H. E. WHITE & W. H. HAM.

REINFORCED CONCRETE STRUCTURE.

APPLICATION FILED SEPT. 28, 1906.

975,307.

Patented Nov. 8, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

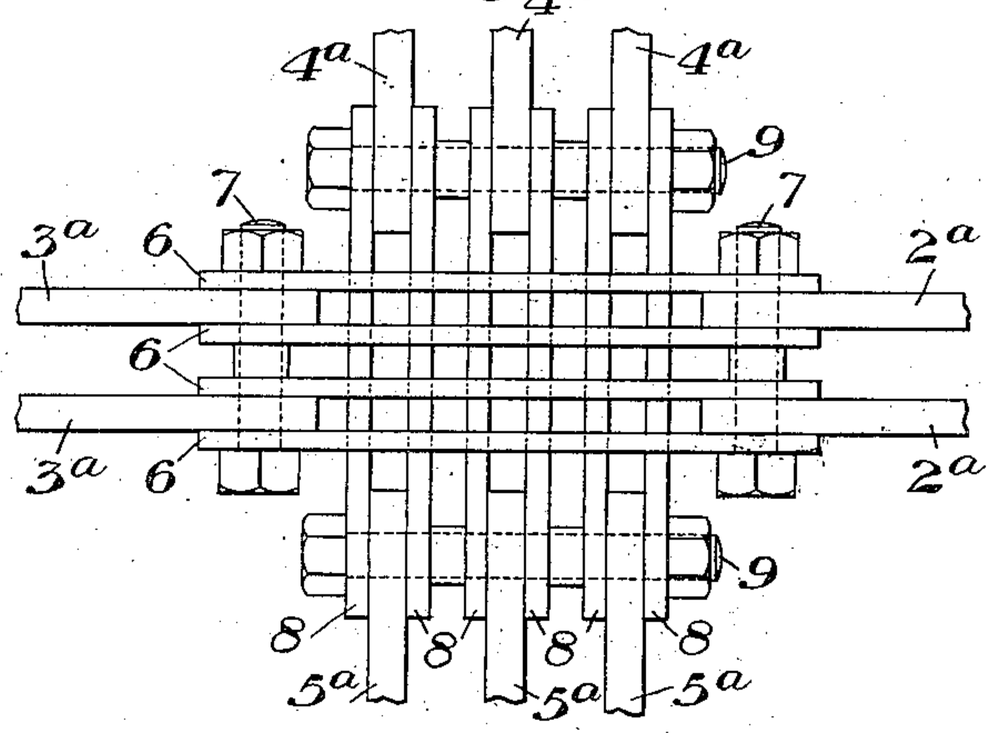


Fig. 2.

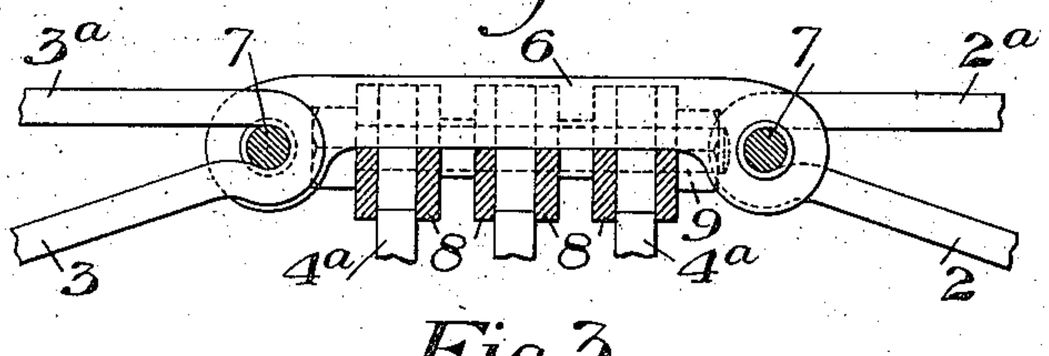
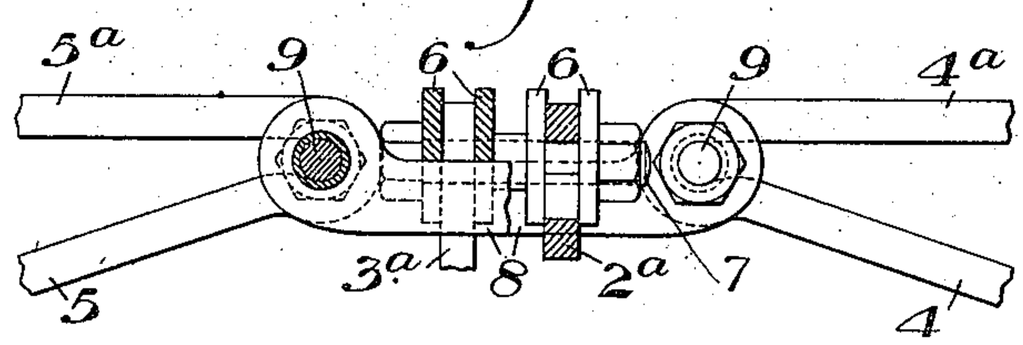


Fig. 3.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 4.

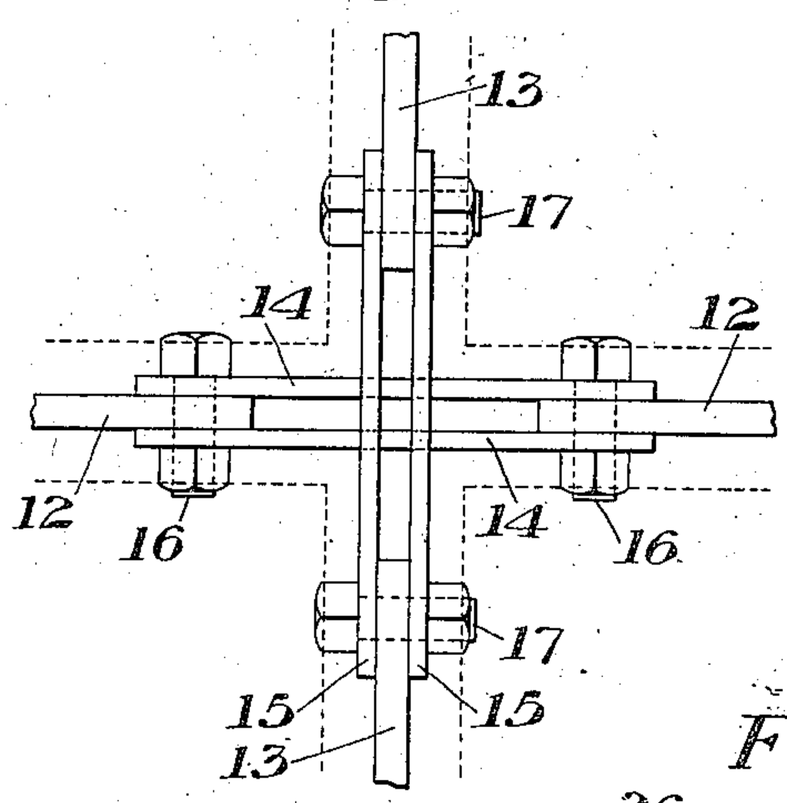


Fig. 5.

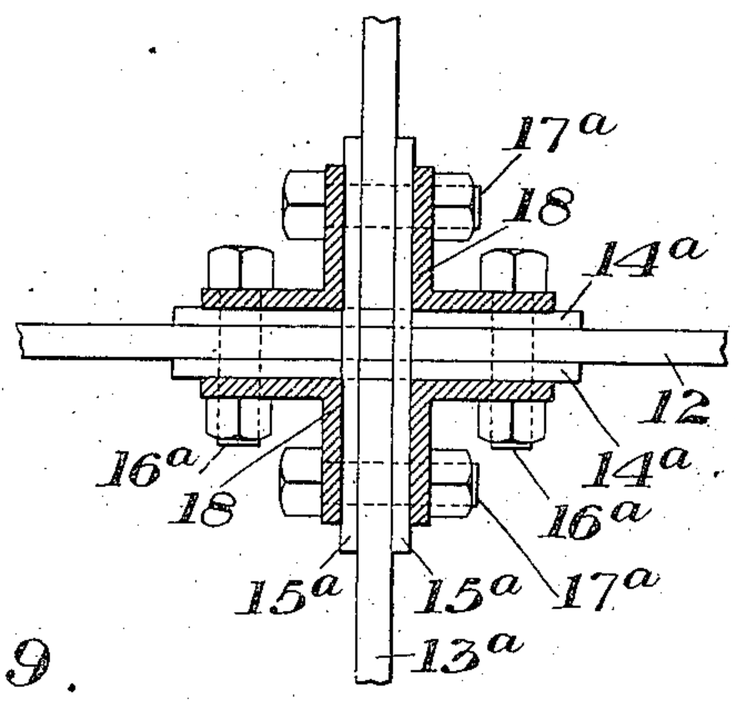


Fig. 9.

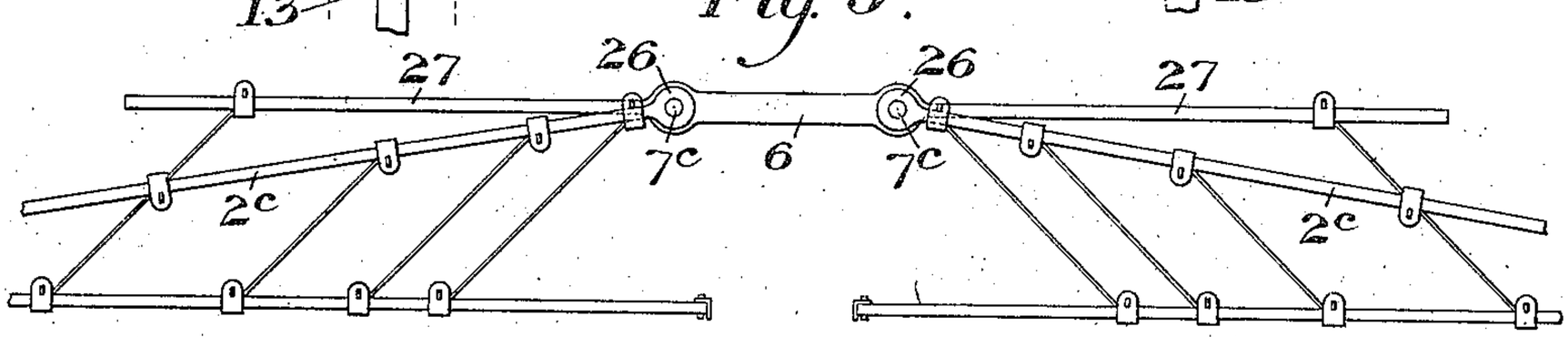


Fig. 6.

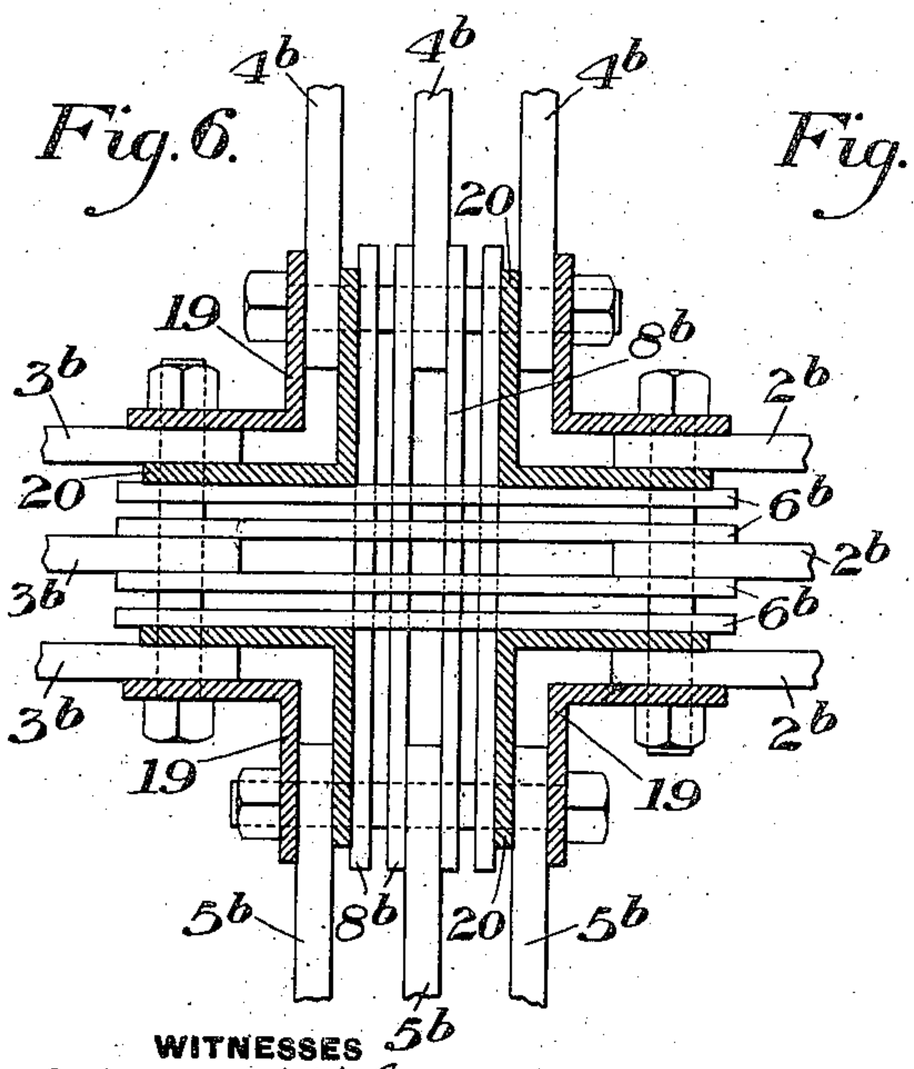


Fig. 7.

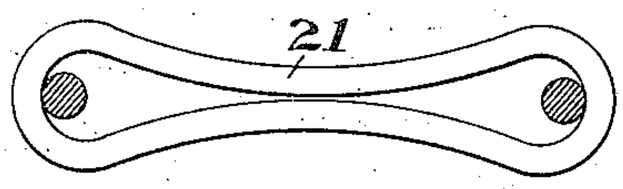
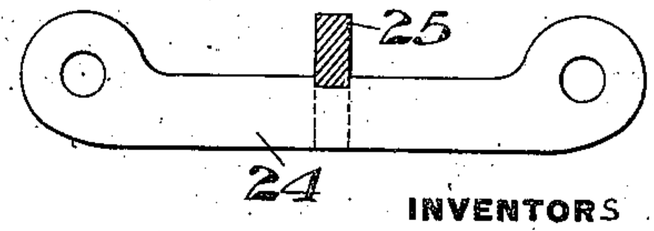


Fig. 8.



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UNITED STATES PATENT OFFICE.

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REINFORCED CONCRETE STRUCTURE.

975,307. Specification of Letters Patent. **Patented Nov. 8, 1910.**

Application filed September 28, 1906. Serial No. 336,529.

To all whom it may concern:

Be it known that we, HERBERT E. WHITE, of Youngstown, Mahoning county, Ohio, and WILLIAM H. HAM, of New York, county and State of New York, have invented a new and Improved Reinforced Concrete Structure, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a partial top plan view, showing one form of our improved beam and girder connections; Figs. 2 and 3 are partial cross sections of Fig. 1, the two sections being taken at right angles to each other; Figs. 4, 5 and 6 are plan views showing other forms of the connection; Figs. 7 and 8 show different forms of connecting links or eye-bars; and Fig. 9 shows another modification of the connection.

Our invention relates to reinforced concrete beam and girder construction; and particularly to the inter-connecting of the ends of reinforces in such structures, and also their connection with the vertical reinforcing members of columns or posts of the structure.

Heretofore the ends of such reinforces in beams or girders have usually been extended and embedded in the cement or concrete. This necessitates a considerable extension of the reinforce, or a member thereof, and it relies upon the adhesion of the concrete therewith.

Our invention provides for mechanically connecting the adjacent ends of beams or girders, especially those meeting at a vertical column. It also provides for mechanically connecting the end or ends of such reinforces with a vertical reinforcing member or members of the vertical column; and also for inter-connecting the ends of beams or girders where several of such ends meet at a vertical column.

In the drawing, referring to the form of Figs. 1, 2 and 3, 2, 2 and 3, 3 represent the ends of reinforcing members of beams extending endwise in line with each other. We have shown these reinforcing members as each consisting of a rod which is bent backwardly in its upper portion, as shown at 2^a and 3^a.

4^a and 5^a represent corresponding reinforces of beams or girders, these being shown as three in number to each girder, whereas the beam reinforces are shown as two in number. The number and form, however, of these reinforces may be varied without departing from our invention. The girder reinforces may be of the same shape and arrangement as the beam reinforces, the bent-back ends of these reinforces terminating either at a vertical column or intermediate of the columns.

The reinforces 2 and 3 are mechanically connected together by links or eye-bars 6 and pins 7. These links or eye-bars are preferably bent upwardly, as shown, to allow for the passage under them of the links or eye-bars 8, which, together with the pins or bolts 9, connect the members 4 and 5 of the girders. The cross-sectional detail of Figs. 2 and 3 clearly illustrate the manner in which the links or eye-bars extend over and under each other, so that these crossing eye-bars connect the four ends of the beam or girder reinforces.

In Fig. 4 we show four reinforced beams having reinforcing members 12 and 13 connected by the links or eye-bars 14 and 15. These eye-bars are secured by bolts 16 and 17 and the eye-bars 15 extend over the eye-bars 14, as in the previous form.

In Fig. 5 we show a form similar to that of Fig. 4, in which similar parts are marked with similar numerals, with the letter *a* applied; but in this case the reinforcing members 12^a and 13^a are not only connected to each other by the links 14^a and 15^a, but are also connected to reinforcing members 18 of the vertical concrete column, at which the horizontal reinforces meet. These vertical reinforces of the vertical concrete column are here shown as rolled angles; but they may be of any desired form or shape and may be continuous or intermittent along the vertical column. We have shown these angles as secured to the horizontal reinforcing members by the same bolts 16^a and 17^a which connect the links 14^a and 15^a. It will, of course, be understood that the number of reinforces 12^a and 13^a may be varied, as well as their shape and form, within the scope of this invention.

The angles 18 or their equivalent may be used to connect the reinforces at the adja-

cent ends of beams or girders extending at an angle to each other, whether at a vertical column or intermediate of the columns.

In Fig. 6 we show a form similar to that of Fig. 1, except that three reinforces 2^b and 3^b are employed, the reinforces 4^b and 5^b also being in sets of three. The connecting links or eye-bars 6^b and 8^b are used as before, some of these extending over the others. In this form the vertical column is provided with two sets of reinforcing angles 19 and 20. We have shown four of these sets arranged in the outer corners between the beam or girder reinforced, the inner angle being spaced apart from the outer by the ends of the outer reinforcing members. Either or both of these angle reinforces for the vertical column may be intermittent or continuous in form.

It will be understood that in any of the forms where vertical reinforces are used, such vertical reinforce may be of any desired form or shape and may be continuous or intermittent; also that as many vertical reinforces may be used as desired, in the column.

In Fig. 7 the link 21 is made in the form of a chain link with the legs bent toward each other in the intermediate part, so as to clear the legs of the crossing link. One link may be bent in one direction and the corresponding bar of the other link bent in the other direction.

In the form of Fig. 8, each eye-bar 24 has a notch to fit into a corresponding notch in the crossing eye-bar 25. Many other forms of connecting links or eye-bars may be employed within the scope of our invention.

In Fig. 9 we show another form of the invention wherein the upwardly-inclined member 2^c of the reinforce terminates in an eye 26 at its upper end. In this case the connecting link 6^c is in the form of a bar having eyes to receive the pins 7^c and provided with extensions 27 which are embedded in the concrete. In this form, therefore, instead of bending back and extending the upper members of the reinforce, they are simply connected to the link or eye-bar, which in turn is extended within the beams or girders.

The advantages of our invention will be apparent to those skilled in the art.

A secure connection is made at the vertical column between the ends of three or more beams or girders, this connection being a mechanical connection between the reinforces, and hence affording a secure and permanent joint. The connecting of the horizontal reinforcing members to the vertical reinforcing member or members of the column adds strength and stability, and the staggering of the connecting links or members between the ends of the reinforces enables the ends of three or more beams to be mechanically connected. It will be noted that the connecting pins, where these are used, are in the same plane, although the links or cross bars are deflected or bent to allow them to pass each other. This permits of a very simple and efficient method of directly connecting the horizontal members of the floor structure with each other, and also connecting them with the vertical members of the column structure, to transfer the strains from the reinforcing members of the floor to the upright, reinforcing members of the column. The reinforce of the girder or beam may be provided with an aperture for receiving the pin, either by punching or drilling or otherwise forming a hole therein, or by bending back the member, as shown in the drawing.

By using connectors such as described, a maximum strength is obtained with a minimum amount of metal. Moreover, by the use of these intermediate connectors the parts may be made tight so that strains will be communicated from one reinforce to the other without lost motion which would tend to crack the concrete or inclosing substance.

By the word "concrete" in the claims, we understand to cover any plastic composition of a cementitious or similar nature.

Our invention is not restricted, in its broader application, to the joining of beams and girders at the supporting columns. The union of girders and beams can be arranged in the spaces intermediate between the supporting columns to provide a continuous beam or girder from one side of the building to the other. Where the connection is made at the columns, a connection may or may not be used between the horizontal reinforces and those of the vertical columns.

Many changes may be made in the form and arrangement of the reinforcing members, the columns, the connections, etc., without departing from our invention.

We claim:

1. In reinforced concrete structures, a plurality of concrete beams arranged in pairs and meeting at a common connecting point, each beam having a metallic reinforce therein, and links connecting opposite reinforces, one link or set of links crossing another link or set of links and being placed on edge or with their greatest dimensions vertically; substantially as described.

2. In reinforced concrete structures, a vertical post or column, and a plurality of horizontal beams or girders joining the column and radiating therefrom in pairs, each beam or girder having metallic reinforcing elements embedded therein, each of said elements being connected with the element of the other beam by a link, said links extending within the column and crossing each other and being offset vertically at the points of crossing; substantially as described.

3. In reinforced concrete structures, a ver-

tical post or column, and a plurality of horizontal beams or girders joining the column and radiating therefrom in pairs, each beam or girder having metallic reinforcing elements embedded therein, each of said elements being connected with the element of another and opposite beam by two parallel links extending within the column and crossing each other, and the column having vertically extending reinforcing members to which the links are also connected; substantially as described.

4. In reinforced concrete structures, a vertical post or column, and a plurality of horizontal beams or girders joining the column and radiating therefrom in pairs, each beam or girder having metallic reinforcing elements embedded therein, each of said elements being connected with the element of another beam by a link, said links extending within the column and crossing each other, the points of connection between the links and the reinforcing elements of the beams or girders being in the same plane, and the links being bent or offset in a vertical direction to permit them to pass each other; substantially as described.

5. In a reinforced concrete structure, a set of four beams or girders meeting at a column and each having a reinforcing element, and separate metallic pieces connecting the reinforcing elements in pairs, said pieces extending through the column and one set of them crossing the other set said pieces being edgewise disposed, or with their greatest dimensions vertical; substantially as described.

6. In reinforced concrete structures, a column, a plurality of beams or girders meeting at the column and radiating therefrom in pairs, each beam or girder having a plurality of reinforcing elements therein and metallic members connecting reinforcing elements of opposite beams and crossing each other within the column said pieces being edgewise disposed, or with their greatest dimensions vertical, and having vertically offset portions to permit their end portions to be connected to the reinforcing elements in the common plane of said elements; substantially as described.

7. In reinforced concrete structures, a column a plurality of beams or girders meeting at the column and radiating therefrom, each beam or girder having a plurality of reinforcing elements therein and metallic members connecting opposite reinforcing elements and crossing each other within the column, the column having a plurality of vertically extending reinforcements, the ends of the metallic connecting members extending between and secured to the vertical reinforcements; substantially as described.

In testimony whereof, we have hereunto set our hands.

HERBERT E. WHITE.
WILLIAM H. HAM.

Witnesses:
O. D. KAISER,
B. C. FAGLEY.