain the same longitudinal compression; a plow blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said plate projects exteriorly of said crib; and means for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits.

5. In pipe laying apparatus, the combination comprising: a trench digging machine; a pipe laying crib pivoted to the rearward end of said machine; reciprocable means in said crib for engaging the end of a pipeline to maintain the same longitudinal compression; elevator means in said crib for adjusting the vertical position of said reciprocable means in said crib; means to adjust the angular position of said crib about said pivot; a plow blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said plate projects exteriorly of said crib; and means for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits.

6. In pipe laying apparatus including a trench digging machine, the combination comprising: a pipe laying crib; a framework in said crib; a set of guides fixed with said framework; support means movable rearwardly on said guides; selectively actuable means fixed with said support means for engaging a section of pipe; a pair of fluid pressure operable rams pivoted at their forward ends to said crib and connected at their rearward ends to said support means; a third ram to engage the end of a pipe to hold the pipeline in compression; a pair of arms rotatable on said support means from a position spaced from to a position engaging the sides of a pipe section; a fourth ram on said support means to move said arms; a plow blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said plate projects exteriorly of said crib; and means for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits.

7. Pipe laying apparatus comprising: a trench digging machine; a pipe laying crib pivoted to the rearward end of said machine; means to adjust the angular position of said crib about said pivot; a plow blade mounted on said crib at the forward lower end thereof in a position such that the lower end of said plate projects exteriorly of said crib; means for adjusting the vertical position of said blade to control the position of said crib in the trench within narrow vertical limits; a framework in said crib; a set of guides fixed with said framework; support means movable rearwardly on said guides; selectively actuable means fixed with said support means for engaging a section of pipe; a pair of fluid pressure operable rams pivoted at their forward ends to said crib and connected at their rearward ends to said support means; a third ram to engage the end of a pipeline to hold the pipeline in compression; a pair of arms rotatable on said support means from a position spaced from to a position engaging the sides of a pipe section; and a fourth ram on said support means to move said arms from either of said positions to the other.

8. In pipe laying apparatus including a trench digging machine, the combination comprising: pipe laying crib; reciprocable means in said crib for engaging the end of a pipeline to maintain the same longitudinal compression; and elevator means in said crib for adjusting the vertical position of said reciprocable means in said crib, said reciprocable means including support means carried slidably on horizontal cylindrical rods fixed with said elevator means.

9. In pipe laying apparatus including a trench digging machine, the combination comprising: pipe laying crib; reciprocable means in said crib for engaging the end of a pipeline to maintain the same longitudinal compression; and elevator means in said crib for adjusting the vertical position of said reciprocable means in said crib, said reciprocable means including support means carried

slidably on horizontal cylindrical rods fixed with said elevator means, said support means having wheels thereon of a concave cross section to engage the cylindrical surface of said cylindrical rods.

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