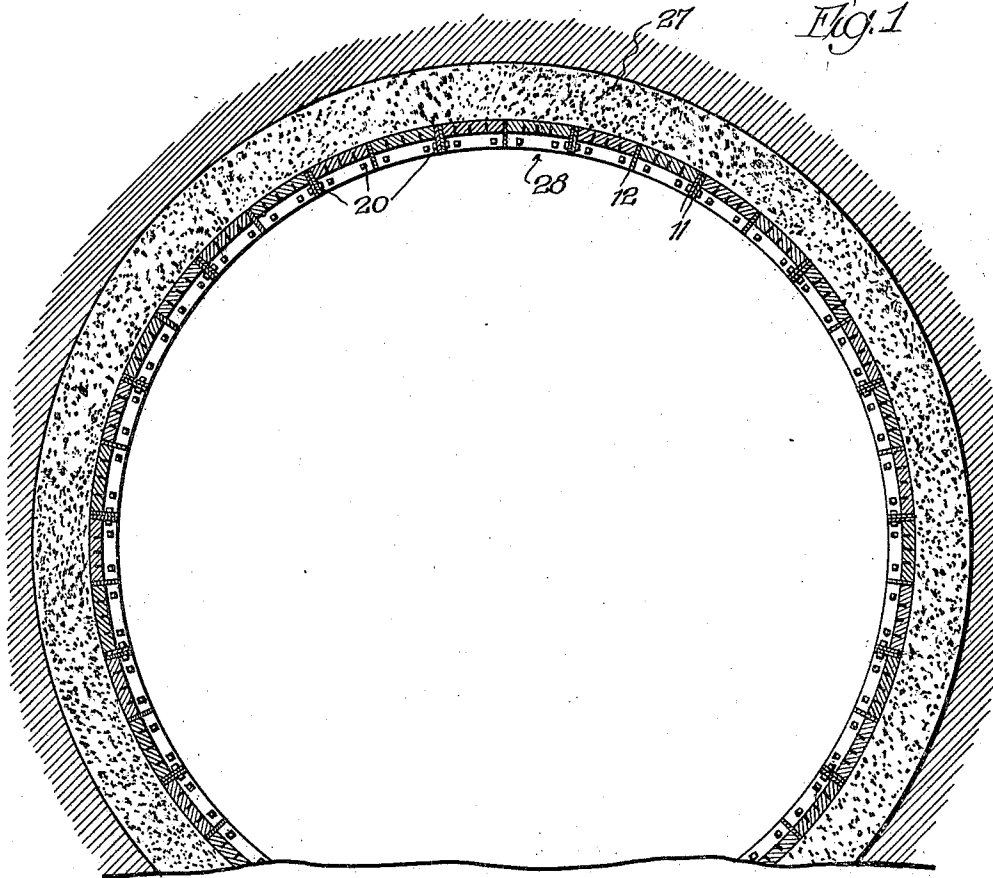


G. W. JACKSON.  
SUPPORTING FORM FOR CONCRETE AND MASONRY STRUCTURES.  
APPLICATION FILED APR. 3, 1920.

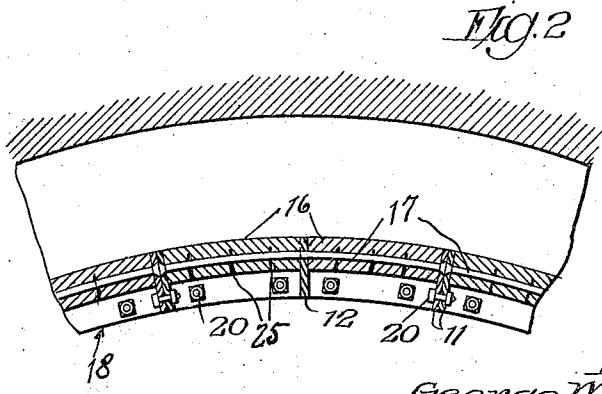
1,398,968.

Patented Dec. 6, 1921.

3 SHEETS—SHEET 1.



*Fig. 1*



*Fig. 2*

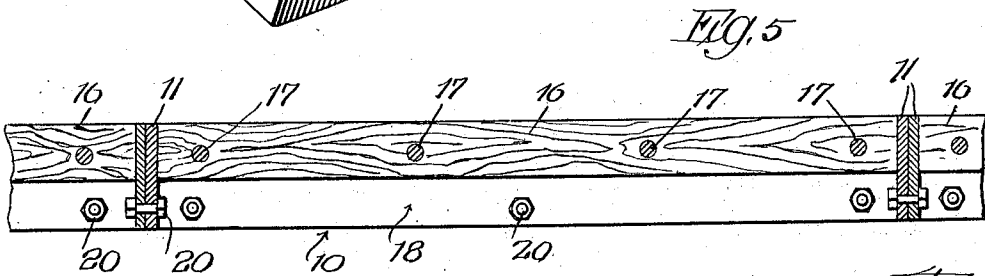
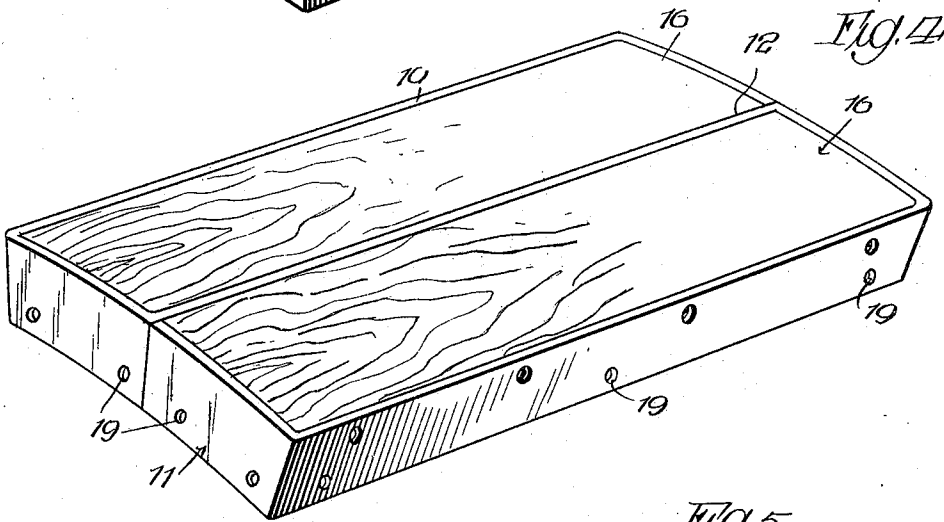
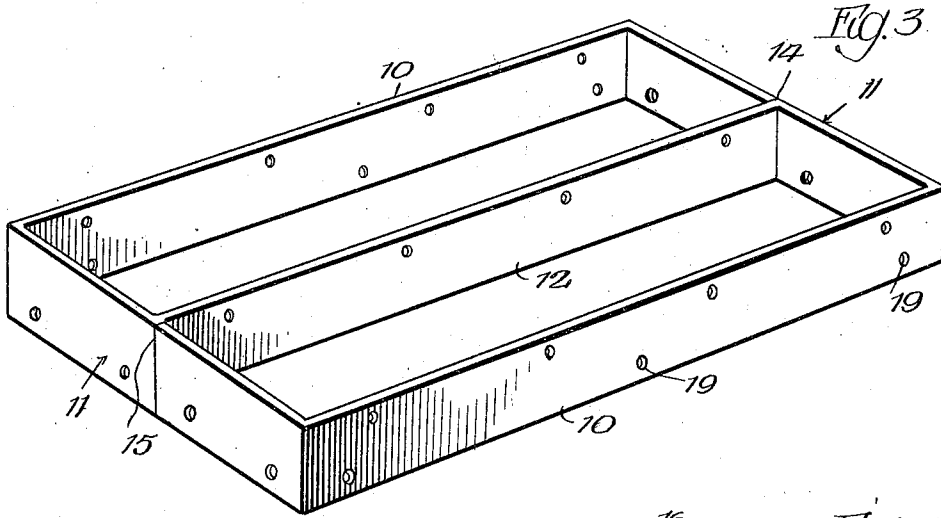
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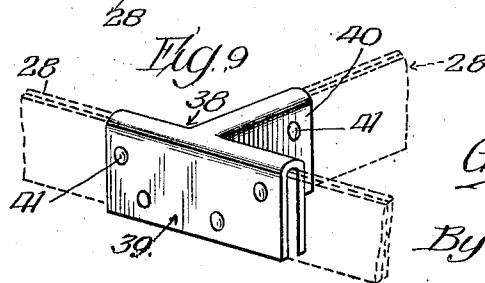
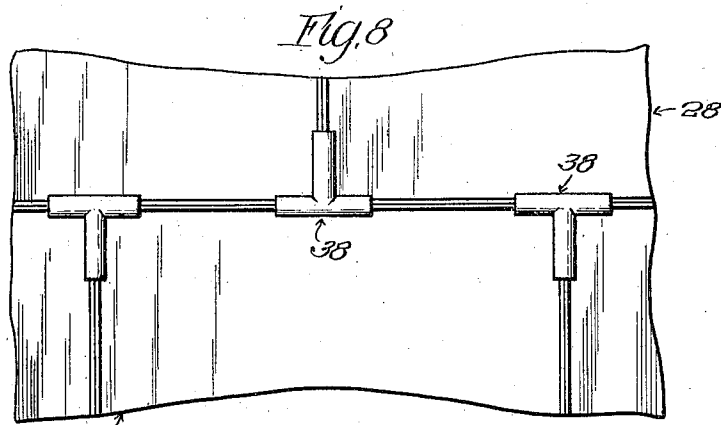
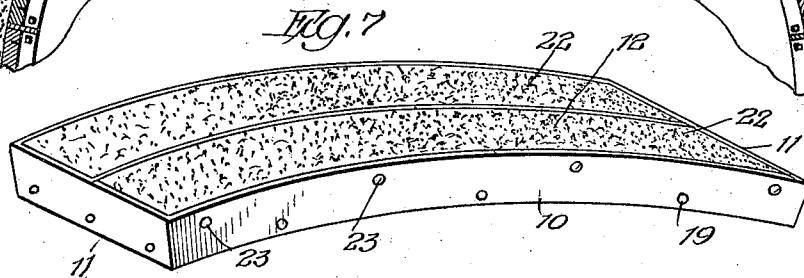
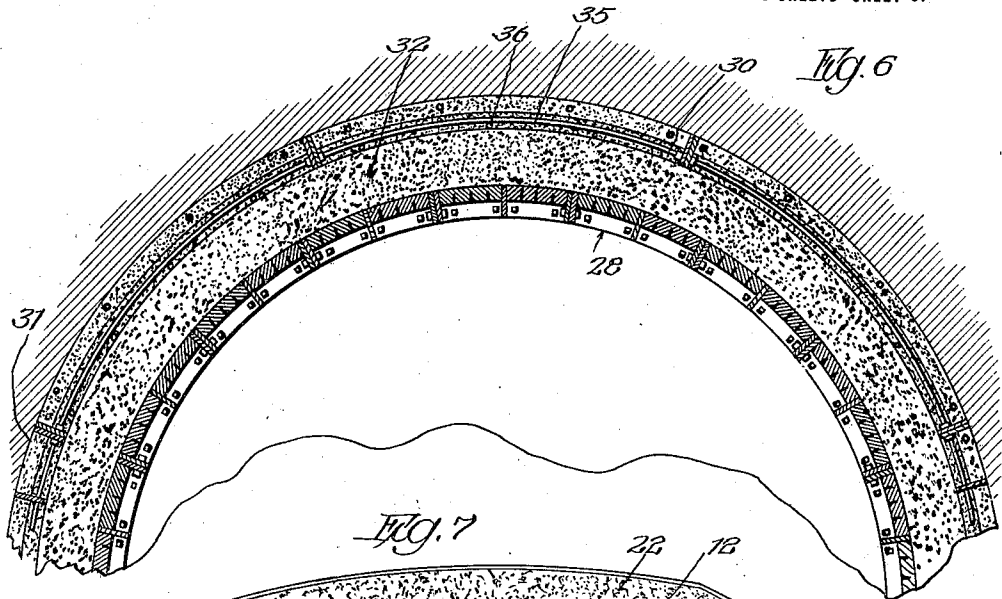
Inventor  
George W. Jackson  
By William H. Hall

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3 SHEETS—SHEET 3.



Inventor  
George W. Jackson  
By *William H. Hall*  
Attys

# UNITED STATES PATENT OFFICE.

GEORGE W. JACKSON, OF EVANSTON, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS,  
TO GEORGE W. JACKSON & FITZPATRICK COMPANY, OF CHICAGO, ILLINOIS, A  
CORPORATION OF ILLINOIS.

SUPPORTING-FORM FOR CONCRETE AND MASONRY STRUCTURES.

1,398,968.

Specification of Letters Patent.

Patented Dec. 6, 1921.

Application filed April 3, 1920. Serial No. 370,973.

*To all whom it may concern:*

Be it known that I, GEORGE W. JACKSON, a citizen of the United States, and a resident of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Supporting-Forms for Concrete and Masonry Structures; 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 characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in temporary supporting forms for concrete masonry, or like structures, such as tunneling, bridges, sewers, arches of all kinds, retaining walls and the like, of that general character shown in my prior United States Letters Patent Number 749,735, granted January 19, 1904.

Among the objects of the invention is to simplify the units, commonly termed lagging, of the structure, both in respect of the manner in which the units are fabricated, the economy of their structure and the character of their lightness whereby they may be readily handled, and also with respect to the construction of said units or lagging designed to facilitate their assembly in a supporting form for the general purposes set forth and the manner of securing together such units whereby they may be readily assembled and readily taken apart.

The invention consists in the combination and arrangement of the parts shown in the drawings and described in the specification, and is pointed out in the appended claims.

In the drawings:

Figure 1 is a segmental cross section of a tunnel showing the manner in which my improved lagging is adapted to constitute the supporting form for the concrete by which the tunnel is lined.

Fig. 2 is a fragmentary section on an enlarged scale of the supporting form.

Fig. 3 is a perspective view of the metal or skeleton frame of the unit or lagging.

Fig. 4 is a perspective view of the finished unit or lagging, of one type.

Fig. 5 is a section through a number of adjacent units of the type shown in Fig. 4.

Fig. 6 is a fragmentary segment of an arch or tunnel showing my improved form

constructed to serve both as a liner to support the earth and as a form to support the concrete while it sets.

Fig. 7 is a perspective view of another type or modification of the unit or lagging.

Fig. 8 is a fragmentary inner face view of a number of assembled lagging showing a fitting for holding the lagging relatively in their places.

Fig. 9 is a perspective view of the fitting shown in Fig. 8, with the lagging rims indicated in dotted lines.

One type of the lagging is shown in Figs. 3, 4, and 5. Fig. 3 shows the metallic frame of a type of lagging that may comprise in its construction a skeleton frame, and fillers that occupy the open portions of the skeleton frame and are supported therein. Such fillers may be either wood, cement, metal plates, or the like. The frame is preferably oblong, as shown in Fig. 3, and comprises side members 10, 10, end members 11, 11, and an intermediate member 12, which is parallel to the side members and is either made integral with or fixedly attached to the end members. Preferably and as herein shown, the said skeleton frame is made of a single strip of sheet metal, the major portion of the length of which, as herein shown, comprises one-half of the two ends of the frame and one side member and the intermediate member 12, and the other portion comprising the other parts of the end wall and one side member of the frame. The terminals 14, 15 of the strip may be brazed, welded, or otherwise suitably secured to the adjacent portion of the structure, the whole constituting when completed an oblong rectangular figure having the intermediate member 12. So far as the broader phase of the invention is concerned, the strip may be otherwise bent up or formed to produce the essential members of the skeleton frame or, if desired, a single strip may be employed to produce the side and end members of the frame and the intermediate member may constitute a separate element to be rigidly joined at its ends to the end members.

In addition to the frame described, the complete unit or lagging embraces filler elements 16, 16. The filler elements 16 shown in Fig. 4 are made of wood of a character to be sufficiently light, and may be treated with a water-proofing material to avoid wa-

ter logging. The said filler members 16 are made of dimensions to fit closely within the open parts of the skeleton frame, and are herein shown as attached to said frame by means of transverse tie-bolts 17 that extend through the side members of the frame and through openings in the filler members 16, thus tying or fastening the filler members rigidly to the frame. The said tie-bolts or rods extend continuously from one side of the frame to the other and, therefore, through the intermediate member 12 of the frame. The thickness of the filler member is less than the width of the frame members, as most clearly shown in Fig. 5, so that there remains, after the fabrication of the units or lagging, flanges or ribs 18. The said filler members fill the openings in the frame at the outer side thereof or the sides which, when the units or lagging members are assembled in the form, support a concrete layer formed thereon and supported thereby; and the ribs or flanges 18 are pierced with openings 19 to receive connecting bolts 20 by which adjacent units of a composed form are fixedly attached together, as shown in Figs. 1, 2, and 5.

Instead of making the filler members of wood, as shown in Figs. 4 and 5, said filler members may be made of bodies of concrete 22, as shown in Fig. 7; and the tie-bolts 23, corresponding to the fastening bolts or rods 17, may constitute a portion or all of the metallic or reinforcing elements of the concrete structure.

If the lagging thus generally described is to be used as the supporting form or the liner wall of straight faced concrete structures, the lagging may have the form illustrated in Fig. 3. In the event, however, that the lagging is to constitute liner or supporting forms for use in tunnel or arch work said lagging or a portion of them adapted to produce the form will be curved to correspond to the curvature of the earthen wall of the tunnel or arch and the curvature of the resultant concrete lining of a tunnel or the wall of the arch. In this event, therefore, it becomes necessary to give to the otherwise completed lagging a slight curvature, depending upon the size of the lagging and the camber of the wall formation.

For instance, the unit or lagging, after the filler members 16 have been applied and attached thereto, is submitted to pressure between suitable dies so as to transversely bend the unit or lagging, as shown in Fig. 4. The filler members 16 may take the curvature when they are made of wood by cutting the inner sides thereof with saw kerfs that extend a distance into the filler members from their inner faces thereof, as shown at 25 in Fig. 2, so as to permit the wood fillers to properly bend without imposing a breaking strain on the fibers thereof when the lagging

or unit is subjected to the die pressure. However, if desired, the filler members may be subjected to a steaming operation before or after they are fitted in the skeleton frames, so as to enable them to bend readily to conform to the curvature of the unit as a whole.

When the filler members are concrete, the skeleton frames may be bent to proper form before the filler members are applied thereto and are held therein by the proper reinforcing medium constituting, as parts thereof, the tie rods or bars 23.

Fig. 1 illustrates the application of a form which may be employed as a supporting form for the concrete lining 27 of a tunnel or, modified, may constitute the supporting form of an arch. In this arrangement the units which are designated in Fig. 1 as a whole by 28 are bolted together through their inwardly extending flanges or ribs by the bolts 20; said bolts extending through registering openings in the ribs or flanges at the inner sides of the units or lagging. It will be understood that when the supporting form is used in the manner illustrated in Fig. 1, to support the concrete lining of a tunnel, the tunnel has been driven through a material which is self-supporting such as granite, a hard clay, or the like, so that the earthen or rock walls require no support. It will also be understood that suitable means will be employed within the tunnel bore to support the lagging or units as they are being composed to produce the form. Such auxiliary devices, however, are well known and need not be illustrated. In the construction shown in said Fig. 1, the lagging or units remain until the concrete or lining wall hardens and are thereafter removed.

In the construction shown in Fig. 6, it is assumed that the tunnel or other excavation is being driven through a character of soil that is not self supporting, and in this event, there will be applied to the earthen wall of the tunnel, as the same is being excavated, a liner 30 made up of units corresponding in general to the structure hereinbefore described. Preferably when this is done the lagging units will be curved in the direction of their length, as illustrated in Fig. 7 so that it will not be necessary to excavate such distance into the soft earth as would tend to cause the same to cave in. Therefore, the units which support the upper radius of the earthen wall may be of the same or greater length than those shown in Fig. 4; but the width thereof will be comparatively small so that the placing of the units or lagging will so closely follow the excavation that danger of collapsing will be avoided. Below the arch of the tunnel wall and at points where the danger of caving in is less likely the shorter units 31 transversely

curved, as shown in Fig. 4, may be employed. In the construction shown in Fig. 6, it is intended that the liner form shall remain as a permanent part of the wall, and in this event it is preferable that the filler members of the laggings or units shall be of concrete or some other comparatively indestructible material; although certain woods properly treated will answer the purpose as filler members.

In said construction, as shown in Fig. 6, the supporting form, designated as a whole by 28 may be made identically like that shown in Fig. 1, said form being properly spaced from the liner form to receive the cementitious material to constitute the lining wall 32. After the concrete lining wall hardens the lagging or units of the supporting wall or form are removed in the manner described in connection with Fig. 1. The finished or ultimate wall, therefore, embraces, in connection with a concrete or like cementitious material, the concrete fillers 22 of the lagging or units, and the tie rods or bars 35 and 36 which extend, respectively, longitudinally and transversely of the lagging or units, constitute reinforcing elements for the outer layer of the ultimate liner wall. In the use of the lagging to constitute supporting forms for the concrete, it is desirable that the filler members shall be of a material other than concrete in order to prevent bonding between the filler members and the material of the liner wall as it hardens.

In addition to the tie bolts or rods, hereinafter referred to, for rigidly connecting the lagging or units, I may employ the channel clips 38 shown in Figs. 8 and 9, and comprising, as shown, a T-shaped element, composed of a straight member 39 and a right angle member 40, the members being grooved and open on their inner sides and closed at their outer sides, so that they may be dropped over overlapping intersecting ribs or flanges of the units and attached to adjacent flanges by the rivets 41, as best shown in Fig. 9.

It will be understood that the structural details of the invention as embodied in the drawings herewith may be considerably varied without departing from the scope and spirit of the broader claims hereto appended and that the invention is not, therefore, limited to the illustrative details, except as to such claims wherein they are specifically set forth and as imposed by the prior art. For instance, the lagging or units are adaptable to produce other supporting forms for other shapes of concrete or masonry structures and all such variations as are necessary for such adaptation are intended to be included within the broader claims herewith presented.

I claim as my invention:

1. An individual, portable lagging unit

for supporting forms comprising a skeleton frame, and separately formed fillers partially occupying the openings therein and of less thickness than the depth of the frame, and permanently fastened to the frame, to provide attaching ribs or flanges for the lagging units.

2. A lagging unit for supporting forms comprising a skeleton frame, fillers occupying the openings therein and of less thickness than the depth of the frame, to provide attaching ribs or flanges for the lagging units, and tie bolts extending through said fillers and the said frame members to rigidly fix the fillers to said frame.

3. A lagging unit for temporary supporting forms comprising a frame embracing parallel side and parallel end members, and an intermediate member, separately formed fillers partially occupying the spaces between, and of less thickness than, the depth of the frame members, and means for permanently attaching the fillers to said frame members.

4. A lagging unit for temporary supporting forms comprising a frame embracing parallel side and parallel end members, and an intermediate member, fillers occupying the spaces between and of less thickness than, the depth of the frame members, and tie bolts extending throughout the filler and the frame members, the fillers and frame members being curved transversely of the unit.

5. A lagging unit for temporary supporting forms comprising a skeleton frame, filler units occupying the openings of the frame, and tie-bolts extending through the filler units and through the frame members, said frame being made deeper than the thickness of the filler and provided with openings for connecting bolts.

6. A lagging unit for temporary supporting forms comprising a skeleton frame made of a continuous strip of metal embracing side and end members and an intermediate member parallel with two of the outer members, and fillers occupying the openings between the intermediate member and the outer members.

7. A lagging unit for temporary supporting forms comprising a skeleton frame made of a continuous strip of metal embracing side and end members and an intermediate member parallel with two of the outer members, and fillers occupying the openings between the intermediate member and the outer members, and of less thickness than the depth of the frame members.

8. A lagging unit for temporary supporting forms comprising a skeleton frame made of a continuous strip of metal embracing side and end members and an intermediate member parallel with two of the outer members, fillers occupying the openings between

the intermediate member and the outer members, and tie bolts extending through the said frame members and through the fillers.

5 9. A lagging unit for temporary supporting forms comprising a skeleton frame made up of flat metal to constitute parallel sides, parallel ends, and an intermediate member, and fillers in the openings between the intermediate and surrounding members, and permanently fixed to the frame, said frame and fillers being curved through one dimension.

10 10. An individual portable lagging unit for temporary supporting forms comprising a skeleton frame made up of flat metal to constitute sides, ends, and an intermediate member, and fillers in the openings between the intermediate and surrounding members, and permanently fixed to the frame, said frame and fillers being curved through one dimension, and said fillers being of a thickness less than the depth of the frame members to provide connecting ribs or flanges.

15 11. A lagging unit for temporary supporting forms comprising an oblong frame having parallel end walls and parallel side walls and an intermediate member, wood fillers between the side walls and fixed to the end walls occupying the spaces between

the intermediate members and the surrounding members, tie bolts extending through the wood fillers and through openings in the frame members, said frame member and the fillers being curved throughout one dimension thereof. 35

12. A lagging unit for temporary supporting forms comprising an oblong frame having parallel end walls and parallel side walls and an intermediate member, wood fillers occupying the spaces between the intermediate members and the surrounding members, and tie bolts extending through the wood fillers and through openings in the frame members, said frame member and the fillers being curved throughout one dimension thereof, said fillers being of less thickness than the depth of said frame members to provide attaching ribs or flanges. 40 45

13. The method of making a temporary form lagging unit which comprises the steps of forming a closed frame, filling the opening in the frame with a deformable material, fastening the filler to the frame, and curving the filler and frame throughout one dimension thereof. 50 55

In witness whereof I claim the foregoing as my invention, I hereunto append my signature this thirty-first day of March, 1920. 60

GEORGE W. JACKSON.