F. S. LAMSON.

PROCESS FOR MAKING CONCRETE DAMS, WALLS, BRIDGES, CONDUITS, SEWERS, &c.

APPLICATION FILED FEB. 6, 1906. RENEWED MAR. 9, 1908.

963,159. Patented July 5, 1910.

Fig. 1.

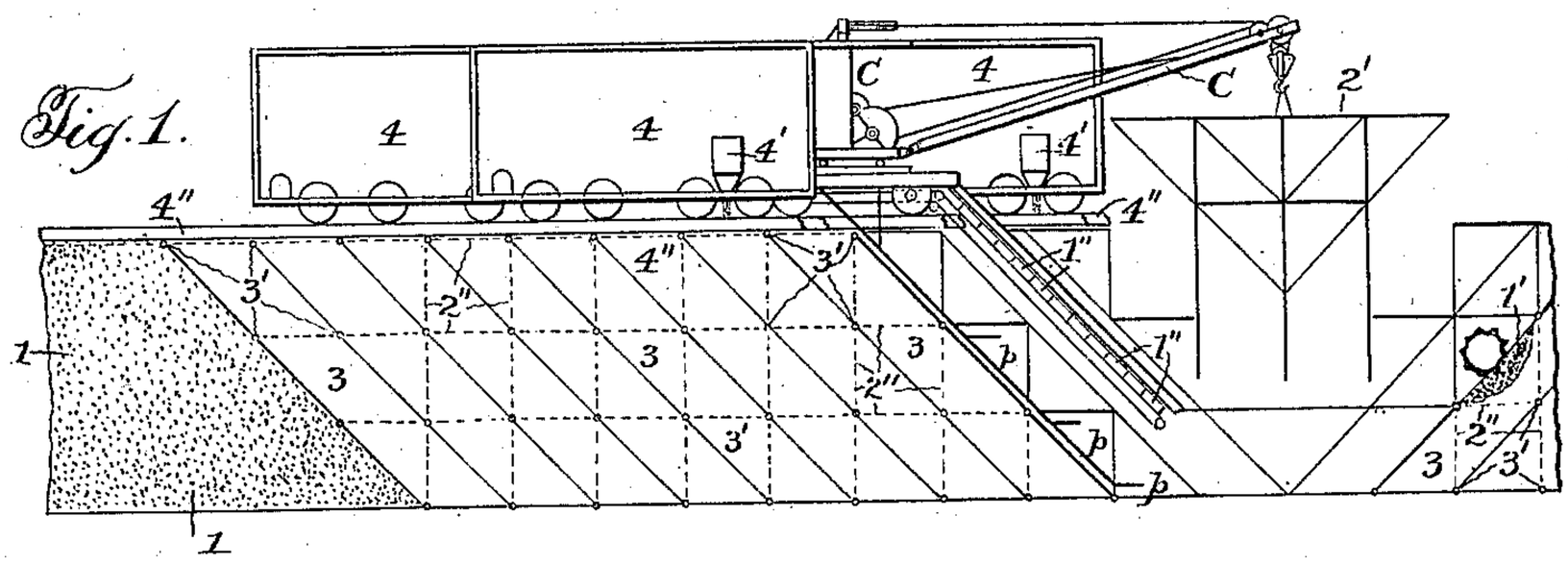


Fig. 2.

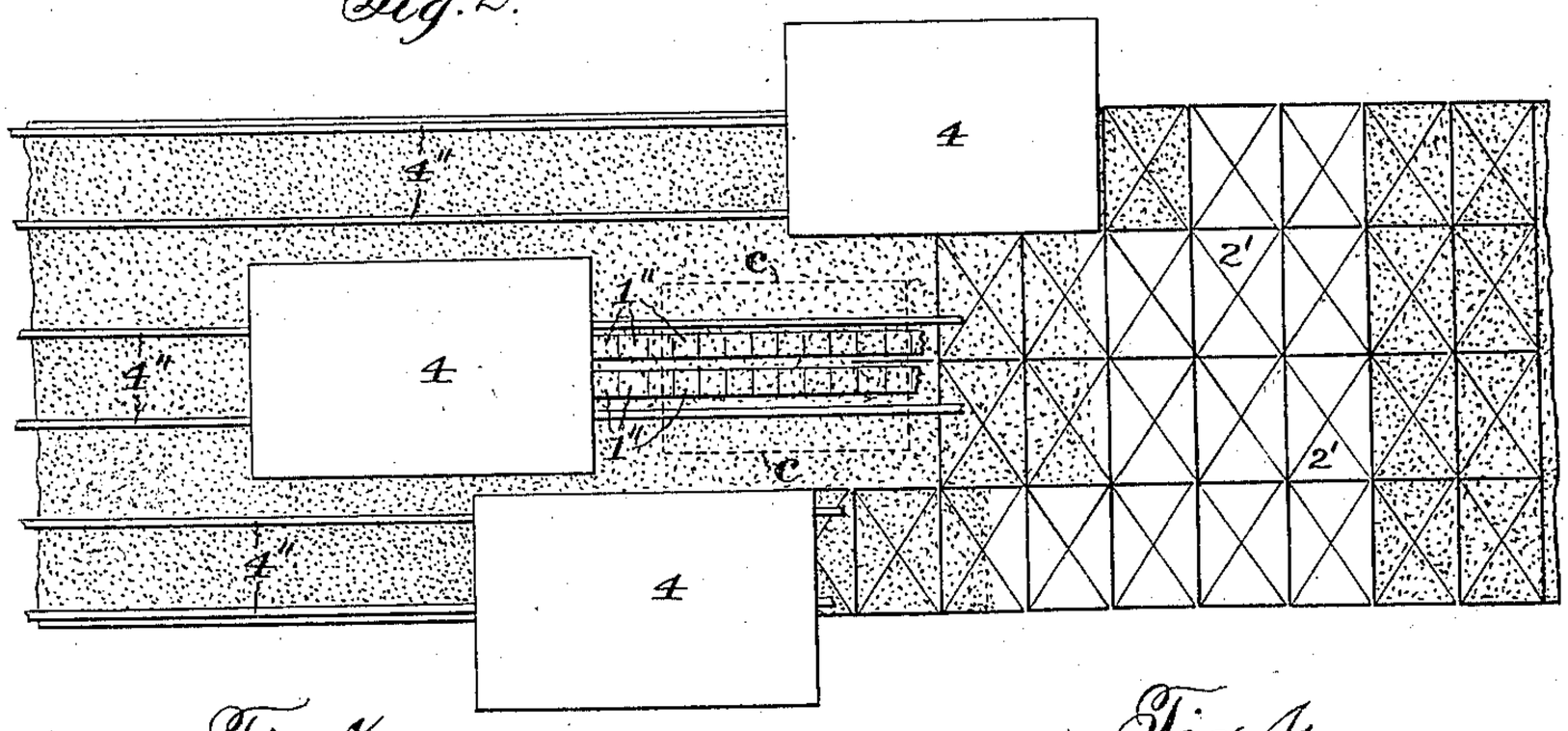


Fig. 3.

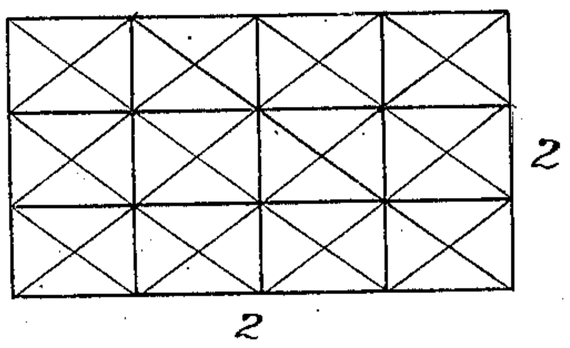


Fig. 4.

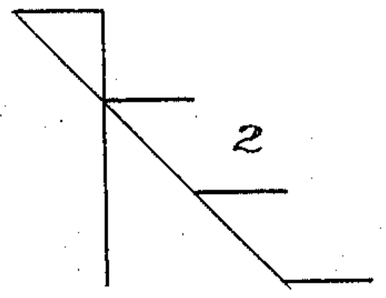
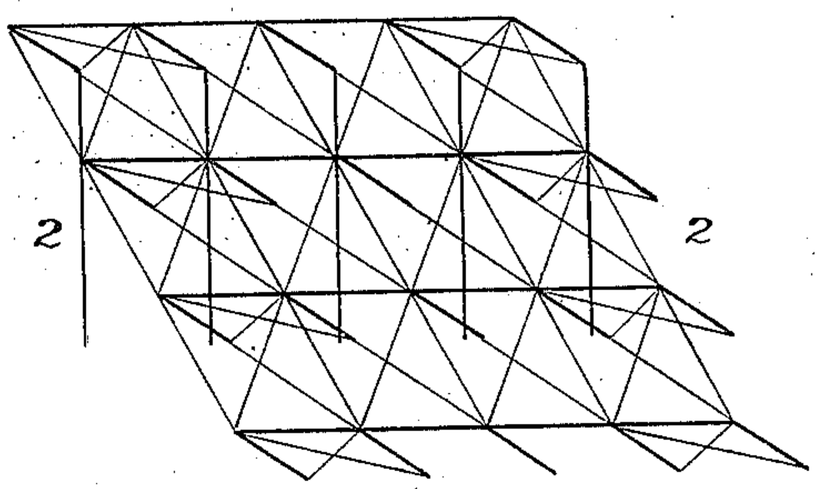


Fig. 5.



Witnesses:
Jas. E. Hutchinson.
Thos. C. Heath.

Inventor:
Franklin S. Lamson.

UNITED STATES PATENT OFFICE.

FRANKLIN S. LAMSON, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO COSMOS CONSTRUCTION COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA.

PROCESS FOR MAKING CONCRETE DAMS, WALLS, BRIDGES, CONDUITS, SEWERS, &c.

963,159. Specification of Letters Patent. **Patented July 5, 1910.**

Application filed February 6, 1906, Serial No. 299,800. Renewed March 9, 1908. Serial No. 420,056.

To all whom it may concern:

Be it known that I, FRANKLIN S. LAMSON, a citizen of the United States, residing at Washington, District of Columbia, have discovered a new and useful Improvement in Processes for Making Concrete Dams, Walls, Bridges, Conduits, Sewers, &c., of which the following is a specification.

This discovery relates to the making of that class of the above-named—and other—structures in which the concrete is made of Portland cement—as the binding material—in combination with sand, gravel, crushed stone and water; and has for its object the construction of said structures by the use of such a process and such appliances as will give to the mass formed by the mixture of the said concrete material such stiff plasticity as will enable it to receive concrete forms which can be laid in layers at an angle from the horizontal of 45°, more or less, without sliding or slumping; which will retain such plasticity until the successive layers can be operated upon and compressed—each with its preceding layer—before the setting of the cement takes place; which series of operations can be continued to any desired extent, so as to make practicable the construction of the named structures of any desired size and length, and yet each structure be a monolith, without joint; and which operations can be performed by the use of machines with great accuracy and rapidity; the whole forming a new system of concrete construction by means of which such structures may be progressively completed from bottom to top as the work advances, and may be constructed in as many completing sections as may be desired but with monolithic union as a whole; thereby enabling a rapidity of construction only limited by the ability to furnish the required material.

As stated in my prior applications—Serial No. 119,673, (patented Nov. 5, 1907, No. 870,370) filed August 14, 1902, and Serial No. 163,043, (patented Nov. 30, 1909, No. 941,886) filed June 25, 1903, I have discovered that when the combination of such materials, in proper proportions and properly worked, is made with the temperature of the materials at about 39° to 32° F. it gives such stiff plasticity to the concrete mixtures as to enable the use of operative machines in the production of sections of concrete of regular size which retain their form while being transferred to places of deposit. I have also discovered that when such stiffly-plastic sections, or blocks, are laid in layers at an angle from the horizontal of 45°, more or less, then, in the construction of said dams, walls, bridges, conduits, sewers, and other structures to which this method may be applicable, the said layers are, each, relatively short; can be quickly laid while fresh, and by rolling or compression be united and compacted—each—with its preceding plastic layer; that the production of said concrete sections in regular sizes enables the regular introduction and embedment, between said layers, of metal supporting and strengthening frames, which will hold the said concrete sections in place while being rolled and grooved or indented—in one operation, will support movable inclosed operative construction-plants during construction, will sustain mold-forms, and also serve as a metal reinforcement in the concrete structure.

In the accompanying drawings—which illustrate the application of the described methods in the construction of a steel-reinforced concrete dam—Figure 1 is a side view of a portion of such structure nearing completion, in which 1 represents concrete surface with mold-forms removed, 1′, on the right, a slope of plastic concrete being rolled , 1″, a series of plastic concrete blocks being conveyed en-slope for emplacement by workmen stationed on the slope platforms *p*, *p*, *p*; 2′, indicates the completing-section of steel-reinforce framing being lowered to place by crane C; 2″—in dotted lines—indicates the embedded steel-reinforce framing; 3, indicates a transferable section of mold-forming connected at points 3′ to the reinforce-framing and supported thereby; 4, 4, 4, construction-plant cars for preparing and delivering the plastic concrete direct from the mixers 4′, 4′, to structure—being supported on trackage 4″, connected to and supported by the steel-reinforce framing as shown, the movable crane being also similarly supported; Fig. 2, a plan of the same, but with the position of crane C indicated by dotted lines *c*, the plastic concrete blocks 1″ on the level part of the conveyers beneath the crane, and the

completing-section 2′ of the steel-reinforce framing shown as placed in position, uniting the two advancing slope-series of sectional reinforce framing; Fig. 3, a front view, Fig. 4, a side view and Fig. 5, a view in perspective, each showing a regular section, 2, of the steel-reinforce framing, as described.

Similar characters refer to similar parts.

In the practical application of this process the stiffly-plastic material is prepared and conveyed to the workmen at the site as described in the said prior applications; in the preparation for construction—beside the necessary foundation-clearance, and the concrete-making-and-delivering-plant placement—a set of prepared sectional mold-forms (of wood or metal), having suitable connecting cross-bars or tie-bolts, adapted in material, size, strength and form to the work, is to be provided; between such singly-placed pairs of mold-forms (set at an angle of 45°±) the stiffly-plastic material is to be placed in consecutive sections, each of which may be rolled or compressed, and in the same operation be grooved or indented—as by suitably-shaped strips or blocks attached to the faces of the rollers or compressors; as the concrete sets and hardens to suitable strength the mold-forms at the rear are to be moved to the front, consecutively.

Metal frames provided with cross-bars (suitably spaced to receive the concrete sections) may be placed and embedded between selected layers of concrete; these frames to be adapted to the triple purpose of retaining the concrete sections in place before and during compression, of sustaining the mold-forming and an inclosed movable operative construction-plant, and as a metal reinforcement of the concrete structure, the said spaced cross-bars preferably crossing each other diagonally so as to form truss-braces in the frame; selected cross-bars of said frame may extend to the exterior of the structure, and thus form tie-bolts for the mold-forms, or may be provided with temporary or permanent anchors; when structures are of great width, and it is desired to construct them in sections (as to width), the inner ends of the tie-bolts of the first section may be provided with sockets into which the tie-bolts of its adjoining section may connect; each of the said cross-bar frames placed on its slope is to be provided with metal bars or links to which its succeeding angle-frame may be connected, (or, when desired, strong horizontal truss-frames may connect the angle-frames in lieu of bars or links), the whole series of sectional frames thus combining with the concrete in forming a strengthened structure. In preparing and emplacing such section-assembled framing each member of a section should be so devised as best to adapt the construction for its varied uses. In such combined constructions authorities have held that the expansion and contraction of the steel and the concrete is practically the same, and also that the adhesion between steel and the concrete which has set around it (550 to 680 pounds per square inch) is above the safe compressive stress for the concrete, so that it may be assumed that slip between them will not occur. In the preparation for construction, also, a block-layer's platform is to be provided, which platform should be movable on adjustable inclined ways (by rack and pinion or other devices) on a supporting frame, which frame should be movable as the work progresses (as by being supported on a series of trucks movable on tracks to be laid on the structure as the work progresses), and should also be inclosed so as to protect the workmen and the work, and enable a continuous operation from start to finish; such inclosed frame should be constructed in sections adapted to a rapid setting up, adjustment, extension, and removal; when desired two or more layers' platforms may be used, as on long slopes, and rollers to follow each platform, the said rollers to be attached to said platforms, or operated separately; or platforms, and rollers, may operate side by side on wide slopes; also, when desired, stair-case platforms—movable sidewise—may be used, the lines of blocks being laid up or down the slope instead of across; or such lines may be laid at any desired angle.

In arranging for the rapid construction of the above-named structures provision is to be made for shifts of workmen to prosecute the work day and night; suitable lighting to enable sight during darkness; and competent supervision. In cases where great rapidity of construction is required the structure may be begun at both ends, working toward each other, and also at one or more points between, in each case working both ways so as to meet and unite with another advancing construction; or, in some cases, the construction may begin at one side of a structure, and advance its whole length simultaneously across the structure, building upward but with sloping layers and monolithic construction.

The above general description of process and devices may be adapted to suit the circumstances and objects of any given structure: as instances—horizontal truss-brace frame-connections may connect the angle-slope frames at the bottom and top of a structure, while at points between the bottom and top bars or links may connect said frames, as desired; such horizontal connections between angle-slope frames may be short or long, so as to include few or several layers of concrete in a section, as may be

practicable; the placing of concrete in the spaced cross-bar frames may begin at any point or points in said frames and proceed in any direction.

As many lines of rails may be laid and connected to the embedded framework as may be required, and each rail-end's joint may be central as to its adjacent side rail. The covered work-inclosing frame may be of cantaliver construction, and have a part thereof projecting in front so as to protect the slope being worked on. Should the utility of the rails in any structure cease with its completion, the blocks, or other devices, which may connect said rails with the embedded framework may be disconnected and removed, any holes left to be filled with concrete.

It is evident that plastic material of irregular form may be used in connection with similar material of regular form, as in wide structures where exterior portions might be constructed of material of regular form, which—with tied molds and framework, would serve as retaining walls for an interior portion filled in with material of irregular form, the mass uniting in monolithic construction; or, as a variation, the material of regular form may be centrally placed, and that of irregular form extend from thence to the side molds. It is also evident, since the freezing of freshly mixed concrete material does not injure the setting quality of the cement after the frost is withdrawn, that sustaining—or retaining—blocks of frozen fresh concrete may be emplaced in a structure, and such frozen formations surrounded by fresh material of suitably higher temperature; the frozen material supporting the mass until its surrounding material shall have set, and the heat therefrom gradually extracting the frost, its cement will also set without injury.

By reference to the disclosure in the named prior patents it will be seen that progressive continuity of concrete mixture and emplacement, to enable rapid continuous construction of concrete structures, was a principal object to be obtained; that such continuous mixture of separate materials necessarily implies their continuity of supply for such union; and that continuous movement of materials to union and of the product of such union to structural emplacement and compaction while plastic is fully shown. In this application additional rapidity of such construction is disclosed:—By providing a progressive method of structural-reinforce-framing emplacement—in adapted sections—which will also enable the supporting of progressively emplaced mold-form sections, the sustaining of construction-plants (for placement of such metal-framing sections and mold-form sections, and for mixing and delivering concrete) in advance of the deposit of concrete, and the continuous deposit and compaction of the plastic mixture on, in or with an advancing formation which may complete a structure from bottom to top, as it advances, and from end to end in monolithic union.

I claim.

1. In the construction of concrete dams, walls, bridges, conduits, sewers, etc., which are made of plastic material, laid in layers, to be united or compacted while fresh, the method of laying such layers of plastic material at an angle from the horizontal of 45°, more or less, whereby each layer of fresh material is relatively short, and may be united or compacted with its preceding plastic layer and its succeeding fresh layer, thereby enabling the making of structures of any desired length monolithic constructions, and also the completing of structures from bottom to top, as the work advances, without joints.

2. In the slope-angle method of placing layers of plastic concrete, substantially as described, deeply grooving or indenting each layer as it is being rolled, or compressed, whereby material of each succeeding layer is forced into such grooves, or indents, and the slipping or slumping of such layer thereby prevented.

3. In the angle method of laying plastic concrete layers, substantially as described, placing cross-bar frames on selected slopes of concrete, and connecting each frame with its preceding embedded frame, whereby each included section of layers is securely bound to its preceding sections.

4. In a system of reinforced concrete construction which consists in emplacing freshly plastic cement material in connection with a reinforcing metal frame for joint load-supporting strength, the method of emplacing such reinforce frame in sectional progressive continuity in advance of progressive continuity of emplacement of such freshly plastic cement material; such framework serving to support, in progressive continuity, movable construction-plants for advancing structural formations.

5. In a progressive-continuity method of reinforced concrete construction, progressively emplacing, with connected continuity, sections of metal framing which may serve as permanent structural reinforcement, as progressive mold-form support, and as progressive support for advancing construction-plants.

6. In a progressive-continuity method of reinforced concrete construction, progressively emplacing, with connected continuity, sections of metal framing which may serve as permanent structural reinforcement, as progressive mold-form support, and as progressive support for advancing construction-plants, and progressively advancing such

connected mold-forming emplacement and construction-plant movement on such connected continuity of reinforce framing.

7. In a process of reinforced concrete construction which consists in constructing and emplacing a work-supporting metal-reinforce framing in advance of concrete emplacement, the method of assembling such work-supporting framework in adapted sections, and progressively emplacing such sections in connected continuity.

8. In the slope-angle method of plastic concrete construction, embedding metal frames in the concrete, connecting said frames in series, supporting a work-inclosing cover on said framework, and moving said cover forward as the work progresses; the said motion being substantially synchronous with the progress of the work, and the said framework serving to support said cover in advance of the setting of the concrete.

9. In a process of monolithic concrete construction, substantially as described, the method of laying freshly plastic material of irregular mass-form in connection with similar material of regular form.

10. In a process of monolithic concrete construction, substantially as described, the method of inclosing frozen formations of freshly mixed concrete material in fresh material of higher temperature, the frozen material serving to sustain its inclosing material until set, and the inclosing material withdrawing the frost from its inclosed frozen material and enabling the setting of the cement therein.

11. In a process for making concrete structures which consists in embedding metal strengthening material in freshly plastic concrete, the steps of assembling such strengthening members into desired sections, and of emplacing such assembled sections as units on, in or at a structural site.

12. In a process for making concrete structures which consists in embedding metal strengthening material in freshly plastic concrete, the steps of assembling such strengthening material members into desired sections; of emplacing such assembled sections as units on, in or at a structural site, and embedding such sections in the concrete.

In testimony whereof I have signed my name to this specification.

FRANKLIN S. LAMSON.

Witnesses:

C. T. LAMSON,

SOLON C. KEMON.