

Feb. 25, 1947.

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2,416,501

GROUND BORING DEVICE

Filed Feb. 5, 1943

2 Sheets-Sheet 1

Fig. 2

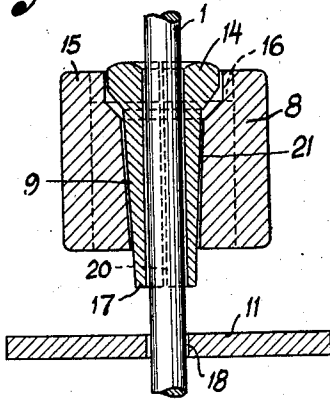


Fig. 3

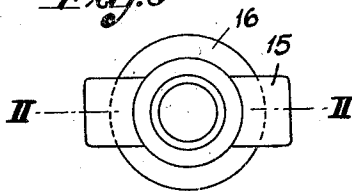
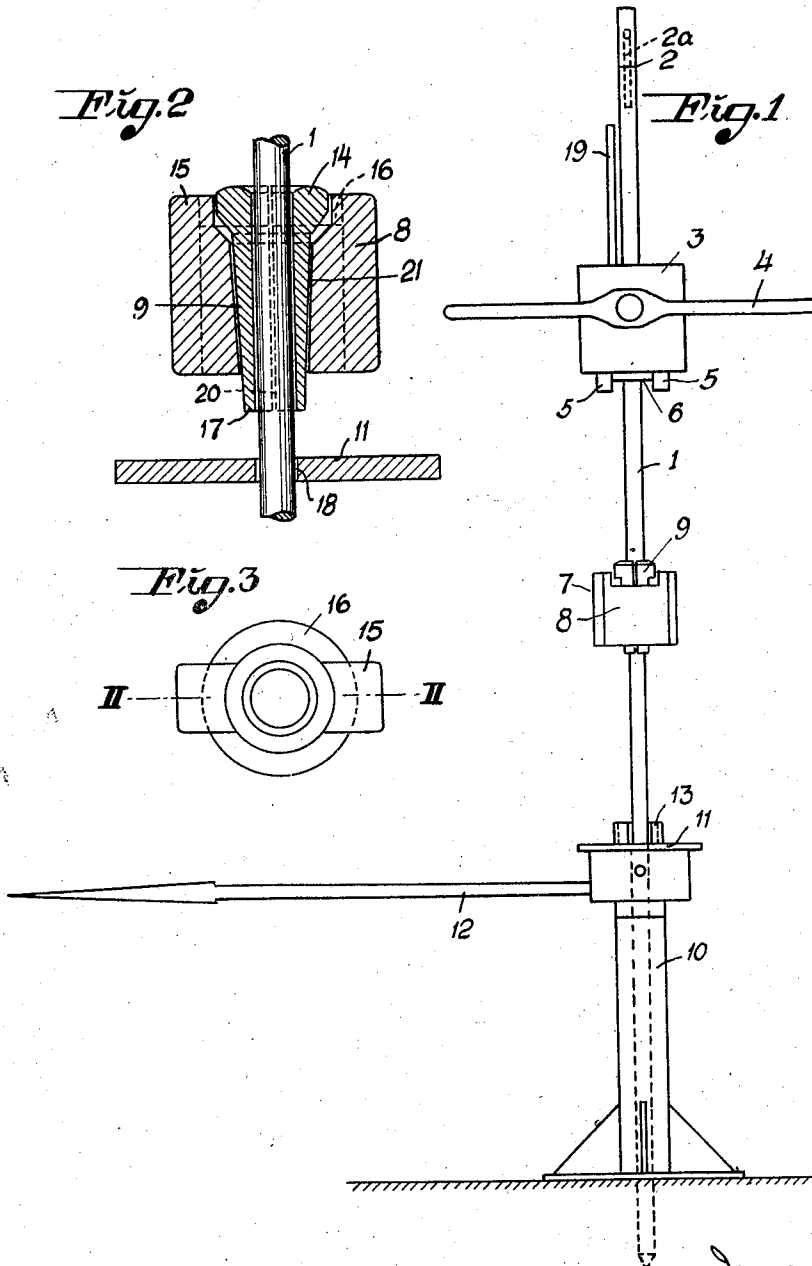


Fig. 1



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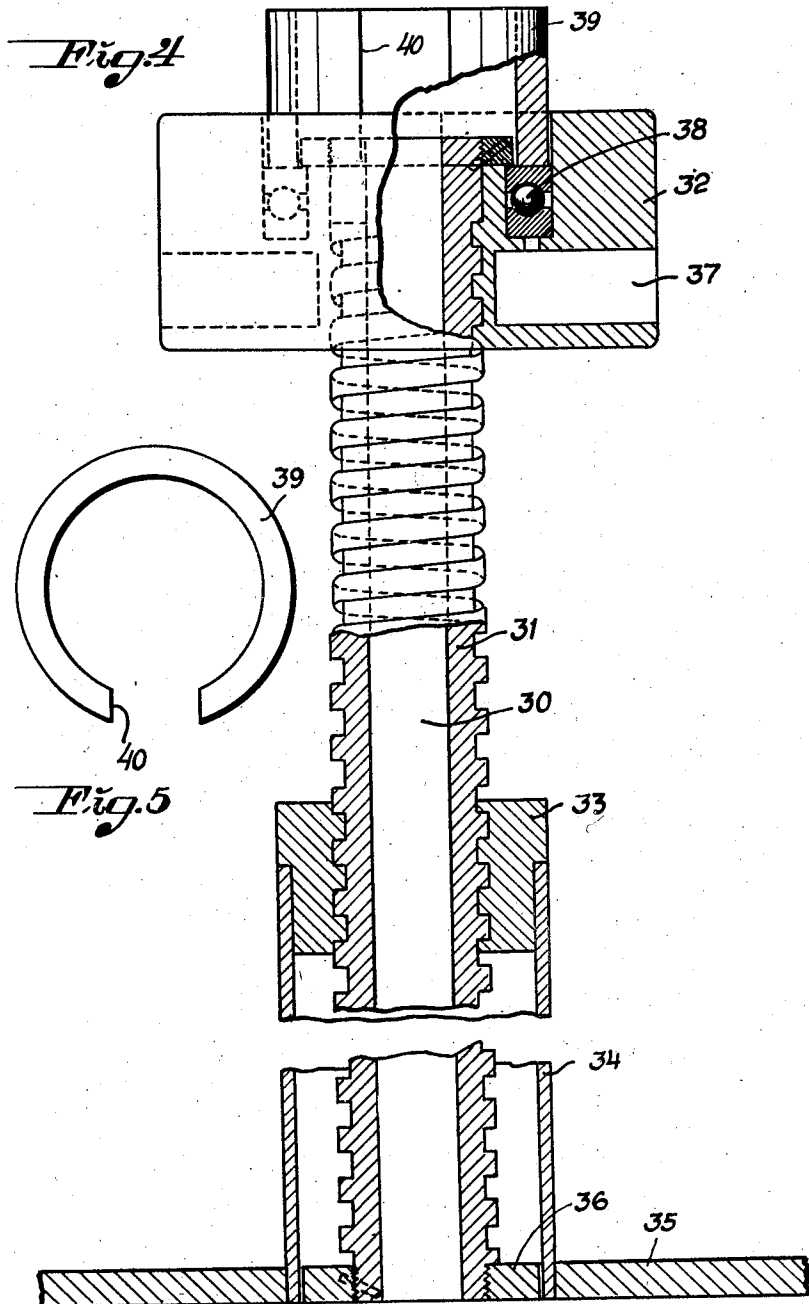
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UNITED STATES PATENT OFFICE

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GROUND BORING DEVICE

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16 Claims. (Cl. 61—73)

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This invention relates to improvements in ground boring devices.

For certain ground tests, ground boring devices are used which comprise a rigid rod or tube having, for instance, a diameter of one inch or more, which rod or tube is driven into the ground in vertical or substantially vertical direction. If the depth of the hole to be bored is considerable, for instance 100 ft. or more, the boring rod consists of a plurality of rod members longitudinally joined to another. Usually, the rod is driven into the ground by means of a ram or hammer having an opening for the rod, said hammer being adapted to strike a blow upon a blow transmitting member detachably secured to the rod. Said blow transmitting member is gradually moved upwards on the rod as the latter is driven down more and more into the ground. Hitherto, the blow transmitting member is usually secured to the bore rod by means of a screw-actuated clamping device, which, however, is not absolutely reliable and the operation of which is time-wasting. Further, the bore rod is liable to be deformed by the heavy clamping action which is often necessary to secure firm engagement between the rod and the blow transmitting member. The above named construction is not only inconvenient in manipulation but is detrimental to the bore rod which is frequently subject to wear due to the fact that the blow transmitting device, especially when operating in hard ground, is sliding on the rod in clamped position. A further inconvenience coherent with ground boring devices of the type considered consists in the use of impractical lifting jacks or similar mechanisms for lifting the rod driven down into the ground.

The invention has for its object to provide a ground boring or penetrating device of the character indicated, by which the above inconveniences are entirely avoided. The principal object of the invention is to provide a blow transmitting device which automatically can be fastened to, and released from the bore rod by the agency of the bore driving hammer. A further object of the invention is to provide a jack device for convenient lifting of the rod from the ground after the boring operation is finished.

Further objects of the invention will appear from the following description of a preferred embodiment of the invention, reference being had to the accompanying drawings forming part of this specification and in which—

Fig. 1 is a general view of the boring device with the various parts thereof in operative positions; Fig. 2 is a sectional view, to an enlarged

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scale, of the blow transmitting device, and the movable plate associated with the bore rod; Fig. 3 is a top view of the blow transmitting member shown in Fig. 2; with the wedge members omitted; Fig. 4 is a vertical sectional view through a lifting device, parts thereof being shown in elevation; and Fig. 5 is a top view of a detail belonging to the lifting device.

The invention may be applied not only to ground boring or penetrating devices but also to similar devices by means of which a member of tube or rod shape is to be forced into, and withdrawn from a mass or body. Although the invention is particularly intended to be used in connection with rods or tubes for ground testing purposes and having a diameter of one inch or some inches, it will be obvious that the invention may be equally well used for tubes or rods having smaller or larger cross-sections, for instance, for tubes having an outer diameter of some feet.

Referring now to the drawing, numeral 1 indicates the bore rod which is intended to be driven into the ground and which normally consists of a plurality of rod members suitably secured to each other, each rod member having, for instance, a length of about 10 ft. The joints 2 are advantageously constructed in a manner such that the end portions of the rods are provided with internal threads for a connecting screw 2a so as to avoid projecting parts, such as connecting sleeves or the like members. Numeral 3 indicates a ram or hammer having a central passageway for the rod 1 and being provided with operating handles 4 and downwardly extending abutting faces 5 and 6. The hammer is intended to strike blows upon a blow transmitting member 7 consisting of a casing 8 and a number of wedges 9 surrounding the bore rod 1. The rod 1 further extends through a combined vertically adjustable support and lifting jack 10 which will be described in detail later on and on which there is resting a movable plate 11 having a central opening 13 for the rod 1 (Fig. 2). The jack 10 can be operated manually by means of an iron bar or lever 12 having a needle point 12' on its outer end which may be used for making a starting hole for the rod to be driven into the ground.

As will be seen from Fig. 2, the casing 8 has a central bore in the shape of an inverted frustum of a cone. The inner face 21 of the casing is arranged to cooperate with the outer faces of the wedges 9 whereby to force the inner faces of the wedges into locking engagement with the rod 1. If the hammer 3 is turned through 90° about the rod 1 as compared with the position shown in

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Fig. 1, the abutment 6 will strike, upon downward movement of the hammer, on the upper abutments 14 of the wedges and thereby cause firm engagement between the casing 8 and the wedges 9 and between the wedges and the rod 1, with the result that the bore rod will be moved downwards together with the blow transmitting member so as to be driven into the ground. With the hammer in the angular position indicated, the abutments 5 will not come into contact with the blow transmitting member. If the blow transmitting member has been forced downwards to a certain extent, it must be moved a certain distance upwardly relative to the rod 1. To this end, the hammer 3 is turned into the position shown in Fig. 1, in which the abutments 5, which are projecting downwardly beyond the abutment 6, will come, upon downward movement of the hammer, into contact with upwardly projecting abutments 15 on the casing 8, which abutments extend above the upper edge 16 of the casing (see also Fig. 3).

In the position shown in Fig. 1, when the abutments 5 are striking upon the abutments 15, the casing 8 will tend to get loose from its locking engagement with the wedges. However, the casing and the wedges are normally so firmly interlocked that, if the ground is loose or yielding, the member 8, 9 will be forced downwards together with the rod rather than be unfastened from the rod. In order to ensure releasing of the blow transmitting member from the rod even if the latter continues to move downwards, a combined support and lifting jack is provided between the downwardly projecting lower ends 17 of the wedges and the ground, which support prevents continued downward movement of the wedges. The said support is constructed and arranged to constitute a combined adjustable support and rod lifter comprising a lifting jack 10 which steadily rests on the ground and through which the rod 1 extends so as to be guided and maintained properly in position relative to the work. The loose plate 11 prevents the support 10 from being damaged by engagement with the blow transmitting member. When the lower end portions 17 of the wedges come into contact with the plate 11 resting on the support, the hammer 5 striking on the casing 8 will release the same from the wedges, thereby unfastening the blow transmitting member from the rod 1.

If the boring operation is to be continued, the blow transmitting member 7 is to be moved upwards a certain distance on the rod 1. To this end, the plate 11 is preferably rapidly lifted together with the blow transmitting member resting thereon, the hammer 3 being again turned through an angle of 90° and maintained in a position a certain distance above the jack. If, during the rapid upward movement of the blow transmitting member, the upper portions 14 of the wedges come into contact with the abutment 6, the casing 8 will due to inertia continue its upward movement so as to effect sufficient engagement with the wedges to fasten the blow transmitting member to the rod 1.

In order to obtain rational tests of the qualities of the ground with respect to its resistance to the downward movement of the bore rod, the hammer should exert blows of equal power at each downward stroke. In other words, the hammer should always be lifted to the same height above the blow transmitting member and be allowed freely to fall by its own weight. To this end, the hammer is advantageously provided with a measur-

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ing-stick 19 of suitable length, by means of which a mark may be taken on the bore rod to indicate the position to which a certain part of the hammer is to be lifted.

Although the wedges shown in the drawing by way of example are projecting above and below the end faces of the casing 8, it will be obvious that the invention is not limited to this particular construction, and that one or both end portions of the wedges may be located within the casing, in which instance the projecting portions 14 and 17 may be replaced by suitable rings or similar members. Obviously, the inner abutment 6 may be located at a lower level than the outer abutments 5, in which instance the upper faces of the wedges should be located below the abutments 15 or even below the upper edge 16 of the casing 8.

In order to obtain firm engagement of the blow transmitting member, there must be a certain clearance 20 between the wedges when they are abutting both against the casing and the rod 1. Although two wedges are shown in the drawing, it is obvious that one wedge only or more than two wedges may be used.

The lifting jack illustrated in Fig. 4 comprising a screw 31 with a central bore 30 for the rod 1 and a head 32 rigidly secured to the upper end of the screw by any suitable means such as the pin 42 (Fig. 4). The screw cooperates with a nut 33 secured to a casing 34 which by means of a base plate 35 steadily rests on the ground. At its lower end, the screw 31 has secured thereto a guide ring 36 serving also as a base plate for the screw. If the ring 36 is threaded onto the screw, the path of the threads is advantageously opposite to that of the screw 31. The head 32 has, for instance, four symmetrically disposed radial holes 37 for engagement with one or more bars or levers 12 (see Fig. 1) for rotating the screw 31. It will be seen that the hollow sleeve or jack member 31 may be inserted in position before the rod or elongated member 1 is driven into the ground or material, so that the sleeve is immediately available to be brought into operation to extract the rod or penetrating member 1 from the ground or work.

During the operation of the combined support and lifting jack 10, the head 32 is acting upon a flow transmitting member or an ordinary pipe tong secured to the bore rod. If, however, according to the embodiment shown, the head 32 is rotated upon upward movement of the screw, it is preferred to provide the head with a bearing which advantageously is in the form of an axial thrust ball bearing 38. If, according to Fig. 4, the bearing 38 is sunk into the head 32, in order to protect the bearing when the jack is used as a support for releasing the blow transmitting member from the bore rod, a loose ring or similar member 39 is preferably placed between the bearing and the member secured to the rod. The ring 39 has a longitudinal slot 40 so that it can be easily removed from the rod.

The blow transmitting member secured to the rod may, in smaller boring devices, consist of one or more pipe tongs. In cases where great forces are necessary to lift the bore rod out of the ground, said member is advantageously constituted by the blow transmitting member. In this case, the lifting force is transmitted to the casing 8 of the blow transmitting member 7 by means of a ring 13 (see Fig. 1) similar to the ring 39 and placed upon the plate 11. The blow transmitting member may be placed upside down, in which

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instance the lifting force will be transmitted to the wedges 9.

The invention is obviously not limited to the construction of the lifting jack just described. While, in the embodiment illustrated, the head 32 is rigidly fixed to the screw, it may instead thereof be rotatably mounted on the screw which, in this instance, may be provided with holes for the bars or levers 12. In a similar manner, the nut 33 may be mounted for rotation, and the screw arranged to move in axial direction without rotation.

Also in other respects, the invention is not limited to the embodiment thereof shown and described above. For instance, the blow transmitting member may be disposed or constructed in a manner such that, when the bore rod is to be driven into the ground, the blows are delivered upon the casing 3 rather than upon the wedges.

What I claim is:

1. A ground penetrating device comprising a rod, a hammer movable longitudinally of said rod, and a blow transmitting member on said rod, said blow transmitting member including a casing and at least one wedge movable relative to said casing whereby either to fasten said blow transmitting member to, or to release said member from said rod, and said hammer having two abutments and being arranged to assume different angular positions relative to said blow transmitting member, one of said abutments being arranged in one of said positions to contact with said casing to release the blow transmitting member from the rod, and the other one of said abutments being arranged in another position of said hammer to contact with said wedge to fasten the blow transmitting member to the rod.

2. A ground penetrating device comprising a rod, a hammer movable longitudinally of said rod and rotatable to assume different angular positions relative to said rod, and a blow transmitting member on said rod, said blow transmitting member including a casing and at least one wedge movable relative to said casing whereby either to fasten said blow transmitting member to, or to release said member from said rod, said hammer including a first abutment arranged in one of said positions to contact with said casing to release the blow transmitting member from the rod, and a second abutment arranged in another position of said hammer to contact with said wedge to fasten the blow transmitting member to the rod, said wedge being arranged in the fastening position to project outside at least one end of said casing.

3. A ground penetrating device comprising a rod, a hammer movable longitudinally of said rod and rotatable to assume different angular positions relative to a blow transmitting member, and a blow transmitting member on said rod, said blow transmitting member including a casing and at least one wedge movable relative to said casing whereby either to fasten said blow transmitting member to, or to release said member from said rod, said hammer including a first abutment arranged in one of said positions to contact with said casing to release the blow transmitting member from the rod, and a second abutment arranged in another position of said hammer to contact with said wedge to fasten the blow transmitting member to the rod, said first abutment projecting beyond said second abut-

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ment as viewed in the direction of the working stroke of said hammer.

4. A ground penetrating device comprising a rod, a hammer movable longitudinally of said rod and rotatable to assume different angular positions relative to a blow transmitting member, and a blow transmitting member on said rod, said blow transmitting member including a casing and at least one wedge movable relative to said casing whereby either to fasten said blow transmitting member to, or to release said member from said rod, said hammer including a first abutment arranged in one of said positions to contact with said casing to release the blow transmitting member from the rod, and a second abutment arranged in another position of said hammer to contact with said wedge to fasten the blow transmitting member to the rod, said abutments being located at different radial distances from said rod.

5. A penetrating device of the class described including a hammer, a blow transmitting member arranged to be engaged by the hammer, said hammer being rotatable relative to said blow transmitting member and having spaced surfaces arranged to selectively engage complementary surfaces on said blow transmitting member so that in one position the hammer when brought into engagement with the blow transmitting member fastens the latter to a tool and rotated to another position releases the blow transmitting member from the tool, the parts being constructed and arranged so that when the hammer contacts one of said spaced surfaces, the other surface is out of contact therewith.

6. A ground penetrating device comprising a rod, a rotatable hammer movable longitudinally of the rod, a blow transmitting member on said rod having separate outer and inner coaxially disposed wedging elements, said hammer having transversely disposed offset surfaces, one of said surfaces arranged to engage one of the wedging elements to fasten the blow transmitting member to the rod and the other surface arranged to contact the other wedging element to release the blow transmitting element from the rod, the parts being constructed and arranged so that when the hammer is rotated to contact with one of the wedging elements, the other wedging element is free from engagement therewith.

7. A ground penetrating device comprising a rod, a rotatable hammer movable longitudinally of the rod, a blow transmitting member on said rod having separate outer and inner coaxially disposed wedging elements, said hammer having transversely disposed offset surfaces, one of said surfaces arranged to engage the inner wedging element to fasten the blow transmitting member to the rod and the other surface arranged to contact with the outer wedging element to release the blow transmitting element from the rod, the parts being constructed and arranged so that when the hammer is rotated to contact with one of the wedging elements, the other wedging element is free from engagement therewith.

8. A penetrating device comprising an elongated member, a hammer, a blow transmitting member including inner and outer wedging elements adapted to be fastened to said elongated member upon the working stroke of said hammer as the latter is brought into contact with one of said wedging elements and adapted to be released from said elongated member upon the working stroke of said hammer as the latter is

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brought into contact with the other of said wedging elements, the parts being constructed and arranged so that when the hammer is brought in a position to contact with one of the wedging elements the other wedging element is free from engagement therewith, and a support for the blow transmitting member having a vertical opening through which the elongated member extends, said blow transmitting member being movable downwardly during the operation of the device to rest on the support, said hammer when the blow transmitting member contacts said support being moved to a position so that the hammer when brought into contact with the blow transmitting member strikes the other of said wedging elements to release the blow transmitting member from the elongated member.

9. A penetrating device comprising an elongated member, a hammer, a blow transmitting member including inner and outer wedging elements adapted to be fastened to said elongated member upon the working stroke of said hammer as the latter is brought into contact with one of said wedging elements and adapted to be released from said elongated member upon the working stroke of said hammer as the latter is brought into contact with the other of said wedging elements, the parts being constructed and arranged so that when the hammer is brought in a position to contact with one of the wedging elements the other wedging element is free from engagement therewith, a support for the blow transmitting member having a vertical opening through which the elongated member extends, said blow transmitting member being movable downwardly during the operation of the device to rest on the support, said hammer when the blow transmitting member contacts said support being turned so that the hammer when brought into contact with the blow transmitting member strikes the other of said wedging elements to release the blow transmitting member from the elongated member, and a plate mounted on the top of the support having an opening through which the elongated member extends, said plate being arranged to raise the blow transmitting member away from the support when the wedging elements are released from the elongated member.

10. A penetrating device comprising a boring rod, a hammer, a blow transmitting member including inner and outer wedging elements adapted to be fastened to said rod upon the working stroke of the hammer when the latter is brought into contact with the inner wedging element and adapted to be released from said rod upon the working stroke of said hammer as the latter is brought into contact with the outer wedging element, the parts being constructed and arranged so that when the hammer is brought in a position to contact with one of the wedging elements the other wedging element is free from engagement therewith, and an adjustable support having a vertical opening through which the boring rod extends, said blow transmitting member being movable downwardly during the operation of the device to rest on the support, said hammer when the blow transmitting member rests on the support being turned so that upon continued operation, the hammer contacts with the outer wedging member to release the blow transmitting member from the rod.

11. A penetrating device comprising a boring rod, a hammer, a blow transmitting member including inner and outer wedging elements adapt-

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ed to be fastened to said rod upon the working stroke of the hammer when the latter is brought into contact with the inner wedging element and adapted to be released from said rod upon the working stroke of said hammer as the latter is brought into contact with the outer wedging element, the parts being constructed and arranged so that when the hammer is brought in a position to contact with one of the wedging elements the other wedging element is free from engagement therewith, an adjustable support having a vertical opening through which the boring rod extends, said blow transmitting member being movable downwardly during the operation of the device to rest on the support, said hammer when the blow transmitting member rests on the support being turned so that upon continued operation, the hammer contacts with the outer wedging member to release the blow transmitting member from the rod, and a plate longitudinally slidable on the boring rod and arranged to rest on the top of said support, said plate when the blow transmitting member is released from the rod being arranged to move the blow transmitting member away from the support.

12. A ground penetrating device comprising a rod, a rotatable hammer movable longitudinally of the rod, a blow transmitting member on said rod having separate outer and inner coaxially disposed wedging elements, said hammer having transversely disposed offset surfaces, one of said surfaces arranged to engage the inner wedging element to fasten the blow transmitting member to the rod and the other surface arranged to contact with the outer wedging element to release the blow transmitting element from the rod, the parts being constructed and arranged so that when the hammer is rotated to contact with one of the wedging elements, the other wedging element is free from engagement therewith, a support for the blow transmitting member having a vertical opening through which the rod extends, said blow transmitting member being movable during the operation of the device to rest on the support, said hammer when the blow transmitting member contacts said support being turned so that the hammer when brought into contact with the blow transmitting member strikes the outer wedging element to release the blow transmitting member from the rod.

13. A ground penetrating device comprising a rod, a rotatable hammer movable longitudinally of the rod, a blow transmitting member on said rod having separate outer and inner coaxially disposed wedging elements, said hammer having transversely disposed offset surfaces, one of said surfaces arranged to engage the inner wedging element to fasten the blow transmitting member to the rod and the other surface arranged to contact with the outer wedging element to release the blow transmitting element from the rod, the parts being constructed and arranged so that when the hammer is rotated to contact with one of the wedging elements, the other wedging element is free from engagement therewith, a support for the blow transmitting member having a vertical opening through which the rod extends, said blow transmitting member being movable during the operation of the device to rest on the support, said hammer when the blow transmitting member contacts said support being turned so that the hammer when brought into contact with the blow transmitting member strikes the outer wedging element to release the blow transmitting member from the elongated member, and

a plate mounted on the top of the support having an opening through which the rod extends, said plate being arranged to raise the blow transmitting member away from the support when the wedging elements are released from the rod and the hammer is raised to its uppermost position, so that when the blow transmitting member contacts with the hammer, it will cause the wedging elements to be fastened to the rod.

14. A ground penetrating device comprising a rod, a rotatable hammer movable longitudinally of the rod, a blow transmitting member on said rod having separate outer and inner coaxially disposed wedging elements, said hammer having transversely disposed surfaces, one of said surfaces arranged to engage one of the wedging elements to fasten the blow transmitting member to the rod and the other surface arranged to contact the other wedging element to release the blow transmitting element from the rod, the parts being constructed and arranged so that when the hammer is rotated to contact with one of the wedging elements, the other wedging element is free from engagement therewith.

15. A penetrating device having in combination an elongated member, a hammer, a blow transmitting member including inner and outer wedging elements adapted to be fastened to said elongated member upon the working stroke of said hammer as the latter is brought into contact with one of said wedging elements, the parts being constructed and arranged so that when the hammer contacts one of the wedging elements it is out of contact with the other wedging element, a shifting support for the blow transmitting member having a vertical opening and being longitudinally slidable on said elongated member, said shifting support, when the wedging elements are

released from the elongated member and said hammer is raised to its uppermost position, being arranged to move the blow transmitting member rapidly against the hammer so that when the blow transmitting member contacts with the hammer it will cause the wedging elements to be fastened to the elongated member.

16. A penetrating device of the class described comprising an elongated member to be driven into a material by the blows of a hammer, a blow transmitting member comprising an outer wedging member and a plurality of separate, symmetrically disposed inner wedging members adapted to be arranged around and to be fastened to said elongated member, and a hammer slidable along the elongated member to simultaneously apply impacts on the symmetrically arranged inner wedging members without contacting the outer wedging member.

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