Jan. 3, 1967 M. MESHORER 3,295,330

SHORING EQUIPMENT

Filed Jan. 20, 1964 3 Sheets-Sheet 1

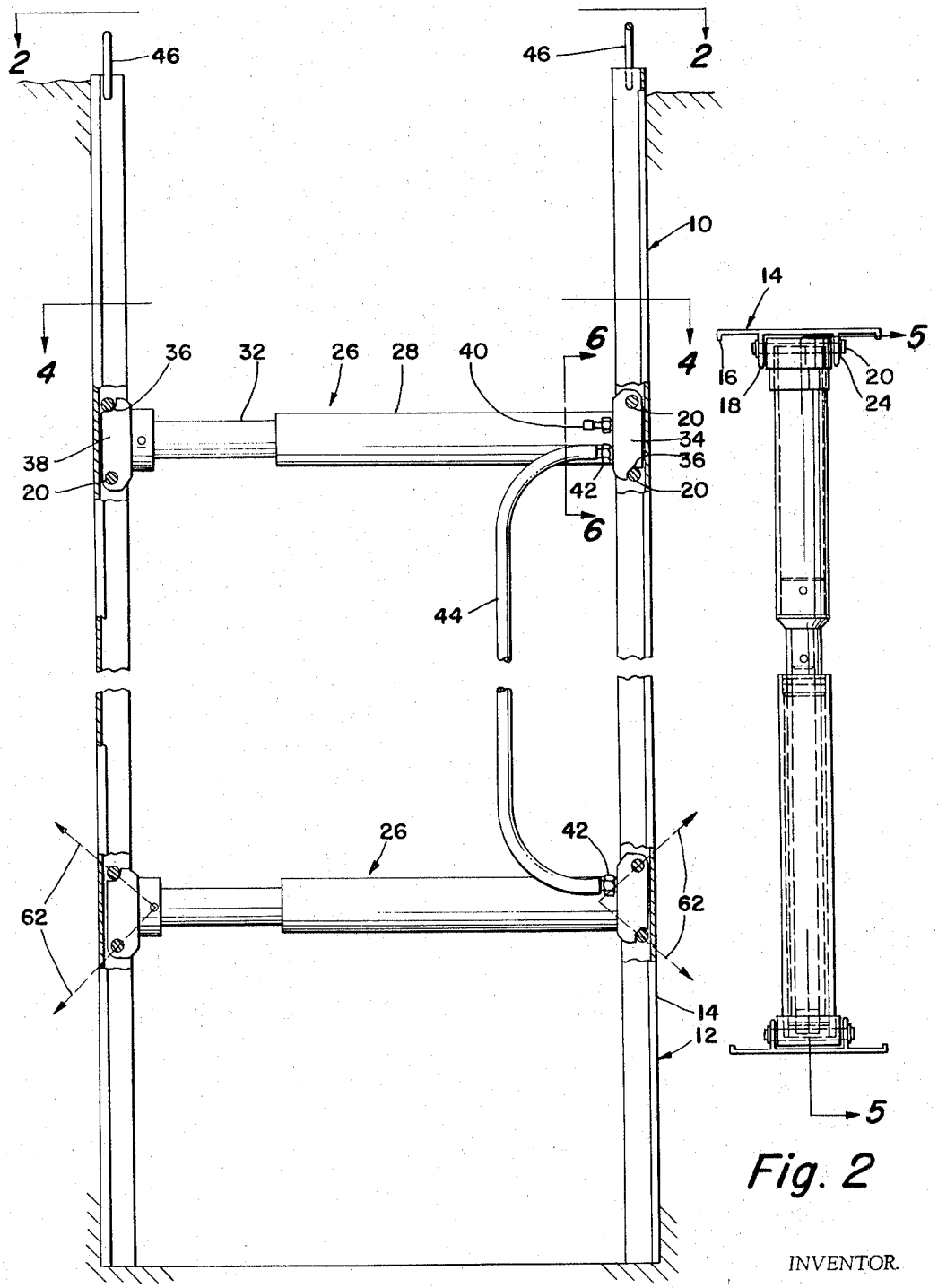


Fig. 1

Fig. 2

INVENTOR.
MARC MESHORER
BY
Cushman, Darby & Cushman
ATTORNEYS

Fig. 3

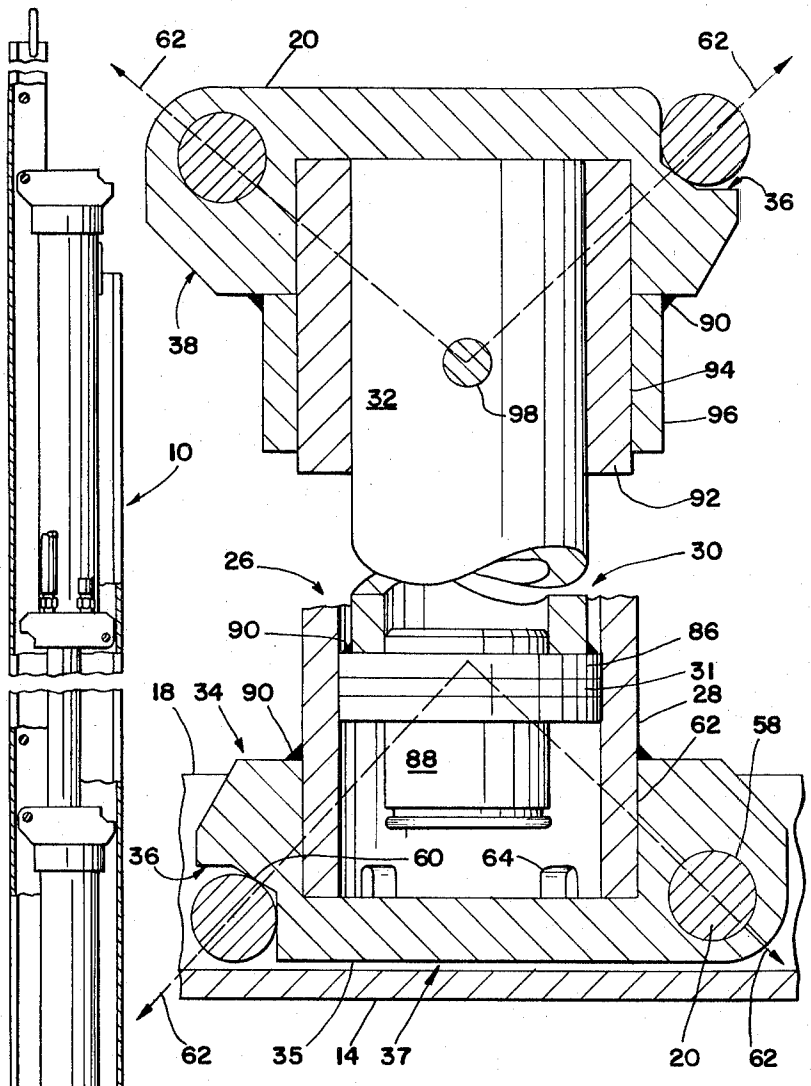


Fig. 4

INVENTOR.
MARC MESHORER
BY Ely, Pearne & Gordon
ATTORNEYS

Jan. 3, 1967 M. MESHORER 3,295,330

SHORING EQUIPMENT

Filed Jan. 20, 1964 3 Sheets-Sheet 3

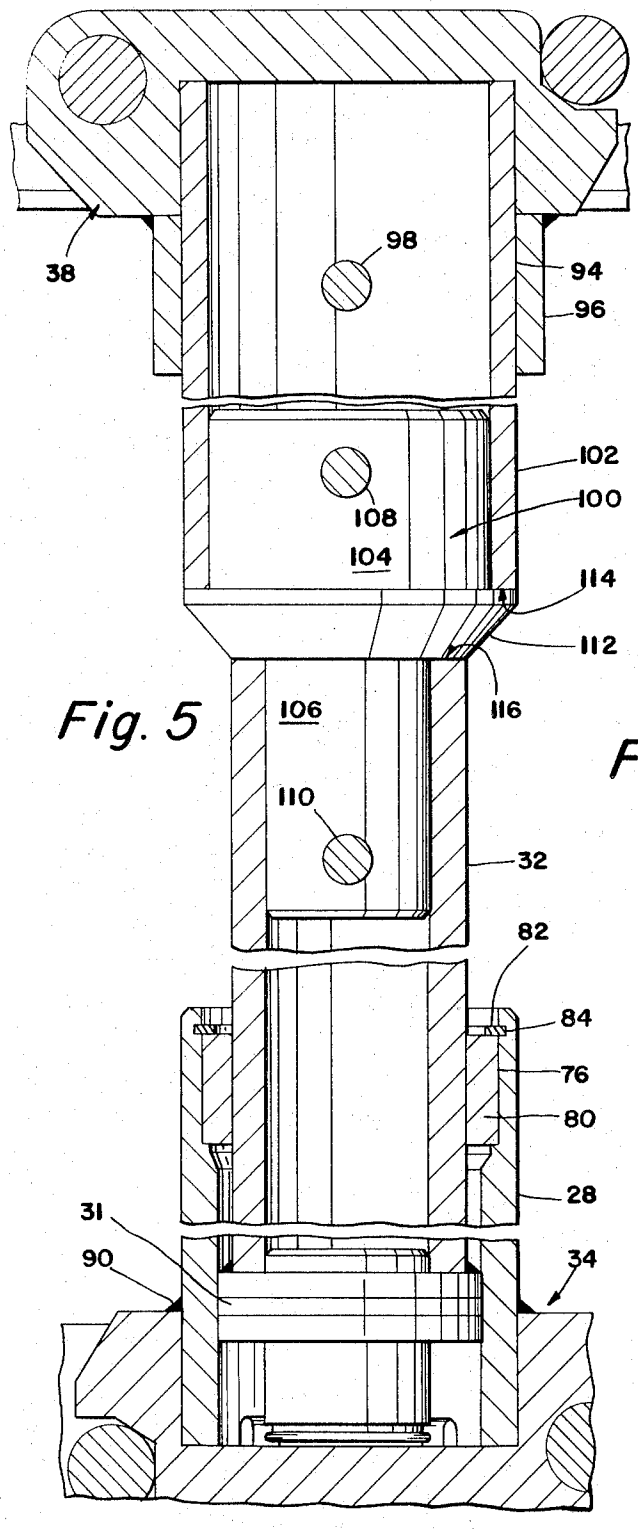


Fig. 5

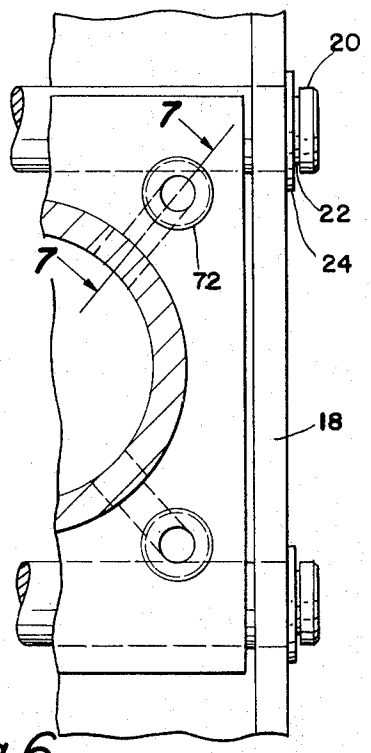


Fig. 6

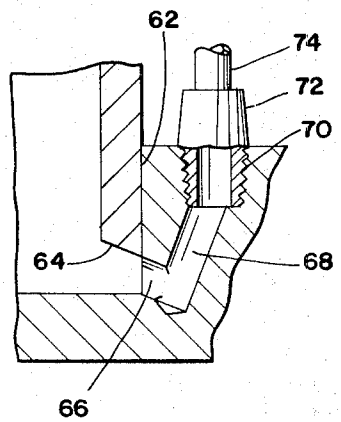


Fig. 7

INVENTOR.
MARC MESHORER
BY
Hall Barnard & Gordon
ATTORNEYS

United States Patent Office 3,295,330 Patented Jan. 3, 1967

3,295,330

SHORING EQUIPMENT

Marc Meshorer, Cleveland, Ohio, assignor to Allied Steel & Tractor Products, Cleveland, Ohio, a corporation of Ohio

Filed Jan. 20, 1964, Ser. No. 338,971
7 Claims. (Cl. 61—41)

This invention relates to apparatus for shoring trenches, tunnels and the like dug in sandy soils and earth likely to cave in and, more particularly, to such apparatus incorporating unique features of load support and improved stability against collapse, along with portability and unique extensibility to accommodate trenches of various widths.

Heretofore, trenches in sand or other unstable soils were conventionally shored with timbers or planks placed against the opposed sides of a trench and wedged apart by suitable cross timbers. To overcome the time, material, and labor costs of both installing and removing such conventional planking, portable units have been available. In general, these comprise jacks of an operable length to span the width of a trench and pivotally connected to suitable plate-like rails vertically arranged against the sides of the trench. However, present shoring devices of this nature are characterized by the several disadvantageous features. For example, these prior portable units must either employ heavy rail members to withstand the imposed loads, resulting in undue weight for easy portability and higher costs of the units, or the rails may bend and distort in use, especially at the areas of high load concentration, i.e. where the jacks bear against the rails. For convenience in installation and removal, the prior portable units pivot the jacks to the rails so that when installed, the jacks are theoretically perpendicular to the rails; the pivots permit the units to be collapsed by shifting to a parallelogram arrangement. Unfortunately, stones and soil may be caught between the pads of the jacks and the rails as the units are erected, preventing the jacks from assuming a rectilinear position with respect to the rails. The resultant jamming imposes bending loads on both the jacks and rails and increased jack pressures may even cause the units to shift to a parallelogram position, thereby, due to the unstable structure of the jammed units, promoting the instability of the shored walls rather than stabilizing them.

An object of this invention is to overcome the above disadvantages of the prior parallelogram arranged shoring units by portable shoring apparatus of extremely light weight, but having high strength-to-weight ratio which spreads hydraulic jack cylinder pressures to the shored earth by divergent vector forces, utilizing effectively the greater depth of section of ribs in the rails.

Another object is to provide earth shoring apparatus that is collapsible for portability, yet incorporates automatic stability locking on erection.

A further object is to provide shoring apparatus incorporating novel cylinder saddle mounting to produce anti-jam pivoting of the hydraulic jacks to the rails.

A still further object is to provide earth shoring apparatus adaptable to varying trench widths by the use of a tubular piston rod and an extension adaptor therefor.

FIGURE 1 is a vertical side elevational view, broken to foreshorten length, and partly broken away in section to show hidden details of parts, of a shoring device of invention installed in a trench;

FIGURE 2 is a plan view taken as along line 2—2 of FIGURE 1, but illustrating by hidden lines the details of a piston rod extension mechanism of invention;

FIGURE 3 is a side elevational view of the apparatus of FIGURE 1 in collapsed position, and with some parts broken away in section for greater clarity of illustration;

FIGURE 4 is an enlarged, foreshortened, fragmentary axial sectional view taken as along line 4—4 of FIGURE 1, illustrating the spreading vector forces through the unique saddle-pin arrangement providing improved stability and strength characteristics;

FIGURE 5 is an enlarged, foreshortened fragmentary section along the line 5—5 of FIGURE 2, more clearly showing the piston rod adaptor and extension;

FIGURE 6 is an enlarged fragmentary plan view of a cylinder head as taken along line 6—6 of FIGURE 1; and

FIGURE 7 is a fragmentary sectional view taken along line 7—7 of FIGURE 6.

Broadly the present invention will be understood to encompass a novel shoring apparatus, collapsible in the nature of a parallelogram for portability and ease of installation, and providing the following unique features:

(1) Utilizing fulcrum-type blocks or saddles as heads for the cylinder and for the piston rod—both operating on spaced pins in a manner to provide automatic locking against collapse, and by spreading the compression force vectors outwardly, providing an effectively larger base while applying the load through a greater depth of section of rail or beam.

(2) Providing a pivotal connection and support which spaces the saddles of the hydraulic jack elements from the rails when the apparatus is erected to rectangular position, thereby avoiding jamming by soil and small stones which are nearly certain to be present.

(3) Utilizing a unique tubular piston rod in combination with a novel extension and adaptor arrangement to accommodate various widths of trench.

Referring to FIGURE 1, we note that the environmental surroundings of the present invention is a trench 10 of rectangular, transverse section, produced as by a back hoe operation or power ditcher in the surface of the earth. Inasmuch as the soil or strata in which the trench 10 is formed is apt to collapse because of sandy structure or relatively high moisture content, the walls must be shored up for the safety of workmen employed therein, as to lay water and sewer mains, underground cables, pipe lines, or the like.

Continuing to refer to FIGURE 1, we note that the shoring elements of the invention comprise rails 12 having a flat web 14. Along the edges, the web has upturned short ribs 16 for strength and rigidity and inwardly of the edge ribs 16 are the main strength ribs 18.

It will be observed that the main ribs 18 receive the ends of support pins 20 that function as pivots and as supports for the cylinder and piston base plates to transfer load through the rib section of the beams and lock the unit against collapse.

By reference to the enlarged view of FIGURE 6, it will be noted that the pins 20 are provided with a groove 22 adjacent each end to receive a lock ring 24, whereby they are retained in place.

As shown in FIGURE 1, with rails 12 of appropriate dimension, an average trench up to 6 to 8 feet in depth can be shored by a unit comprising two vertically spaced cylinders 26 acting between parallel beams or rails. These each comprise a cylinder 28, having a piston therein, but not shown in this view, but later designated 30, see FIGURE 4, with an attached piston rod 32 of tubular configuration.

At the base of the cylinder 28 there is provided a cylinder head 34, pivoted at its top side on the upper of a pair of pins 20 and engaging by means of a notch sectioned groove 36 of particular configuration the lower of the pin pair.

At the free or terminal end of the piston rod 32 is a fulcrum block 38. In order to provide parallelogram folding, fulcrum block 38 is pivoted along its bottom side

on a pin 24 and has a notched section groove of the configuration of 36 on its top side to engage in a manner which will be brought out hereinafter, the upper of a pair of pins 20.

In erecting the unit in the trench, it is placed therein in the manner illustrated in FIGURE 3, that is in a folded parallelogram position. Spanning the main ribs 18 at the top of each rail 12, is a lifting bail 46. These lifting bails 46 are utilized by the workman standing alongside the trench 10 to position the unit in the trench. One rail is laid against one side of trench 10 with the bottom end of the rail 12 against the bottom of the trench, the same as in FIGURE 1. Then the upwardly folded opposite rail 12 is parallelogrammed over toward the other side of the trench until the cylinders are perpendicular to the rails. Thereafter, the cylinders 28 are pressurized as will become evident, and the rods 32 extended to drive the opposite rails 12 into locked contact with the opposite side of the trench 10.

As self-contained, portable units no pressurizing equipment need be a permanent part thereof. In actual practice, a workman attaches a hose from a pump or other source, usually portable, of hydraulic fluid under pressure, to an inlet coupling and check valve connection 40, see upper part of FIGURE 1. The manner in which this is ported to the back side of the cylinder will be apparent from the following discussion relative to FIGURE 4. The two cylinders 28 are connected in parallel by means of second and third fittings 42 and an interconnecting, high pressure, flexible line 44. Pressurized fluid is introduced until the rails are jacked apart to the extent desired. The pressure source is then disconnected for use on other units. The check valve of the unit 40 retains the fluid in the cylinders until released by release of the check valve by a workman at a later time, as when the trenching operation is completed and the shoring to be removed.

An important feature of invention is shown at the bottom of FIGURE 4 wherein pins 20 hold the back side 35 of the cylinder head 34 a short distance away from the web 14 of the rail 12. It will be evident that any earth or foreign material falling into the unit at any time as during installation, will be received in or pass through the gap 37. Since the backside 35 does not come into direct contact with the web 37, dirt will not be jammed therebetween and will neither score the parts nor distort the cylinder head 34 nor the pins 20, nor the flange 14, as has been a problem of structures of the prior art.

Details of the hydraulic cylinders and the head and fulcrum block

Referring to FIGURES 4 and 6, the cylinder head 34 is a thick plate, of generally square outline in plan view. Along one side it is provided with a bore 58 to receive a pivot pin 20 and along the other side with the notch sectioned groove 36 by which the other pin of the pair is engaged. Note carefully the cam surface 60 in FIGURE 4 in the innermost corner of the groove 36. When pressure is applied to the cylinder head 34 by means of the hydraulic cylinder assembly 26, the cam surface 60 will provide the following dual effect:

(1) First, it will tend to wedge the cylinder head 34 between the two spaced pins. In so doing it will become locked between the two pins. This prevents the normally collapsible parallelogram configuration of the unit as viewed in FIGURE 1 from collapsing in its installed relationship in the trench.

(2) Secondly, the tendency of the cam surface 60 to spread the pins 20, being spaced apart a distance greater than the diameter of the cylinder, will produce an expanding force vector pattern as indicated by the vectors 62. This in effect produces a support column base that is greater than the diameter of the cylinder and greater than the area of the cylinder head 34. The load is thus spread over a greatly enlarged area of earth or trench wall as compared to the relatively small end of the hydraulic cylinder. This additionally prevents distortion of the thin plate section between the ribs as would otherwise be the case if the thrust were applied perpendicularly thereto.

(3) Further, this expanding force vector pattern is effective to spread the load through a greater depth of section of the channel ribs 18, as a result of the expanding force vector pattern provided by the spaced centers of the pins 20. It will be evident that in accordance with strength of materials, much greater load can be supported per unit depth of rib 18 than would be the case if the force were applied perpendicularly.

The hydraulic cylinders and porting thereof

Referring now to FIGURES 4 and 6, we note that the hydraulic cylinder 28 is a simple tube, having one end inserted into a stopped bore 62 formed in the cylinder head 34 and welded at 90. At spaced points on the end edge are provided notches 64 for inlet, by-pass and exhaust of fluid. By reference to FIGURE 7 it will be noted that the notches 64 mate with drilled holes 66, produced by drilling from inside the stop bore 62. The holes 66 intersect canted holes 68, produced by boring from the inside face of the cylinder head 34. The bores 68 are counterbored and tapped as at 70 to receive connectors 72 for attachment of tubular conduit 74.

The terminal end of the hydraulic cylinder is not shown in FIGURE 4 to avoid crowding. However, this detail can be seen by reference to FIGURE 5, the lower central portion. As there shown, the upper end of the cylinder 28 is counterbored at 76 against which rests a guide bushing 80, in turn retained by snap ring 82, fitting in annular groove 84 at the terminal end of the cylinder 28.

The piston and tubular piston rod

By reference to FIGURE 4, piston 30 comprises an annular ring portion 86 carried near the front end of cylindrical core 88. Portion 86 may carry on O-ring 31 for seal. The core 88, being of lesser diameter than the ring portion 86, provides circulation through the upper cylinder assembly even during initial filling as when the piston is bottomed in the cylinder so that some fluid can flow on down to the lower cylinder by by-pass action through the two holes or notches 64.

The tubular piston rod is welded at its root end as at 90 to the front side of the cylindrical portion 88 of the piston 30; and at its free end carries a basic adaptor 92 of the configuration of a short piece of thick walled tubing by which it is fitted into a bore 94 of the fulcrum block 38. The bore 94 is actually formed as a short, stopped bore in the body of the fulcrum block 38 and as a short tubular extension 96 welded thereto as at 90. A pin 98 is passed through appropriate apertures for locking the assembly.

The body of the fulcrum block 38 is essentially the same as the cylinder head 34 previously described, being a square plate, with a bore at one end to receive a pin 20 and a notch sectioned groove 36 at the other end as previously described.

The piston rod extension and adaptor

Referring now to FIGURE 5 of the drawings, reading from bottom to top, a cylinder head 34 accommodates a cylinder 28 with the previously described guide bushing 80 at the terminal end to accommodate the piston rod 32 in slidable relationship therethrough.

In this view of the drawings, it will be noted that the basic adaptor 92 of FIGURE 4 has been removed from the free end of piston rod 32 and in its place has been substituted the piston rod extension adaptor, designated generally 100. This is effected by removal of the pin 98 to release the basic adaptor 92 and the free end of the piston rod from its fulcrum block 38. The piston rod extension is a larger diameter tube 102 and concisely fits the bore 94 of the fulcrum block 38-tubular extension 96. This is secured at its free end by replacing the pin 98

through appropriate apertures in the terminal end of the piston rod extension **102** and the tubular extension **96** in which it fits.

The piston rod adaptor is essentially a stepped cylindrical block or plug member **100** as illustrated in FIGURE 5, having a larger diameter portion **104** fitted or telescoped into the end of the piston rod extension and a smaller diameter portion **106** fitted into the free end of the hollow piston rod **32**. Portion **104** is fastened by a pin **108** and the portion **106** by a pin **110**. Between the larger diameter portion **104** and the smaller diameter portion **106** is a convergent taper portion **112** forming a smooth step. This step has a maximum diameter equivalent to that of the piston rod extension, thus forming a step **114** abutting the end of the piston rod extension, serving to transmit force. A step **116** is also provided between the smaller diameter portion **106** and the base of the taper **112**, to receive force by abutting the end of the piston rod **32**.

From the foregoing it will be evident that a substantial amount of versatility is encompassed within the scope of invention in that the unit is readily adaptable to varying widths of trench. Of course it is to be understood that the piston rod extension is not of any particular length, and more than one may be used.

The use of a hydraulic cylinder in the present invention will be understood to provide the basis for the broad terminology of the claims "motor means for spreading apart or biasing apart the beams." It is to be understood that other force means, such as air cylinders, mechanical screw jacks, ratchet-type jacks and the like will therefore fall within the scope of invention.

As materials of construction, it will be evident that aluminum and magnesium will be preferred because of the light weight thereof lending to portability. However, other materials of appropriate strength will be evident to the skilled artisan, and accordingly are to be included within the scope of invention.

It is also to be understood that the scope of invention would include a reversal of parts as regards the configuration of the piston rod extension adaptor. Thus the portion **106** could be telescoped over the outside of the end of piston rod **32** and vice versa as to the portion **104**.

Accordingly, this invention is not to be deemed limited to the specific embodiment disclosed, but only by the appended claims.

What is claimed is:

1. In shoring equipment,

a pair of normally parallel beams each having a longitudinally extending web portion and,

a pair of longitudinally extending spaced ribs integral with the web of each beam and defining a channel section opening toward the channel section of the other beam,

a pair of pins traversing said channel of each beam and supported by the ribs thereof, one pin of each pair constituting a pivot pin and the other a bearing pin,

lineraly extensible forcing means extending between said beams and a head block and a foot block carried at opposite ends of said forcing means,

said head block being pivotally mounted on the pivot pin for movement into and out of bearing engagement with the bearing pin of a pin pair carried by one beam,

and said foot block pivoting on the pivot pin for movement in and out of bearing engagement with the bearing pin of a pin pair carried by the other beam,

each of said blocks being maintained in a spaced position from the web of the beam with which it is associated by its pivot pin when said block does not engage its bearing pin and by its pivot pin and bearing pin when said block bears on its bearing pin and the surface of the block bearing on its bearing pin being oriented and arranged with respect to said forcing means to direct the line of extension substantially perpendicularly to the beam on which said block is pivoted,

the pivot pins being diagonally arranged with respect to each other in the corners of the quadrilateral located by the said pin pairs, whereby said beams may be moved toward each other upon pivoting said blocks on said pivot pins and out of engagement with said bearing pins for insertion and removal from between opposed surfaces and, when said blocks engage said bearing pins, extension of said forcing means permits said beams to shore opposed surfaces.

2. In shoring equipment as defined in claim **1**, wherein,

a second pin pair is similarly carried by each of said beams, said second pin pair of each beam being spaced from the first pin pair thereof and, in these two pin pairs carried by a beam, the pivot pin of one pair being adjacent the bearing pin of the other pair,

a second extensible forcing means including a head block and a foot block carried at opposite ends thereof and pivoted on the diagonally arranged pivot pins of said second pin pairs,

each of said head blocks and foot blocks being configured to engage the bearing pin of the pin pair to which it is pivoted with a wedging action tending to force the pins of the pair apart,

each of said extensible forcing means including a hydraulic cylinder for forcing apart its associated head and foot blocks,

check valve means connected to one of said cylinders and a by-pass passage communicating with said check valve on the same side thereof that is connected to said one cylinder,

an inlet to the other cylinder,

and conduit means extending between said by-pass passage and said inlet,

whereby both said cylinders may be simultaneously pressurized from a single source of fluid pressure when said check valve is connected thereto and pressure may be thereafter maintained in said cylinders when the source is disconnected from said check valve until said check valve is actuated to release the pressure in said cylinders,

3. In shoring equipment,

a beam having a flanged web and spaced ribs extending longitudinally of said web and inwardly of its flanges to define a channel,

a pair of spaced pins supported in said ribs and extending across said channel,

a pressure transfer pad of plate-like configuration and having a bore pivotally receiving one of said pins,

a groove in said pad spaced from said bore and embracing at least a part of the other pin when said pad is pivoted into engagement therewith,

a surface of said groove tending to wedge said pins apart on application of load on said transfer pad to produce an expanding pattern of force vectors transfering said load to said flanged web through a longer rib section than the length of the rib between the spaced centers of said pins,

and extensible means connected at one end to said pressure pad,

whereby, when said flanged web bears against a surface and the other end of said extensible means bears against an opposed surface, extension of said extensible means will apply a load to said transfer pad.

4. The shoring equipment defined in claim **3** wherein said surface of said groove comprises a cam surface on the wall of said groove.

5. Shoring equipment as defined in claim **3** including a lifting bail attached to an end of one beam, and a second lifting bail attached to the corresponding end of the other beam.

6. In shoring equipment,

opposed beams each comprised of a flanged web and

longitudinally extending integral spaced ribs defining a channel section,

a pair of pins spanning the ribs of each beam and spaced from the web thereof,

a hydraulic cylinder assembly including a tubular cylinder,

a cylinder head having a socket receiving and closing one end of said cylinder and pivotally connected to one of said beams by one of its pins and limited against pivotal movement against the web of said beam by the other of its pins,

a piston reciprocable in said cylinder, the surface of said piston adjacent said cylinder head being stepped to provide a passage across the closed end of the cylinder when said piston engages said head,

a tubular piston rod connected at one end to said piston and having an opposite end to extend from the open end of the cylinder,

a fulcrum block pivoted to the other of said beams by one of the pair of its pins and limited against pivotal movement against the web of said other beam by the other of its pins, said fulcrum block having a bore adapted to receive said opposite end of said piston rod,

and means removably connecting said piston rod and fulcrum block.

7. In shoring equipment as defined in claim 6, in which said means connecting said piston rod and fulcrum block include,

a piston rod adaptor comprising an elongated body member with one end telescoped to said piston rod,

and an elongated piston rod extension having one end telescoped to the other end of said adaptor and its opposite end received in the bore of said fulcrum block.

References Cited by the Examiner

UNITED STATES PATENTS

217,059	7/1879	Case	285—177 X
2,270,604	1/1942	Roemhild	285—177 X
3,230,720	1/1966	Bennett	61—41

FOREIGN PATENTS

672,857	10/1963	Canada.

OTHER REFERENCES

German printed application 1,123,988, February 1962.

JACOB L. NACKENOFF, *Primary Examiner.*

JACOB SHAPIRO, *Examiner.*