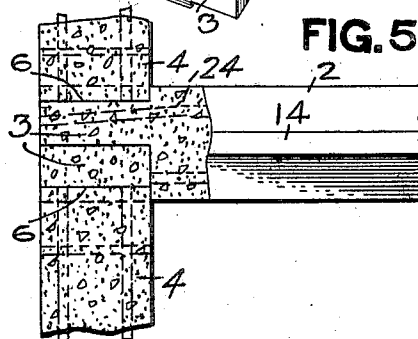
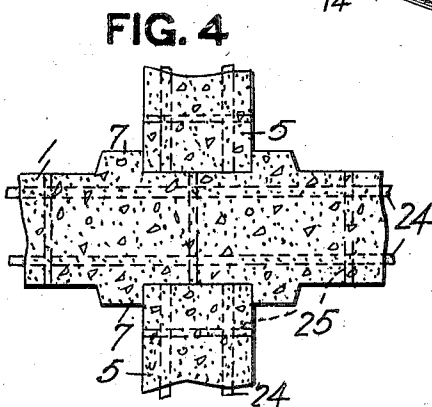
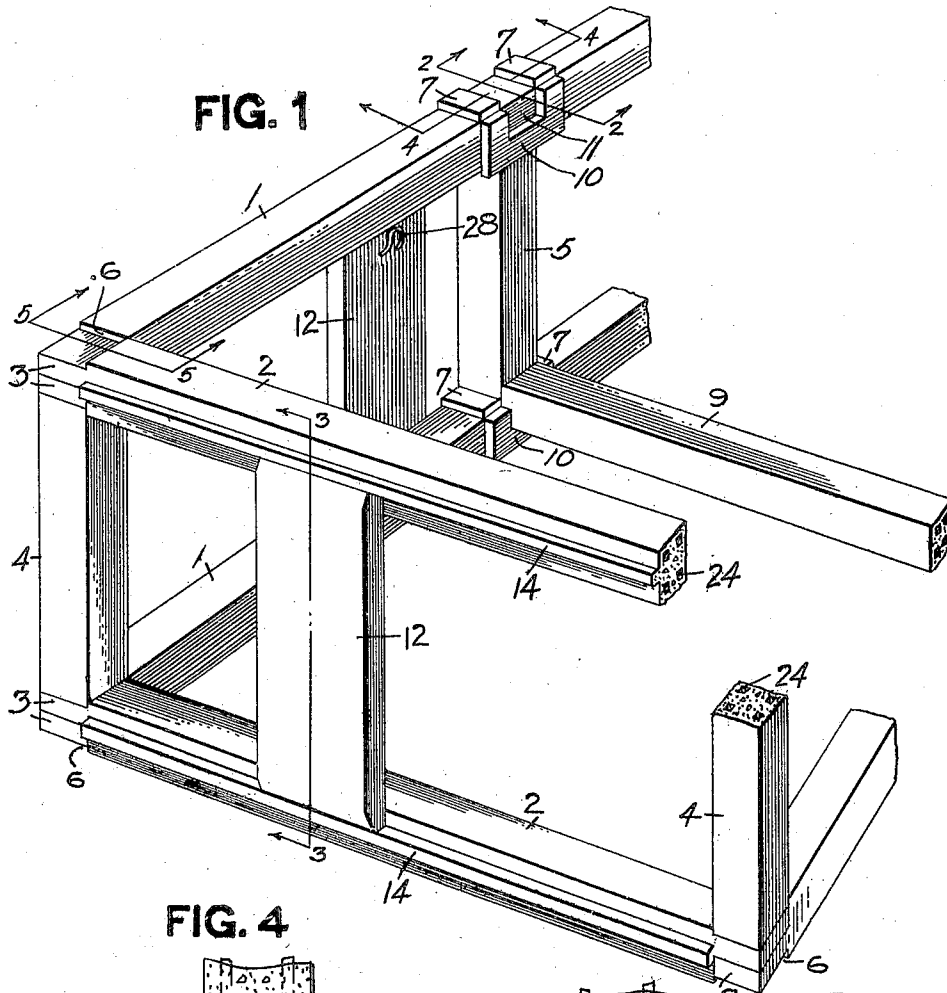


R. M. DRAVO & F. DONALDSON.
LINING FOR SHAFTS.
APPLICATION FILED APR. 11, 1907.

971,733.

Patented Oct. 4, 1910.

2 SHEETS-SHEET 1.



WITNESSES.

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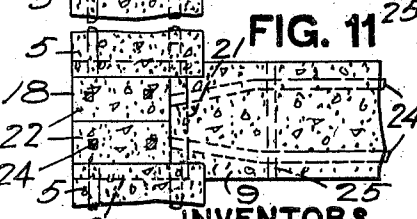
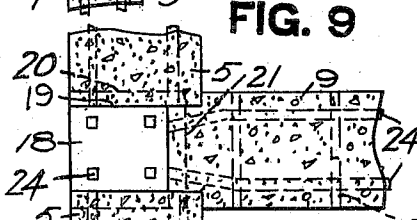
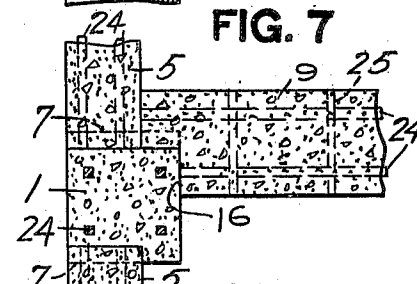
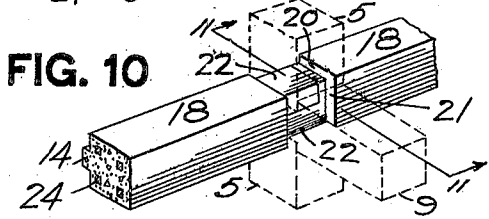
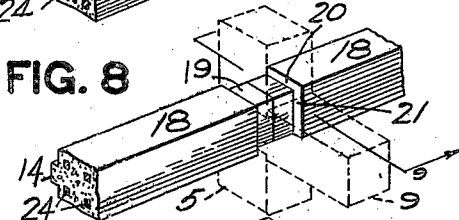
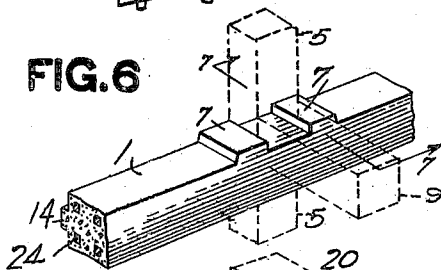
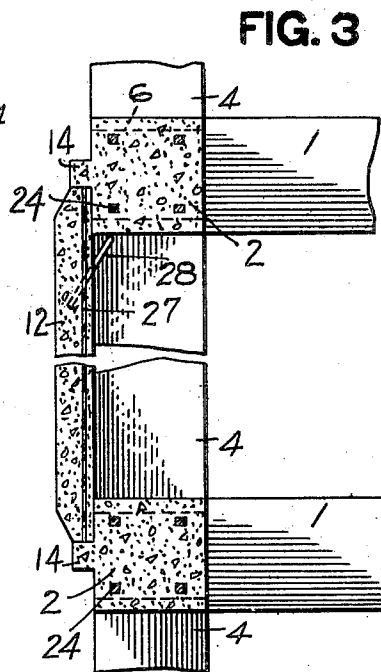
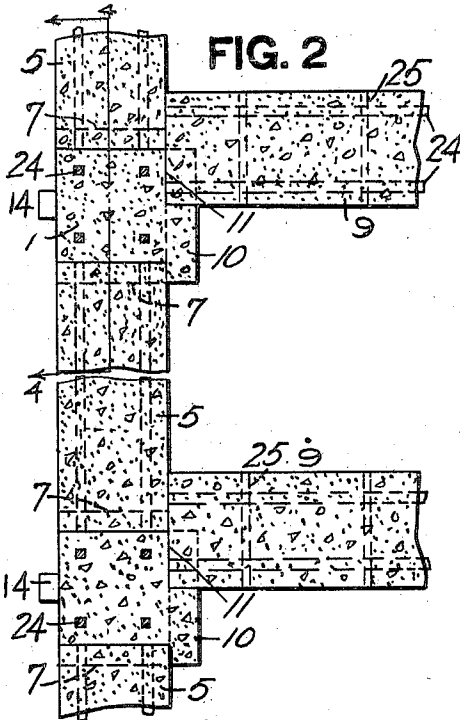
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2 SHEETS—SHEET 2.



WITNESSES.

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UNITED STATES PATENT OFFICE.

RALPH M. DRAVO, OF EDGEWORTH, PENNSYLVANIA, AND FRANCIS DONALDSON, OF DAVENPORT, IOWA.

LINING FOR SHAFTS.

971,733.

Specification of Letters Patent.

Patented Oct. 4, 1910.

Application filed April 11, 1907. Serial No. 367,567.

To all whom it may concern:

Be it known that we, RALPH M. DRAVO, a resident of Edgeworth, in the county of Allegheny and State of Pennsylvania, and FRANCIS DONALDSON, a resident of Davenport, in the county of Scott and State of Iowa, have invented a new and useful Improvement in Linings for Shafts, &c.; and we do hereby declare the following to be a full, clear, and exact description thereof.

This invention relates to linings for shafts, wells and the like. Its object is to provide a shaft lining which is strong, durable, or indestructible by decay or chemically, and which can be quickly put in place so as not to interfere with the other work in the shaft.

In an application of even date herewith, Serial No. 367,566, there is described and claimed a shaft lining consisting of separate reinforced concrete members which are molded on the surface and then set up or assembled in the shaft, said lining comprising suitable ring beams, posts, cross struts and lagging. This application is one of the specific applications referred to in our application above identified and illustrates and claims a specific arrangement coming within the broad claims of the aforesaid specification.

The invention comprises the construction and arrangement of parts hereinafter described and claimed.

In the accompanying drawings Figure 1 is a perspective view of a portion of the shaft lining; Figs. 2 and 3 are vertical sections taken respectively on the lines 2—2 and 3—3, Fig. 1; Fig. 4 is a vertical section through one of the ring beams and the intermediate posts, taken on the line 4—4, Fig. 2; Fig. 5 is a vertical section taken at the corner of the lining; Fig. 6 is a perspective showing a modification; Fig. 7 is a vertical section through the same; Figs. 8 and 10 are perspective views showing two forms of sectional ring timbers or wall plates; and Figs. 9 and 11 are vertical sections through the same.

All parts of the lining are constructed of reinforced concrete and the lining is built up of sections or members which can be molded at the surface and allowed to set and can then be lowered down into the shaft and assembled or erected to form a strong and durable lining. The lining shown com-

prises ring sets of side beams 1 and end beams 2. These at their ends are reduced, preferably by having the same as shown at 3, so as to overlap and form mutual abutting shoulders. The several ring sets are separated or spaced apart by means of posts 4 placed at the corners, and in case of a large sized shaft, by intermediate or side posts 5. Preferably the ring beams will have their ends further reduced or recessed as indicated at 6 so as to form seats or sockets for the ends of the corner posts. The intermediate or side posts 5 have their ends seated between lugs or projections 7 formed on the beams.

The cross struts 9 are arranged with their ends abutting against the side beams 1 and preferably are supported by the other, such as by forming projecting portions 10 on the faces of the wall beams, said projections being provided with sockets 11 for receiving the ends of the struts. The projections 10 and 7 are molded integral with the beams 1. The struts not only abut against the face of the beams 1 but also against the side of the side posts 5. Said struts serve as a connection for the usual guides for the cage.

The spaces between the beams and posts are closed by suitable slabs or plates 12 likewise of reinforced concrete and these are held in place by having their ends seated on ledges or ribs 14 formed on the rear faces of the ring beams. In putting them in place, they are lowered down between the wall of the excavation and the ring beams and are then drawn inwardly until they rest upon the bottom ledge 14 and come underneath the top ledge, after which rubble, rock, earth or any available material is thrown behind the same to hold them in place.

Figs. 6 and 7 show a slight modification in which the projection 10 which provides the socket 11 is omitted. In this case the side post 5 is made comparatively shallow so as to have a portion of the top face of the wall beam 1 exposed and the strut 9 has its end cut away, as at 16, to provide a projecting portion which rests on top of the wall beam and also to form a shoulder to abut against the inner face of said beam.

In case of a very large shaft it may be desirable to use wall ring beams formed in sections. Figs. 8 to 11 show two ways of accomplishing this. In Figs. 8 and 9 the beams 18 are shown as provided with re-

duced end portions 19 which abut end to end, said reduced end portions providing the top shoulders 20 and side shoulders 21, the former providing a seat or socket for the end of a side post and the latter receiving between the same the end of a strut. Figs. 10 and 11 show a somewhat similar arrangement except that the projecting portions 22 are halved and overlapped. In all cases of sectional wall or ring beams, the joint is at the point of application of a side post and cross strut.

The various members forming the lining will be reinforced with metal in any approved manner. For instance, the ring beams are provided with longitudinal tension rods 24 arranged in any suitable way to impart the necessary strength and to take care of the strains to which the member will be subjected. At the reduced end portions of these beams the rods 24 are brought together. To take care of the longitudinal shearing strains, and also to unite and space the tension rods, suitable stirrups 25 may be employed. The cross struts and posts will be reinforced in a similar manner with longitudinal rods and transverse stirrups, while the lagging slabs 12 will be reinforced by means of expanded metal 27 or other suitable metal mesh or small rods or wire crossing each other. Preferably also the lagging slabs will have anchored therein the loops 28 for receiving the hook of a derrick or other mechanism for handling said slab.

All parts of the lining can be molded on the surface in suitably formed molds and can be made of any size or shape to meet the conditions presented. They will be molded and allowed to set or harden thoroughly and can then be lowered down into the shaft and assembled or erected. The work of erecting these parts can be done very quickly so as to reduce the time of interference with the other work in the shaft, it not being necessary to interrupt such work while the parts are being molded and setting. As set forth in said application Serial No. 367,566, the

lining described not only prevents interference with other work in the shaft, but is otherwise cheaper than prior concrete and masonry linings, due to the small quantity of concrete required, and the fact that it is not necessary to build molds or casings in the shaft. The lining is very strong and is practically indestructible by decay or chemical action.

While the lining is shown as applied to a vertical shaft, it obviously can be adapted to inclined shafts.

What we claim is:

1. A shaft lining comprising ring beams and posts formed of metal reinforced concrete, said beams having their ends halved and overlapping and having the top and bottom faces of the overlapped portions reduced to form seats for the posts.

2. A shaft lining comprising ring beams formed of metal reinforced concrete having their ends suitably joined and provided with sockets on their side faces, and metal reinforced concrete struts having their ends seated in said sockets.

3. A shaft lining comprising ring beams formed of metal reinforced concrete having their ends suitably joined and provided with sockets on top, bottom and sides, concrete posts having their ends seated in the top and bottom sockets, and metal reinforced concrete struts having their ends projecting into the side sockets.

4. A shaft lining comprising sectional ring beams formed of metal reinforced concrete having reduced meeting ends and providing shoulders or sockets on top and inner sides, and concrete struts and posts having their ends projecting into said sockets.

In testimony whereof, we the said RALPH M. DRAVO and FRANCIS DONALDSON have hereunto set our hands.

RALPH M. DRAVO.
FRANCIS DONALDSON.

Witnesses:

M. D. VOGEL,
F. W. WINTER.