

No. 764,802.

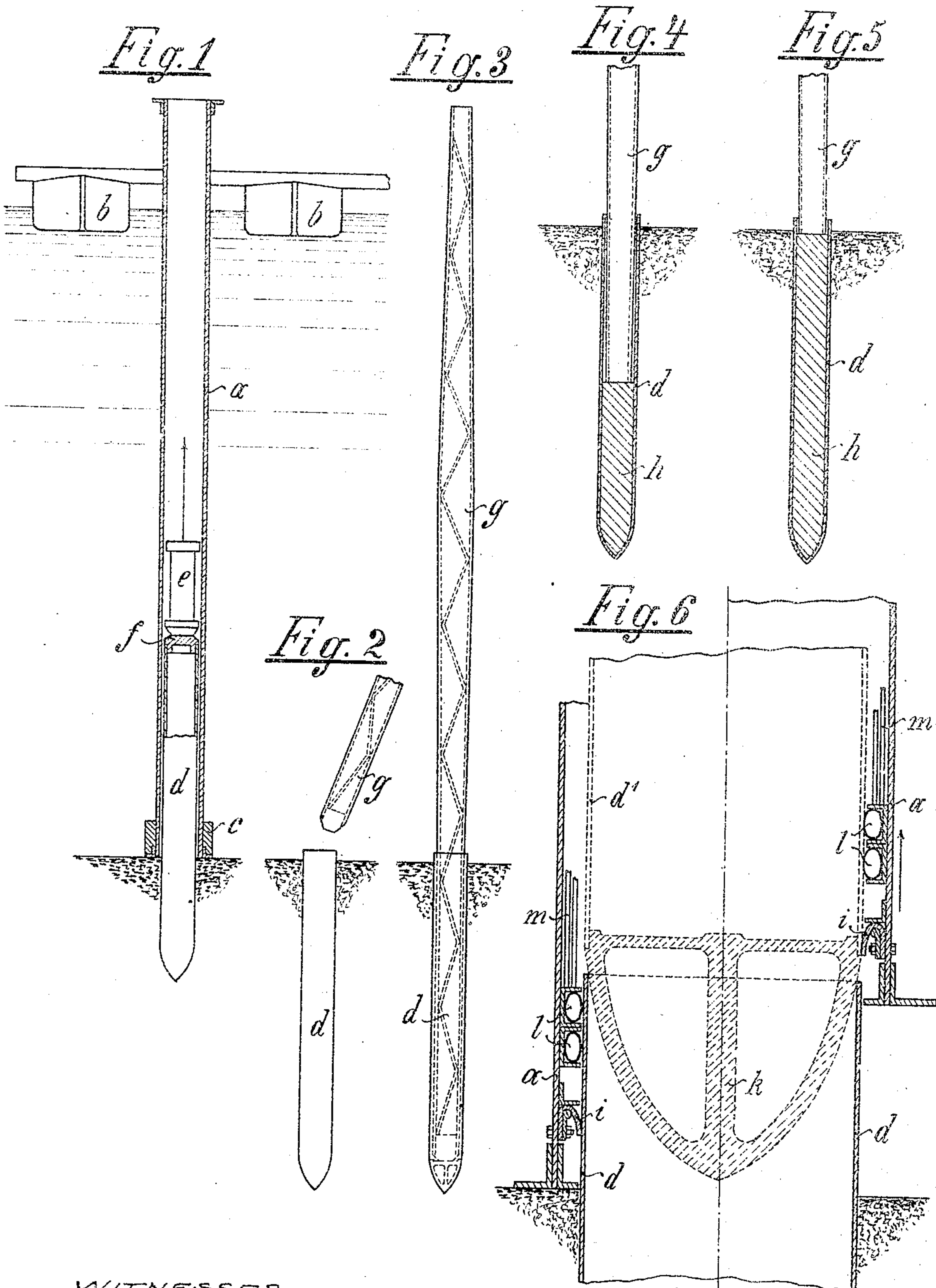
PATENTED JULY 12, 1904.

A. H. ENDERLEN.

METHOD OF AND APPARATUS FOR PILE DRIVING.

APPLICATION FILED JAN. 30, 1904.

NO MODEL.



WITNESSES

H. M. Kuehn  
H. M. Golding

INVENTOR

Albert H. Enderlen

BY Richard

ATTORNEYS



# UNITED STATES PATENT OFFICE.

ALBERT H. ENDERLEN, OF WIESBADEN, GERMANY, ASSIGNOR TO VEREINIGTE MASCHINENFABRIK AUGSBURG UND MASCHINENBAUGESELLSCHAFT NÜRNBERG A.-G., OF NUREMBERG, GERMANY.

## METHOD OF AND APPARATUS FOR PILE-DRIVING.

SPECIFICATION forming part of Letters Patent No. 764,802, dated July 12, 1904.

Application filed January 30, 1904. Serial No. 191,343. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT H. ENDERLEN, engineer, a subject of the German Emperor, residing at Wiesbaden, in the Empire of Germany, (whose full postal address is 6 Walluferstrasse, Wiesbaden, aforesaid,) have invented certain new and useful Improvements in Pile-Driving, of which the following is a specification.

In submerged pile foundations it is usual for concrete piles strengthened with iron to be driven into the ground; but by this method the piles are exposed to damage owing to the vibration caused by the driving, which is apt to make the beton or concrete to crumble off. By the present invention and in order to avoid this drawback in driving piles at great depths hollow shoes are first driven into position, and one end of metal-strengthened cement piles are inserted in the shoe, or the shoe is partly or wholly filled with cement, and the end of the pile rests on said cement. In driving the shoes into position I employ a cylinder which extends from the ground into which the shoe is to be driven above the surface of the water. The shoe is placed in this cylinder and is driven into the ground by means of a monkey traveling in the cylinder. The shoe is held water-tight in said cylinder, and after one shoe is driven into position another one is inserted in the cylinder and driven down until its point rests on the first shoe, after which the cylinder is raised, so as to grip the second shoe water-tight, and then the cylinder, with the shoe therein, is moved to the place where the second shoe is to be driven.

In order to explain this improved pile-driving operation and the improved apparatus employed for carrying out the same, reference will now be made to Figures 1 to 6 of the accompanying drawings, in which—

Fig. 1 shows the shoe being driven into the ground; Fig. 2, the pile being inserted in the shoe; Fig. 3, the pile when inserted in the shoe. Figs. 4 and 5 show the shoe partially and quite filled with cement. Fig. 6 is an enlarged detail view.

This apparatus consists of a cylinder or

trough *a*, (the simplest form of which is an iron pipe of suitable length,) the upper end of which extends above the surface of the water and is retained by several anchored pontoons *b*, arranged on each side of it, and the lower end of which tube, which rests on the ground, is weighted by ballast *c*. In this pile-driving tube both the iron hollow shoe *d* and the monkey *e* are guided or mounted. The lower end of the tube is provided with suitable packing, as shown in Fig. 6 and to be hereinafter described, to form a water-tight connection between the tube and shoe. The said shoe *d* has at the top a pile-block *f*, of wood or iron, which transmits to the shoe *d* the blows of the monkey *e*, so that the shoe is driven into the ground through the lower aperture of the pipe *a*. On the completion of the driving or ramming operation the driving apparatus, together with the pile-block *f*, is removed from the shoe, after which the lower end of the pile *g*, made of concrete strengthened by metal, is inserted in the upper end of the shoe, which only projects slightly above the ground and is sunk into the shoe as far as is desired. (See Fig. 3.) The lower end of the pile rests on the bottom of the shoe, as shown in Fig. 3, or the shoe may be filled either partially or wholly with cement and the end of the pile supported thereby, as shown in Figs. 4 and 5. To hold the pile firmly in the shoe, the interstices between the pile and shoe can be filled with cement by means of a pipe or any other suitable means.

Fig. 6 shows, on an enlarged scale, the lower end of the ramming-tube *a* and the upper end of the rammed-in shoe *d*. In the left-hand half of this figure the pile-driving pipe *a* is shown in the position which it assumes during the driving operation, its lower end resting firmly on the ground. The penetration of water into the annular space remaining between the pile-driving pipe *a* and the shoe is prevented by a large number of packings or washers and during the ramming operation substantially by the lower washer or packing *i*, which is made like a rubber flange,



through which the shoe when being rammed gradually sinks downward. When the driving operation is completed, in order to allow of the tube being lifted away from the shoe without allowing water to penetrate the tube or pipe the operation is carried out as follows: As soon as the shoe has been fully driven down the monkey is withdrawn from the pipe *a*, and before the latter is raised the fresh shoe *d'*, which is to be driven down next and the lower end of which is shown in dotted lines in Fig. 6, is lowered in the pipe *a* until it reaches the shoe already fully driven down in such a way that the pile-point *k*, fixed in the lower end of the shoe *d'*, rests on the upper end of the shoe already fully rammed down. The fresh shoe *d'* is then weighted by the again inserted monkey *e*, Fig. 1, and, if desired, also by further weights placed on the monkey. The pipe *a*, as shown in the right-hand half of Fig. 6, is then alone raised, the multiple washers *i* *l*, fixed at the lower end of the pipe *a*, slide upward successively along the upper end of the shoe *d*, which has already been fully rammed down, and come successively in tight-fitting contact with the lower end of the fresh shoe *d'*, which is to be rammed down. The said washers *l* consist of feed-pipes, which are kept full with air or water by means of pressure-pipes *m* and which when the tube *a* travels upward, in conjunction with the india-rubber flange-washer *i*, prevent the penetration of water into the pipe *a* along the two shoes *d* and *d'*.

35 As soon as all the washers rest against the fresh shoe *d'*, contained in the pipe *a*, Fig. 6, right-hand half, the said pipe, together with the fresh shoe *d'* and the monkey, are drawn away entirely from the shoe *d*, which has

been fully driven down, and brought to a fresh working place without the water being able to penetrate into the pipe *a*.

I declare that what I claim is—

1. The herein-described method of driving hollow pile-shoes which consists in dropping a shoe through a tube sunk in the water, driving said shoe the desired distance while maintaining a water-tight joint between the shoe and the lower end of the tube, removing the driving mechanism from the tube and dropping a second shoe into the tube and forming a water-tight joint between said second shoe and tube to prevent the entrance of water into the tube and finally moving the tube and second shoe to a fresh position and driving said second shoe, substantially as described.

2. An apparatus for driving hollow pile-shoes consisting of a tube through which the shoe is driven into the ground and means at the lower end of the tube for maintaining a water-tight connection between the tube and the shoe, substantially as described.

3. An apparatus for driving hollow pile-shoes comprising a tube through which the shoe is driven into the ground and means at the lower end of the tube for maintaining a water-tight connection between the tube and the shoe, said means being capable of being raised so as to form a water-tight connection with a second tube so as to allow the apparatus to be moved.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALBERT H. ENDERLEN.

Witnesses:

ROBERT THEIS,  
H. R. PIEPENBRINK.