Sept. 21, 1971 L. J. DE WEESE ET AL 3,606,757

METHOD FOR LAYING PIPE

Original Filed June 21, 1967 4 Sheets-Sheet 1

FIG-1

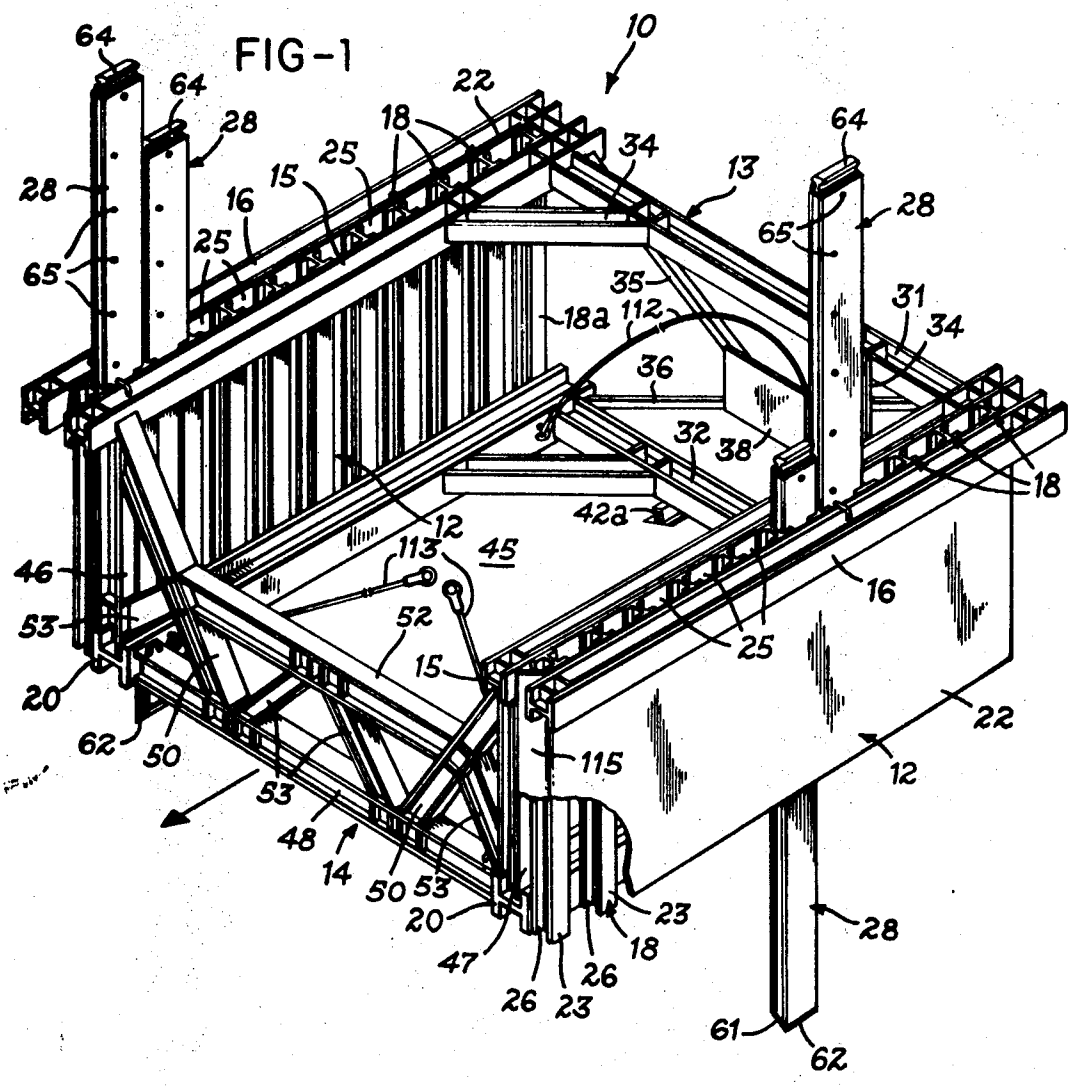
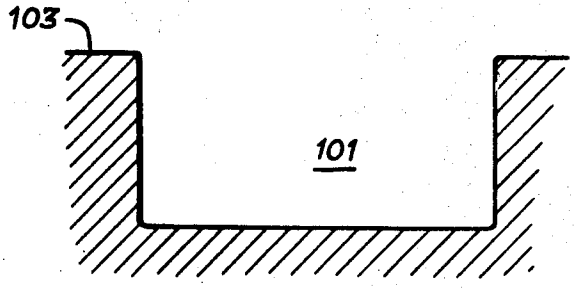


FIG-2



INVENTORS
LLOYD J. DeWEESE &
M. LANGSTON DeWEESE
BY
Marechal, Biebel, French & Bugg
ATTORNEYS

FIG-3

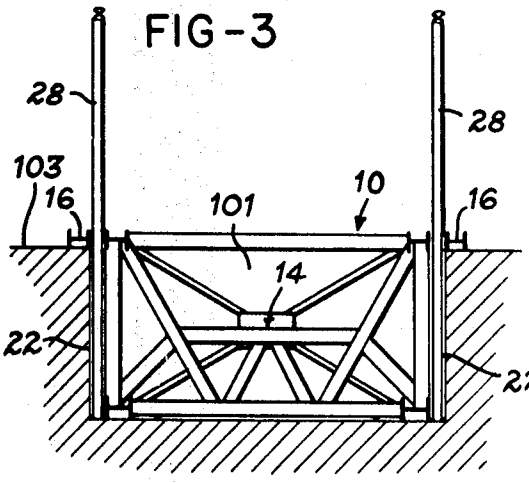


FIG-5

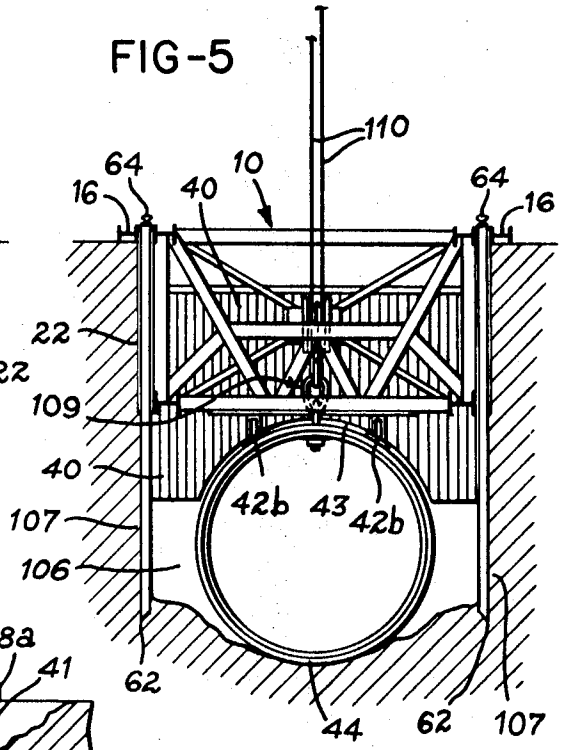


FIG-4

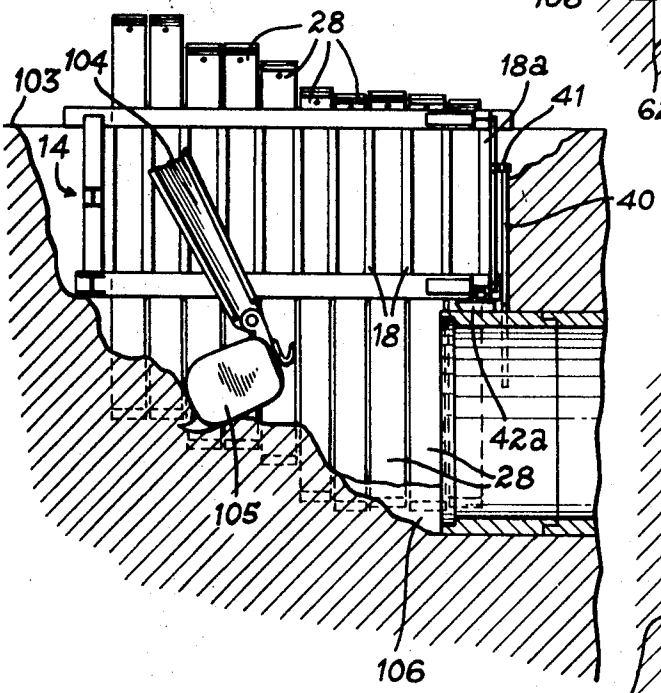


FIG-6

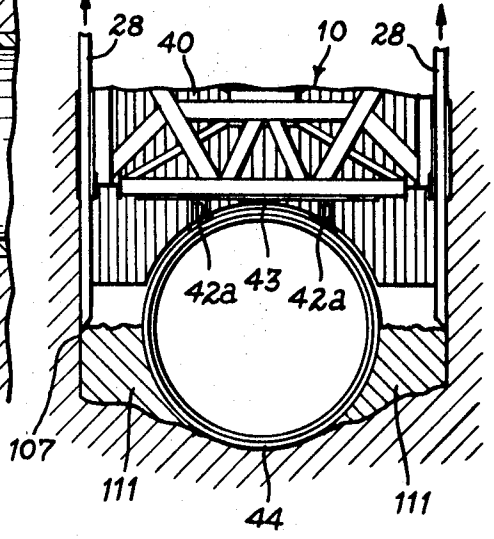


FIG-7

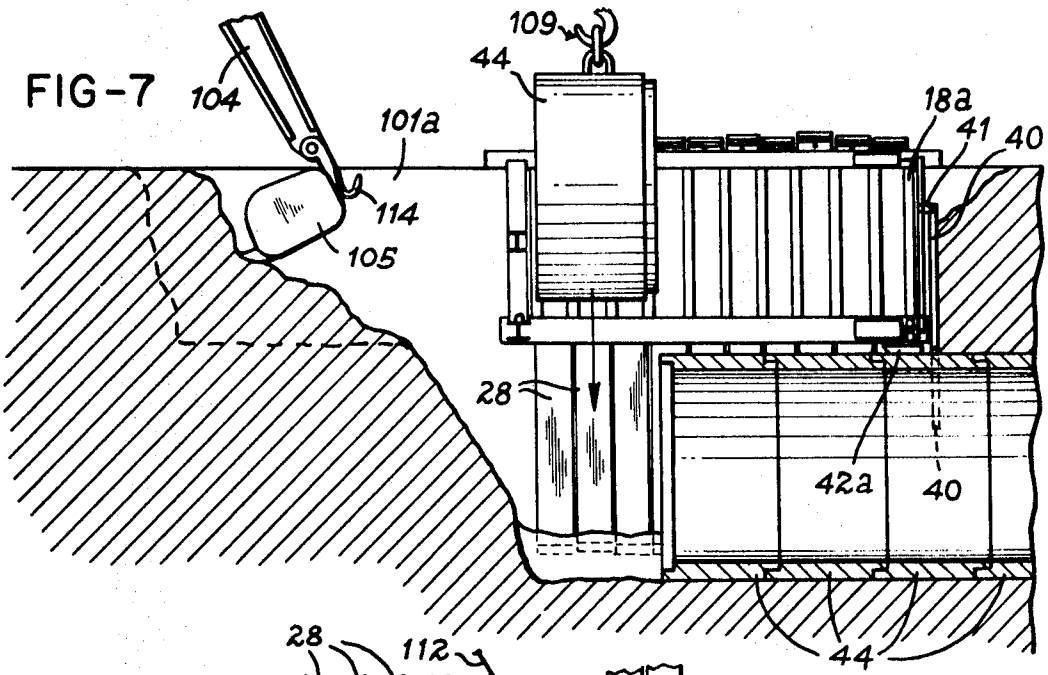
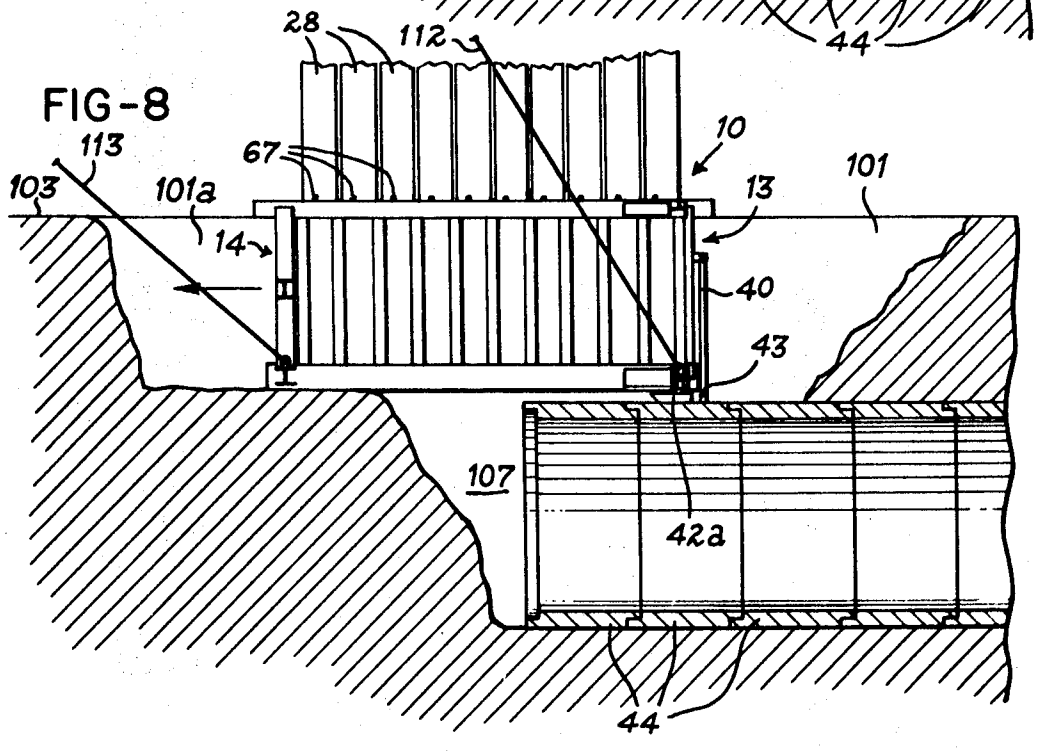

109
44
104
101a
18a
41
40
114
105
28
42a
40
44

FIG-8


28
112
113
67
10
103
101a
101
13
14
40
43
107
42a
44

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FIG-9

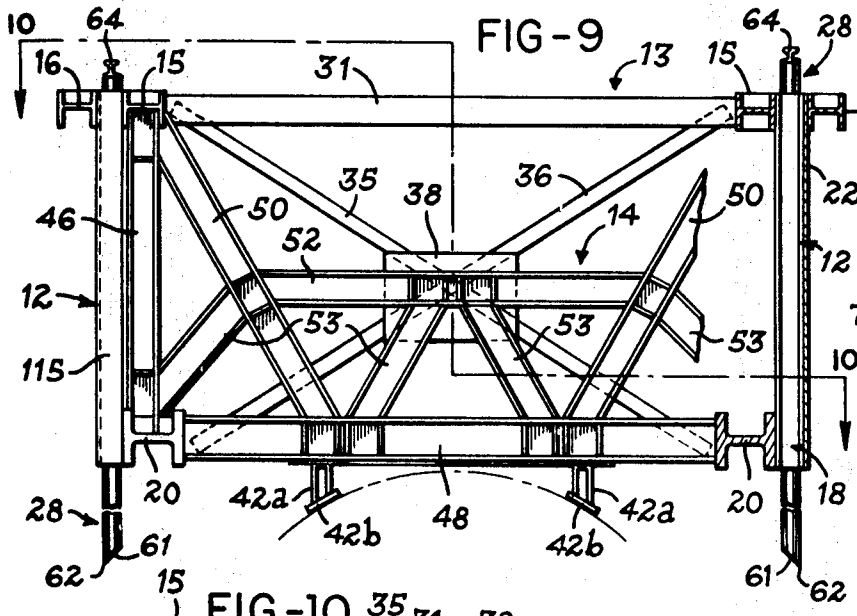


FIG-12

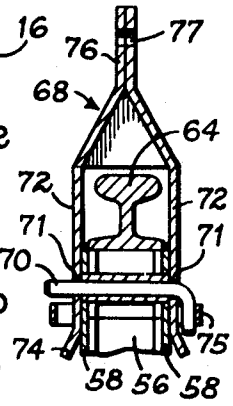


FIG-10

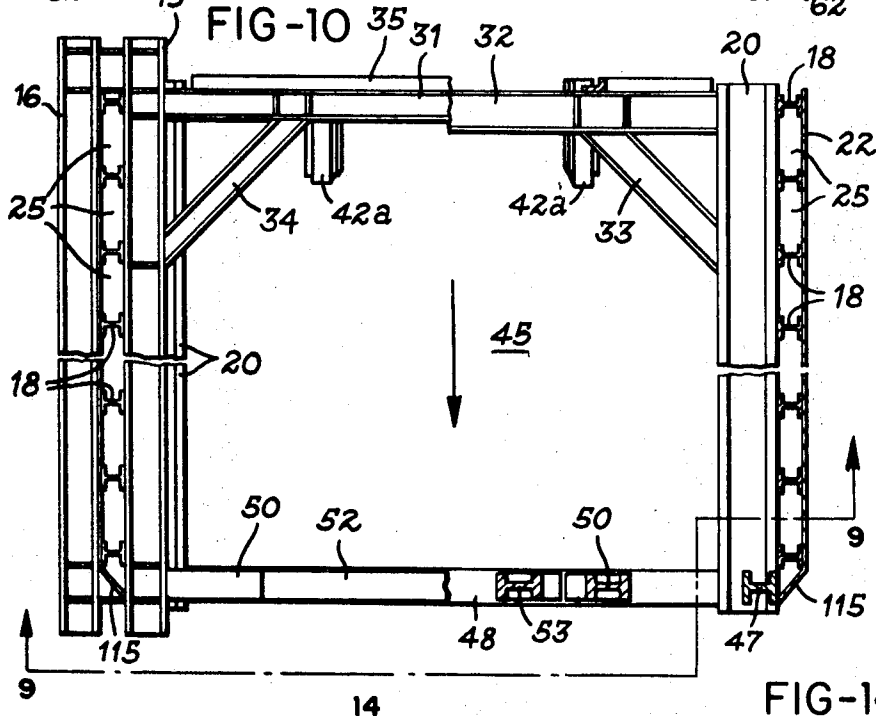


FIG-11

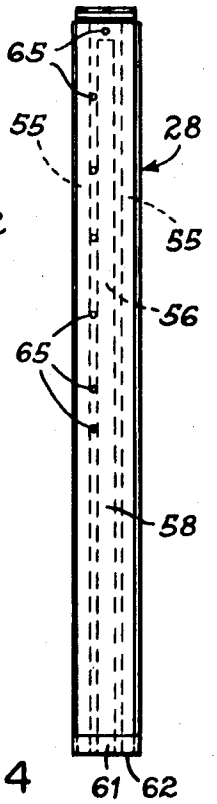


FIG-13

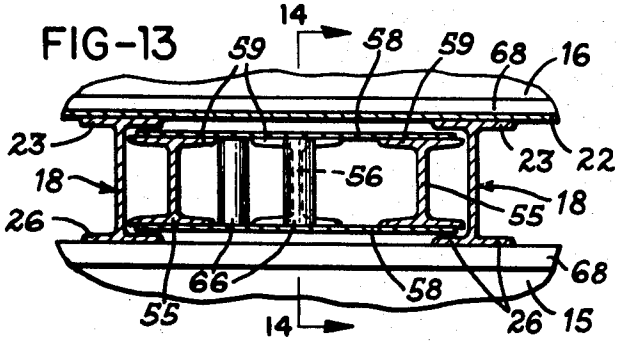
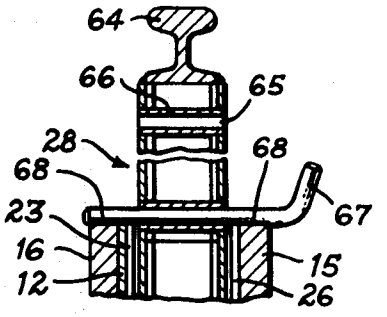


FIG-14



United States Patent Office 3,606,757 Patented Sept. 21, 1971

3,606,757

METHOD FOR LAYING PIPE

Lloyd De Weese and Marilyn Langston De Weese, both of 6280 Garber Road, Dayton, Ohio 45415

Original application June 21, 1967, Ser. No. 647,692, now Patent No. 3,496,727, dated Feb. 24, 1970. Divided and this application Aug. 8, 1969, Ser. No. 848,618

Int. Cl. E02d 5/02, 5/06

U.S. Cl. 61—41 5 Claims

ABSTRACT OF THE DISCLOSURE

Method for laying large diameter concrete pipe in an excavation of minimum width with maximum safety provided for the personnel laying the pipe includes the steps of digging a partial trench, inserting an excavating cage therein, completing the ditch and lowering sliding individual cantilevered shear members to reinforce the side walls of the trench, laying the pipe and digging an adjacent partial trench, raising the shear members and advancing the cage into the adjacent partial trench and then repeating the cycle. The excavating cage is a rigid frame having a large unobstructed center to permit completion of the excavation therein with a back hoe. The vertically slidable shear members are rigidly supported in guide slots and are capable of withstanding the substantial pressures in their extended position without being cross braced, and a rear shield is provided to permit back filling of the excavation.

RELATED APPLICATION

This application is a division of application Ser. No. 647,692, filed June 21, 1967, now Pat. No. 3,496,727.

BACKGROUND OF THE INVENTION

In the digging of deep trenches for laying of large pipe and the like, it is necessary to provide reinforcement to the side walls of the trench for the purpose of limiting the width of the trench so that the adjacent water and sewer lines are not disturbed and so that safety is provided for the personnel laying the pipe. The reinforcement has heretofore been provided by driving H-beam pilings and then starting the excavation. Sheeting is placed behind the pilings and whalers across the trench as the excavation is dug. This procedure is both time consuming and expensive. The present invention is thus directed to an improved method for laying large diameter pipe at a comparatively fast rate while providing reinforcement of the side walls of the trench.

The pertinent prior art to this invention includes the patents to De Lillo, Nos. 3,159,977 and 3,159,978, both issued Dec. 8, 1964, and Benintend No. 3,212,270, issued Oct. 19, 1965. Each of these patents is designed for laying pipe of a much smaller diameter than contemplated by the present invention. Moreover, in each of them the opening defined by the side walls is obstructed by cross members which are necessary for reinforcing the side walls.

In particular, De Lillo No. 3,159,977 utilizes telescoping side members having cross members therebetween. The telescoping side members cannot be lowered into position until the excavation is completed so that special problems are involved when the excavation is being made through loose gravel or wet soil. The cross members prohibit use of a back hoe or the like to remove dirt after the shoring device is installed. Similarly, De Lillo No. 3,159,978 uses telescoping side members which again cannot be driven downwardly and the cross members obstruct the removal of the dirt. Neither of the De Lillo devices uses an end frame but rather the side members

are adjustably positioned on the cross members which are supported on opposite sides of the trench.

In Benintend, the side walls are formed by large sheet metal plates which are dropped in position after the excavation is completed. Cross members are again required to provide lateral support to the side plates since these plates are not strong enough to withstand the forces of the side walls. These cross members obstruct the center of the excavating device and prohibit digging after the side walls are lowered. Moreover, the Benintend structure is intended for use in laying small diameter concrete pipe and thus has not solved many of the problems raised in laying a large diameter pipe, for example, 10 to 12 feet in diameter.

SUMMARY OF THE INVENTION

The invention relates to a method for laying large diameter concrete pipe in sections and includes an excavating cage which is utilized to lay the individual sections of concrete pipe. The cage is rigid in construction and has an unobstructed center so that the excavation can be completed without moving the cage. One end of the cage is provided with a configuration to permit excavation to a substantial depth with a back hoe while the other end thereof is provided with a pivotal shield which permits back filling after the cage has been advanced.

The method contemplates digging a partial trench, inserting the cage, driving individual shear members vertically downwardly through guide members, completing the excavation by removing dirt through the unobstructed center of the cage, laying the pipe through the unobstructed opening, partially back filling to secure the pipe in position, raising the shear members until their lower ends no longer extend below the lower ends of the cage, advancing the cage into a previously dug adjacent partial trench, and repeating the operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the excavating cage in accordance with the invention;

FIG. 2 is a partially dug trench ready to receive the excavating cage;

FIG. 3 is a view similar to FIG. 2 with the excavating cage in the partial trench;

FIG. 4 is a sectional view taken through the trench showing the completion of the digging operation;

FIG. 5 is a transverse sectional view showing the pipe being laid in position;

FIG. 6 is a view similar to FIG. 5 showing the initial filling of the trench;

FIG. 7 is a longitudinal sectional view showing the preparation of the adjacent partial trench;

FIG. 8 is a view similar to FIG. 7 showing the movement of the excavating cage;

FIG. 9 is an end view, partially in section, of the cage taken along the line **9—9** of FIG. 10;

FIG. 10 is a view of the excavating cage taken along the line **10—10** of FIG. 9;

FIG. 11 is an elevational view of one of the shear members;

FIG. 12 is a vertical sectional view through the coupling used to raise the shear members;

FIG. 13 is a sectional view through one of the shear members mounted in place; and

FIG. 14 is a sectional view taken along the line **14—14** of FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus will first be described and followed by the method of the invention and the operation of the apparatus. Accordingly, FIG. 1 illustrates the excavating

cage **10** in accordance with the invention including parallel side walls **12** which are identical in construction and interconnected by the back and front walls **13** and **14**. Each of the side walls **12** includes the parallel upper members **15** and **16** in the form of H-beams having welded therebetween the downwardly extending parallel guides **18** (also H-beams) which are also rigidly welded to the lower horizontal H-beam member **20** (FIG. 9).

A metal plate or skin **22** is welded to the outside surfaces of the flanges **23** of the guide **18** and this plate is of sufficient size to cover completely the entire side of the cage except for the upper member **16**. Guide slots **25** are thus formed between the adjacent guides **18** with the flanges **23** and **26** of the H-beams providing restrictions which limit the movement of the slidable shear members **28** therein, as will be seen.

The back wall **13** of the cage **10** includes the parallel upper and lower members **31** and **32**, also in the form of H-beams, which are secured to the inside of the upper and lower side members **15** and **20** of the side walls and braced by the corner members **33** and **34**. The cross braces **35** and **36** provide additional strength to the rear wall and extend in a criss-cross pattern from weld connections adjacent the juncture of the upper and lower members **15, 31, 20** and **32**. A central plate **38** is utilized to reinforce the cross braces **35** and **36** at the point at which they cross.

A pivotal rear shield **40** (FIG. 4) is secured on the rear wall **13** to facilitate back filling, as will be described. It is mounted on brackets **41** secured to the rear guides **18***a* below the upper member **31**. This shield is fabricated from interconnected panels of ribbed metal and extends downwardly beyond the lower member **32** and has the central portion **43** thereof removed to accommodate the concrete pipe **44**, as shown in FIG. 5. This wall is adapted to pivot in a counterclockwise direction, as viewed in FIG. 7, about the pivot bracket **41** whereas it engages the cross members **35** and **36** and the lower member **32** to limit movement in the clockwise direction. A pair of skids **42***a* having the curved contact plates **42***b* are provided on the lower member **32** for partially supporting the cage **10** on the pipe **44**.

The front wall **14** is an important part of the invention and is designed to permit excavation through the unobstructed central opening **45** by a conventional back hoe. Accordingly, this wall includes the vertical side members **46** and **47** rigidly welded between the upper and lower side members **15** and **20** and the lower horizontal member **48** which is secured between the front ends of the lower side members **20**. A diagonal member **50** extends downwardly from each of the upper side members **15** to a rigid connection the lower member **48** at points spaced from its end about one-third the width of the cage. Another horizontal member **52** is rigidly welded between the centers of these diagonal members **50** so that there is no obstruction to the upper half of the front wall **14**. The four intermediate braces **53** provide additional rigidity to the front wall.

The slidable shear members **28** are shown in detail in FIGS. 11–14 and include a pair of side and center H-beams **55** and **56** which extend vertically the entire length of the shear members. The metal plates **58** are rigidly welded to the outer surface of the flanges **59** of these members to create relatively flat side walls on the shear members. The lower end of the members **28** is tapered, as shown in FIGS. 9 and 11, and a flat plate **61** secured thereto to thereby create a cutting edge **62** on the lower end of the shear members.

The upper end of the shear members **28** has a heavy striking member **64** in the form of a section of railroad track welded thereto, as shown in FIG. 12, to provide means for driving the shear members **28** into place, and this striking member extends the entire width of the shear member (FIG. 11). In addition, the upper portion of each shear member has a series of openings **65** therein having tubular pipes **66** extending completely therethrough to receive the locating pins **67** so that the downward movement of the shear members **28** is limited by contact between the pin **67** and the top edges **68** of the upper members **15** and **16**.

The uppermost opening **65** is utilized to raise the shear members by placing the lifting assembly or coupling **68** over the top of the shear member and inserting the elongated pin **70** through the openings **71** in the side walls **72** of the coupling **68** and the upper opening **65**. The bottom edges **74** of the side walls **72** are tapered outwardly to facilitate mounting on the shear member **28** and a locking strap **75** may be provided to secure the pin **70** in place. The upper portion **76** of the coupling has an opening **77** through which a cable is attached for lifting by a suitable crane.

The method in accordance with the invention and the operation of the excavating cage **10** include the initial step of digging a partial excavation or trench **101** having a width and length slightly greater than the respective width and length of the cage **10**, and a depth substantially equal to the height of the cage, as shown in FIG. 2. The entire cage **10** is then placed into the partial trench, and then the individual shear members **28** are inserted into each of the guide slots with a pin extending through the lowermost opening **65** to hold the shear members **28** in their raised position so that the lower edge **62** thereof does not project below the lower side members **20**. Once the cage is in the partial trench **101**, as shown in FIG. 3, the sides of the trench **101** are back filled against the skin **22** of the cage **10** to provide sufficient pressure thereon to hold the cage in position as the digging is continued.

Since the partial trench **101** has a length only slightly greater than the length of the cage, a conventional back hoe can be placed on the top surface **103** of the ground closely adjacent the front **14** of the cage **10** and utilized to remove the remaining dirt and complete the excavation through the unobstructed opening **45**. The lowered or cut-away front wall **14** permits the arm **104** and bucket **105** of the back hoe to reach deep into the excavation and remove the dirt substantially vertically below the front wall **14** as well as in the rear portion of the trench. As the lower portion **106** of the excavation is being dug by the back hoe, the shear members **28** slide by their own weight or are forced downwardly to reinforce the walls **107** thereof.

The back hoe may be utilized to tap the striking members **64** on the shear members **28** to drive them downwardly so that the lower edges **62** of these shear members are always moved downwardly with the depth of the excavation and thus the shear members are always aligned with the bottom contour of the trench. Since the taper **61** on the lower ends of the shear members **28** is on the inside thereof it provides a cutting action so that the dirt on the walls **107** is caused to crumble forward into the excavation as the shear members **28** move downwardly thus facilitating the excavation of the trench **106**. The shear members **28** ride smoothly in the guide slots **25** of the side walls of the housing with the flanges **26** of the guide **18** limiting the movement of the shear members **28** except in a vertical direction. The skin **22** prohibits dirt from the walls **107** from entering the guide slots **25** and obstructing vertical movement of the shear members **28**.

Once the lower trench **106** is completed, the back hoe immediately commences digging of an adjacent partial trench **101***a* having substantially the same dimensions as the aforesaid partial trench **101** and being located immediately adjacent the front **14** of the excavating cage **10**, as shown in FIG. 7. As this dirt is being removed, and if it is a suitable quality, it is loaded on to a truck and moved to the rear of the cage **10** to back fill the excavation immediately behind the cage **10**, as will be further described. At the same time, other workmen utilizing a crane lower the large pipe sections **44**, e.g., 12 feet in diameter, into the completed trench by using a connection

assembly **109** extending through openings in the pipe sections and supported by the cables **110** of a crane. As the pipe sections **44** are lowered into the excavation, they are aligned and interconnected and the dirt **111** is tamped at the opposite sides of the trench up to the spring line or the widest portion of the pipe sections **44**, as shown in FIG. 6. This is necessary to hold securely the pipe **44** in place since the succeeding back filling operation might well disturb the location of the pipe or might not completely fill the area below the spring line of the pipe.

Once the adjacent partial trench is completed and the number of pipe sections **44** laid in the completed excavation, the shear members **28** are raised by attaching the coupling **68** thereto and individually raising them so that the lower edge **62** does not project below the lower side members **20**. The pins **67** are used to secure the members **28** in this raised position and, when all of them have been raised, the cable loop **112** having its ends secured to the rear of the lower side members **20** is connected to a crane and the short cables **113** on the front ends of the lower member **20** are hooked onto the hook **114** on the back hoe, and the entire cage **10** is moved forward. The crane need not be of a size capable of lifting the cage **10**, but merely sufficient to take some of the weight off the pipe **44**, as the skids **42***a* support the rear portion of the cage on the previously laid pipe as it is advanced. Likewise, the back hoe primarily provides a horizontal movement although some lifting is present, and the plates **115** (FIG. 10) on the leading edges of the side walls **12** facilitate entry into the adjacent partial trench **101***a*. The cables **112** and **113** are also used to lift the entire cage **10** by a single hook of a crane since these cables will reach to the center of the cage.

Once the cage **10** is in the adjacent partial trench **101***a*, the back hoe commences to dig the lower portion **106** of the trench to complete the excavation with the shear members **28** being lowered, as discussed above. The removed dirt is loaded into trucks and transported to the trench from which the cage was just removed wherein it is dumped over the pipe **44**. As the previous trench is filled, the shield **40** on the rear wall **31** which extends below the cage **10** and almost reaches the dirt **111** tamped around the pipe **44** prohibits the fill dirt from falling into the trench presently being completed and worked in. The sequence of this operation continues until the entire pipe line has been completed.

Accordingly, the method of this invention permits use of the expensive equipment in the form of a back hoe and crane to be utilized at their maximum efficiency since they do not stand idle more than a short period during the laying of this pipe. It has been found that by using this method, as many as twelve pipe sections can be laid in one day as opposed to three sections by the conventional methods. The shear members cooperate with the guide slots to provide a rigid cantilevered support for the side walls of the lower portion of the trench which requires no cross bracing as present in the prior art even when hundreds of thousands of pounds of pressure are exerted thereon.

The shearing effect of the lower end of the shear members **28** cuts a vertical side wall and facilitates the digging of the trench since the earth is crumbled inwardly with little or no disturbance of the earth outside of the shear members **28**. Moreover, the configuration of the front wall permits the use of a conventional back hoe to complete the lower portion of the trench as opposed to a clamshell on a crane as heretofore required. In addition to the above, the excavating cage causes a substantial reduction in the width of the trench which must be dug

thereby permitting laying large diameter pipe in a narrow right of way and reducing the cost of laying the pipe since the adjacent utility lines are not disturbed and therefore do not require repair or replacement.

While the method herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise method, and that changes may be made without departing from the scope of the invention.

What is claimed is:

1. A method for continuously laying large diameter pipe comprising

digging a partial trench having present depth, width and length,

inserting an excavating cage in said partial trench to reinforce the side walls of said partial trench,

lowering a plurality of individual shear members, which are narrow in relation to their length, one at a time vertically downwardly through guide members in the opposite sides of said excavating cage to position said shear members in the earth beneath said partial trench,

removing the earth between the lower portions of said positioned shear members through the unobstructed center of said cage to form a completed trench whose sides are supported by said positioned shear members,

inserting the pipe section through the interior of said cage into the completed trench,

preparing an adjacent partial trench at one end of said excavating cage,

raising said shear members upwardly until the lower ends thereof no longer extend below the lower ends of said cage,

advancing the cage horizontally into said adjacent partial trench,

supporting the rear portion of said cage at least partially on a pipe section previously laid, and

repeating the steps of lowering said shear members downwardly, removing the earth and inserting the pipe sections.

2. The method of claim **1** including the step of

securing said shear member in the raised position prior to advancing said cage.

3. The method set forth in claim **1** wherein said removing and preparing steps occur substantially simultaneously for maximum equipment use and speed.

4. The method set forth in claim **1** further including the steps of backfilling and tamping earth around the inserted pipe section at least to the spring line of the pipe section to secure the pipe section in place.

5. The method as set forth in claim **1** wherein said removing step includes transporting the earth removed from said adjacent partial trench to backfill the trench from which the cage has just been advanced.

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JACOB SHAPIRO, Primary Examiner

U.S. Cl. X.R.

61—72.1