A. ROTINOFF.

WELL BORING TOOL.

APPLICATION FILED DEC. 20, 1911.

1,049,151.

Patented Dec. 31, 1912

Fig. 1

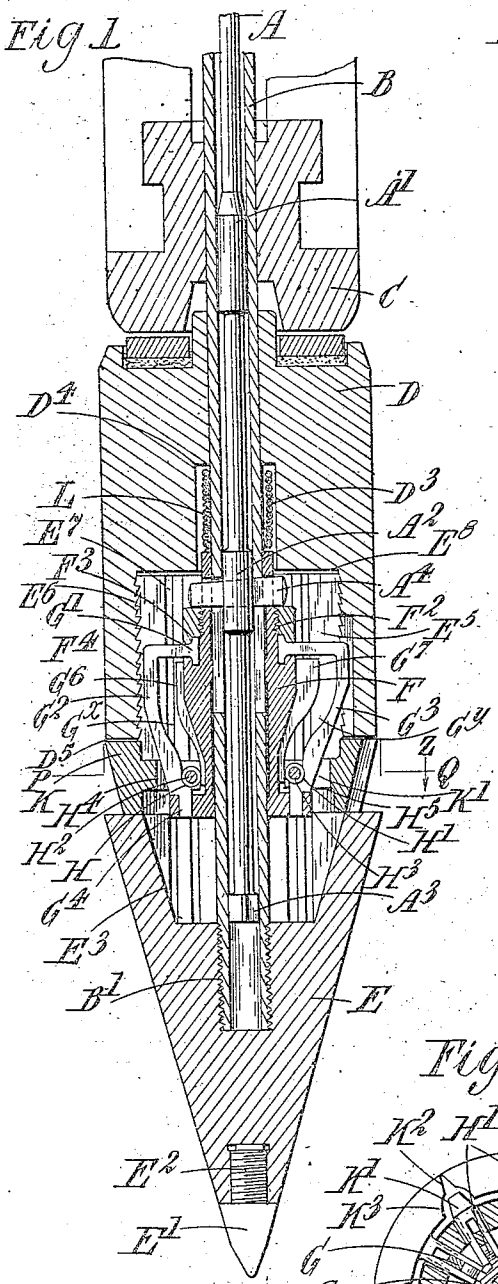


Fig. 2.

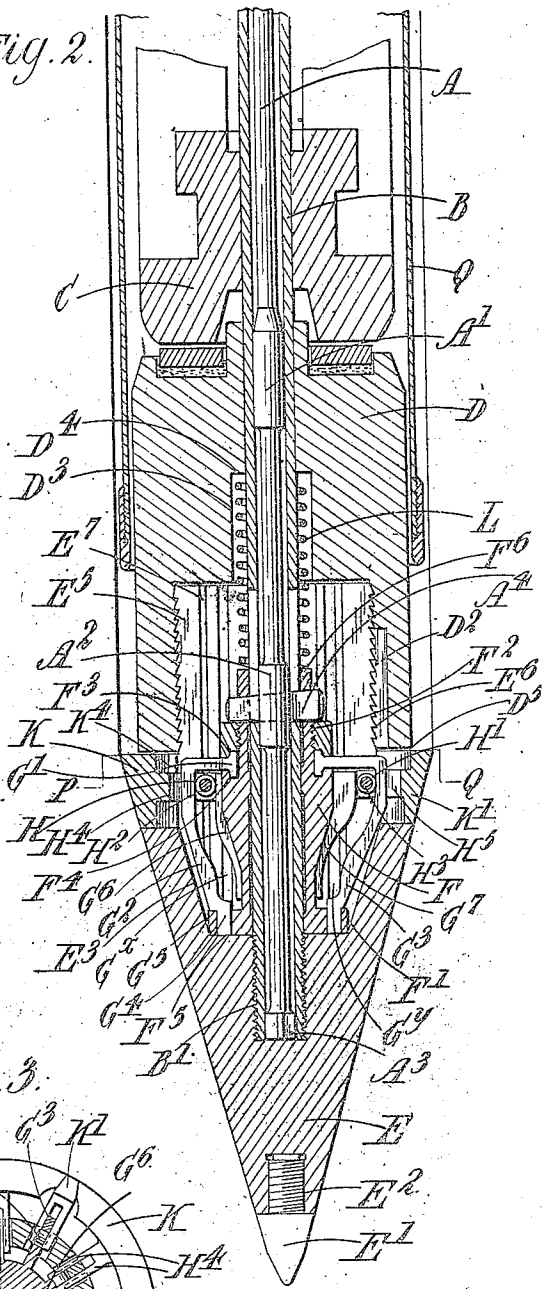
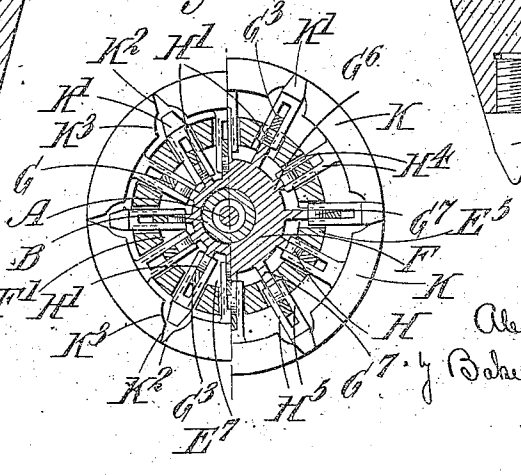


Fig. 3.



Witnesses.

Jesse B. Keller.

G. B. Fleming

Inventor.

Alexander Rotinoff

by Bakewell Byrnes & Parmelee

Attys

UNITED STATES PATENT OFFICE.

ALEXANDER ROTINOFF, OF ST. PETERSBURG, RUSSIA.

WELL-BORING TOOL.

1,049,151. Specification of Letters Patent. Patented Dec. 31, 1912.

Application filed December 20, 1911. Serial No. 666,908.

To all whom it may concern:

Be it known that I, ALEXANDER ROTINOFF, a subject of the Czar of Russia, residing at St. Petersburg, Russia, have invented certain new and useful Improvements in Well-Boring Tools, of which the following is a specification.

This invention relates to new and useful improvements in well-boring tools and refers particularly to contractible heads therefor.

The object of this invention is to provide a well-boring tool which can be withdrawn with ease and operates with certainty.

To more particularly disclose one convenient way of constructing the contractible head according to this invention, reference is made to the accompanying drawings, in which:—

Figure 1 is a part sectional elevation through the head showing the same in its contracted state; Fig. 2 is a similar view but shows the head with the parts in their expanded position; Fig. 3 is a section on the line P—Q viewed in the direction of the arrow Z, the right-hand part of the view showing the position of the various parts when the head is contracted as in Fig. 1, and the left-hand part of the view showing these parts in the expanded position.

In a head of this description used in a sinking tool, a conical or similar form is employed and the base of this conical head, made of rigid sections, is contractible. The head is so constructed that when its tip is unsupported from below or when a pull is exerted on it, the diameter of the said head is reduced automatically to an extent sufficient to enable it to travel up and down without hindrance through the tube or bore-hole. The stoppage of the tip of the head by the ground while the descent of other portions of the tool continues will result in the automatic expansion of the contractible portion of the head to its maximum dimension. The rigid sections forming the contractible part or base of the conical head are so disposed that their faces with or without those of the head, present a single smooth external contour when the contractible part is expanded. For such a contractible head, mechanism is provided which is constructed to contract the head by moving the sections inward in succession and characterized by that construction in such a manner that it acts positively, is inelastic and unyielding. The contraction and expansion of the head is brought about by an operative connection with the monkey or with the suspension rod of the sinking tool.

Referring to the drawings and more particularly to Fig. 2, A is a rod which, in conjunction with the sleeve B, is operatively connected in any convenient way to the monkey indicated at C. The rod A slides within the tube or sleeve B and takes a bearing within the latter on the enlargements A^1 A^2 A^3 formed upon itself. At its lower end B^1 the sleeve B is screwed into the conical head E which constitutes the working portion of the tool and is provided at E^1 with a hardened or other specially treated point screwed into the conical part E at E^2. A cotter A^4 passes through the enlargement A^2 of the rod A and into a sleeve or slider (which is made to be a sliding fit upon the outside of the sleeve B), thereby securing the rod A to the sleeve F and causing it to follow any movements of the rod A. The sleeve F has a flange F^1 at its lower end and at its upper end is provided with a ring F^2 which screws over the sleeve as shown provided with shaped recesses at F^3 which coöperate with similar recesses F^4 formed within the upper part of the sleeve. The flange F^1 is also drilled at F^5. The recesses at F^3 and F^4 in the cap F^2 and sleeve F grip the T-shaped heads G^1 of shaped strips G^2 G^3, while the holes at F^5 receive dowel pins G^4 also formed on the strips G^2 G^3 which are shouldered at G^5 to abut against the upper side of the flange F^1 so as to position them and hold them securely in place. The sleeve F has short projecting shaped webs G^6 G^7 which coöperate with the strips G^2 G^3 respectively to form the cam slots G^x G^y indicated in the drawings. These slots receive rollers H H^1 mounted respectively on spindles H^2 H^3, which spindles are secured in the pairs of arms H^4 H^5 which project inwardly from the pieces K K^1 of which they form a part. The pieces K are, as will be seen from a reference to Fig. 3, of approximately segmental shape in plan while the pieces K^1 are wedge-shaped and narrow. The segments are beveled at K^2 and rounded at K^3 and conform, as also do the wedge-shaped pieces, to the general shape of the conical head E as regards their vertical section. The segmental pieces, in their expanded po-

sition, do not quite fill up the periphery; the pieces K^1 therefore are of such width that when they move outward for the expansion of the head, the external contour of the latter is smooth and unbroken.

The conical part E, the expanding part made up of the pieces K and K^1 and the upper part of the head D, are recessed suitably at E^3 K^4 and D^2 to permit of movement of the various parts contained within them. The part D of the head is also recessed as at D^3 to receive the spring L which abuts upon the end D^4 of the clearance D^3 and exerts pressure upon the end F^6 of the sleeve F. The part E^5 of the lower or conical part E of the head passes upward through the contractible part thereof and at E^6 is threaded to receive the correspondingly threaded upper part D as indicated by Fig. 2. The part E^5 is slotted as at E^7 to permit of the passage of the operating mechanism of the contractible portion of the head. The part D is clear of the latter at D^5 and not only does not interfere with the motion of the operating mechanism but by its construction transmits the blows of the monkey direct to the working point of the head and not through the various sections or through the operating mechanism. Sinking tube is shown at Q.

The slots G^x G^y respectively represent sets of slots shown in Fig. 2 which correspond to the segmental pieces K and the wedge-shaped pieces K^1. Each of the set of slots represented by G^x is of different shape from each of the set of slots represented by G^y, that is to say, G^y is more sharply inclined to the vertical center axis of the head and the inclined portion of it commences at a point nearer to its lower end and finishes at a point nearer the upper end than is the case with a slot belonging to the G^x group.

In operation, the movement of the monkey C in the position of Fig 1, causes the rod A to move downward should any of the parts stick and during the descent of this monkey and with it the rod A, the sleeve F is caused by the spring L to move downward so that the rollers H and H^1 move relatively up their respective cam slots G^x and G^y and so force the arms H^4 H^5 to which they are respectively pinned, to move radially outward from the center of the head and thus to carry outward the respective pieces which they bear. Because of the different inclination and shape of the slot G^y from that of the slot G^x the pieces K will move first to their expanded position as shown by the left-hand half of Fig. 3 and a little later on the pieces K^1 will begin to move outward so as to fill up the spaces which are left between the expanded segmental pieces K. When the monkey C is withdrawn by any means which may be convenient, it acts first upon the rod A, then upon the sleeve B and raises the same together with the head E. In so doing, the rollers H and H^1 move in a relative sense down the slots and by a movement converse to that which brings about the expansion of the head, cause the wedge-shaped pieces K^1 to move inward first and at an interval bring back the segmental pieces K, as will be well understood. That is to say, the pieces making up the contractible part of the head move in succession—the head can only be contracted when the parts K^1 are moved clear of the parts K. The maximum external diameter of the head may be greater than that of the sinking tube when such is used and its minimum diameter may be less than the internal diameter of the sinking tube so that withdrawal of the head is rendered very easy.

It will be seen that external pressure of the soil in the bore-hole or of water which may be present there cannot readily cause the head to contract as the parts, rigid and unyielding, are to a large extent interlocking in their expanded state. Nor can the working of the tool be easily interfered with as the head presents a single smooth external contour in its expanded position. The operation of contracting the head may also be performed by an operative connection with the suspension rod on which the whole tool may be carried.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a well-boring tool, the combination with a suspender therefor, of a head with a taper-ended lower portion comprising movable sections presenting a single smooth annular external contour, means operatively connecting the said sections and the suspender to automatically move said sections to reduce and enlarge the diameter of the said lower portion by a non-rotary rectilinear movement of the suspender, substantially as described.

2. In a well-boring tool, a head with a taper-ended lower portion, an expansible annular series of laterally movable sections at the heel of the tapered part, mechanism for expanding and contracting the sections, a monkey, and an element connecting the monkey and the said mechanism whereby a non-rotary rectilinear movement of the monkey can expand and contract the sections, substantially as described.

3. In a well-boring tool, a head with a taper-ended lower portion, an expansible annular series of laterally movable sections at the heel of the tapered part, mechanism for expanding and contracting the sections, a monkey, and a loaded rod movable in the direction of its length in a plain guide in the head and connecting the monkey and the said mechanism, whereby a non-rotary rectilinear movement of the monkey can ex-

pand and contract the sections, substantially as described.

4. In a well-boring tool, a head with a taper-ended lower portion, an inflexible extension upward from the tapered portion to receive and to transmit direct to the said lower portion the blows of a monkey, an expansible series of laterally movable rigid sections which is so shaped as to present a single smooth annular external contour located at the heel of the tapered part and below the said extension struck by the monkey so that the driving shock from the monkey shall be transmitted to that tapered part otherwise than through said series, substantially as described.

5. A well-boring tool having a head with a taper-ended lower portion, an inflexible extension upward from and immovable in relation to that tapered portion and receiving the blows of the monkey, guides constituted by the top of the tapered part together with an opposed end-face of the aforesaid inflexible extension, and an expansible series of laterally movable rigid sections in those guides and so shaped as to present a smoothly curved non-stepped annular external contour when expanded and also when contracted, substantially as described.

6. In a well-boring tool, an expansible series of laterally-movable rigid sections with their faces so disposed that the sections when expanded present a smoothly curved non-stepped external contour, in combination with a mechanism which is positive and is constructed to contract and expand the series by moving the sections inward in succession, substantially as described.

7. In a well-boring tool, an expansible series of laterally movable rigid sections which is so shaped as to present a smoothly curved non-stepped annular external contour, in combination with a mechanism comprising two sets of cams and a slider movable in the axial line of the series to impart a radial movement to the sections in succession, substantially as described.

8. A well-boring tool having a head with a tapered end, radially movable members at the upper end of the tapered portion, cams for moving said members in a radial direction, and means for operating said cams, substantially as described.

9. A well-boring tool having a head provided with a tapered portion, a plurality of arc-shaped members movably mounted in said head, a plurality of wedge members movably mounted between said arc-shaped members, and means for moving said arc-shaped members and wedge members in a radial direction, substantially as described.

10. A well-boring tool having a body portion, a tapered head fixedly connected thereto, a plurality of radially movable members slidably mounted between the body and the head, said members forming a frustum of a cone when in their expanded position, and means for moving said members in a radial direction, the moving means forming a lock to retain said members in their expanded position, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALEXANDER ROTINOFF.

Witnesses:

T. BATES,

HARRY B. BRIDGES.