(No Model.) 2 Sheets—Sheet 1.

J. C. GOODRIDGE, Jr.

PROCESS OF CONSTRUCTION AND REPAIR WITH BETON OR CONCRETE.

No. 317,338. Patented May 5, 1885.

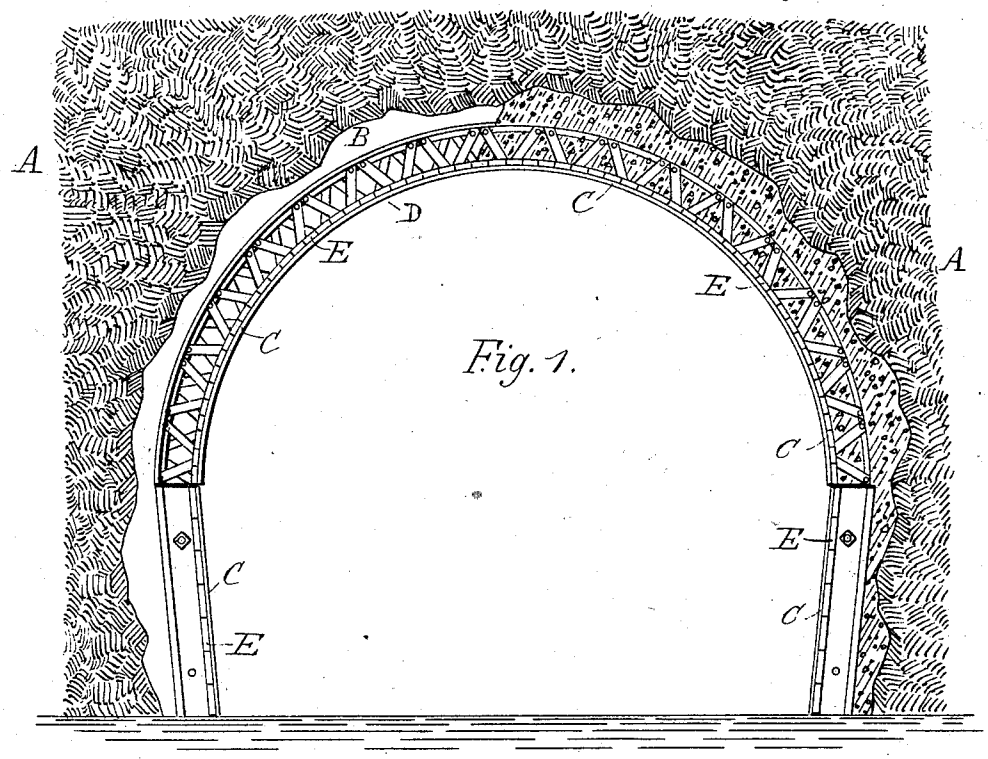


Fig. 1.

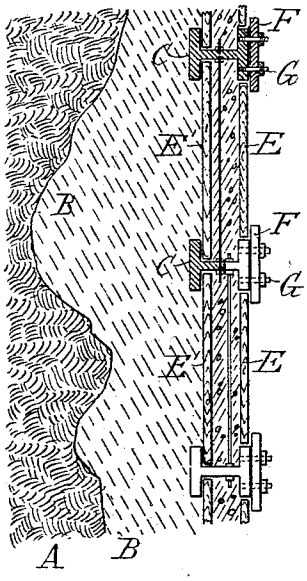
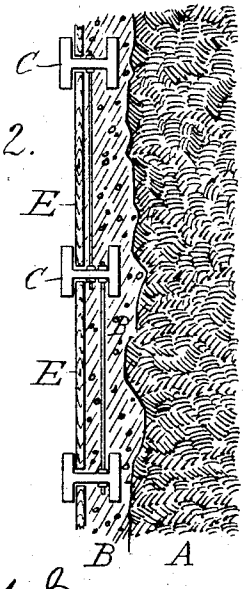


Fig. 3.

Fig. 2.



WITNESSES:

Wm. A. Lowe

Edward Fitzpatrick

John C. Goodridge Jr. INVENTOR

BY Henry P. Wells

his ATTORNEY

N. PETERS. Photo-Lithographer. Washington, D. C.

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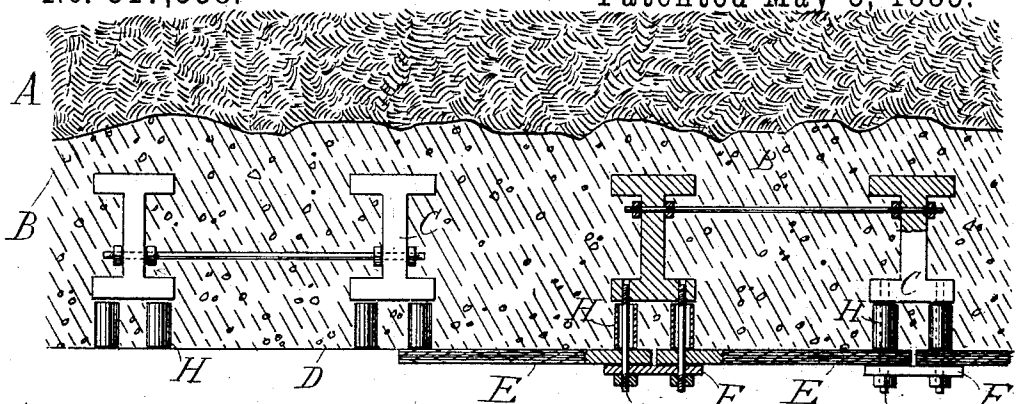


Fig. 4.

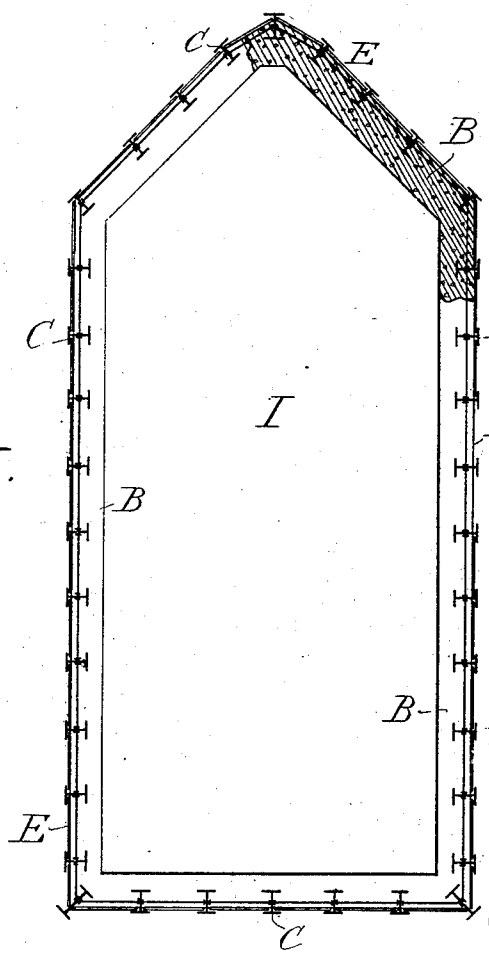


Fig. 5.

WITNESSES:

Wm. A. Lowe

Edward Fitzpatrick

John C. Goodridge Jr.

INVENTOR

BY Wm. A. Wells

ATTORNEY

N. PETERS. Photo-Lithographer. Washington. D. C.

UNITED STATES PATENT OFFICE.

JOHN C. GOODRIDGE, JR., OF NEW YORK, N. Y.

PROCESS OF CONSTRUCTION AND REPAIR WITH BETON OR CONCRETE.

SPECIFICATION forming part of Letters Patent No. 317,338, dated May 5, 1885.

Application filed February 4, 1885. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. GOODRIDGE, Jr., of the city of New York, in the county of New York and State of New York, have invented a new and useful Improvement in Processes of Construction and Repair with Beton or Concrete, of which the following is a specification, reference being had to the accompanying drawings.

It has been the custom heretofore in construction or repair with beton or concrete, first, to prepare a mold of timbers and afterward to fill the beton or concrete within the mold, allowing the latter to remain until its contents have hardened, and then to remove the mold. This method is open to this objection: In railroad work—such as lining tunnels, &c.—large and heavy centers and timbers placed within the tunnel so reduce its area as to impede the use of the track altogether. It might further be observed that in all such cases the mold adds nothing to the ultimate strength of the work, while it is an expense.

My invention consists in combining the mold with the work itself in such a manner that the ordinarily useless portions of the mold form an integral portion of the completed work, and add the strength of the material of which they are composed to the strength of the beton or concrete; or, in other words, it has been the practice to support the lagging which gives the desired form to the beton or concrete upon centers or other heavy timbering placed without the space to be occupied by the completed work, while my method is to erect the supports for the lagging or centering within the space to be filled with the completed work and hanging the lagging upon them, so to speak, thus diminishing the working room required, cheapening the cost of the structure, increasing its strength, and simplifying and expediting it.

Figures 1, 2, and 3 represent my method as applied to the lining of railway tunnels or arches. Fig. 4 represents a detail in the same construction. Fig. 5 represents my method as applied to a bridge-pier or any mass of masonry or of earth or natural rock which it is necessary to strengthen.

I line a tunnel by my method as follows: I provide a sufficient number of iron beams bent to conform to the required arch, and erect them at proper distances from one another—say from three to six feet apart, according to the load they are to sustain. These I brace and tie together in the usual manner, thus forming a center within the arch, as shown in Fig. 1, in which A is the natural rock; B, the space to be filled; C, one of the iron beams; D, the contour of the completed lining, and E the lagging. For important work, beams of the cross-section shown in Fig. 4, and of a depth proportional to the load to be borne are preferred, while for minor work old railway-rails will answer every purpose; but the best sectional dimensions for and the intervals between these beams will of course vary with the peculiarities of each individual case, and can readily be calculated by any engineer familiar therewith. When the center is complete, as aforesaid, the lagging is then placed upon the flanges of the beams by pushing them into place, as shown in Fig. 2, which is a plan view of the work, and in which A indicates the natural rock; B, the space to be filled; C, the iron beams aforesaid; E, the lagging, which may be either of boards, as is usual, or iron plates. The space B between the lagging and the natural rock is then filled in the usual manner with beton or concrete. The beams and their tie rods and braces thus become solidly embedded in and become an integral part of the work, and lend their strength thereto, while they are completely protected by the substance by which they are incased from deterioration. Often large void spaces intervene between the lagging and the natural rock where the latter has fallen down. These it has been the custom to fill in with the same material as the lining itself at, of course, a like expense per cubic foot. In such cases I proceed as shown in Fig. 3, wherein A is the natural rock; B, the space to be filled; C, iron beams; and E E′, two separated layers of lagging, secured as shown. I then fill in the space between the two layers of lagging with the material with which the tunnel is to be lined; but the space B between the lagging E′ and the natural rock I fill with broken stone, sand, or other cheap material, which will answer every purpose.

Where it is not desired to remove the lag-

ging, no special provision need be made for that purpose; but where it is desired, I arrange it as shown in Fig. 4. In that figure, F are iron plates secured to the inner flanges of the beams by screw-bolts and nuts, as shown. E is the lagging resting on said iron plates F. G are the screw-bolts screwed into said iron beams and passing through the plates F, and there provided with nuts. These bolts G are surrounded by thimbles H. The beton or concrete is then packed in and around them in the usual manner, and when it has set, by unscrewing the nuts, the plates F and the lagging E may be removed. Then by unscrewing the bolts G from the beams only the thimbles remain to be filled. Thus the beams C are completely embedded in the beton, and a smooth inner surface to the tunnel is obtained. Still the thimbles may be dispensed with and the iron bolts allowed to project; or they may be cut off after the lagging is removed, if preferred. It is obvious that this method is equally applicable to the construction of a shaft by conforming the beams to the required shape of the work.

It is often desirable to incase a bridge-pier or other structure or a mass of earth or rock. This has been done by building a mold without the structure supported by timbers sufficiently heavy for the purpose, and filling in between the molds and the structure to be re-enforced with beton or concrete; but in addition to the objections already stated there are others which manifest themselves, particularly in incasing a bridge-pier. Then it is exceedingly difficult and troublesome properly to adjust and retain in place the timbers to sustain the mold against their buoyancy. My method is shown in Fig. 5, in which it is applied to a bridge-pier, and in which I is a masonry pier to be incased. C C are iron beams erected perpendicularly at such distances from one another as the nature of the strain they are to endure requires—say from three to six feet apart—and surrounding the work. These are clamped together by tie-rods and braces in the usual manner, thus forming a skeleton frame-work surrounding the pier. E is the lagging placed as hereinbefore described, and B the space to be filled. The lagging is placed in position piece by piece as the work progresses, so as to have as little as possible thereof unfilled to be supported against the current of the water. When the beton has set, the beams and their connections are firmly embedded in the beton and become an integral part of the structure, as in the case hereinbefore described. Substantially the same method is used to incase a mass of earth or rock, or any structure like a column or chimney; or it may be built within the structure, as in a well or lining, a monument or statue. In all these cases the lagging may, if necessary, be temporarily braced in position until the filling renders this unnecessary.

Having thus described my invention, what I claim as new, and desire to patent, is—

1. The process of repairing, lining, or incasing tunnels, shafts, piers, abutments, or other structures, which consists in, first, constructing a frame of the required shape, a suitable distance from the structure to be strengthened; next, securing the molding-boards to said frame and then filling in the beton or concrete behind said molding-boards, embedding their supporting-frame, substantially in the manner set forth.

2. The within-described process of lining or incasing tunnels, shafts, and like structures with beton or concrete, consisting of erecting a suitable frame-work, attaching a double layer of lagging thereto, filling between said lagging and around said frame-work with beton or concrete, and filling the space between the lagging and the natural rock or the body to be re-enforced with sand, broken stones, or other cheap material.

In testimony that I claim the foregoing improvement in processes of construction and repair with beton or concrete, as above described, I have hereunto set my hand this 14th day of January, 1885.

JOHN C. GOODRIDGE, JR.

Witnesses:

HENRY P. WELLS,

CHARLES G. COE.