M. BLUMENTHAL.

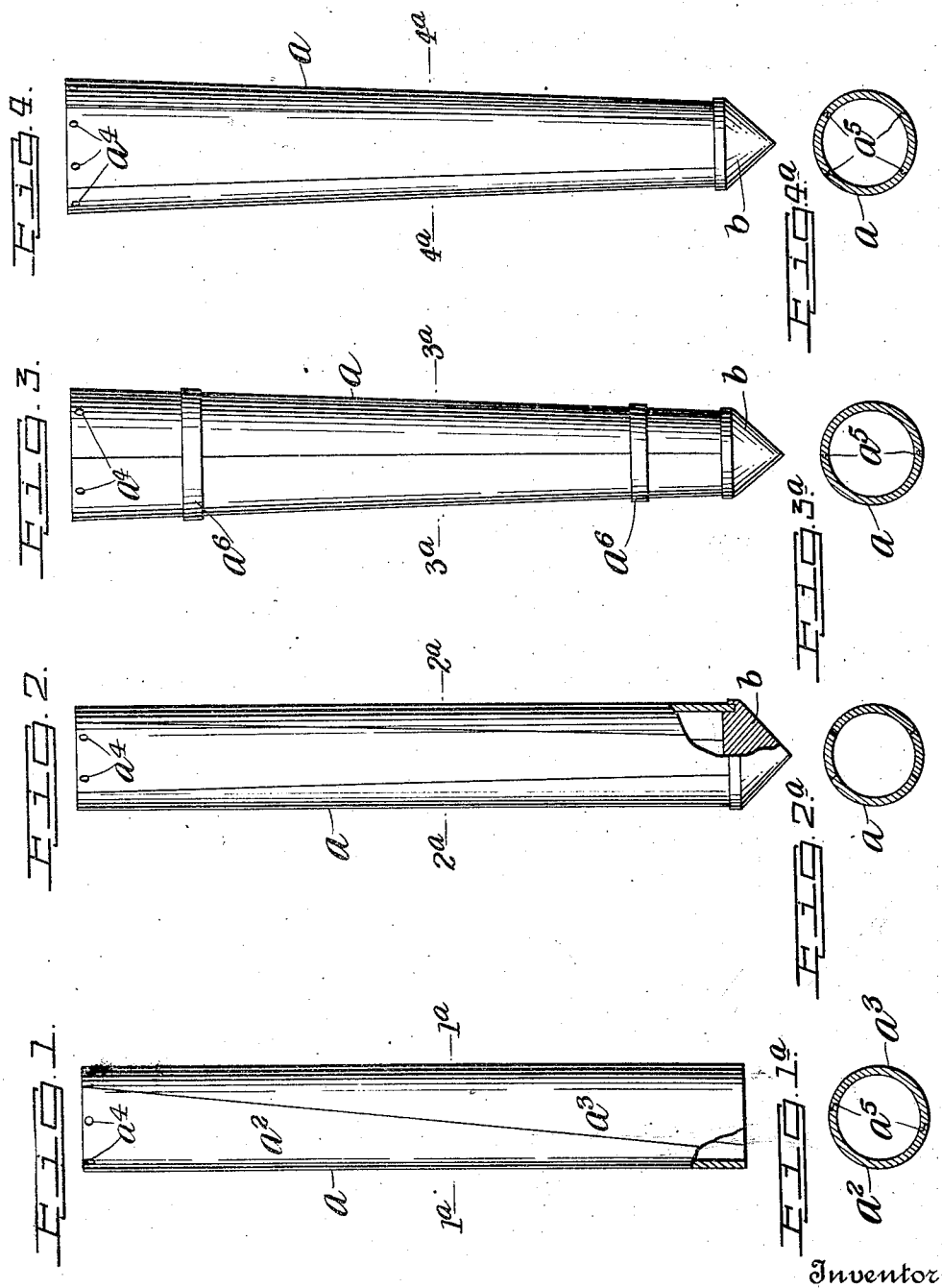
METHOD OF AND APPARATUS FOR MAKING FOUNDATIONS.

APPLICATION FILED JUNE 1, 1917.

1,279,834.

Patented Sept. 24, 1918.

3 SHEETS—SHEET 1.



Inventor

Maurice Blumenthal,

By his Attorneys

Edgar Tate & Co.

M. BLUMENTHAL.

METHOD OF AND APPARATUS FOR MAKING FOUNDATIONS.

APPLICATION FILED JUNE 1, 1917.

1,279,834. Patented Sept. 24, 1918.

3 SHEETS—SHEET 2.

FIG. 5.

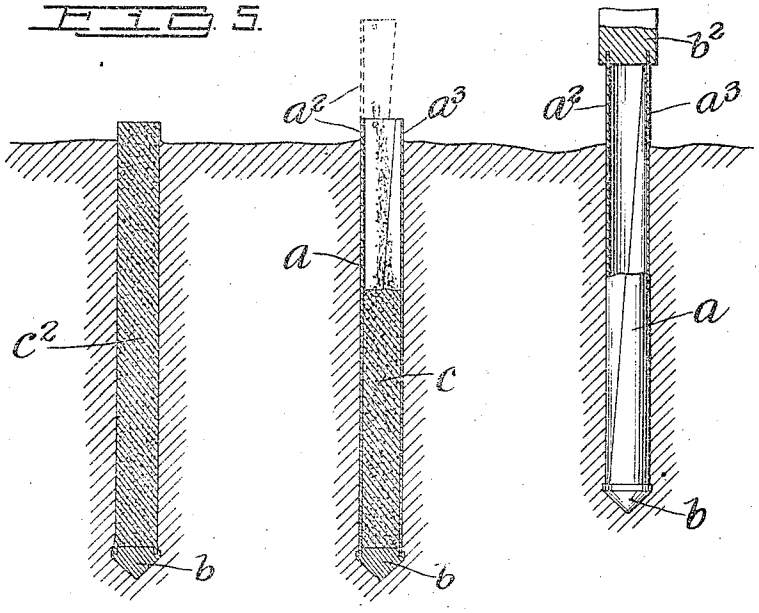


FIG. 6. FIG. 7. FIG. 8.

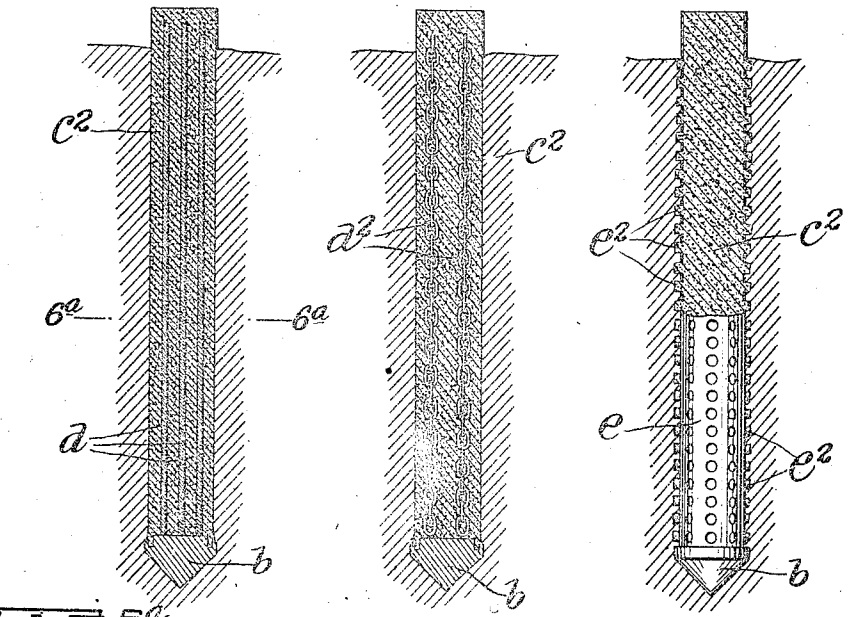
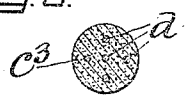


FIG. 6a.



Inventor
Maurice Blumenthal,
By his Attorneys
Edgar Tate & Co.

M. BLUMENTHAL.

METHOD OF AND APPARATUS FOR MAKING FOUNDATIONS.

APPLICATION FILED JUNE 1, 1917.

1,279,834.

Patented Sept. 24, 1918.

3 SHEETS—SHEET 3.

Fig. 9.

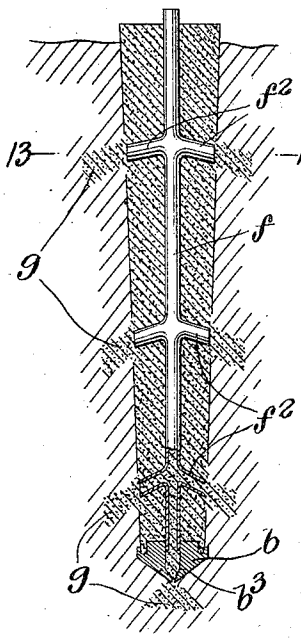


Fig. 10.

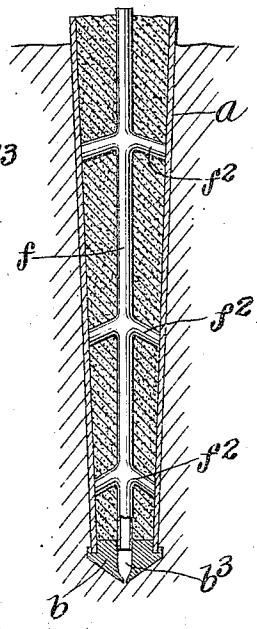


Fig. 11.

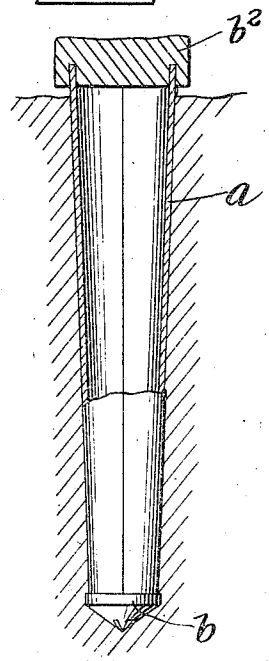


Fig. 12.

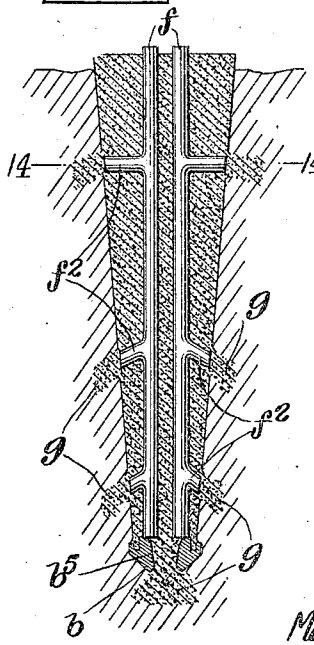


Fig. 13.

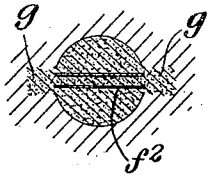


Fig. 14.

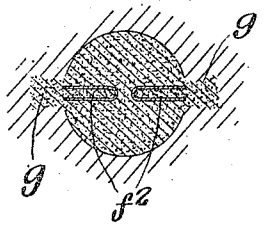
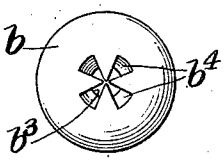


Fig. 15.



Inventor

Maurice Blumenthal,

By his Attorneys

Edgar Tate & Co.

UNITED STATES PATENT OFFICE.

MAURICE BLUMENTHAL, OF BROOKLYN, NEW YORK.

METHOD OF AND APPARATUS FOR MAKING FOUNDATIONS.

1,279,834. Specification of Letters Patent. Patented Sept. 24, 1918.

Application filed June 1, 1917. Serial No. 172,175.

To all whom it may concern:

Be it known that I, MAURICE BLUMENTHAL, a citizen of the United States, and residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Method of and Apparatus for Making Foundations, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to the making of foundations for structures of various kinds and classes in loose earth, made earth, shell earth, sand earth whether stationary or shifting, or any earth of any kind or class, where stationary foundations that will not yield to the weight of any superstructure which it is desired to place thereon are required, and the invention also relates to the reinforcement of the earth for any purpose, as in the building of bulk-heads, piers, retaining walls or similar structures; and the invention consists of an improved method or process of sinking concrete piles and forming such piles, and also of the apparatus or means employed for carrying such method or process into effect.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which:—

Figure 1 is a side view of a hollow tubular pile form which I employ with a part broken away;

Fig. 1ª a cross section thereof on the line 1ª—1ª of Fig. 1;

Fig. 2 a view similar to Fig. 1 but showing a modification;

Fig. 2ª a cross section of Fig. 2 on the line 2ª—2ª;

Figs. 3 and 4 views similar to Figs. 1 and 2 but showing modifications;

Figs. 3ª and 4ª transverse sections on the lines 3ª—3ª and 4ª—4ª of Figs. 3 and 4;

Fig. 5 a view showing the method and apparatus of making concrete piles according to my invention;

Fig. 6 a view showing a complete reinforced pile;

Fig. 6ª a section on the line 6ª—6ª of Fig. 6;

Fig. 7 a view similar to Fig. 6 but showing a modification;

Fig. 8 a view similar to Figs. 6 and 7 but showing another modification;

Fig. 9 a view of another form of concrete pile but showing another method of reinforcing the pile and anchoring the same in the surrounding earth;

Fig. 10 a view showing the means for making the pile shown in Fig. 9;

Fig. 11 a side view, partly in section, of a pile form employed in making piles as shown in Figs. 9 and 10;

Fig. 12 a view similar to Fig. 9 but showing a modification;

Fig. 13 a section on the line 13—13 of Fig. 9;

Fig. 14 a section on the line 14—14 of Fig. 12; and,

Fig. 15 a bottom plan view of the pointer employed in Fig. 11.

Heretofore it has been customary in making concrete piling to employ a metal shell, insert a core piece thereinto, and then drive the core piece with the shell thereon into the earth after which the core piece was withdrawn, the shell remaining in the earth, and being filled with concrete, the shell forming a part of the pile, but this process involved the loss of a shell in the formation and sinking of each pile.

Another process consisted in driving a pile form into the earth and then withdrawing said form and filling the hole thus made with concrete, but this process was objectionable by reason of the fact that the hole made by withdrawing the form would be filled up or partially so by earth falling into the hole before the concrete was placed therein.

Another process consisted in driving a pile form consisting of a tubular shell into the earth, said form being open at the lower end and after the shell was fully driven the material inside thereof would be removed by an air blast, or water blast, after which the concrete would be poured into the shell, but this process was objectionable for the reason that the formation of each pile involved the loss of the pile form.

The advantages of my improved process, and means for carrying said process into effect will be clearly apparent from the fol-

lowing description taken in connection with the accompanying drawings.

In Figs 1 and 1ª of the accompanying drawings, I have shown at *a* the simplest form of a pile form or pile former which I employ, and which consists of a metal tube divided longitudinally into separate similar parts a^2 and a^3, and the abutting edges of which are tapered from one end to the other, and the separate parts are provided in the top thereof with holes a^4 to facilitate the withdrawing of said parts from the earth after the form or former has been driven and filled with concrete, and the wider end of the part a^2 is directed upwardly to facilitate this operation, in which operation the part a^2 is first withdrawn after which the part a^3 may be withdrawn.

The edges of the separate parts of the pile form or former *a* are interlocked as shown at a^5 to facilitate the operation of driving the form or former into the earth, and this interlocking of said parts or the connection thereof may be formed in any desired manner.

In Fig. 5 of the accompanying drawing, I have shown, at the right, the form or former *a* and indicated the same as partially driven into the earth, and in this operation said form or former is provided at the bottom thereof with a conical nose or pointer *b*, and placed on the top thereof is a head member b^2, and the operation of driving the form or former into the earth will be the same as with other devices of this class, or the same as driving ordinary piles composed of wood or any other suitable material, but in my improvement the nose piece or pointer *b* and the head member b^2 both serve to bind the separate parts of the pile form or former together, by means of grooves formed in each, which receive the ends of said parts. In this connection it will be observed that the groove in the nose piece or pointer *b* is so formed that said nose piece or pointer overlaps the ends of the parts of the form or former which also facilitates the driving of the latter into the earth.

After the form or former has been fully driven into the earth, the concrete is poured thereinto as indicated at *c* in Fig. 5, after which the form or former is withdrawn, the part a^2 being first withdrawn as indicated in dotted lines in Fig. 5, after which the part a^3 is withdrawn and the complete pile c^2 is formed as shown at the left of Fig. 5, and in this operation the nose piece or pointer *b* remains in the ground.

The above operation of withdrawing the form or former, or the separate parts thereof, after the concrete has been poured thereinto, may be performed at any time, but I prefer to perform this operation after the concrete has partially set or settled, but while it is still in a more or less plastic condition, and it will be understood that when the form or former has been withdrawn and the concrete poured thereinto has settled, or become fully set, other concrete may be poured in on the top thereof to fill up the hole caused by the withdrawal of the form or former and the full setting or settling of the concrete; and the same result may be accomplished by so driving the form or former as to leave a part thereof extending above the ground, which part will be filled in with concrete before the form or former is withdrawn, and this will produce the result shown at the left of Fig. 5, in which the pile c^2 extends above the surface of the earth, after the form or former is withdrawn.

In Figs. 2, 3 and 4 and 2^a, 3^a and 4^a I have shown different types of the form or former, that shown in Figs. 2 and 2^a, comprising a tube divided into four parts, of which the separate pairs are tapered in opposite directions; while in Figs. 3 and 3^a the form or former *a* is tapered from one end to the other and is composed of two similar parts, said parts being connected by detachable bands a^6 which are left in the ground in the operation of withdrawing the separate parts of the form or former. In Figs. 4 and 4^a the form or former *a* is also tapered from one end to the other and is composed of four parts, of which the opposite pairs are tapered in opposite directions, and in all these forms of construction the form or former, or the separate parts thereof are provided at the top with holes a^4 to facilitate their withdrawal from the earth, as hereinbefore described.

In Figs. 6 and 6^a and Figs. 7 and 8, I have shown methods of reinforcing a pile formed, as hereinbefore described; and in Figs. 6 and 6^a this method consists in suspending wire cords, cables or similar devices *d* in the form or former, before the concrete is poured thereinto and which remain in the concrete when the form or former is withdrawn. This style of reinforcement is particularly designed for use in shifting earth or earth composed of shifting sands having a lateral movement and is designed to give the pile, when formed, a degree of flexibility whereby it may yield to a certain extent laterally without being entirely broken and the separate parts thereof disconnected.

In the construction shown in Fig. 7, I employ chains d^2 which are suspended in the form or former before the concrete is poured thereinto, and which remain in the pile after the form or former is withdrawn, and these chains serve for the same purpose as the wire cables, cords or similar devices employed in the construction shown in Figs. 6 and 6^a, but said chains serve to give the pile in which they are used, a greater degree of flexibility than said wires, cords or cables.

In the construction shown in Fig. 8 I place

in the pile form or former at any time, but preferably after it has been driven, an inner sleeve or lining *e* which fits the inner wall thereof, and which is composed of perforated sheet metal, wire mesh, or any other suitable openwork material, and after the form or former has been driven the concrete is poured thereinto and fills said sleeve or lining, after which the former is withdrawn and the concrete in the sleeve or lining *e* which remains in the earth, in the process of settling and becoming set, oozes out through the perforations or apertures in the sleeve or lining and gives to the pile thus formed a roughened, irregular outside surface as indicated at e^2 and this also strengthens the pile and causes it to adhere to, or unite with the surrounding earth and reinforces and strengthens said surrounding earth, and in this way also reinforces and strengthens the pile itself.

In Figs. 9, 10 and 11 of the accompanying drawing, I have shown one method of using the tapered form or former shown in Fig. 3, it being understood that the use of the bands a^6, Fig. 3, is not absolutely essential and, in this method of procedure the pile form or former is first driven, as shown in Fig. 11, after which a tube *f* is passed downwardly thereinto and said tube is provided with branch tubes f^2 which fit in the form or former and the tube *f* is preferably open at its lower end, and the nose piece *b* employed in this case, is also provided with a vertical aperture b^3 having branch outlets b^4, and in which the lower end of the tube *f* fits, and after the pile form or former has been driven and the concrete poured thereinto, the form or former is withdrawn and other concrete or "grout" is forced down through the tube *f* by compressed air or otherwise, and passes out through the branch tubes f^2, any desired number of which may be employed, and down through the nose piece or pointer *b*, as indicated at *g*, and this concrete or "grout" mingles with and permeates the surrounding earth both at the sides and at the bottom of the pile and unites therewith, and with the material of the pile and the entire body of the earth around the pile may thus be reinforced and made firm and prevented from slipping, shifting or moving, and this form of reinforcement is partially designed for use in what are known as shell earth "rock fill" and loose or made earth, containing interstices, apertures or spaces which are filled in by the concrete as above described.

The pile shown in Figs. 12 and 14, is the same as that shown in Fig. 9, and the method of forming said pile is the same as that of forming the pile shown in Fig. 9, except that a plurality of the tubes *f* are employed, and the nose piece or pointer *b* is provided with a large central aperture b^5 with which the lower ends of the tubes *f* communicate, and it will be understood that this method of reinforcing the pile which involves the use of a tube or tubes *f*, any desired number of which may be used, may be employed in connection with any one of the pile forms or formers herein shown and described.

From the foregoing description it will be seen that there is no loss of any part of the apparatus which I employ in the sinking or forming of a pile, except the nose piece *b*, and tube or tubes *f* which, in the method of procedure hereinbefore described, remains in the earth in all cases, and my improved process depends for its success upon the idea that the form or former employed is tubular in form and consists of separate longitudinal parts so as to facilitate the operation of withdrawing said form or former, or the separate parts thereof, from the earth as herein described.

Although I have described the particular object or objects to be accomplished by the use of the form of piles shown in Figs. 9, 10 and 12, it will be understood that this particular form of pile has many other advantages among which is the fact that it is particularly adapted for use in cases where it is not necessary, or desired, to go to great depth, but is desired to form a substantial foundation, or to fully reinforce earth without going to great depths, and with the form of pile shown in Figs. 9, 10 and 12, and the method of making the same employed, the desired object may frequently be accomplished by employing much shorter piles than would be necessary under other conditions, it being also understood that the pile shown in Figs. 9, 10 and 12 may be of much greater transverse dimensions than would be necessary or desirable under conditions in which it was necessary or desired to go to great depths.

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

1. The method herein described of sinking and forming concrete piles which consists in providing a tubular former, closing one end of said former by a detachable nose piece having a passage, driving said end into the ground, passing a reinforcing tube downwardly through said former, said tube being provided with branch outlets, filling said former with concrete, withdrawing said former and then forcing reinforcing material downwardly through said tube and outwardly through its branch outlets and through said nose piece.

2. The method herein described of sinking and forming concrete piles which consists in providing a tubular former divided longitudinally into separate parts, closing one end of said former by a detachable nose piece having a passage, driving said end into the ground, passing a reinforcing tube having branch outlets downwardly through said

former, filling said former with concrete, withdrawing said former and then forcing reinforcing material downwardly through said tube and through its branch outlets and through said nose piece.

3. The method herein described of sinking and forming concrete piles which consists in providing a tubular former divided longitudinally into separate parts, closing one end of said former by a detachable nose piece having a passage, driving said end into the ground, passing a reinforcing tube having branch outlets downwardly through said former so that it communicates with said passage, filling said former with concrete, afterward withdrawing said former and then forcing reinforcing material downwardly through said tube and through its branches and through the nose piece.

4. The method herein described of sinking and forming concrete piles which consists in providing a tubular former divided longitudinally into separate parts, closing one end of said former by a detachable nose piece having passages, driving said end into the ground, passing reinforcing tubes having branch outlets downwardly through said former so that they communicate with said passages, filling said former with concrete afterward withdrawing said former and then forcing reinforcing material downwardly through said tubes and through their branch outlets and the nose piece.

In testimony that I claim the foregoing as my invention I have signed my name in presence of the subscribing witnesses this 29th day of May, 1917.

MAURICE BLUMENTHAL.

Witnesses:
C. E. MULREANY,
H. E. THOMPSON.