O. B. H. HANNEBORG.

DITCHING AND TILE LAYING MACHINE.

APPLICATION FILED APR. 25, 1916.

1,277,573. Patented Sept. 3, 1918.

Fig. 1.

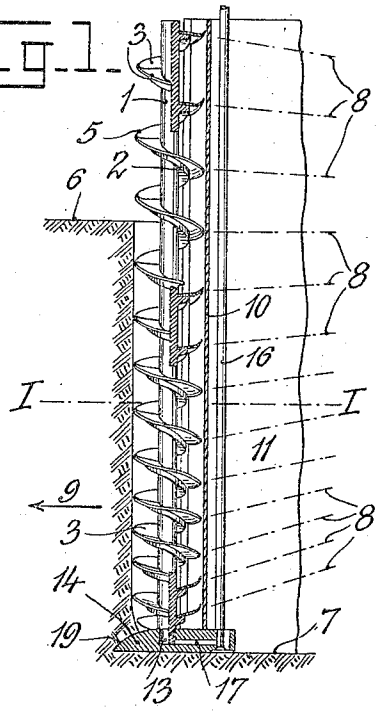



Fig. 3.

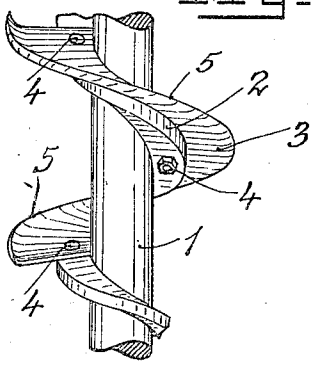



Fig. 4.

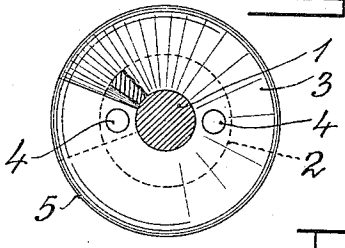



Fig. 2.

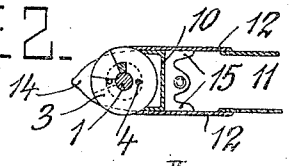



Fig. 6

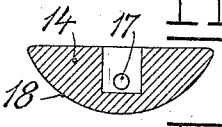



Fig. 7.

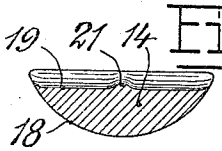
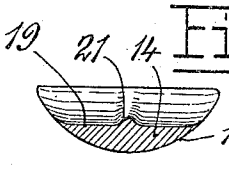



Fig. 8.



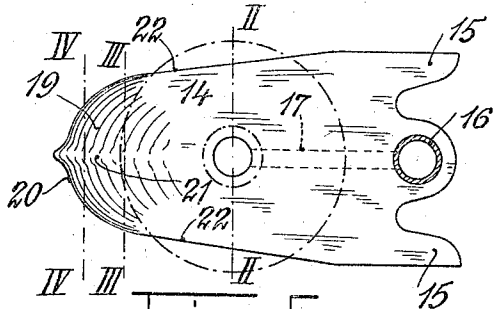




Fig. 5.

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# UNITED STATES PATENT OFFICE.

ODILON BALTAZAR HANNIBAL HANNEBORG, OF HAUGRIM IN URSKOG, NORWAY.

## DITCHING AND TILE-LAYING MACHINE.

1,277,573. Specification of Letters Patent. Patented Sept. 3, 1918.

Application filed April 25, 1916. Serial No. 93,398.

*To all whom it may concern:*

Be it known that I, ODILON BALTAZAR HANNIBAL HANNEBORG, citizen of Norway, residing at Haugrim in Urskog, Norway, have invented new and useful Improvements in Ditching and Tile-Laying Machines, of which the following is a specification.

For the digging of channels or trenches in the earth in order to lay down tiles or drain-pipes or the like machines have been constructed, which are moved forward on wheels upon the soil so as to loosen the earth and lift it up by means of a rotating vertical cutter-screw according as the machine moved forward.

Machines of this sort have required a large expenditure of power, which however has been reduced gradually by several improvements. In this respect the shape and arrangement of the cutting screw and of the shoe receiving its lowermost pivot are of the highest importance, and my present invention has for its object to provide a new construction of these machine elements, whereby a considerable economy as to working and maintenance expenses is obtained.

The invention is illustrated in the accompanying drawing, in which:

Figure 1 is a vertical longitudinal section through a trench, the screw being shown partly in elevation and partly in section.

Fig. 2 is a horizontal section on the line I—I of Fig. 1.

Fig. 3 shows in elevation a portion of the screw drawn to a larger scale.

Fig. 4 is a plan view corresponding to Fig. 3.

Fig. 5 is a plan view of the screw supporting shoe.

Figs. 6, 7 and 8 are cross sections on the lines II—II, III—III and IV—IV in Fig. 5 respectively.

The vertical screw shaft —1— is provided on its lower portion (*i. e.* that carrying the screw proper) with a rib —2— of rectangular cross section coiled helically around the shaft and attached by welding or by rivets. The shaft with rib may also be made in one piece of cast-steel. Upon this rib —2— the screw threads are attached removably. Previously the screw was made as an integral piece, but as the cutting edges of the screw are comparatively quickly worn off, its diameter is reduced, so that after a short use the worn screw had to be replaced by a new screw.

Experience now has shown, that a fully reliable screw is obtained, when its threads are made of loose shares or knife sections —3— of iron or steel plates. A single share or section of this sort is seen in Figs. 3 and 4. It is attached by three or four bolts —4— passing through the plate —3— and the rib —2— so that a continuous helical face is produced, the outer edge —5— of which forms a cutting edge and may be sharpened when necessary.

As shown in Fig. 1 the screw projects beneath the soil surface —6— to the desired trench depth. Therefore, when the screw is rotated and simultaneously moved forward in the direction of the arrow —9—, its front part cuts loose the earth like a knife, which also lifts the loosened earth, the back side of the screw being surrounded by a screen or channel —10— extending up above the soil surface —6—.

As indicated in Fig. 3 the edge —5— of the knife sections is curved somewhat upward in well-known manner. Furthermore is seen from Fig. 1, that the screw pitch increases upward, the reason of which is the fact that the earth quantity to be conveyed up to the soil surface —6— increases from the trench bed —7— to this surface —6—. Such increase in pitch has proved to be important for the easy operation of the screw, because it thereby may work with full efficiency in all heights. However, it proved to be still more important to vary the inclination of the threads —3— in radial direction. This variation is clearly seen from the lines of direction —8— in Fig. 1. The inclination is directed downward toward the screw axis at the lowermost knife section, and upward from this section the inclination decreases gradually according as one approaches the screw top, where the inclination has become inverse so as to ascend toward the screw axis. It is understood that by this construction the loosened earth, according as it is lifted up, is subjected to a gradual alteration in shape, which has the effect that the earth is made loose and at the same time it is more and more separated from the central portions of the screw according as it ascends.

This condition is of the highest importance when the digging takes place in a soil containing clay, because the latter dur-

ing the digging operation tends to transform into a stony mass which adheres very strongly to the central screw portions and thereby decreases the working ability to a high degree. These drawbacks are completely removed, when the inclination of the knife sections varies as indicated by the lines —8—.

Behind the screen —10— a box —11— is arranged. This box is moved forward together with the screw, and its side walls —12— are somewhat less distant from each other than the screw diameter. Within the box a curved tube or channel (not shown) is arranged, through which the drain-pipes may be conducted down to the trench bed according as the work advances.

The bottom pivot —13— of the screw is in well-known manner supported in a shoe —14— moving on the trench bed —7— and having rear side-projections —15—, whereby the shoe is attached to the walls —12—. Through a tube —16— lubricating oil is conducted down to the shoe and through the channel —17— to the pivot —13—.

It will be clear, that the shape of the shoe —14— is also of high importance for the working ability of the machine. After many experiments the shape shown in the drawing was found to be the most advantageous one. The underside —18— of the shoe here is formed as a face which is convex in cross direction. Hereby the shoe makes little resistance to the moving forward in the trench bed, and simultaneously the bed obtains the most suitable shape for receiving the drain-pipes. Furthermore the upper side of the shoe is rounded downward at its front part as shown at —19— in Fig. 1 so as to meet together with the underside —8— in a forwardly directed sharp edge —20— (Fig. 5), which may be easily sharpened. The face —19— is provided with a low central rib —21— extending longitudinally and serving to divide the earth. Finally the shoe —14— has inclined sides —22— it being somewhat more narrow in front than in the rear as clearly shown in Fig. 5.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a ditching and tile-laying machine, a rotatable cutting screw arranged vertically and having its screw threads inclined downwardly in a radial direction toward the screw axis at the lower end of the screw and gradually decreasing in such inclination upwardly so as to be inverse in the uppermost portion of the screw.

2. A ditching and tile-laying machine comprising a rotatable cutting screw arranged vertically and having the threads thereof graduated in pitch from the upper end of the screw to the lower end, and inclined downwardly in a radial direction toward the screw axis at the lower end of the screw and gradually decreasing in such inclination upwardly so as to be inverse in the uppermost portion of the screw.

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

ODILON BALTAZAR HANNIBAL HANNEBORG

Witnesses:
AXEL LAHN,
MOGENS BUGGEE.

**Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."**