United States Patent

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[15] **3,685,301**

[45] **Aug. 22, 1972**

[54] **PROCESS AND APPARATUS FOR THE INSTALLATION OF JACK PILES**

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[22] Filed: **Nov. 24, 1970**

[21] Appl. No.: **92,375**

[52] **U.S. Cl.**.....**61/51,** 61/53.5

[51] **Int. Cl.**.....**E02d 27/48**

[58] **Field of Search**.....61/51, 50, 53.5, 63, 45 A, 61/45, 45 D

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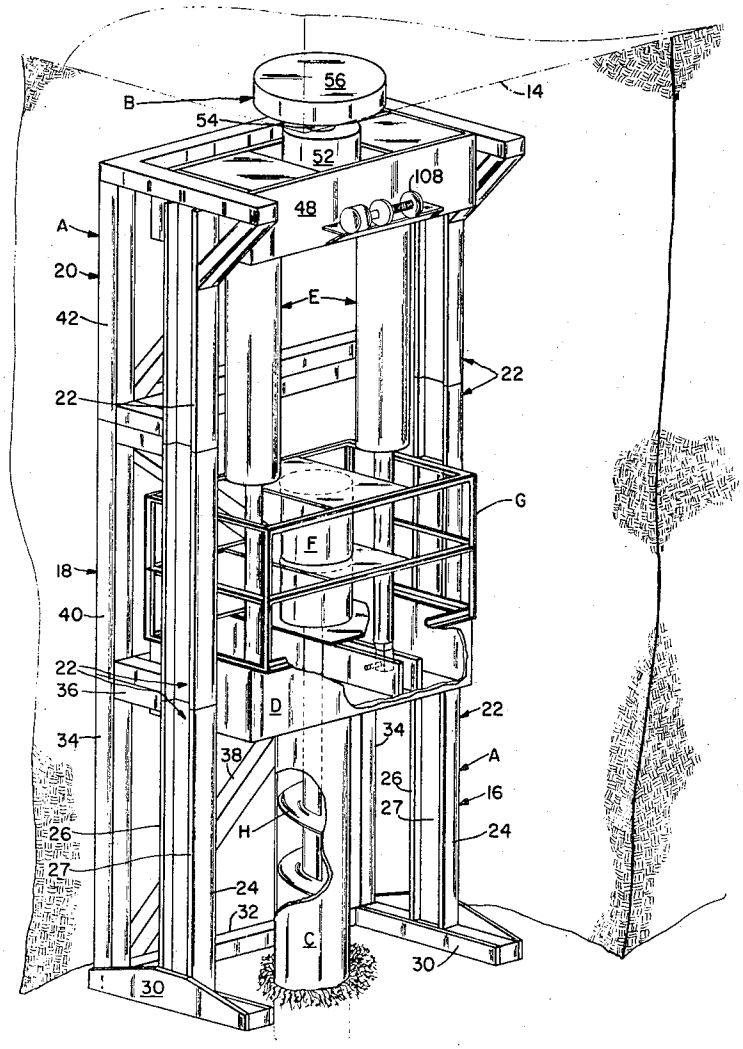
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[57] **ABSTRACT**

Apparatus is illustrated for the placement of jack piles underneath footings of existing buildings. Typically, tunneling is provided to expose a segment of the building. The jack pile apparatus of this invention is erected under the exposed footing. Once erected, the apparatus is jacked to securely rest on the bottom surface of the tunneling at its lower end and to support the exposed portion of the footing at its upper end. The jack pile casing is jacked or crowded from the apparatus in discrete sequential segments. Simultaneously with this jacking the earth from the center of the jack pile casing is removed with a continuous flight auger. Once the casing is inserted, concrete is used to fill the casing and support the exposed footing.

5 Claims, 5 Drawing Figures



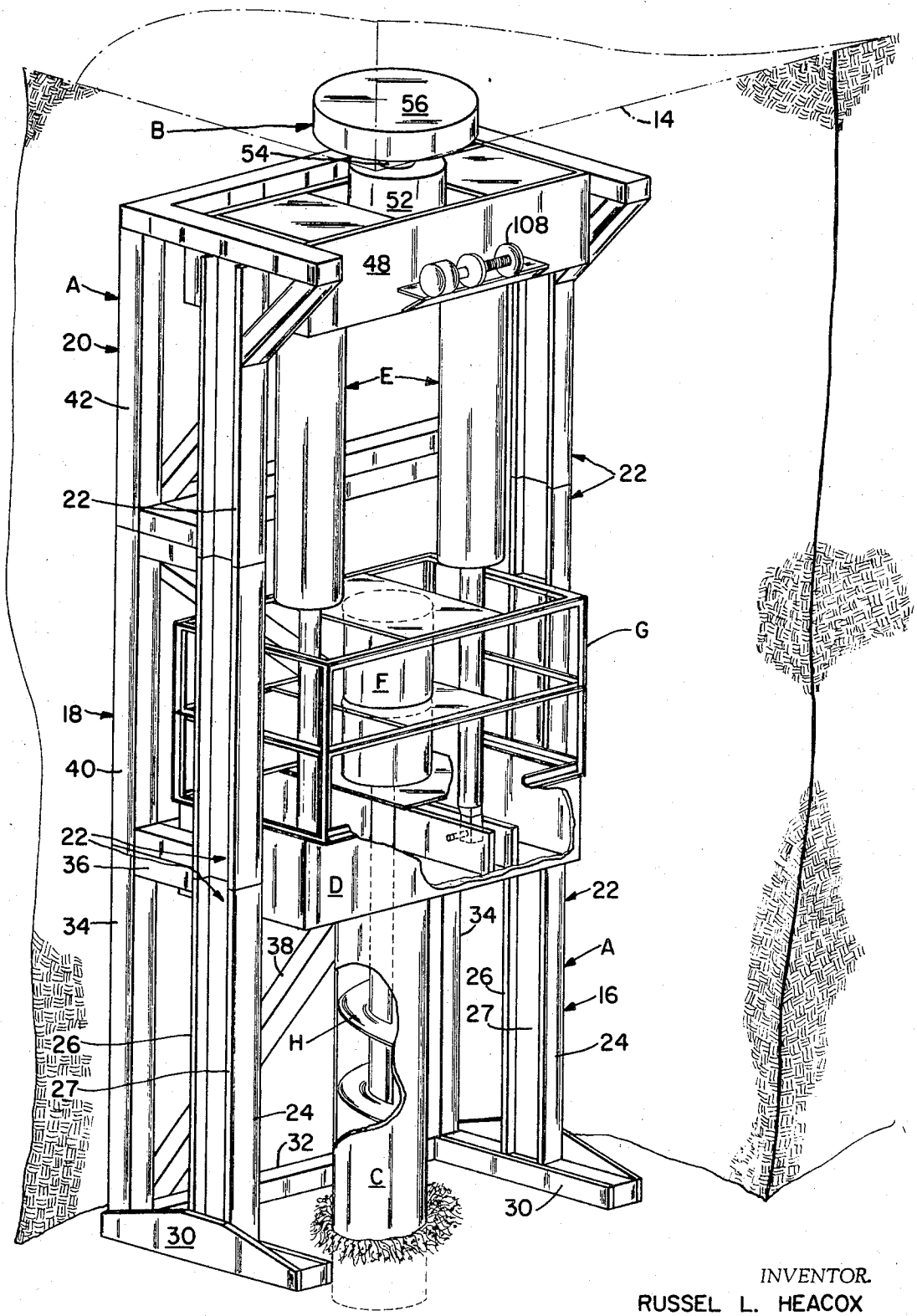


FIG_1

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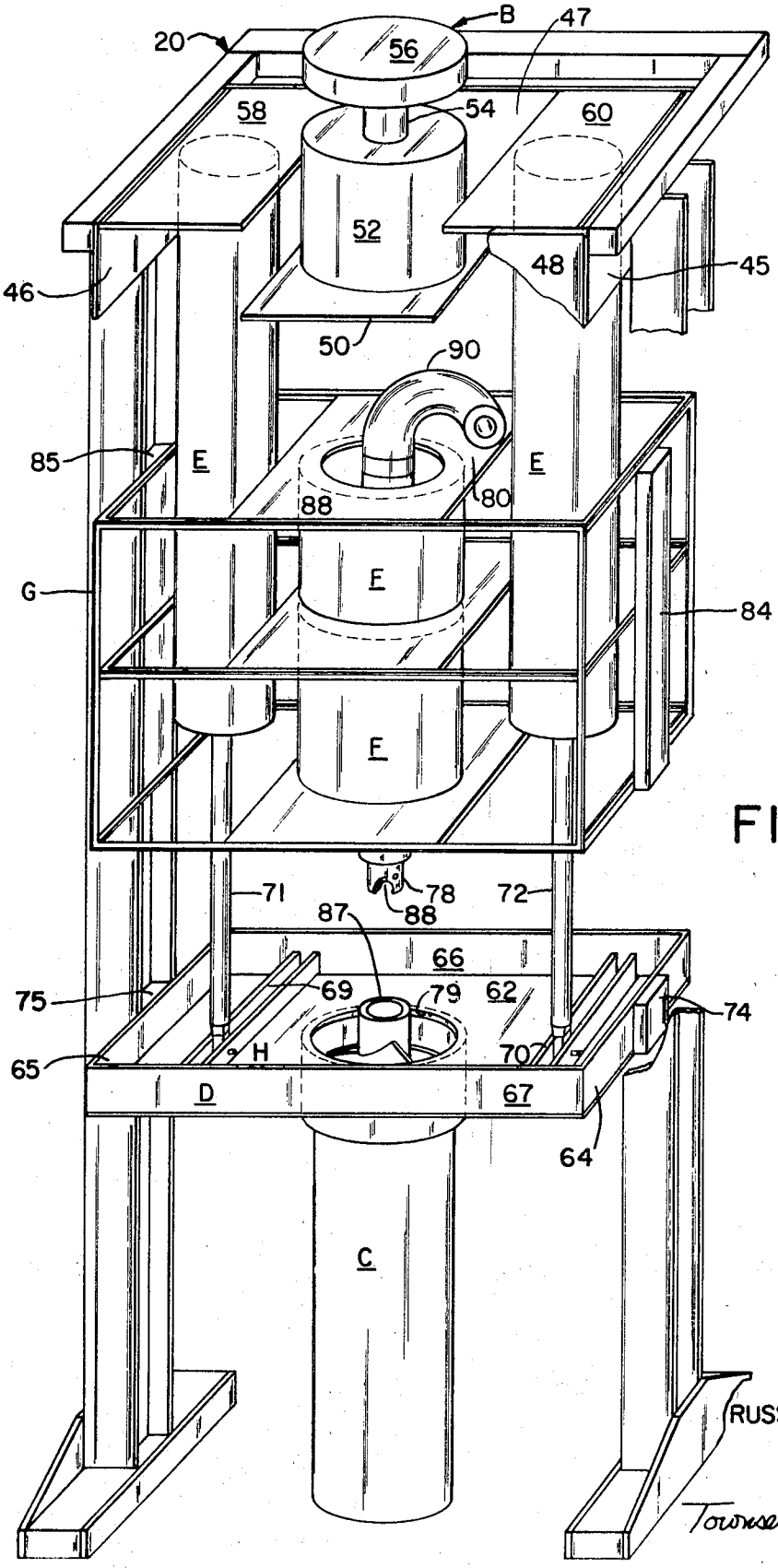


FIG_2

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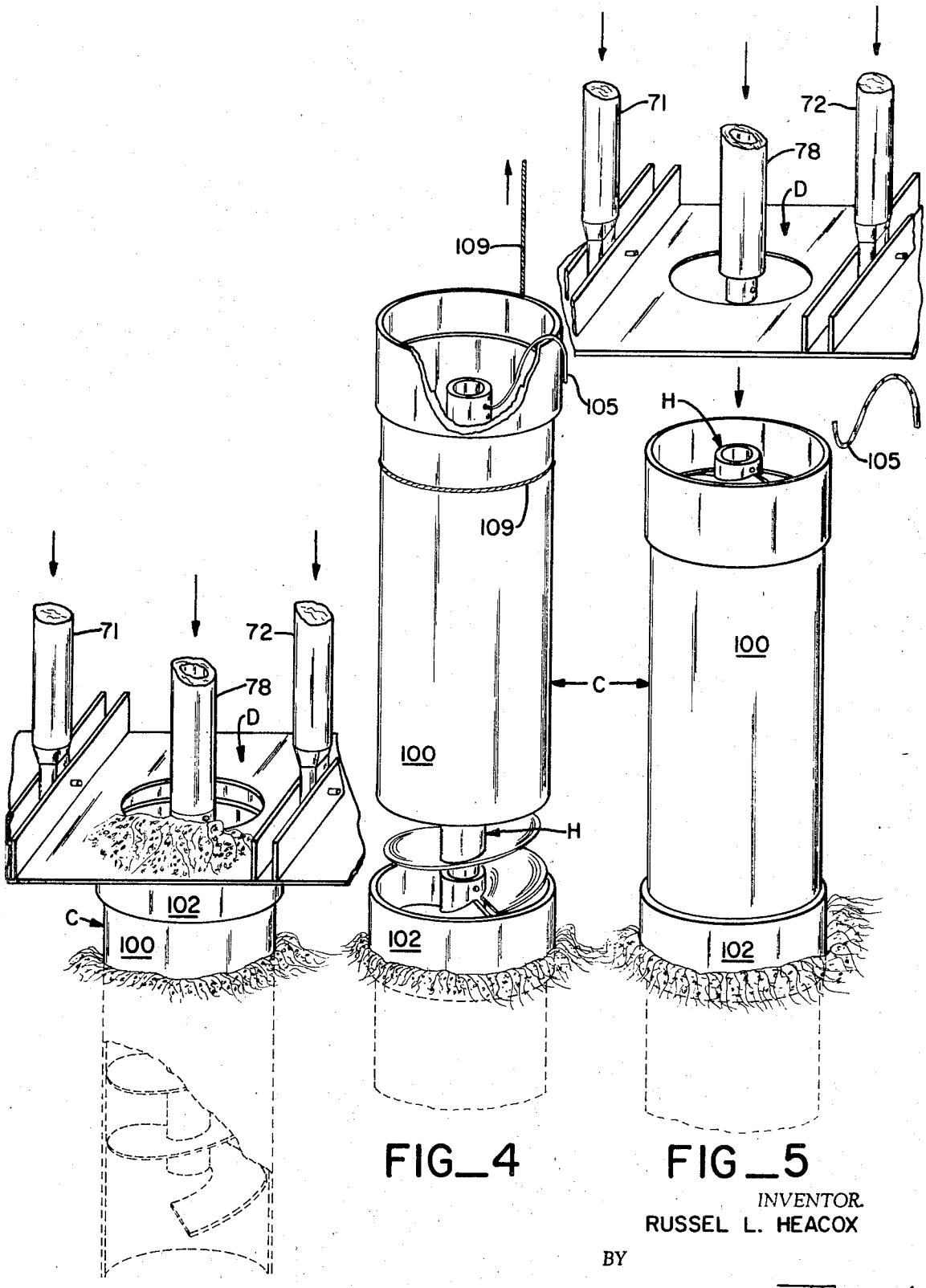


FIG_3

FIG_4

FIG_5

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PROCESS AND APPARATUS FOR THE INSTALLATION OF JACK PILES

This invention relates to forming piles in the ground. More particularly, this relates to jack piles which are commonly crowded in the ground underneath existing building footings and thereafter formed to support building footings.

Many buildings are commonly supported on large concrete blocks or pads. These blocks or pads rest against the soil underlying the building at their bottom surface and have the columns or other vertical supporting members of the building bearing on their upper surface.

After the building has been installed, it is frequently necessary to underpin and support such footings. This is necessity for additional support can arise when the building settles, when earth immediately adjacent the building is excavated, or when additional loadings are being placed within the building and on footings. Jack piles are commonly used to provide such underpinning.

In the conventional installation of jack piles, a tunneling underneath the footing of a building is first made. This tunneling exposes typically a small part and less than all of the under surface of the building footing. Thereafter, a hollow casing having the outer diameter of the jack pile is forced or "crowded" into the ground. Typically, this forcing or crowding is done by placing a jack against the exposed portion of the building footing at its upper end and against the upward and exposed portion of the pile casing at its lower end. When the jack is expanded, the pile casing is driven or crowded into the ground.

Simultaneously with such crowding or forcing of the pile casing into the ground, a hand-supported and rotated auger is inserted interior of the casing. Typically, these augers consist of a series of rods having at their bottommost portion an auger of one, two or three flights. As the jack pile casing is crowded into the ground, the auger is revolved by hand to loosen small quantities of soil (approximately **6** or **8** inches). When such a small quantity of soil is loosened, the auger is brought to the surface, and the loose soil removed. The auger is then reinserted into the earth and the sequence repeated.

The process of inserting jack piles heretofore known has several serious disadvantages. First, the insertion, rotation and removal of an auger by hand is laborious. Secondly, when jacking or crowding of a segment of jack pile casing into the ground occurs, the building footing is loaded vertically upward; when such jacking ceases, the building footing is not loaded. Jacking the jack pile segments into the ground results in fluctuating loads on the building footing. Such a fluctuating loading on the building footings may not be desired, especially where the structure is old or extremely fragile. Finally, the process is slow; crews of four men are often limited to installing only 5 feet of casing for an 8-hour shift in adverse soil conditions.

An object of this invention is to disclose an apparatus for the placement of jack pile casings into the ground. Accordingly, a frame structure is disclosed which bears on the bottom of the tunneling on one hand and on the exposed under portion of the building footing on the other hand. The jack pile casing, in the form of a pipe is crowded into the ground by a press table jacked from the framing. Simultaneously, a continuous flight auger within the jack pile casing is rotated by hydraulic motors; evacuation of earth from the center of the casing simultaneously occurs.

An advantage of this apparatus is that installation of jack pile casings is much faster; a crew of three men working within the confines of a tunnel can install 60 feet of pile per 8-hour shift.

An additional advantage of this invention is that the mechanism is capable of supporting and rotating a continuous flight auger. Dirt can be continuously evacuated from the interior of a jack pile casing without periodic removal of the auger.

A further object of this invention is to securely brace both the mechanism for crowding the jack pile segments into the ground as well as the mechanism for supporting and rotating the auger. This is accomplished by securely jacking the frame of the apparatus in the invention between the bottom of the tunneling on one hand and the exposed portion of the building footing on the other hand.

An advantage of this bracing is that the building footing can be submitted to substantially constant loading. When the pile segments are not being jacked into the ground, the loading of the building is transmitted through the machine framing onto the exposed earth at the bottom of the tunneling. When a pile is being jacked into the ground, the loading of the building footing shifts from the framing onto the jack pile segment being crowded into the ground.

A further advantage of the bracing of the machine framing is that true linearity of the jack pile and auger can be maintained during insertion of the jack pile.

A further object of this invention is to control the depth of penetration of the auger with respect to the depth of penetration of the jack pile casing. Accordingly, the auger motor and supported auger can be retarded with respect to the jack pile casing as they are both advanced into the ground.

An advantage of this adjustability of the auger with respect to the jack pile is that where jack pile casings are inserted below an existing water table, a plug of earth can be maintained at the bottom of the jack pile casing sufficient to prevent the percolation of water into the interior of the jack pile casing.

A further advantage of this invention is that the auger can be fixed with respect to the table which crowds the jack pile casing into the earth. With this adjustment, the auger can also be crowded into the earth.

A further object of this invention is to disclose an auger and motor for supporting and rotating the auger through which earth entrained in water from a flooded jack pile casing can be removed. Such removal of earth in water can be made without flooding the confines of the narrow tunneling under the building footing.

Yet another advantage of this invention is to provide for the erection and removal of the apparatus in discrete segments which can be conveniently handled in the narrow confines of a tunnel.

Other objects, features and advantages of this invention will become more apparent after referring to the following specification and attached drawings in which:

FIG. **1** is a perspective view at the end portion of tunneling exposing a corner of an existing footing (shown in broken lines) with the jack pile apparatus of this invention shown braced in place and installing a jack pile casing segment into the earth;

FIG. 2 is a perspective view similar to FIG. 1 but taken from a different angle showing the jack pile apparatus, press table, auger motor and footing jack with most of the frame not shown to facilitate understanding;

FIG. 3 is a perspective view of a jack pile casing segment being crowded into the ground by a pressure plate with the auger segment being rotated interior of the casing segment;

FIG. 4 illustrates the jack pile segment of the casing of FIG. 3 completely crowded into the earth with an additional jack pile segment and auger segment being placed for subsequent overlying and sequential insertion; and,

FIG. 5 shows the placed jack pile and auger segment immediately before further insertion of the jack pile casing into the ground.

Referring to FIG. 1, the jack pile apparatus of this invention is shown in perspective during the installation of the jack pile. The apparatus includes a frame A with a footing jack B mounted at the upper portion thereof. Typically, tunneling is made to expose a portion of a preexisting footing **14**. Thereafter, frame A is assembled, underlying the footing. The footing jack B is then actuated so as to bear against the exposed portion of footing **14**. Secure bracing of frame A and partial support of footing **14** results.

A jack pile casing segment C is shown being crowded into the ground by a pressure table D. Pressure table D is in turn forced downwardly and onto jack pile casing segment C by hydraulic cylinders E braced within frame A.

A hydraulic motor F supported in a vertically movable cage G powers a continuous flight auger H. During insertion of jack pile segment C into the ground, continuous flight auger H serves to evacuate earth from the center of the casing segment C.

Jack pile segments C and continuous flight auger segments H are inserted into the ground in the sequence illustrated in FIGS. 3 through 5. Once insertion of the casing to the desired depth has completely occurred, auger H is withdrawn and the casing segments C are allowed to remain in place. Thereafter, the interior of casing segment C is filled with concrete, as by tremmie pouring or other techniques, and thereafter allowed to cure and harden. Subsequently, the jack pile apparatus is removed, the poured and cured jack pile connected to the underside of the exposed footing **14**, and the tunnel filled. The result is that footing **14** at its exposed portion is completely underpinned.

By the expedient of tunneling under and inserting jack piles at other portions of the building footing or footings, a pile foundation can be provided for an existing building structure.

Frame A consists of three discrete segments. These segments are bottom frame segment **16**, intermediate frame segment **18** and top frame segment **20**.

All three frame segments have two features in common. First, the frame sections are provided with I-beam segments **22** on either side. I-beam segments **22** are each aligned with their front flanges **24** and their rear flanges **26** in parallel planes. The webs **27** of each I-beam segment **22** are parallel and spaced apart.

The I-beam segments on opposite sides of each frame segment are placed in overlying relation and define opposed U-section channels. These opposed U-section channels provide opposed U-sectioned tracks by which the press table D and auger motor supporting frame G can subsequently ride vertically up and down during insertion of the jack pile segment C interior of the ground.

The second feature that the frame segments have in common is that they each define an overlying and corresponding horizontal U-shaped section when viewed in plan. This U-shaped section provides an interval in which the press table D, auger motor F, and auger motor supporting frame G can be moved upwardly and downwardly during insertion of the jack piles into the earth.

Bottom frame section **16** bears against the bottom of the tunneling at footing bars **30**. Footing bars **30** underlie each I-beam segment **22** at the two sides of the U-cross section of the frame A. A transverse footing bar **32** extends across the frame interconnecting footing bars **30** on either side thereof. It can thus be seen that the two footing bars **30** and the transverse footing bar **32** together define the U-section at the bottom of segment **16** of frame A.

At the two junctures of footing bars **30** and transverse footing bar **32**, two vertical beams **34** are placed. Each vertical beam **34** extends upward the full length of frame segment **16**. At the upper end of the vertical beams **34**, two horizontal beams **36** are placed. Horizontal beams **36** interconnect the top of each I-beam segment **22** of frame segment **16** with the top of each beam **34** defining the sides of the U-sectioned frame segment **16** at its upper end. Similarily, the top of the respective vertical beams **34** is connected by a horizontal beam (obstructed in the view here shown). This horizontal beam defines the bottom of the U-sectioned frame segment **16** at its upper end. As is apparent, suitable cross bracing **38** can be provided in bottom frame segment **22** as required.

Middle frame segment **18** is constructed in a manner analogous to and complementary to bottom frame segment **16**. This section includes overlying I-beam segments **22**, overlying vertical beams **40**, and beams and bracing interconnecting the vertical beams and I-beam segments which are analogous to the bracing illustrated with respect to the bottom frame segment **16**.

Top frame segment **20** is analogous to frame segments **16** and **18**. This frame segment includes its own I-beam segments **22**, its own vertical beams **42** and beams and bracing interconnecting the I-beam segments and vertical beams.

Frame A is designed primarily for vertical loading. This vertical loading is passed through the respective vertically aligned I-beam segments **22** and the vertical beams **34**, **40** and **42** from the top of frame A to the bottom of frame A. Thus the load of the building exerted on the frame by footing jack B is passed through the frame to the bottom of the tunneling underlying the footing **14**.

Top frame segment A has affixed rigidly thereto footing jack B. The attachment of jack B to this portion of upper frame segment **20** can be best illustrated with respect to FIG. 2.

Referring to FIG. 2, it will be seen that the top portion of frame segment **20** accommodates interior of its U-shaped section four steel plates welded together in a rectangular section as viewed in plan. Plates **45** and **46**

form the side edges of the rectangle parallel to the side edges of the U-shaped section of frame A. Plate **47** interconnects the inward ends of plates **45** and **46** and extends parallel to the bottom section of the U-shaped frame segment **20**. Similarly, plate **48** closes the front portion of the rectangle across the forward ends of plates **45** and **46**.

The rectangular frame consisting of plates **45** through **48** is rigidly welded and secured to frame segment **20** at its upper end. This rigid securing is necessary as substantially all of the vertical loading of the frame through footing jack B is transmitted through the rectangular frame of plates **45** through **48** to the frame A.

Three horizontal plates are welded to the frame of plates **45–48**. A first bottom and central plate **50** is welded between rear plate **47** at one hand and forward plate **48** at the other end. Typically, the plate **50** is welded at the bottom medial portion of plates **47** and **48**.

Plate **50** supports the end of a hydraulic cylinder **52**. Hydraulic cylinder **52** has an enclosed piston (not shown) and a rod **54** extending upwardly and concentrically from cylinder **52**. Rod **54** in turn attaches to a bearing plate **56** at its upward end.

It can thus be seen that when frame A is assembled underlying an exposed portion of a footing **14**, the upward hydraulic movement of the rod **54** and bearing plate **56** will accomplish two objectives. First, plate **56** will contact and impart support to the footing. Secondly, plate **56** will load frame A through plates **50** and then plates **47** and **48** to compressively brace the frame A of the apparatus of this invention in place. The apparatus of this invention will thus be rigidly secured interior of the tunneling. As will become more fully apparent hereafter, the loading of footing jack B will be shifted between the bottom of frame A and the jack pile casing segment C as the segments C are crowded into the earth.

In addition to supporting plates **50** thereacross, the frame of the plates **45–48** supports at each end plates **58** and **60**. Plates **58** and **60** are attached in spaced apart relation at either end of the plates **47** and **48** at their upper edges. These plates define between them an interval sufficient to accommodate hydraulic cylinder **52**. Additionally, the plates each have a width sufficient to form a rest and support point for each of the hydraulic cylinders E.

Press table D includes a rectangular plate **62** and floor border plates **64**, **65**, **66** and **67**. Border plates **64–67** are typically welded at the edges of erectangular plate **62**, extend above the upper surface and together form a boundary which enables the upper surface of the table to retain earth before it is removed. It will be noted that the overall rectangular section of plate **62** and framing plates **64–67** is such that the press table D will fit interior of the U-shaped cross section of frame A.

Extending between framing plates **66** and **67** are two sets of parallel bars **69** and **70**. These bars fasten plates **66** and **67** at either end, and to the rectangular plate **62** at their lower surface.

Typically, each set of paired and parallel bars **69**, **70** are spaced apart so as to receive therebetween the rods **71** and **72** extending from the pistons interior of hydraulic cylinders E. Bar sets **69** and **70** and the ends of the respective piston rods **71** and **72** between the bars of each set are cross bored and pinned to affix the press table D to the ends of the hydraulic piston rods.

Plates **64** and **65** have affixed thereto U-shaped channels **74** and **75**, respectively. These U-shaped channels **74** and **75** have U shape which is complementary to the opposed U-sectioned channels defined by I-beam segments **22**. It will be immediately seen that hydraulic piston rods **71** and **72** are moved towards and away from hydraulic cylinders E, the press table in following such movement will be guided by U-shaped channels **74** and **75** riding in the opposed U-shaped channels of I-beam sections **22**. With the alignment of the U-shaped channels **74**, **75** within the opposed U-sectioned channels of I-beam segments **22**, the horizontal alignment of the press table D during movement towards and away from the bottom of the tunneling is assured.

Plate **62** is provided with a concentric bore **79**. Typically bore **79** has a diameter which is slightly less than the diameter of the jack pile casing segment C. It can be seen that when the jack pile segment C is placed in centered abutment below the press table D, its periphery will contact press table D immediately adjacent the borders at aperture **78**. The hollow interior of the segment C will be exposed for removal of dirt.

It will be remembered that when hydraulic motor F supports and rotates continuous flight auger H during crowding of the casing segment C into the ground, earth will be continuously discharged from the top of the continuous auger flight. This discharge of earth will occur through aperture **79** and onto the upper surface of plate **62** of press table D. Here the earth can be conveniently removed by shovel or other means.

While press table functions to crowd casing segment C into the ground, auger motors F as supported by motor frames G serve to support and rotate continuous flight auger H. With reference to FIG. **2**, it will be seen that paired hydraulic motors F mounted in coaxial relation each drive a hollow drive shaft **78**. Motors F are each secured to plates **80** and **81** which are in turn fixed to a frame G.

Frame G is rectangular in plan having a cross section which fits interior of frame A. This frame G, typically constructed from angle bars, has U-section channels **84**, **85** affixed to either side thereof.

U-sectioned channels **84**, **85** function in a manner analogous to the channels **74**, **75** on press table D. Typically, these U-sectioned channels ride interior of the opposing U-sections of I-beam segments **22** and provide horizontal alignment to the frame G and motors F during their sliding vertical movement interior of frame A.

Unlike press table D, hydraulic motors F and frame G are free to vertically move with respect to frame A. Thus, it will be seen that the continuous flight auger normally will be crowded downwardly into the ground by its own weight, the weight of hydraulic motors F and the weight of frame G.

This free floating arrangement of motors F and frame G relative to press table D furnishes several advantages. First, it is often desired to progressively retard auger flight F with respect to the pile casing segment C being crowded into the earth. Typically, where the pile casing

segments are being placed below an ambient water table, a plug of earth must be maintained at the bottom of the casing C. Without such plug of earth being maintained, water will frequently percolate interior of the casing C, flood it in the entirety, and make the earth removal by the auger difficult or impossible to transport up the auger flights.

As is apparent, by the expedient of inserting wedges between the lower portion of frame G on one hand and the upper portion of press table D on the other hand, the relation between the advancement of the lowest auger segment H and the advancement of the lowest pile casing segment C can be easily controlled.

A second advantage of the free floating arrangement of the frame G and hydraulic motors F with respect to press table D is that where crowding of the auger into the earth is desired, frame G can be secured to press table D. This securing can occur by cables, can be adjusted to any particular interval, and is conveniently actuated by lowering press table D.

Thirdly, it will be observed that when press table D is raised, frame G and its supported hydraulic motors F will also be raised. Thus, the press table D can be used to raise and lower the auger where required.

Referring to continuous flight auger H, it will be noted that this auger is of conventional construction save and except for a hollow bore **87** interior thereof. Similarly, hydraulic motors F at their drive shaft **79** are of conventional construction save and except for a hollow bore **88** therein. Bores **87** and **88** overlie one another, form a fluid-tight seal when motors F are conjoined to continuous flight auger H and can be used for the removal of drilling slurry removed by the auger when the jack pile casing is flooded.

It will be remembered that the apparatus of this invention is used at the end of tunneling underneath the exposed footing of a building. Where piles are inserted below an existing water table, it sometimes is inevitable that the pile casing when inserted in the ground becomes flooded with water from the ambient water table. This is especially true where the jack piles are being placed in porous soils.

Once the pile casing becomes flooded with water, earth removed from the center of the pile casing can no longer work its way up the continuous auger flights. Typically, the earth forms a slurry with the ambient water and must be removed by pumping.

With the continuous flight auger H here shown, fluid is removed through the center aperture **87** in the auger and the center aperture **88** in the hydraulic motors F and pumped out through a hose connection **90** to the exterior of the tunnel. This removal of slurry prevents the spillage of water in the tunneling where such water could produce intolerable working conditions, and possibly cause undesired building settlement due to hydraulic mining. In the event that water must be placed into the jack pile casing segment C to replace the water being withdrawn, it can conveniently be poured through aperture **78** to pass down the auger flights for entraining displaced earth.

Referring to FIG. **3**, the construction of each jack pile casing segment C can be easily understood. Typically, the jack pile segments C comprise a hollow steel pipe **100** having an inside diameter equal to the desired outside diameter of the poured and cured concrete portion of the jack pile. Pipe **100** typically extends for most of the length of each jack pile casing segment C and is surrounded at its upper portion by a welded sleeve **102**. Sleeve **102**, typically has an inside diameter equal to the outside diameter of pipe **100**. This sleeve has half its longitudinal lengths fastened to the upper portion of pipe **100**. The remaining half of its longitudinal length protrudes upwardly and above the top of pipe **100**.

As can be seen from FIGS. **4** and **5**, sleeve **102** permits the lower ends of jack pile segments C at their respective pipes **100** to be freely received, centered and aligned when one casing segment C is placed on top of a lower casing segment C. Thus, the placement of the jack pile casing segments is easily facilitated by the sleeves **102**.

The construction of continuous flight auger H is also easily understood. Typically, the continuous flight auger H comes in segments, each segment being of a length equal to the length of the jack pile casing segment C.

The outer diameter of the continuous flight auger H is complementary to but slightly less than the inner diameter of pipe **100** of casing segment C. This permits the auger to evacuate substantially all of the earth interior of the casing segment C and additionally centers the auger H with respect to the pile casing as the pile casing is crowded into the earth.

Referring to FIG. **3**, a first jack pile segment C is shown being crowded into the earth. It will be noted that press table D is in contact with the upper portion of sleeve **102** and that the respective hydraulic piston rods **71**, **72** from hydraulic cylinders E are pushing press table downwardly. At the same time, shaft **79** powered by hydraulic motors F is causing the continuous flight auger H to rotate.

It will be noted at the lower end of the auger H that a plug of earth has been maintained between the lower edge of the casing segment C and the lower end of the auger H. This will prevent flooding of the pile casing. Consequently, dirt will pass up the continuous flight auger and out through the aperture **78** in press table D.

It will be noted in FIG. **3** that the jack pile casing segment C is shown crowded almost to its full depth of penetration interior of the earth. Typically, when this occurs, shaft **79** will be disconnected from continuous flight auger H and press table D retracted upwardly relative to frame A by the hydraulic retraction of piston rods **71**, **72** into their respective hydraulic cylinders E. Once press table D has moved upwardly and towards the top of frame A, it will move with it hydraulic motors F and their supporting frame G. An interval will exist between the top of the jack pile casing segment C and the bottom of the press table D sufficient for the insertion of another jack pile casing segment C.

Referring to FIG. **4**, the insertion of a jack pile casing segment C can be easily understood. Typically, the jack pile casing segments C each have a complementary section of auger H inserted within them. This section of auger H is suspended by a hook **105** which passes through the upper portion of the auger shaft at one end and drapes over the upper lip of sleeve **102** at the other end. Typically, this retaining hook is of S-shape and of such a length so that the segment of the auger H is supported at a level well below the lower end of pipe **100** of casing segment C.

The casing segment C and its contained auger segment H are usually of considerable weight. Therefore, frame A is provided with a small hydraulic winch **108** at the forward end thereof. Typically, cable **109** from this winch is passed around the outside surface of the casing segment C and its contained auger segment H and lifted to a position where the casing segment and auger segment can be swung into place overlying previously installed pile casing segments and auger flights already in the earth.

As can be clearly viewed in FIG. **4**, once casing segment C is raised, hook **105** will permit the lower end of auger segment H to protrude downwardly and below the lower portion of pipe **100**. When the casing segment C is placed overlying a previously installed casing segment C, it will be seen that the coupling for the continuous flight auger H can be easily made without interference from the sidewalls of the pipe **100**.

Once connection has been made between the two overlying continuous flight auger segments, cable **109** and the supported casing segment C will be lowered. Typically, the lower end of pipe **100** will fit concentrically interior of the upper sleeve **102**. With such a fit, hook **105** will no longer be needed and will be removed as illustrated in FIG. **5**. Once cable **109** is detached, press table D and shaft **79** will be engaged with the casing segment C and the auger segment H, respectively, and the insertion of the jack pile casing continued.

It will be understood, that the jack pile apparatus and process of this invention will admit of a number of variations. For example, the frame structure A can be constructed of numerous configurations so long as it permits the sliding movement of apparatus for crowding the casing segment C into the ground and additionally centers the apparatus for supporting and rotating the continuous flight auger H. Further, numerous drilling apparatuses could be used. For example, jetting could be used. Likewise, other modifications may be made to the disclosed invention without departing from the spirit and scope thereof.

What is claimed is:

1. Apparatus for installing a jack pile casing downwardly into the earth under a footing partially exposed by tunneling, said apparatus comprising: a vertical frame for placement on the bottom of said tunneling underneath said exposed footing; a jack resting on said frame at one end and expansible to transmit the downward loading from said exposed footing through said frame between said exposed portion of said footing at the top and said tunneling at the bottom; a press table attached to said frame for vertical up and down movement, said press table defining a surface for contacting the upwardly exposed portion of said jack pile casing upon downward movement of said table; means for jacking attached between said frame and said table for urging said table vertically downward with said jack pile casing into the ground whereby downward loading from said footing to said frame at least partially shifts from said frame at said tunneling to said jack pile casing to crowd said casing into the earth while maintaining substantially constant upward loading at said footing.

2. The apparatus of claim **1** and wherein said frame is fabricated in a plurality discrete and overlying segments of corresponding horizontal cross section and said press table includes a complementary horizontal cross section to permit vertical movement of said press table over and between said discrete frame sections.

3. A process of installing a jack pile casing comprising: tunneling underneath an existing footing to expose a part but not all of said footing; providing and placing a frame having a vertical dimension slightly less than the vertical distance between said exposed footing at the top and said tunneling at the bottom; providing and expanding an expansible jack member to brace said frame between said exposed footing at the top and said tunneling at the bottom to support at least a portion of the downward load of said footing through said frame from the bottom of said tunneling; jacking said jack pile casing downwardly into the ground from a point on said frame whereby at least a portion of the load from said footing is shifted from said frame on the bottom of said tunneling to said casing being jacked.

4. Apparatus for installing jack pile casings underneath a portion of a foundation exposed by a tunneling comprising: a frame extending substantially between the bottom of said tunneling on one hand and the exposed portion of said foundation on the other hand; a horizontal press table attached to said frame; means for moving said press table vertically on said frame and maintaining said press table horizontal during said vertical movement; means for jacking said press table downwardly from a point of said frame; said press table configured at the lower surface for abutting the upper portion of a jack pile casing and crowding said casing into the ground; said press table further defining an aperture for permitting earth interior of said casing to be removed through said press table to the exterior of said casing; a continuous flight auger dependingly supported from a point on said frame through said aperture interior of said casing; and, means for rotating said auger attached to said auger and frame for removing earth from said jack pile casing segment as it is crowded into the ground.

5. The process of claim **3** and including the step of excavating the interior of said jack pile casing simultaneously with said jacking step by excavating with a first continuous auger flight when said first segment of said jack pile casing is jacked into the ground; disconnecting said first continuous auger flight, placing a second continuous auger flight section within said second jack pile casing segment; connecting said second continuous auger flight section to said first continuous auger flight section and simultaneously with said jacking of said first and second jack pile casings into the ground utilizing said first and second auger flights to excavate said interior of said jack pile casings.

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