No. 846,816. PATENTED MAR. 12, 1907.

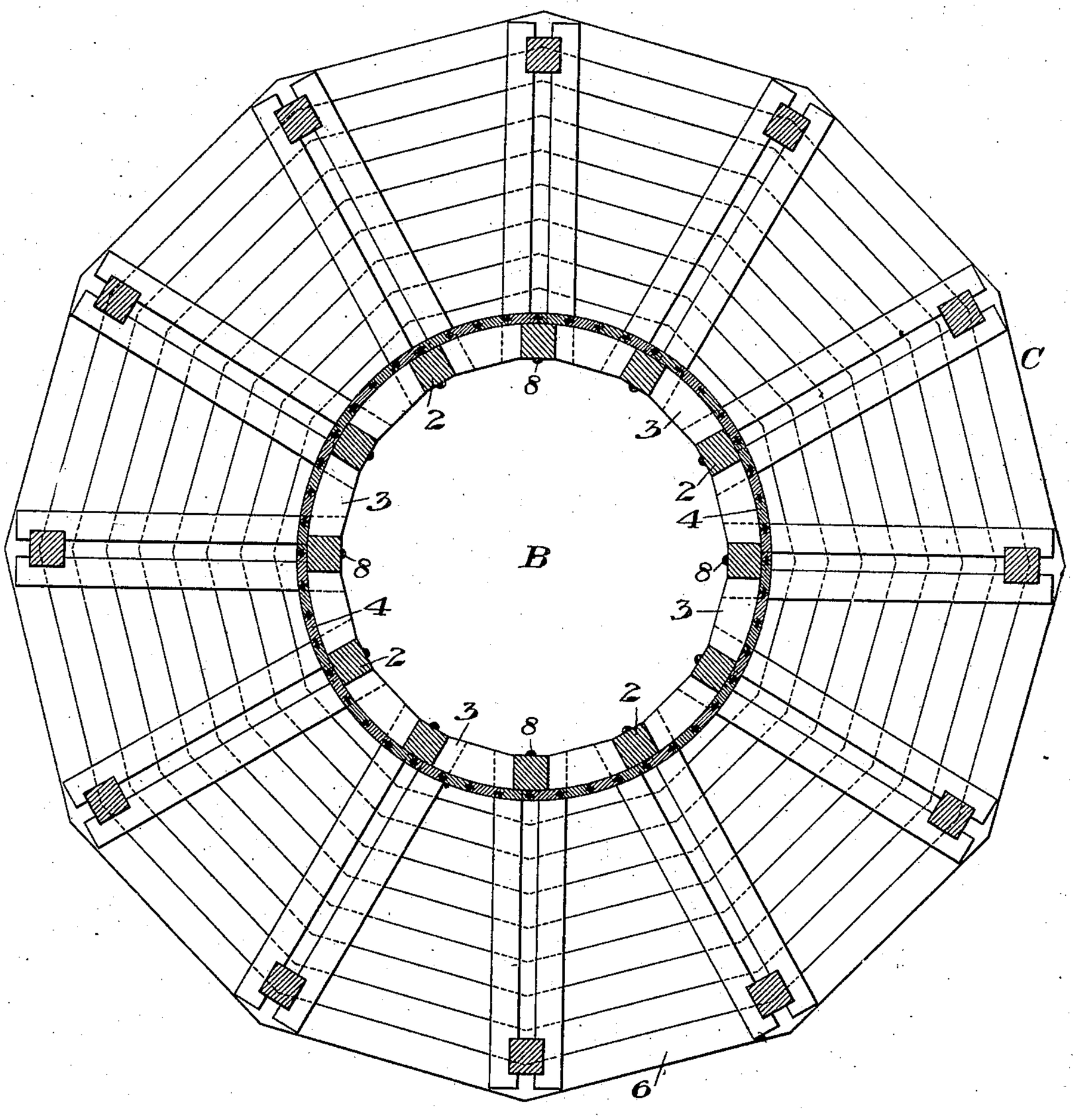
R. BAGGALEY.

APPARATUS FOR SINKING SHAFTS.

APPLICATION FILED SEPT. 20, 1904.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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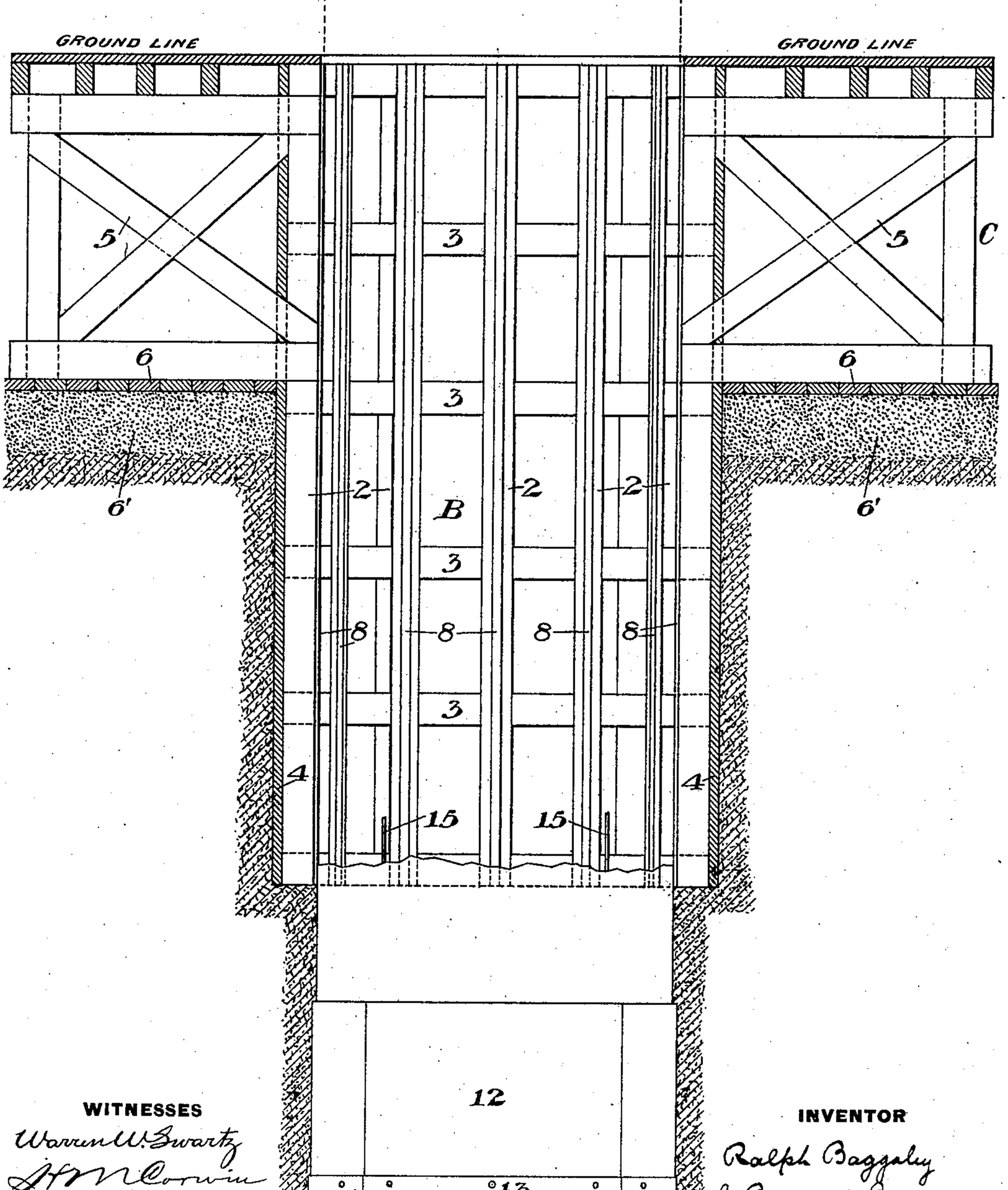
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3

Fig. 3.

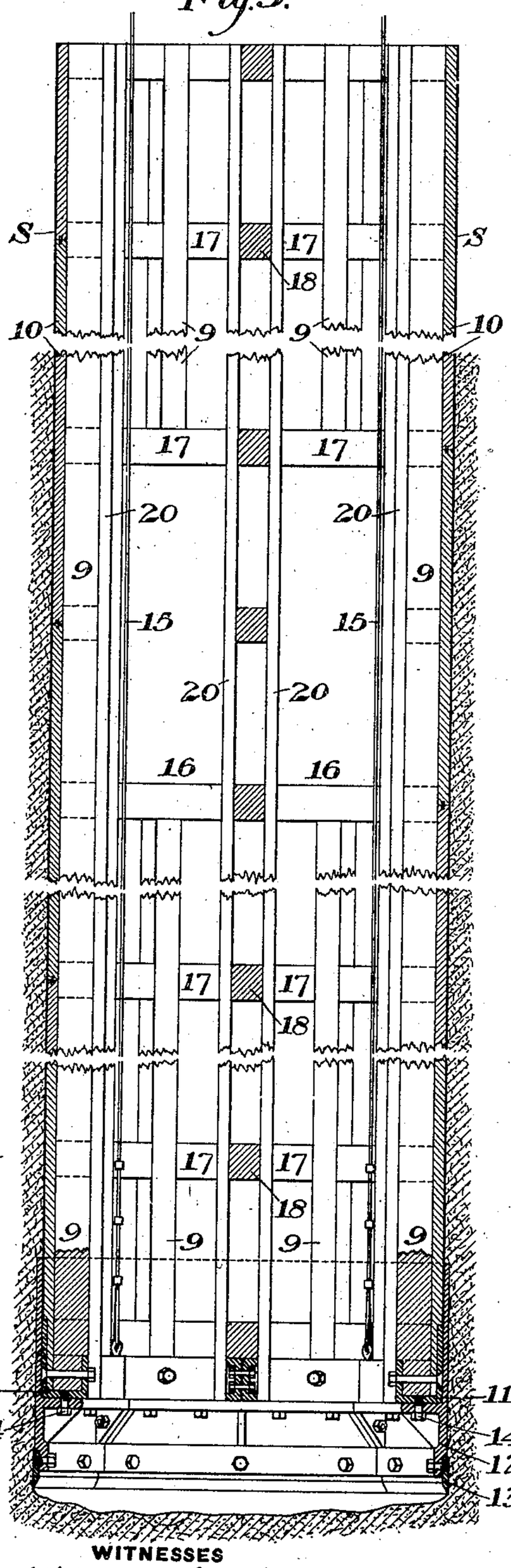


Fig. 6.

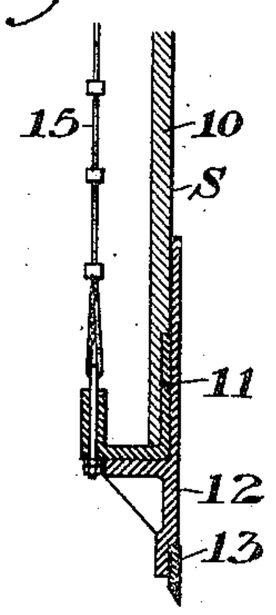


Fig. 7.

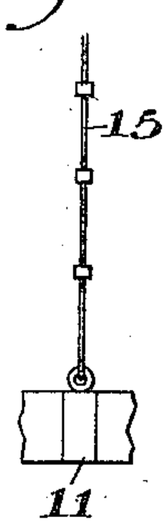
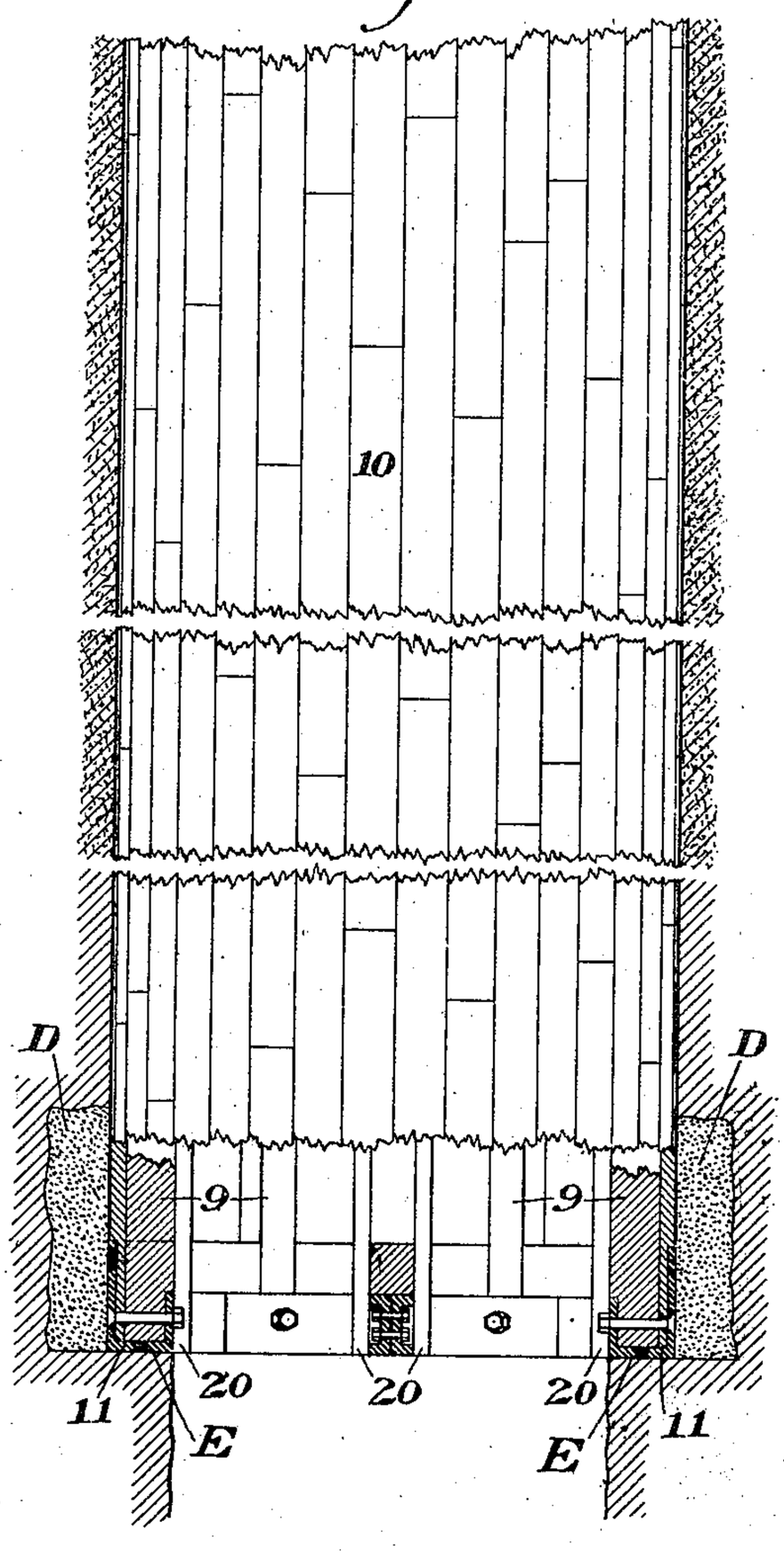


Fig. 8.



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4 SHEETS—SHEET 4.

Fig. 5.

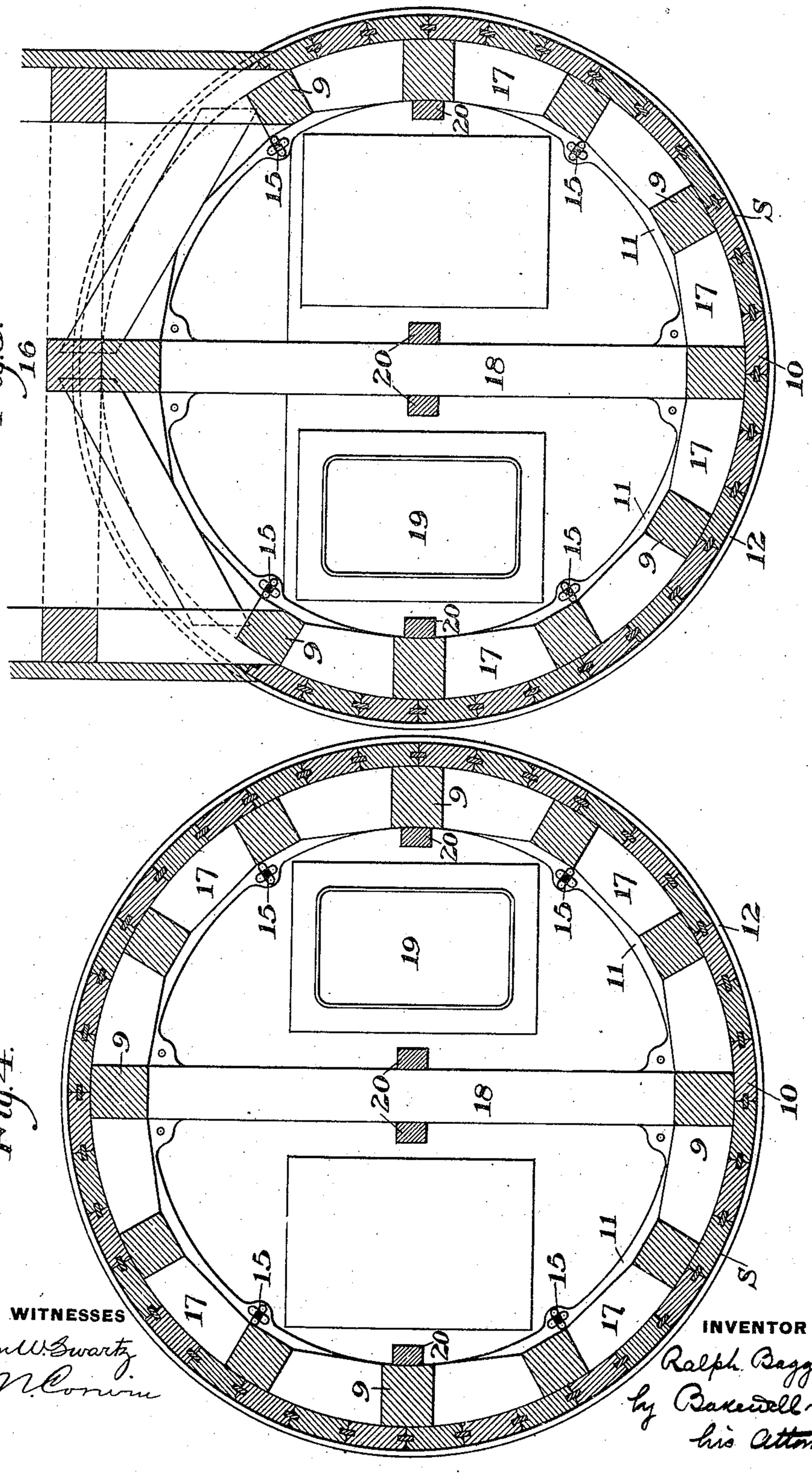

Fig. 4.

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UNITED STATES PATENT OFFICE.

RALPH BAGGALEY, OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR SINKING SHAFTS.

No. 846,816. Specification of Letters Patent. Patented March 12, 1907.

Application filed September 20, 1904. Serial No. 225,234.

To all whom it may concern:

Be it known that I, RALPH BAGGALEY, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Apparatus for Sinking Shafts, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 shows a plan view of the surface platform and shield, intended to prevent the caving of ground around the collar of the shaft near the surface. Fig. 2 represents a vertical section of Fig. 1. Fig. 3 represents a cross-section of the shaft itself. Fig. 4 represents a plan view of Fig. 3. Fig. 5 is intended to show the construction at a station-landing. Fig. 6 illustrates the removable bottom shoe and cutter-bar used during the excavation work. It also shows the metal sheathing, which may be applied to the shaft. Fig. 7, as well as Fig. 6, illustrates the method of suspending and lowering the shaft during excavation and construction; and Fig. 8 is a side elevation, partly broken away, showing the lower end of the shaft in its final position.

The object of my present invention is to produce a lighter and a cheaper form of construction than that which is illustrated and described in United States Letters Patent No. 766,132, granted to me on July 26, 1904, for a safety-shaft for quicksand or other dangerous ground.

My present invention embodies the following new features, which in certain cases are important and advantageous:

First. It is cheaper, although not so durable; but in many instances it is preferable.

Second. It is lighter. Hence it may be suspended during construction by four cables, or even by two, in so far as the weight is concerned. I, however, prefer to use four cables, because in so doing I am able to adjust and to regulate with them the vertical drop of the shaft to a nicety, whereas with two cables this is difficult to accomplish, inasmuch as the shaft in its descent is liable when only two cables are used to shear off either to one side or to the other.

Third. In sinking shafts of this description in certain kinds of ground, and particularly in quicksand, the shaft may be subject to side strains caused by a sudden rush of quicksand that at times may cause a greater pressure on one side of the shaft than on the other. These side strains may break the shaft in two longitudinally, notwithstanding the fact that shafts of my construction are intended to be perfect circles, and therefore capable of resisting much greater outside pressure than any other form of shaft. Where a side rush of quicksand occurs, a shaft constructed of timber according to my present invention will be less apt to fracture longitudinally than one constructed of vitrified brick or tile, such as that described in my patent above referred to.

Fourth. In my present invention, where timber construction throughout is utilized, I can dispense with the upright internal timbering and the many bolts necessary to hold such timbering securely in place, as described in the invention above referred to, and thus I materially cheapen the operation.

Fifth. In my present invention I can utilize heavy central cross-timbers in the construction of the shaft, as illustrated in Figs. 4 and 5. These cross-timbers are preferably placed five feet apart from the bottom to the collar of the shaft.

Sixth. In constructing shafts of this description in swamps or in quicksands such as exist in the flats in the Butte copper-mining district one of the greatest difficulties encountered is through the settling or caving of the surface around the collar of the shaft. I have seen the surface settle for a distance of twenty feet on each side and to a depth of twenty or thirty feet, resulting in destroying the shaft.

In my present invention I have provided ample means, as illustrated in Figs. 1 and 2, against surface caving, for sustaining the heavy weights of the superstructure, on which the shaft proper is suspended during construction, and for guiding the shaft proper in its vertical descent during construction work and until it is finally bedded on its plastic concrete foundation in soild rock below the level of surface waters and loose ground.

Referring now to Figs. 1 and 2, the shield B (illustrated in section and in plan view) is constructed of timbering, the main supports 2 2 being preferably of ten by ten or twelve by twelve timbers. At intervals, preferably of five feet each, short sections 3 of timber similar in size are placed between the uprights. On the outside of the shield planking 4, of from two to four inches in thickness, is used, and this planking is preferably

tongued and grooved or grooved and united by tenon-strips. The end joints of this planking both in the shield and in the shaft itself are purposely arranged to meet at the centers of the cross-timbers, and tongues and grooves, or preferably tenon-strips, are also used at the junction-points of the plank ends, as illustrated at the central sides of Fig. 3. In the sectional view of the surface shield, as illustrated in Figs. 1 and 2, I show the collar C of the shaft and the shield supported by heavy timber trusses 5, that completely encircle the shaft proper. These trusses, which preferably cover a circle, say, of thirty feet in diameter, rest on a platform 6, of heavy planking, as shown in Fig. 2, and this planking is located whatever distance below the surface line that the dimensions of the trusses may render necessary. If the ground is particularly treacherous, this planking may be bedded, for instance, on a twenty-four-inch platform 6′, of concrete grouting. In Fig. 1, which represents a plan view of the shield, the half-round strip 8, shown on the inner side of each vertical timber 2, represents iron or steel bars that guide the shaft-casing while it is being lowered during excavation work.

Fig. 3 illustrates in vertical section the shaft-casing proper constructed of heavy timbering 9, the same as the shield, and also having water-tight planking 10, cut to the segment of the proper circle, incasing the outside of the timbering. If desired, the planking may be provided on its outer surface with metal sheathing S, Fig. 3, as a means of reducing friction. The entire timbering is suspended by cables, the bottom shoe 11 preferably being made of a steel casting in segments, as illustrated clearly in Figs. 6 and 7. The entire outer protecting-shoe 12 is preferably a steel casting and carries on its lower edge a wrought-steel cutting-knife 13, and it is suspended from the shaft-carrying shoe 11 by means of tap bolts or screws 14, as illustrated in Fig. 3. My object in so arranging these shoes is so that when the shaft has been lowered the requisite distance through the waters of a lake or pond or through a swamp or quicksand into the solid rock stratum below I can hold the shaft suspended by the cables 15 and remove the cutting-shoe by unscrewing the segments of which the cutting-shoe is composed and removing them below the shaft, while the shaft-cylinder itself is still suspended by the cables, as shown. After these cutter-shoe segments have been removed the shaft-cylinder is lowered through a body of plastic hyraulic cement D into its final resting-place, Fig. 8. Fig. 3 also illustrates in its central portion a station-level 16 and the means of constructing the passageways for ore-cars or for miners from the cages to the station-levels.

Fig. 4 shows the upright timbering 9, the cross-timbers 17 at intervals, preferably spaced five feet apart, the method of uniting the outside water-tight planking 10, the heavy cross-brace timbers 18, the position of the hoisting-cages 19, and the upright guides 20 for the cages. Fig. 5 illustrates the same, and in addition it shows the method of constructing the station-landings 16. At the points in the shaft furthest removed from the landing a stairway or ladders may be erected for the use of the miners in the event of anything getting out of order in connection with the machinery. The remaining spaces in the shaft, as shown, are intended for air-pipes, water-pipes, steam-pipes, electric-light wires, signaling devices, &c.

Figs. 4 and 5 show means for suspending the shaft with eight cables during construction. This number, however, will not be found to be necessary, as four cables will be ample to sustain and to properly guide downward any ordinary shaft and also in constructing shafts to any ordinary depths.

Figs. 6 and 7 indicate the mode of suspending the shaft-casing during construction, and Fig. 6 also shows the removable bottom shoe 12 and cutter-bar 13. The means for lowering the shaft-casing and the means of bedding it in its final resting-place in the solid rock are fully illustrated and described in United States Patent No. 766,132, granted to me on July 26, 1904.

My present invention embodies many advantages. By mounting the shield B and the top platform on a securely-anchored barge a shaft by this means may be sunk with safety directly in the waters of a lake or a pond, for as soon as the cutter-plates encounter the soil of the bottom and the weight of the shaft is permitted to rest directly upon the metal shoe it will have the effect of sealing out the outside water. The inside water may then be pumped out and excavation and rock-sinking work may thereafter be conducted continuously until a solid rock stratum has been reached. The heavy steel bottom shoe and cutter-bar may be made ten feet long, if desired, as a means of effectually shutting off outside water from the interior of the shaft, or these shoes and cutters may be changed from time to time during the progress of the work to suit the character of the ground that the cylinder is then passing through. For instance, where very wet, soft, marshy ground is encountered, or particularly where a heavy stratum of soft quicksand is met with, a long cutting-shoe four or six feet in length will be useful in excluding outside water, because when a shoe of this length is firmly driven into the lower stratum of earth with the entire weight of the shaft-casing resting upon it it will not be possible for much outside water to enter the interior or excavated portion of the

shaft. It is also possible that during the progress of excavation the lower shoe or the cutter-bar may become bent, broken, or injured in some manner, so as to necessitate their removal or repair. For this reason also it is important that this lower portion of the mechanism should be capable of removal without interfering with the shaft itself in the position in which it happens then to be.

Blasting work may be conducted in the bottom of the shaft until a safe distance has been reached through the rock stratum—say to a distance of fifty feet below any loose soil. When this point has been reached and when the rock stratum shows that it is free from cracks and fissures that might permit surface water to enter, it will then be safe to bed the bottom of the shaft-casing on its cushion of plastic hydraulic cement and on its final resting-place on a ledge of solid rock. Thereafter a shaft may be sunk through the rock to any desired depth. I have found it desirable to blast out a shaft a considerable distance below the ledge E, on which the timber casing rests, before the casing has been finally lowered into its position. If this is not done, subsequent blasting work is liable to injure the lower portion of the timbering and the metal shoe.

In sinking a shaft such as that described in my present invention in a swamp or in the sands of a desert or in quicksands I preferably proceed as follows: First, at the desired spot I erect a temporary platform of planking for the workmen to stand on; second, I place the cutter-shoes 12 13, and indeed the lower thirty or fifty feet of the casing, in position on the exact spot at which it is desired to sink; third, I start temporary excavation work on the inside of the casing and permit it to sink by its own weight as the excavation work progresses to a depth of, say, thirty or forty feet; fourth, I remove the temporary platform and construct the shield B around the outside of the shaft proper; fifth, after the shield has been completed I erect a framework on the top landing of the shield that is intended to sustain the weight of the shaft-casing, attach the cables 15, and proceed with the excavation of the shaft and construction of the casing and the lowering of the same.

The casing is built by adding successive upright timbers 9 and horizontal pieces 17 and surrounding them with a sheathing or planking 10, fitted together with tongues and grooves or with tenons, as described above, so as to make an impervious water-tight structure. The casing is thus built and lowered successively, the shoe at its lower end penetrating the soil and shutting off the outside water. All surface caving is prevented by my invention.

The shield B may be placed in position first, if preferred; but I prefer the method of procedure above described for many reasons. In very wet soft surface ground it may become necessary to provide a coffer-dam in erecting the shield. In this form of shaft-sinking it is of importance that one should be able to control and to regulate the travel of the shaft downward. This is imperative where work is commenced in the waters of a lake or pond or even when in every marshy ground. It is also essential in soft quicksands ninety feet thick, such as exist in the Butte (Montana) flats. Unless means are provided for actually suspending the structure it is difficult, if not impossible, to follow an absolutely vertical line. If a shaft is not vertical, it produces many complications and expenses in the operation of the cages, water-tanks, &c. Among other things, it throws heavy strains and heavy wear on the guides. In shaft-sinking of this description the best results are obtained if the travel of the casing can be regulated at will. Ordinarily the weight of the casing bearing on the cutting-plates will be sufficient in itself to move it steadily downward as excavation work progresses within and when the cable-unwinding machinery is operated for that purpose. Should it stick or bind in its downward travel, it may readily be started again by the use of overhead weights. Railroad-iron may be used for this purpose to any desired weight by piling it directly on top of the casing. I, however, much prefer a loose timber framework suitably located above the shaft, and on which framework any desired amount of railroad-iron may be piled that may be found to be necessary in starting the shaft downward. With such a heavy mass located immediately above the top of the shaft-cylinder I then preferably use jacks between the top of the shaft and the superimposed body of railroad-iron, because in this way I am enabled to apply pressure, by means of the jacks, to one side of the shaft, on two sides of it, or evenly all around it, as may be deemed necessary in order to produce the best results. By properly utilizing these two forces the travel of the cylinder may be controlled, regulated, and guided at will.

The advantages of my invention will be appreciated by persons skilled in mining and shaft-sinking. It is extremely simple and effective, is readily adaptable to existing modes of mining, and can be practiced with moderate cost. It overcomes one of the most serious difficulties encountered in mining-work and enables shafts to be sunk in places in which it has heretofore been impracticable to do so. Many modifications in the details of this invention will naturally suggest themselves to those skilled in the art, and these may be made without departing from the spirit of my invention, since

What I claim is

1. Means for sinking shafts including a permanent casing suspended from its lower end and made up of superimposed sections capable of being assembled as the casing is lowered, substantially as described.

2. Means for sinking shafts including a permanent casing suspended from its lower end and made up of superimposed sections capable of being assembled as the casing is lowered, each section being an incased framework of beams, substantially as described.

3. Means for sinking shafts including a permanent casing suspended from its lower end and provided with a penetrating bottom, said casing being made up of superimposed sections capable of being assembled as the casing is lowered, each section being an incased framework of beams, substantially as described.

4. Means for sinking shafts comprising a shield at the surface of the ground, and a suspended casing adapted to be lowered through the same, said casing being built up successively as it is lowered; substantially as described.

5. Means for sinking shafts comprising a shield at the surface of the ground having a surrounding supporting-framework; substantially as described.

6. Means for sinking shafts including a permanent casing suspended from its lower end and provided with a penetrating lower edge formed in sections capable of being removed inwardly through the bottom of the casing, substantially as described.

7. Means for sinking shafts including a permanent casing which is built up successively as it is lowered, a ring at the bottom of the casing, suspending means within the casing and connected to the ring, and penetrating shoe-sections detachably connected to the ring and capable of being removed inwardly through the bottom of the casing, substantially as described.

8. Means for sinking shafts including a permanent casing which is built up as it is lowered, said casing including diametric cross-braces and centrally-disposed uprights secured against opposite sides of the braces, substantially as described.

9. Means for sinking shafts including a permanent casing which is built up as it is lowered and provided with a landing-opening, substantially as described.

10. Means for sinking shafts including a permanent casing which is built up as it is lowered, and provided with diametric cross-braces and a landing-opening through that side of the casing against which the ends of the adjacent braces are secured, substantially as described.

11. Means for sinking shafts including a permanent casing which is built up as it is lowered, and provided with diametric cross-braces and centrally-disposed uprights secured to opposite sides of the braces, there being a landing-opening through that side of the casing against which the ends of adjacent braces are secured, substantially as described.

12. Means for sinking shafts including a permanent casing which is built up as it is lowered, and provided with diametric cross-braces and uprights secured to opposite sides of the braces and to the interior of the casing structure, said uprights being disposed to form guides for cages, substantially as described.

13. Means for sinking shafts, comprising a shaft-casing suspended from above by cables, having a carrying-shoe to which the cables are attached and a cutting-shoe or cutter-bar below the carrying-shoe capable of being removed during the progress of the work; substantially as described.

14. Means for sinking shafts including a permanent casing which is successively built up as it is lowered and provided with diametric cross-braces, and uprights secured to opposite sides of the braces and to the interior of the casing structure, said uprights being arranged to form guides for cages, there being a landing-opening formed through that side of the casing to which the ends of adjacent cross-braces are secured, substantially as described.

15. Means for sinking shafts including a permanent casing which is successively built up as it is lowered, a ring secured to the bottom of the casing and extending inwardly, suspending means extending downwardly through the casing and connected to the ring, diametric cross-braces, and uprights rising from the ring and secured respectively to the interior of the casing and to opposite sides of the cross-braces, said uprights being arranged to form guides for cages, substantially as described.

16. Means for sinking shafts, comprising an incased framework of beams suspended from above, the casing thus constituted being built up successively as it is lowered, and being incased with planks; substantially as described.

17. Means for sinking shafts, comprising an incased framework of beams suspended from above, the casing thus constituted being built up successively as it is lowered, and being incased with planks tongued or tenoned together; substantially as described.

18. Means for sinking shafts including a permanent staging having a shaft-opening, and a permanent casing suspended upon the staging and adapted to be lowered through the shaft-opening thereof, substantially as described.

19. Means for sinking shafts including a permanent staging made up of a surface

platform and an elevated platform supported thereon by posts, the two platforms being provided with alined shaft-openings, and a permanent casing which is successively built up as it is lowered and suspended from the staging to be lowered through the shaft-openings thereof, substantially as described.

In testimony whereof I have hereunto set my hand.

RALPH BAGGALEY.

Witnesses:
GEO. B. BLEMING,
JOHN MILLER.