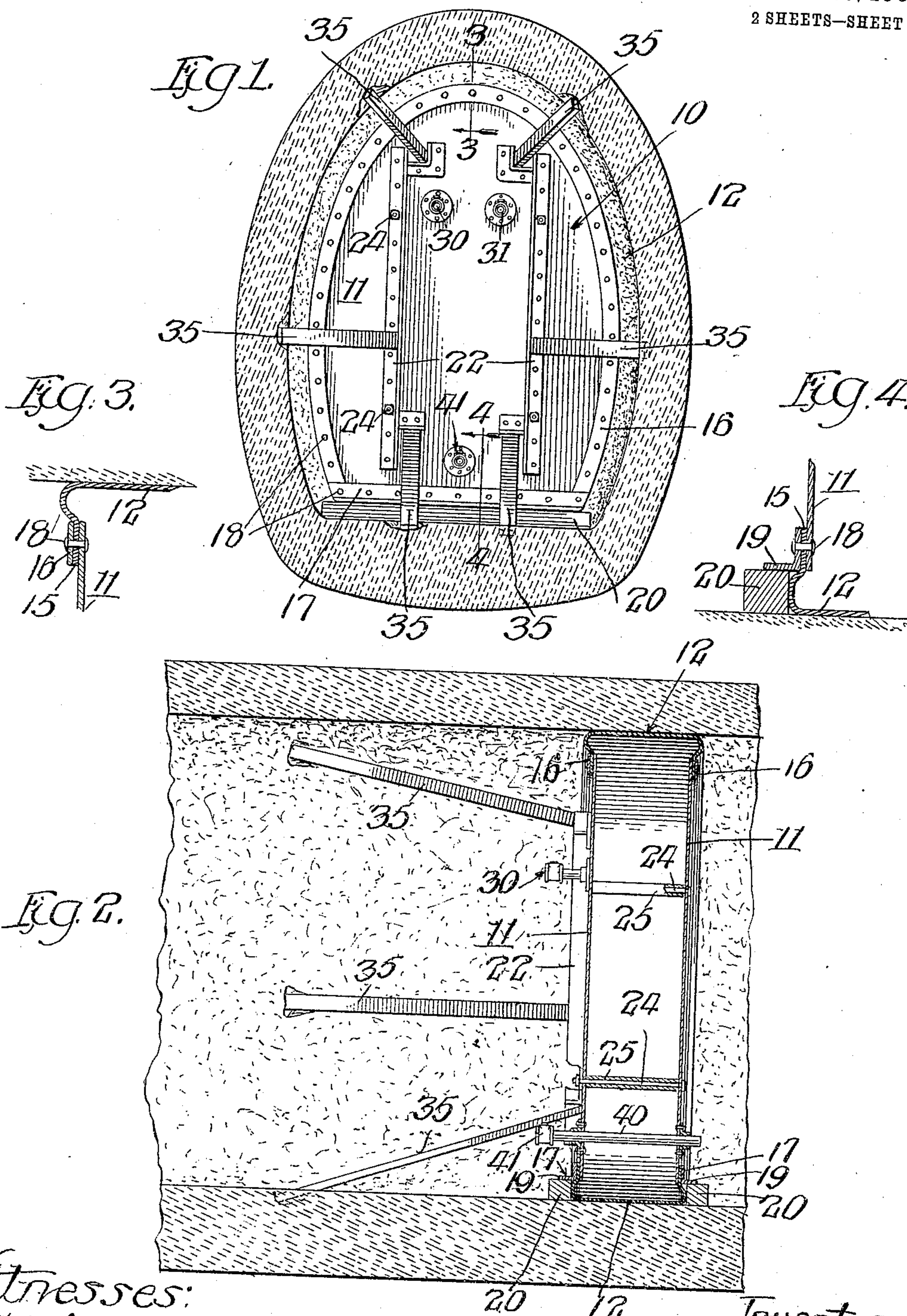


G. W. JACKSON.
BULKHEAD FOR TUNNELS AND THE LIKE.
APPLICATION FILED APR. 28, 1908.

940,323.

Patented Nov. 16, 1909.
2 SHEETS—SHEET 1.



Witnesses:
J. H. Alfords
W. H. Hall

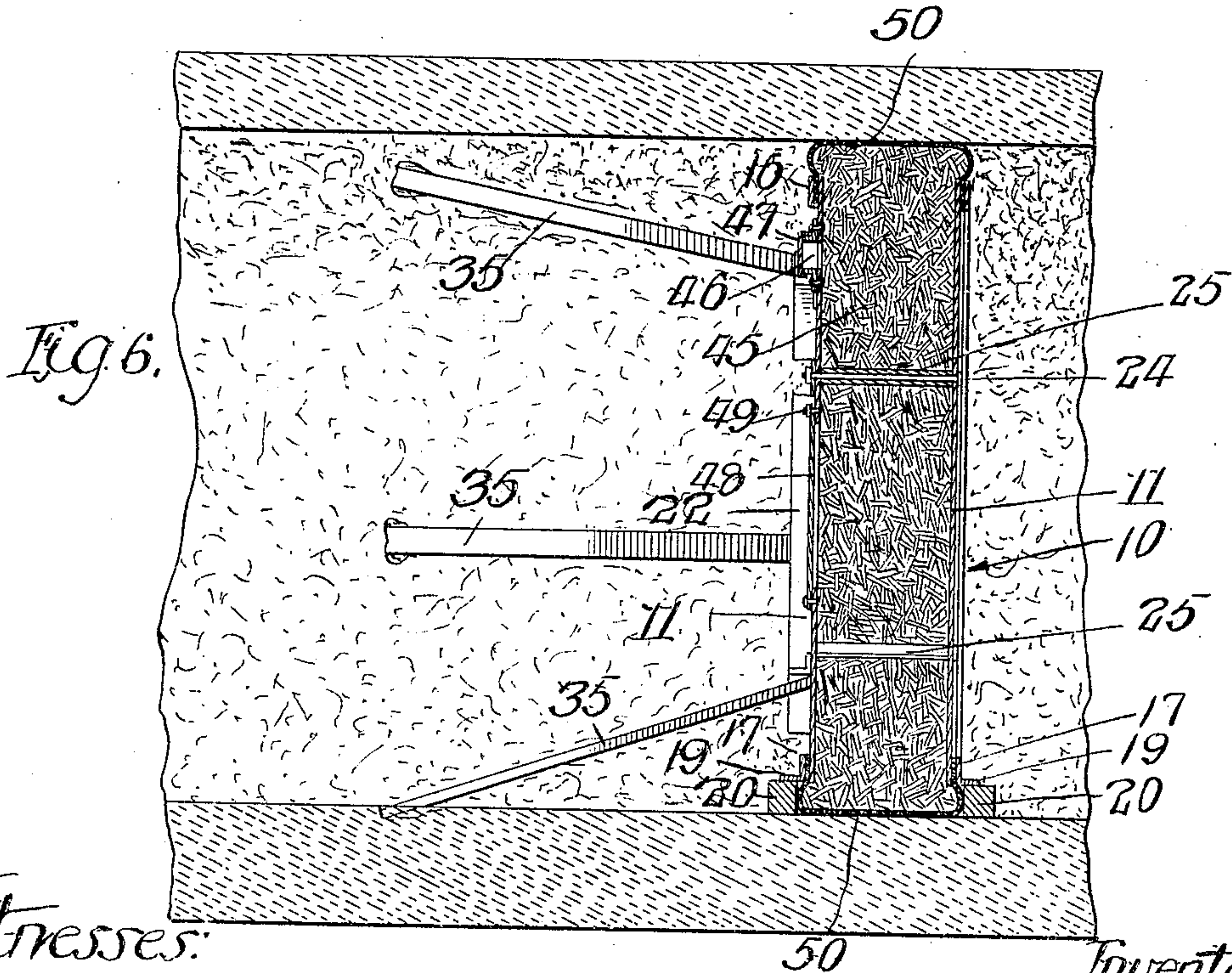
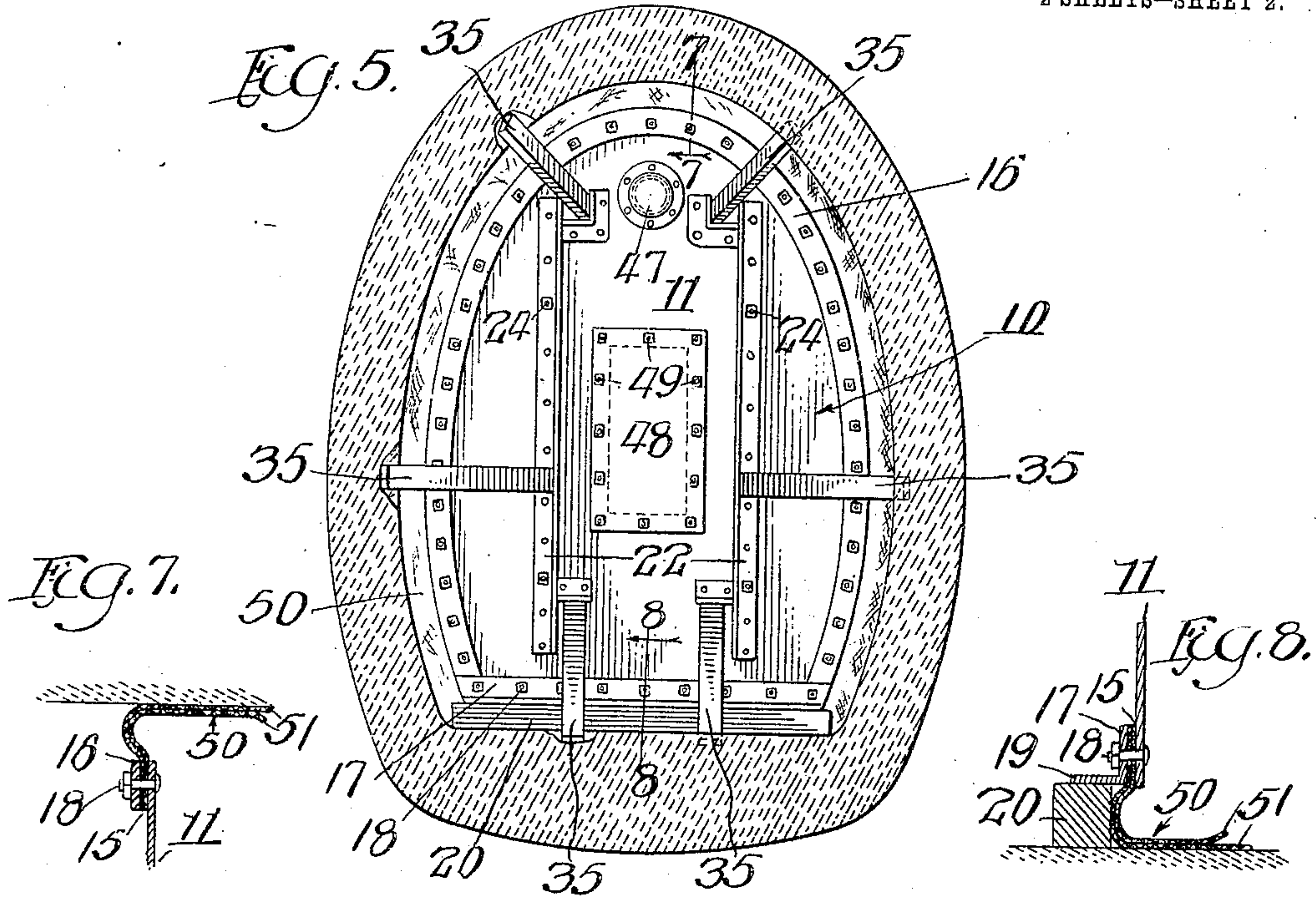
Inventor
Georgell Jackson
by Paul Brown
Attys

G. W. JACKSON.
BULKHEAD FOR TUNNELS AND THE LIKE.
APPLICATION FILED APR. 28, 1908.

940,323.

Patented Nov. 16, 1909.

2 SHEETS—SHEET 2.



Witnesses:
J. H. Alfredson
W. H. Hall

Inventor
George W. Jackson
by Charles Brown
Attys

UNITED STATES PATENT OFFICE.

GEORGE W. JACKSON, OF CHICAGO, ILLINOIS.

BULKHEAD FOR TUNNELS AND THE LIKE.

940,323.

Specification of Letters Patent.

Patented Nov. 16, 1909.

Application filed April 28, 1908. Serial No. 429,620.

To all whom it may concern:

Be it known that I, GEORGE W. JACKSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Bulkheads for Tunnels and the Like; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to a novel bulk-head adapted for use in tunnels and like excavations, it being arranged to extend across the bore of the tunnel to cut off communication of one section of the tunnel from another in order to isolate a section of the tunnel. For instance, it may be desired to employ said bulk-head to cut off or isolate a section or length of a tunnel in case of a leakage through a broken wall of the tunnel from an overhead body of water in order to protect the tunnel while the break is being repaired, or in order to temporarily protect the tunnel while erecting a more substantial bulk-head in the tunnel where the leakage is more serious.

Among the objects of my invention is to provide a light, simple and portable bulk-head which may be quickly thrown across the bore of a tunnel or the like to quickly cut off a flooded section of the tunnel from the other parts of the tunnel and to hold back the water until a more substantial bulk-head may be constructed, preparatory to repairing the break in the tunnel wall. In some instances, where the break in the tunnel wall is slight, the bulk-head herein shown may constitute in itself the only bulk-head required for cutting off communication from a damaged section of the tunnel to the other parts thereof while the broken wall is being repaired.

A bulk-head embodying my invention embraces, in general terms, a rigid imperforate frame which is adapted to be placed across the bore of the tunnel and is made of the same general contour but of less dimensions than said bore, and is formed at its margins with a hollow flexible rim which is adapted to be expanded against the inner walls of the tunnel to form a water tight joint between the frame and said tunnel walls. The

frame itself may be made hollow to receive an inflating or expanding medium which presses the hollow flexible rim outwardly against the tunnel wall. The flexible hollow inflatable rim may be pressed outwardly against the tunnel wall either by the pneumatic action of a body of air forced thereinto, or it may be inflated or pressed outwardly by the expanding action of a substance which is placed in the hollow bulk-head when dry and which is thereafter expanded by moisture applied thereto to inflate the rim. The said bulk-head is held against the force of a body of water acting against one side thereof by means of braces placed between the other side of the bulk-head and the tunnel wall. The said bulk-head may be used either in a finished tunnel or in a tunnel in course of construction. It is herein shown in connection with a tunnel having finished concrete walls.

As shown in the drawings:—Figure 1 illustrates a cross-section of a completed tunnel showing one form of my improved bulk-head in place therein. Fig. 2 is a vertical section thereof. Figs. 3 and 4 are detail sections taken on lines 3—3 and 4—4, respectively, of Fig. 1. Fig. 5 illustrates a cross-section of a tunnel showing another form of the bulk-head. Fig. 6 is a transverse vertical section thereof. Figs. 7 and 8 are detail sections, taken on lines 7—7 and 8—8, respectively, of Fig. 5.

As shown in Figs. 1 to 4 of the drawings, the bulk-head 10 comprises a hollow frame consisting of two parallel, rigidly connected, laterally spaced sheet metal side walls or plates 11, 11, and a hollow marginal, flexible rim 12 which is attached at its margins to the margins of said plates 11 and is adapted for engagement with the inner faces of the tunnel walls. Said hollow frame is made of less diameter than the cross-section of the tunnel bore and the hollow, flexible rim 12 is sufficiently full that when expanded or inflated it is pressed closely against the inner faces of the tunnel walls and provides an effective packing or seal between the rigid portion of the frame and said tunnel walls. Said marginal, inflatable rim may be made of rubber, canvas or the like. It comprises a strip of the selected material which overlaps at its margins the margins of the side plates of the frame, and

said margins of the strips are clamped between the margins of the side walls or plates of said frame and reinforcing strips or bars 16 and 17 which are fixed to said frame plates or bars by means of rivets and bolts 18. The bars 17, which extend across the lower side of the bulk-head, are provided with horizontal flanges 19 which constitute means by which the bulk-head may be supported on two parallel timbers 20, 20 extending transversely across the floor of the tunnel. The other reinforcing and clamping bars 16 may be made plain or unflanged. The said side plates or walls 11 of the bulk-head frame are further reinforced by vertical angle bars 22, 22 fixed to the outer side of said side plates by rivets or the like. The side walls or plates of said hollow frame are connected rigidly together at a fixed distance apart by means of bolts 24 extending through the side plates and spacing sleeves 25 which abut at their ends against the inner faces of the side plates and through which the bolts extend.

As shown in Figs. 1 to 4, inclusive, the inflatable marginal rim of the bulk-head is pressed outwardly against the walls of the tunnel by the pressure of a body of air maintained in the hollow frame. The air is designed to be introduced into said hollow frame by means of an air forcing device (not shown) the hose of which is adapted to be connected with an inlet nipple 30 which extends through the side wall of the hollow frame. The hollow frame may also be provided with a suitable exhaust nipple 31 through which air may be exhausted from the frame without detaching the air inlet pipe of the air forcing device from the inlet nipple.

The bulk-head is supported in place against the pressure of water acting on one side thereof by means of braces 35, 35 which engage at their inner ends suitable pockets or shoulders formed on one side of the bulk-head, and engage at their outer ends notches formed in the concrete walls of the tunnel.

In the use of the bulk-head it is placed in an upright position on the timbers 20 or other suitable supports on the floor of the tunnel before the flexible marginal rim is inflated. Thereafter air under pressure is forced into the hollow bulk-head to inflate or expand the rim against the tunnel walls and the braces are placed to support the bulk-head against water pressure acting on the inner side thereof. When the bulk-head is thus set and braced it affords means for temporarily holding the flow of water past the same and thus permits the work of erecting a permanent bulk-head in rear of the same to proceed unhampered by the presence of water in the tunnel. It will, of course, be understood that in the event of an excessive flow of water in the tunnel the water

will be pumped from the isolated section of the tunnel. If the break in the tunnel wall occurs at a distance from the blind end of the tunnel two bulk-heads will be required to isolate the broken section of the tunnel, one at each side of the break thereof. A valved tube 40 may be employed to draw the water from one side of the bulk-head to the other when desired. Said tube may be provided with a fitting 41 for connection with the induction pipe of a pump.

In the construction shown in Figs. 5 to 8, inclusive, the inflatable rim of the bulk-head is pressed outwardly or inflated through the expanding action of a substance 45 which is placed while in a dry state in the hollow frame and is afterward expended by the application of water thereto. The said body of expanding material may be made of any cellular material, such as cornstalk pith or other vegetable fiber. Water to expand said substance is introduced into the hollow frame through a nipple 46, normally closed by a cap 47. One of the side plates 11 of the latter form of bulk-head is provided with a manhole that is closed by a cover 48 which is fixed over said openings by bolts 49. The removal of said manhole cover affords access to the hollow frame to permit the insertion and removal of said expanding medium. The flexible, inflatable rim 50 of the bulk-head shown in Fig. 5 may be made of two strips 51 of canvas or like material which are attached to the rigid plates of said bulk-head in the same manner as previously described. In other respects, except as hereinabove mentioned, the construction shown in Figs. 5 to 8, inclusive, is generally the same as that shown in the previously described construction and similar parts bear like reference numerals.

In both of the constructions described it will be observed that the rigid frame of the bulk-head proximates in form and dimensions the cross section of the tunnel, so that the edges of the frame lie closely adjacent to the tunnel walls. This arrangement insures that the hollow flexible rim will be firmly supported against the tunnel walls with a maximum width of contact between the periphery of the rim and said walls when said rim is expanded or inflated as will be clear from an inspection of Figs. 2, 3 and 6. This large contact surface insures, not only a water-tight fit between the tunnel walls and the bulk-head, which prevents the leakage of water past the device, but also affords a frictional connection of the device with the tunnel walls which aids greatly to hold the device fixedly in place against the weight of a body of water backed up against the same.

It will be understood that other structural changes may be made without departing from the spirit of my invention and I do not

wish to be limited to the construction herein shown except as hereinafter made the subject of specific claims.

I claim as my invention:—

5 1. A bulk-head for tunnels and the like, comprising a hollow frame, or casing, which proximates in form and dimensions the cross section of the bore of the tunnel and provided with a hollow, inflatable rim in open communication with the casing, and means for admitting an inflating medium to the casing and to the rim for expanding the rim outwardly against the tunnel walls.

15 2. A bulk-head for tunnels and the like comprising a frame or casing consisting of two rigidly connected plates which proximate in form and dimensions the cross section of the bore of the tunnel, a marginal rim adapted for contact with the tunnel walls comprising a flexible strip attached at its margins to the margins of the plates and arranged to be supported by said plates immediately adjacent to the tunnel walls, and means for expanding the rim outwardly
25 against the tunnel walls.

30 3. A bulk-head for tunnels and the like comprising an imperforate frame which proximates in form and dimensions the bore of the tunnel and a flexible, expansible, hollow rim adapted for contact with the tunnel walls and supported immediately adjacent to the tunnel walls by the frame, and braces arranged to extend between one side of the frame and the bottom and side walls of the
35 tunnel, substantially as specified.

4. The combination with a bulk-head for tunnels and the like provided with an expansible rim adapted for engagement with the wall of the tunnel, and flanged bars attached to the lower side of said bulk-head and affording means for supporting the bulk-head in a vertical position. 40

5. A bulk-head for tunnels and the like comprising a hollow frame consisting of rigidly connected side plates and an inflatable rim comprising a flexible strip overlapping at its margins the margins of said side plates, and reinforcing bars attached to said plates and between which and the plates the margins of said rim strip are clamped. 50

6. A bulk-head for tunnels and the like comprising a hollow frame consisting of rigidly connected side plates, a flexible rim connected with the margins of said side plates, means whereby an expanding medium may be admitted to said hollow frame, and a water draw-off pipe extending through the hollow frame for drawing water from one side of the bulk-head to the other. 55

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of witnesses, this ninth day of April A. D. 1908. 60

GEORGE W. JACKSON.

Witnesses:

J. C. MOORE,
K. CLUNTON,
G. N. LAUTH,
E. L. HEFFEMAN.