

A. R. MANGNALL.  
EARTH BORING APPARATUS.  
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1,370,031.

Patented Mar. 1, 1921.

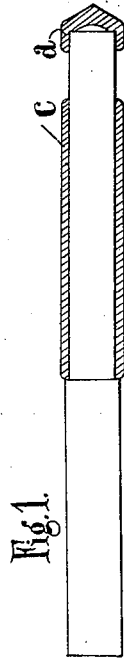


Fig. 1.

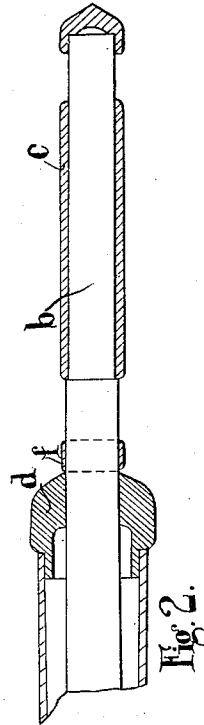
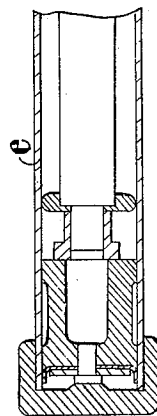
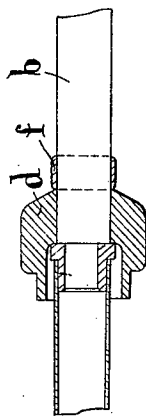


Fig. 2.



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# UNITED STATES PATENT OFFICE.

ARTHUR RIVINGTON MANGNALL, OF CHESTER, ENGLAND.

## EARTH-BORING APPARATUS.

1,370,031.

Specification of Letters Patent.

Patented Mar. 1, 1921.

Application filed November 6, 1920. Serial No. 422,310.

*To all whom it may concern:*

Be it known that I, ARTHUR RIVINGTON MANGNALL, M. C., A. M. I. C. E., A. M. I. M. E., a subject of the King of Great Britain and Ireland, and residing at 43 White Friars, Chester, in the county of Chester, England, have invented certain new and useful Improvements in Earth-Boring Apparatus, of which the following is a specification.

This invention relates to earth boring apparatus of the type comprising a pilot head formed or provided with a length of rigid pipe, rod or the like, and adapted to be actuated by a push pipe or the like for the purpose of boring by displacement, the object of the invention being to devise improvements in the construction and arrangement of apparatus of this type which will result in increased efficiency in practical operation.

The invention consists in earth boring apparatus of the kind referred to, comprising in combination a pilot head, a rigid pipe, rod or the like secured thereto, and a second pilot head of larger diameter than the first-mentioned head and adapted, during the operation of boring, to be located at the rear end of the rigid pipe or the like.

The invention also comprises the form of apparatus hereinafter described or indicated.

The accompanying drawings illustrate one mode of carrying out the invention.

Figure 1 is a side elevation partly in section showing one form of pilot in accordance with the invention, the pilot in this view being assumed to have been launched and the first length of push pipe placed in position.

Fig. 2 is a similar view to Fig. 1, showing the pilot prior to launching.

In carrying my invention into effect in one convenient manner the pilot head *a* is formed or provided with a substantial length of rigid piping *b* or rod which will be of sufficient stiffness to act as a beam for the purpose of taking the load. As the friction upon the apparatus would be very considerable if exerted along the whole length of the guide rod or tube, I provide for the reduction of the friction by arranging upon the tube one or more collars *c*

which are of substantially the same diameter as the pilot head *a*.

It is found in practice that with apparatus of this character there is a tendency on the part of the pilot head *a* to deviate upward from the straight line on account of the greater earth density below the head and in order to correct this tendency and thus insure a greater accuracy of alinement of the bore I provide at the rear end of the rod or the like *b* a collar or head *d* which is of larger diameter than the head *a*. The device may be launched from a hydraulic or other launching apparatus *e*, and the manner in which it operates to secure more perfect alinement than has hitherto been possible of attainment is as follows:—

As above stated, the head *a* tends to rise on account of the greater earth density beneath it but at the same time the head *d* also tends to rise for the same reason.

Since, however, the pipe or rod *b* is of rigid formation, it is clear that both these movements cannot occur simultaneously but the one tendency corrects the other (the beam *b* pivoting about some point in its length) and in consequence it is found that there is very little, if any, tendency for the apparatus to deviate in a vertical direction.

Tendency to lateral deviation is corrected by means of the collar or sleeve *f* loosely mounted upon the rod *b* in advance of the rear collar or head *d*.

It will be clear that with such an arrangement the bore proceeds in two stages, a smaller bore being first formed by the head *a* while the final and larger bore is completed by the head *d*.

The arrangement has a further important advantage inasmuch as it facilitates the withdrawal of the pilot; thus the pilot and tube may be moved backward with minimum friction until the head comes into contact with the sleeves loosely surrounding the rod so that the momentum of the head may be employed for starting the sleeve; the two then move backward until the rear head or collar is encountered when the same action results. If desired in any modification of the invention the pilot head may be so arranged that it can be left in the bore when the push pipe is withdrawn.

Having now described my invention, what

I claim as new and desire to secure by Letters Patent is:—

Earth boring apparatus of the kind described, comprising in combination a pilot head, a rigid rod secured thereto, a second pilot head of larger diameter than the first mentioned head and adapted, during the

operation of boring, to be located at the rear end of the rigid rod, and a sleeve loosely surrounding the rigid rod and located in advance of the second head. 10

In testimony whereof I have signed my name to this specification.

**ARTHUR RIVINGTON MANGNALL.**