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2 Sheets-Sheet 1

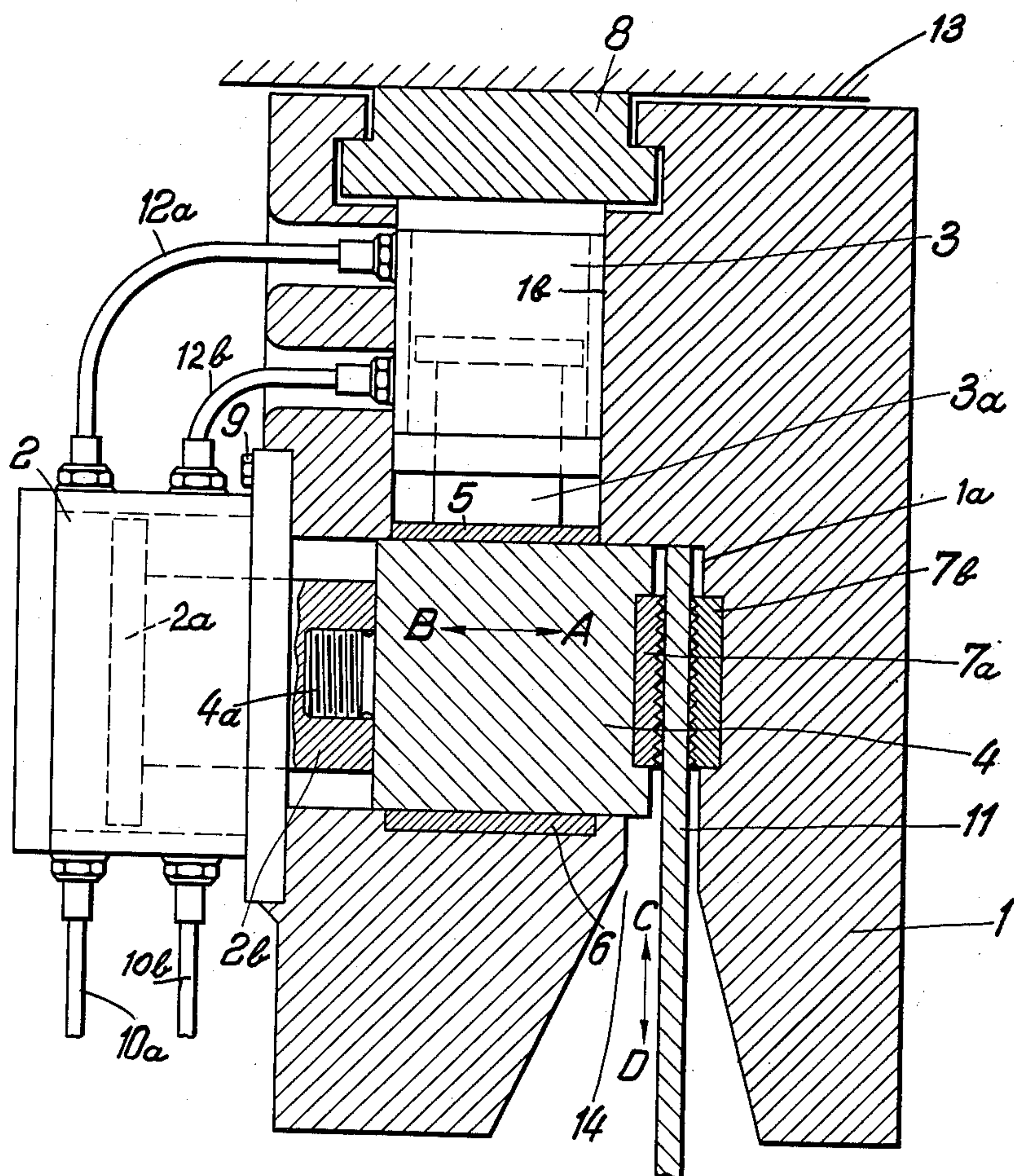


Fig. 1

Inventor:
LUDWIG MÜLLER
By *Hane and Nydick*
ATTORNEYS

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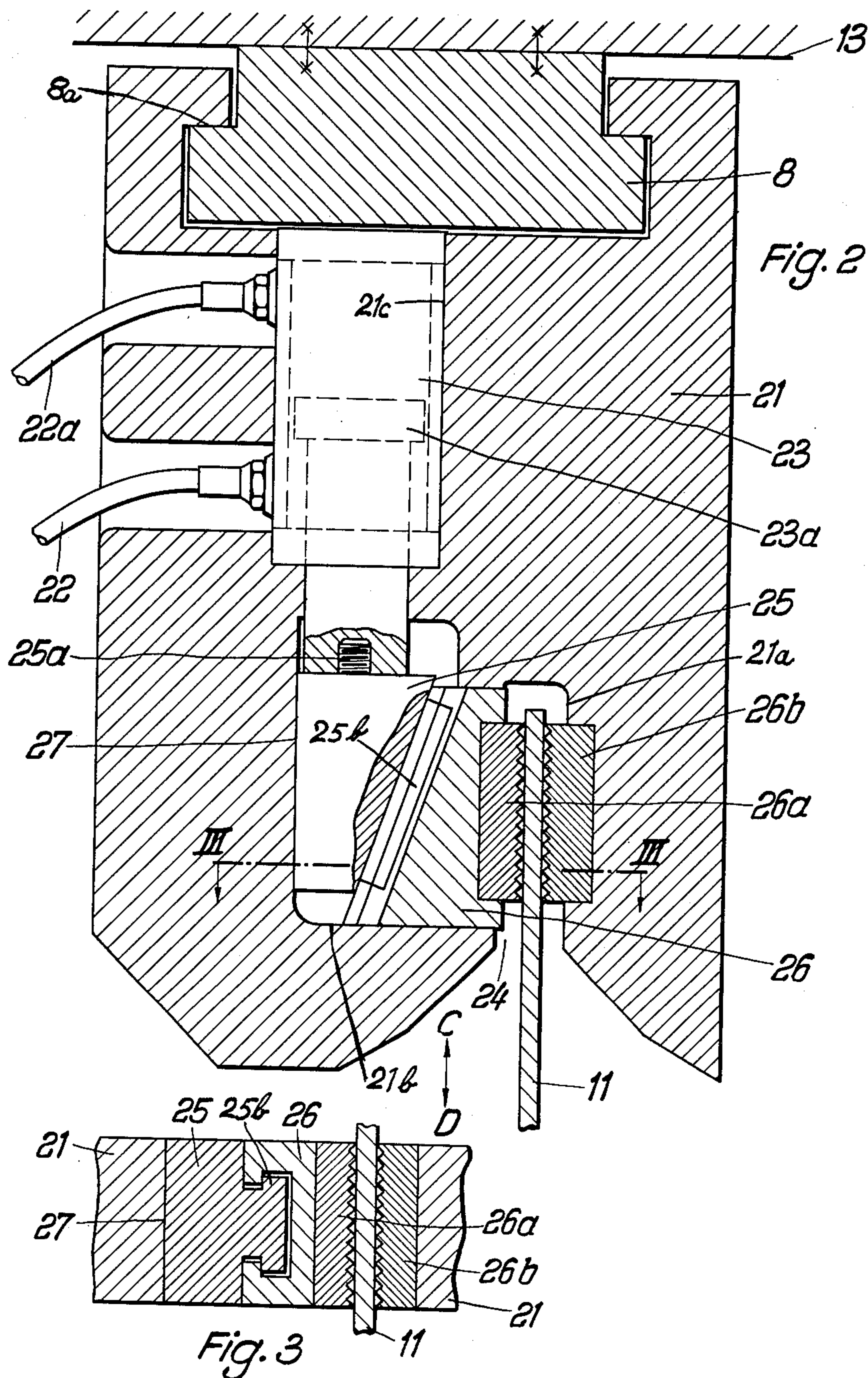
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Inventor:
LUDWIG MÜLLER
By Hauer and Nydick
ATTORNEYS

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CLAMPING DEVICE FOR CLAMPING A PILE BODY TO A VIBRATORY DEVICE

Ludwig Müller, Heinrich-Heine-Str. 41,
Marburg (Lahn), Germany

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The present invention relates to a clamping device for clamping a vibratory device to a pile body such as a sheet pile, etc. to be driven or extracted, and more particularly to a clamping device which clamps the pile body to be driven or extracted by means of clamping jaws movable into and out of a clamping position.

Clamping devices of the general kind above referred to afford a safe clamping action even for high static and dynamic loads due to a displacement of the clamping jaws transverse of the working direction during driving or extracting of a pile body, provided the device is carefully and correctly fitted upon the pile body to be driven or extracted. Such fitting is time-consuming and often difficult, the more so as pile bodies such as pile sheets are often somewhat bent or twisted, especially at the part to be gripped by the clamping device. Obviously, the fitting of the clamping devices could be facilitated by providing a wide receiving opening at the clamping jaws of the device. However, clamping devices of the general kind above referred to, as heretofore known, inherently preclude the provision of a wide receiving opening due to the required ratio of transmission, generally about 100:1, between the clamping jaws and the pressure means acting upon the same. As a result of such required high ratio of transmission, an insertion opening as wide as desirable would require a size of the pressure means and the guide means therefor so large that it is not practical.

It is a broad object of the present invention to provide a novel and improved clamping device of the general kind above referred to, which permits the provision of a wide receiving opening without requiring an enlargement of the components required for actuating the clamping jaws.

A more specific object of the invention is to provide a novel and improved clamping device which does not require the aforementioned high transmission ratio thereby obviating the need for providing unduly enlarged pressure means and corresponding enlarged guide means therefor.

Another more specific object of the invention is to provide a novel and improved clamping device which can be clamped to the pile body to be driven or extracted even if the usual clamping position of the device is not convenient or feasible due to the configuration of the pile body or due to the specific local conditions.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and set forth in the appended claims constituting part of the application.

In the accompanying drawings several preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is an elevational sectional view of a clamping device according to the invention.

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FIG. 2 is a similar sectional view of a modification of the clamping device, and

FIG. 3 is a section taken on line III—III of FIG. 2.

Referring first to FIG. 1, the clamping device according to this figure comprises a support frame 1 in which is formed a receiving opening in the form of a slot 14, the lower part of which is widened to facilitate the insertion of a pile body such as a sheet pile 11 to be driven into the ground or extracted therefrom. Pile 11 is clamped between a pair of clamping jaws, one of which is stationary and formed by a wall portion 1a of frame 1 defining one side of the upper narrow end of slot 14. To facilitate gripping of pile 11 a gripping member 7b is fixedly secured in the aforesaid frame wall. The surface of member 7b facing the slot is suitably roughened, for instance milled, as shown in the figure. The fixed clamping jaw 1a coacts with a movable clamping jaw 4 which is slidable toward and away from the fixed clamping jaw transverse of the longitudinal axis of slot 14. Jaw 4 is slidable in either direction as indicated by the arrows A—B and is guided in the frame by guide plates 5 and 6 which are preferably removably mounted so that they can be conveniently replaced in the event of excessive wear. A gripping member 7a similar to gripping member 7b is fixedly fitted in movable jaw 4.

As is apparent, displacement of jaw 4 toward the fixed clamping jaw, that is in the direction of arrow A requires very little force, a high force being only needed for the actual tightening of pile 11 between the clamping jaws.

The displacement of jaw 4 in either direction is effected by a pressure means generally designated 2, secured to frame 1 by suitable fastening means such as bolts 9. The pressure means comprises a cylinder in which is slidable a piston 2a mounted on a piston rod 2b secured to clamping jaw 4 by a screw connection 4a. Pressure fluid such as oil or air under pressure can be selectively fed to one side or the other of piston 2a by means of conduits 10a and 10b. As is apparent, admission of pressure fluid through conduit 10a and discharge of fluid through conduit 10b will cause movement of jaw 4 in the direction of arrow A and the reversal of the feed and discharge of the pressure fluid will move the jaw into the direction of arrow B. The control of the flow of pressure fluid through conduits 10a and 10b can be effected by any of the control valve arrangements well known for the purpose.

As is apparent, the ratio of transmission in a clamping device according to the invention, as exemplified in FIG. 1, is or may be a ratio of 1:1. Accordingly, there is ample space in the device to provide an insertion opening or slot of the desired width.

To effect driving or extraction of pile 11 the clamping device and with it pile 11 must be coupled by vibration transmitting coupling means with a vibrator which supplies the actual working force. The vibrator is indicated at 13 and should be visualized as being of conventional design so that a detailed description and illustration of the vibrator are not believed to be essential for an understanding of the invention. The clamping device is coupled to the vibrator by means of a coupling member 8 loosely keyed in frame 1. Member 8 faces on one side vibrator 13 and on the other side a cylindrical opening 1b in which

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a cylinder 3 is displaceable between a position tightly abutting against the lower side of member 8 and a loose position. Cylinder 3 houses a piston 3a which in turn engages guide plate 5. Pressure fluid can be supplied to cylinder 3 and discharged therefrom by conduits 12a and 12b which connect the cylinder of the pressure means 2 with the coupling means.

As is apparent, the admission of pressure fluid into cylinder 3 through conduit 12a and the discharge of the pressure fluid through conduit 12b will move cylinder 3 into the direction of arrow C and the piston 3a into the direction of arrow D. As a result, jaw 4 is pressed downwardly, that is against guide plate 6 and coupling member 8 is pressed against vibrator 13 and frame 1. As a result, the entire clamping device is under tension and vibrations can be transmitted from vibrator 13 to pile 11.

In order to release pile 11 from the clamping device the feed of pressure fluid to the cylinders through the conduits is reversed.

FIGS. 2 and 3 show a clamping device which is similar in principle to that of FIG. 1, except that the pressure means and the coupling means are combined to a certain extent and exert pressure in the same direction. According to FIGS. 2 and 3, a support frame 21 is formed with a receiving opening or slot 24 of the desired dimensions. A gripping member 26b is fixedly secured in the wall portion 21a of the frame constituting the fixed clamping jaw of the device. The movable clamping jaw comprises two wedge-shaped members 25 and 26. A gripping member 26a similar to gripping member 26b is fixedly secured to jaw member 26. Jaw member 26 is slidably guided along wall portions 21b of frame 21 for displacement transversely of the longitudinal plane of slot 24, that is transversely of the direction in which pile 11 is either to be driven or extracted. The jaw member is slidably keyed to the second jaw member 25 by means of a key portion 25b engaging a correspondingly shaped key way in jaw member 26. Jaw member 25 is slidable along wall portion 27 of frame 21 in a direction parallel to the slot, that is in the working direction. As is evident, a displacement of jaw member 25 in the direction of arrow D will move jaw member 26 toward its clamping position and a movement of jaw member 25 in the direction of arrow C will release the jaw member 26. Jaw member 25 is coupled to the piston rod of a piston 23a by means of a screw connection 25a. Piston 23a is slidable in a cylinder 23 which in turn is slidable in a cylindrical bore 21c formed in frame 21. Pressure fluid such as oil or air under pressure can be supplied to or discharged from cylinder 23 at either side of piston 23a by means of conduits 22 and 22a.

The operation of the device according to FIGS. 2 and 3 is evident from the previous description. It suffices to state that the admission of pressure fluid through conduit 22a and discharge of pressure fluid through conduit 22 will press cylinder 23 upwardly, that is against coupling member 8 which in turn will be pressed against vibrator 13 and frame 21. As is shown, coupling member 8 is pressed against frame 21 along the shoulders 8a. Piston 23a will force downwardly jaw member 25 which in turn will press jaw member 26 against a pile inserted in slot 24. The entire clamping device is now tensioned so that force can be transmitted from vibrator 13 to pile 11.

Release of the clamping device is effected by reversing the fluid flow through conduits 22 and 22a.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departure from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

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What is claimed as new and desired to be secured by Letters Patent is:

1. A clamping device for clamping a vibratory device to a pile body to be driven and extracted respectively, said clamping device comprising a support frame, a pair of clamping jaws supported on the frame, one of said jaws being fixedly secured and the other being movable toward and away from said fixed clamping jaw, pressure means coacting with said movable jaw for clamping a pile body between said two jaws and releasing it therefrom, and coupling means supported on said frame, said coupling means including two members movable in opposite directions in a plane transverse of the direction of movement of said movable jaw, one of said members being movable into pressure engagement with the movable jaw for locking the same in clamping position and the other being arranged to coact with a vibratory device for coupling the clamping device to the vibratory device in vibration transmitting engagement.

2. A clamping device for clamping a vibratory device to a pile body to be driven and extracted respectively, said clamping device comprising a support frame formed with a receiving slot for the insertion of a pile body, a pair of clamping jaws supported on said frame, one of said jaws being fixedly secured and defining a side wall portion of said slot and the other being movable into and out of a clamping position in reference to said fixed jaw, pressure means for moving said movable jaw into said clamping position to clamp a pile body inserted in said slot between said two jaws, and coupling means supported on said frame, said coupling means including two members movable in opposite directions in a plane parallel to the length of said slot, one of said members being movable into pressure engagement with said movable jaw for locking the same in clamping position and the other being arranged to engage a vibratory device for coupling the clamping device to the vibratory device in vibration transmitting engagement.

3. A clamping device according to claim 2 wherein one of the members of said coupling means is a cylinder mounted in the frame transverse to the direction of movement of said movable jaw and the other a piston slidable in said cylinder, and wherein said coupling means further comprise conduit means communicating with said cylinder on both sides of the piston therein for selectively feeding pressure fluid to one of the sides of the piston to displace the latter in a selected direction and the cylinder in the opposite direction.

4. A clamping device according to claim 2 wherein said movable jaw is movable transversely of the length of said slot and has a clamping surface parallel to the surface of the fixed jaw forming said side wall portion.

5. A clamping device for clamping a vibratory device to a pile body to be driven and extracted respectively, said clamping device comprising a support frame formed with a receiving slot for the insertion of a pile body, a pair of clamping jaws supported on said frame, one jaw being fixedly secured and defining a side wall portion of said slot and the other being movable into and out of a clamping position in reference to said fixed jaw, said movable jaw having two wedge-shaped members in abutment with each other, one of said members being movable transverse of the length of said slot to move said jaw member toward and away from said fixed jaw and the other jaw member being movable at an angle in reference to the direction of movement of said one jaw member, movement of said other jaw member displacing said one jaw member, and coupling and pressure means coacting with said other jaw member for pressing the same and said one jaw member into positions in which a pile body inserted in said slots is clamped between the two jaws and for coupling said jaws and frame to a vibratory device in vibration transmitting engagement.

6. A clamping device according to claim 5 wherein said pressure and coupling means comprise two mem-

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bers movable in opposite directions in a plane transverse of the direction of movement of said one jaw member of said movable jaw, one of said members of said coupling and pressure means being movable into pressure engagement with said other jaw member to lock the same in position and the other member of said coupling and pressure means being arranged to engage a vibratory device for coupling the clamping device to said vibratory device in vibration transmitting engagement.

7. A clamping device according to claim 5 wherein said two members of the movable jaw abut against each

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other along surfaces slanted in respect to the direction of movement of said one jaw member, and wherein said abutting slanted surfaces are slidably keyed to each other.

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