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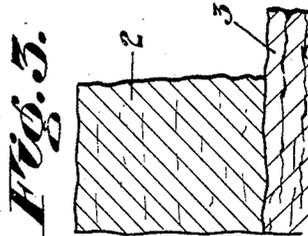
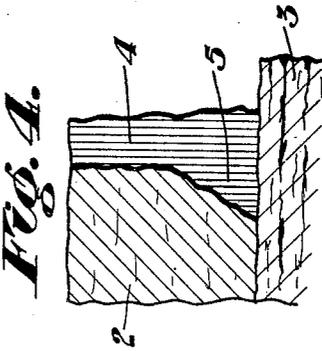
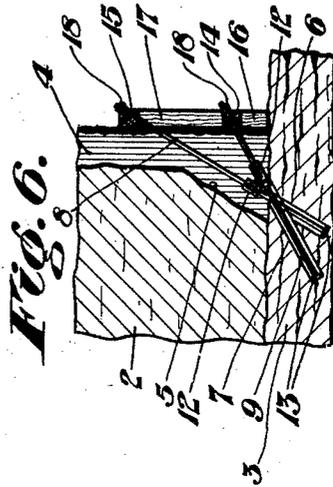
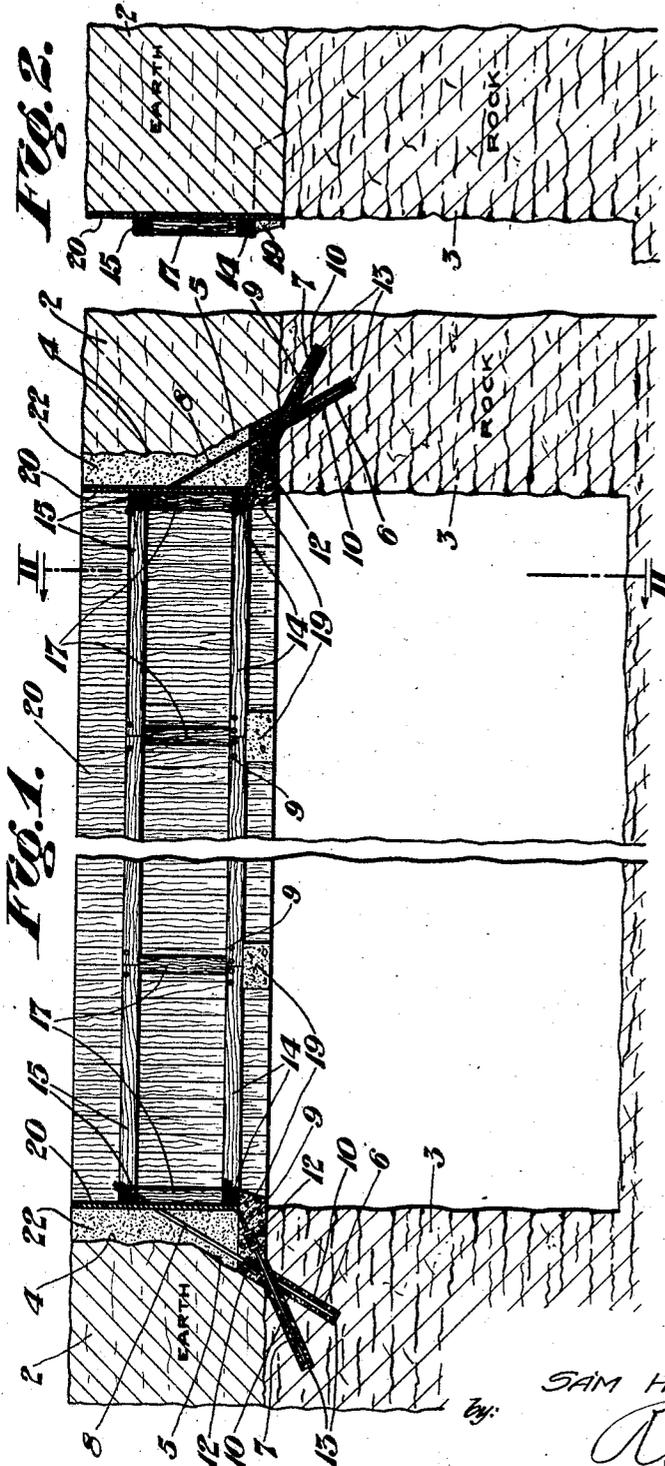
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METHOD OF AND APPARATUS FOR SUPPORTING THE SIDE WALLS OF EXCAVATIONS

Filed March 21, 1928

2 Sheets-Sheet 1



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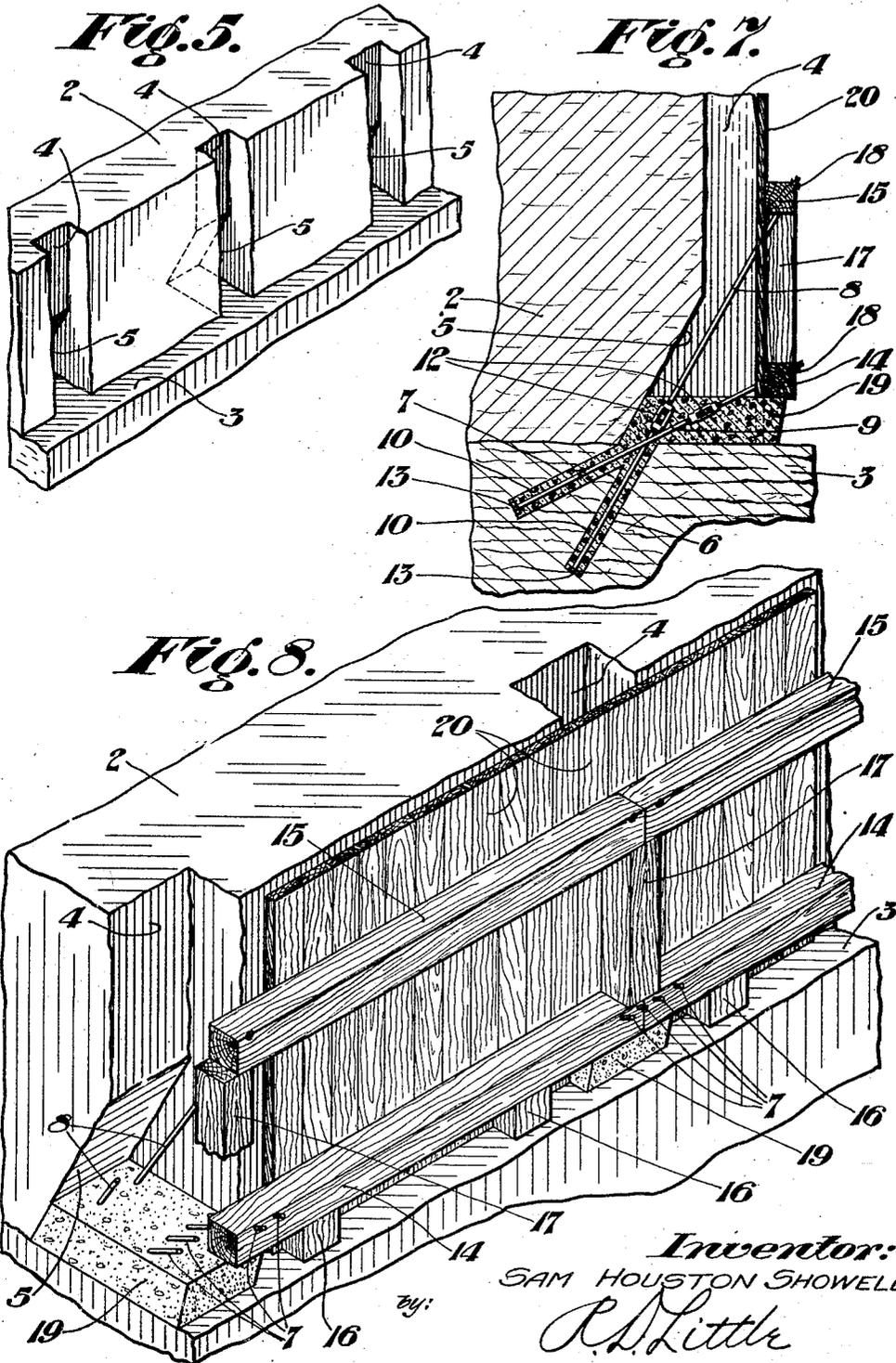
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METHOD OF AND APPARATUS FOR SUPPORTING THE SIDE WALLS OF EXCAVATIONS

Filed March 21, 1928

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR SUPPORTING THE SIDE WALLS OF EXCAVATIONS.

Application filed March 21, 1923. Serial No. 263,249.

This invention relates to methods of and apparatus for supporting the side walls of excavations and, while not limited thereto, relates more particularly to supporting the side walls of excavations which extend down into rock, and has for its object the provision of a supporting structure which will be supported entirely outside of the side walls of the excavation.

When excavations are made for buildings, subways, reservoirs and the like, in built-up sections, it is the practice to cut the sides of the excavations down substantially vertical due to property limitations and, in such cases, it is necessary to employ some sort of bracing to support the sides from caving inwardly. The method, almost universally adopted, is by driving sheet piling vertically in line and placing horizontal wales or rangers in front and in contact with them, and at intervals along these wales are placed shores or braces of timber to counteract the lateral pressure, thus concentrated at these interval points. The braces, in some instances, extend downwardly into the excavation on an angle of about 38 degrees from the horizontal, and the lower ends thereof rest against the bottom of the excavation. In deep work it is impractical to extend the braces down to the bottom of the excavation and, therefore, horizontal braces are extended entirely across the excavation to bear against the corresponding wales of the opposite side, and are held up by truss bracing. This method, although in general use, has many objections and is in itself very expensive to install due to the many and bulky compressive members required. The installation of the bracing members must be closely coordinated with the excavation progress and, due to the obstructing effect of the braces, much of the excavation that otherwise would be removed with steam shovels must be taken out by clam-shell or hand methods and this is a much slower and more expensive operation.

When the above method of supporting the side walls of excavations is used in excavation for buildings, the bracing members interfere with erecting of the structural steel below the surface. Another objection to the above method is that holes must be left in the outside walls to allow each brace to pass through, and after the walls are poured and back-filled and the braces removed, these holes must then be concreted or filled separately.

A still further objection to the use of this old method of supporting the side walls of excavations is that it frequently happens, through oversight or change in plans, that one or more of the bracing members extend into the path of structural members and, therefore, must be moved. This is a difficult operation since the braces are under load and other braces must be placed to take the load from the braces to be removed and other precautions taken to prevent the side walls from caving in.

The present invention provides means outside of the side walls of the excavation for supporting the vertical sheet piling or sheeting, therefore eliminating the use of bracing inside of the excavation whereby the excavation is left open for the free use of steam shovels, the erection of structural steel and other work.

In the drawings—

Figure 1 is a sectional elevation through an excavation, the side walls of which are supported in accordance with this invention.

Figure 2 is a sectional elevation taken on the line II—II of Figure 1.

Figure 3 is a fragmentary sectional elevation showing the first step of excavating in accordance with this invention.

Figure 4 is a similar view showing the second step.

Figure 5 is a perspective elevation showing a length of side wall prepared in accordance with this invention.

Figure 6 is a view similar to Figures 3 and 4 showing the wale members in position.

Figure 7 is a sectional elevation showing the supporting structure completed except for back-filling.

Figure 8 is an enlarged perspective elevation of a section of the completed support.

In carrying out this invention, which is particularly adapted for use in locations where the ground structure consists of a hard base of clay, shale or rock formation with an overlying layer of earth, the excavation will be started by removing the earth layer 2 down to the hard base 3, as shown in Figure 1. After the earth layer has been removed, a plurality of pockets 4 are cut into the earth sides of the excavation, which pockets are undercut at their lower ends, as at 5, to expose a material portion of the hard base 3.

After the pockets 4 are formed, suitable holes 6 and 7 are drilled in the hard base on

angles projecting downwardly and away from the excavation. The holes 6 are drilled on a materially steeper angle than the holes 7 for a purpose to be described.

5 After the holes 6 and 7 are completed, suitable tie or supporting rods 8 and 9 are positioned in the respective holes and secured in place by grouting 10. The rods 8 and 9 are preferably formed in two sections adjustably
10 joined by turnbuckles 12 and have their lower ends upset to form enlargements or shoulders 13 which bear against the grouting 10 and further prevent the rods from pulling out of the holes.

15 After the rods 8 and 9 are secured in position, horizontal wale-members 14 and 15 are positioned along the side walls of the excavation and secured to the rods 8 and 9. The lower wale-members 14 are first positioned
20 along the excavation face and supported temporarily above the hard base by blocks 16. Suitable vertical posts 17 are then positioned on the lower wale-members 14 and the upper wale-members are supported on
25 the posts 17. The rods 8 and 9 are projected through suitable preformed holes in the wale-members 14 and 15 and have nuts 18 threaded thereon to lock the wale-members in position. After the wale-members are thus locked or
30 secured in position, the turnbuckles 12 may be adjusted to tension the rods 8 and 9 and pull the wale-members back against the excavation wall.

After the wale-members are thus positioned, permanent supporting blocks 19 are
35 provided at the bottom of each of the pockets 4 by pouring a bed of concrete therein, as shown, or, if desired, sections of timber may be positioned therein. The blocks 19 are positioned directly on the hard base and project
40 out under the lower wale-members 14, so as to support said members. The blocks 19 are preferably formed from concrete since it is more rigid than timber and also, when it is poured in the pockets it surrounds the turnbuckles 12, serves to lock said turnbuckles in
45 position and also serves to help hold the rods against displacement.

After the wales are thus positioned and supported, the piling or sheeting 20 is driven
50 home along the excavation face and back of the wale-members forming a continuous support for the earth 2 overlying the hard base 3. The pockets 4 are then back-filled in the usual
55 manner, as indicated at 22 in Figure 1, and the excavation may then be continued down into the hard base 3 without danger of the relatively soft or loose earth caving in or falling.

60 The temporary blocks 16 may be removed after the supporting blocks 19 are set, if desired, since the blocks 19 support the lower wale-members. After the blocks 19 are set and the pockets 4 back-filled, the blocks act
65 as cantilevers to support the wales, even if

the side face of the hard base should crumble or be removed under a portion of the block as the excavation is continued.

From the above, it will be readily seen that I have provided a novel structure for holding
70 up the side walls of excavations, which structure is supported entirely outside of the excavation and, therefore, permits free access to all parts of the excavation for completing the excavation or for other work in the excava-
75 tion.

While I have shown and described one specific embodiment of my invention, and a certain sequence of steps used in carrying out my novel method, it will be understood that
80 I do not wish to be limited thereto since various modifications may be practiced without departing from the scope of my invention as defined in the appended claims.

I claim—

85 1. The method of preventing the caving in of the side walls of excavations, which consists in removing the earth from the excavation for a predetermined depth, then forming
90 holes downwardly and outwardly on an angle from the base of the preformed excavation at a plurality of spaced points along the sides thereof, then securing tie-rods in said holes, then positioning wale-members
95 along the side walls of the preformed excavation and securing said wales to said rods, then driving sheeting home between the side walls of said excavation and said wales, and then continuing said excavation to the desired
100 depth without further shoring or support.

105 2. The method of preventing the caving in of the side walls of excavations made in earth covering a hard base, which consists in removing the earth covering over the area to
110 be excavated down to the base, then forming small diameter holes in the base downwardly and outwardly on an angle from the base of the preformed excavation at a plurality of spaced points along the side walls thereof,
115 then securing adjustable tie-rods in said holes, then positioning horizontal wale-members along the side walls of said preformed excavation and securing said wale-members to said rods, positioning vertical posts between
120 the ends of said wale-members, adjusting said rods so as to place said rods under tension, then driving sheeting home between the side walls of said excavation and said wale-members, and then continuing said excavation to the desired depth without further
125 shoring or support.

130 3. The method of preventing the caving in of the side walls of excavations made in earth covering a hard base, which consists in removing the earth covering over the area to be excavated down to the base, then forming vertical pockets in the earth at a plurality of spaced points along the side walls of the preformed excavation down to the
135

5 hard base, then forming small diameter holes
downwardly and outwardly on an angle in
the base at the bottom of said pockets, then
securing tie-rods in said holes, then posi-
10 tioning horizontal wale-members along the
side walls of said preformed excavation and
securing said wale-members to said rods, then
driving sheeting home between the side walls
of said excavation and said wale-members,
15 and then continuing said excavation to the
desired depth without further shoring or
support.

4. In an excavation extending through a
15 layer of earth covering a hard base, a struc-
ture for supporting the earth side walls com-
prising supporting block members formed
on said base at a plurality of spaced inter-
20 vals along the side walls of the excavation,
wale-members supported on said supporting
block members, vertical posts supported on
said wale-members, other wale-members sup-
ported on said posts, tie-rods secured in said
25 base outside of said excavation and extend-
ing upwardly on an angle and secured to
said wale-members to tie said wale-members
in position, and sheeting positioned between
said side walls and said wale-members.

5. In an excavation extending through a
30 layer of earth covering a hard base, a struc-
ture for supporting the earth side walls com-
prising supporting block members formed on
said base at a plurality of spaced intervals
along the side walls of the excavation, wale-
members supported on said supporting block
35 members, vertical posts supported on said
wale-members, other wale-members sup-
ported on said posts, tie-rods secured in said
base outside of said excavation and extending
upwardly on an angle through said support-
40 ing block members and secured to said wale-
members under tension to tie said wale-mem-
bers in position, and sheeting positioned be-
tween said side walls and said wale-members.

6. In an excavation extending through a
45 layer of earth covering a hard base, a struc-
ture for supporting the earth side walls com-
prising supporting block members formed

on said base at a plurality of spaced inter-
vals along the side walls of the excavation,
wale-members supported on said supporting
50 block members, vertical posts supported on
said wale-members, other wale-members sup-
ported on said posts, adjustable tie-rods an-
chored in said base outside of said excava-
tion and extending upwardly on an angle and
55 secured to said wale-members to tie said wale-
members in position, and sheeting positioned
between said side walls and said wale-mem-
bers and supported vertically on said base.

7. The method of preventing the caving
60 in of the side walls of excavations, which
consists in removing the earth from the ex-
cavation for a predetermined depth, then
forming holes downwardly and outwardly
on an angle from the base of the preformed
65 excavation at a plurality of spaced points
along the sides thereof, then securing tie-
rods in said holes, then positioning wale-
members along the side walls of the pre-
formed excavation and securing said wales
70 to said rods, then mounting sheeting be-
tween the side walls of said excavation and
said wales, and then continuing said excava-
tion to the desired depth without further
shoring or support.

8. In an excavation extending through a
75 layer of earth covering a hard base, a struc-
ture for supporting the earth side walls com-
prising supporting members mounted on said
base at a plurality of spaced intervals along
80 the side walls of the excavation, wale-mem-
bers supported on said supporting members,
vertical posts supported on said wale-mem-
bers, other wale-members supported on said
posts, adjustable tie-rods anchored in said
85 base outside of said excavation and extend-
ing upwardly on an angle and secured to
said wale-members to tie said wale-mem-
bers in position, and sheeting positioned between
said side walls and said wale-members and
90 supported vertically on said base.

In testimony whereof, I have hereunto set
my hand.

SAM HOUSTON SHOWELL.