

(No Model.)

3 Sheets—Sheet 1.

J. H. BASSLER.

METHOD OF AND APPARATUS FOR UNITING METALS.

No. 499,277.

Patented June 13, 1893.

FIG. 1

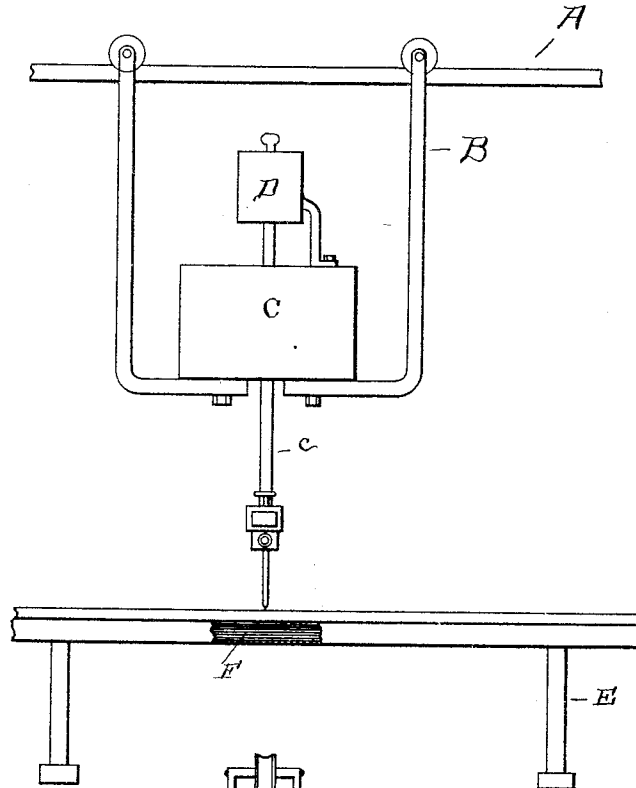
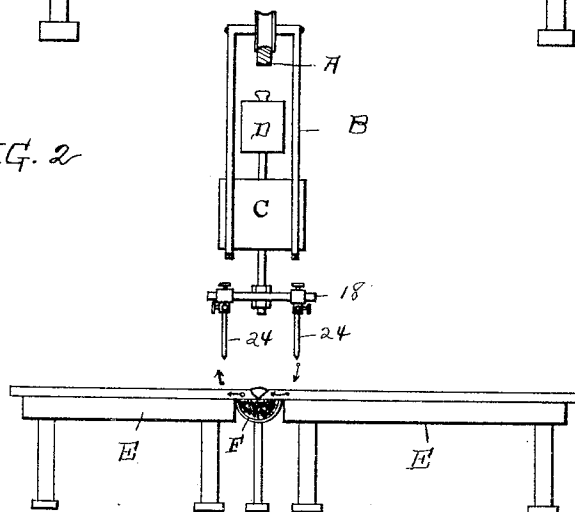


FIG. 2



Witnesses
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FIG. 5

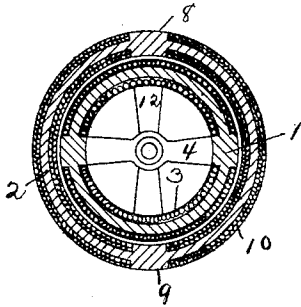


FIG. 3

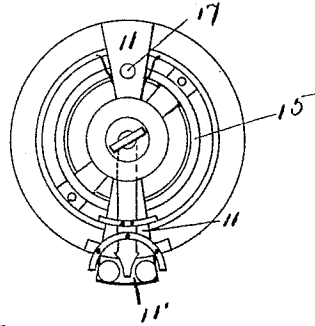
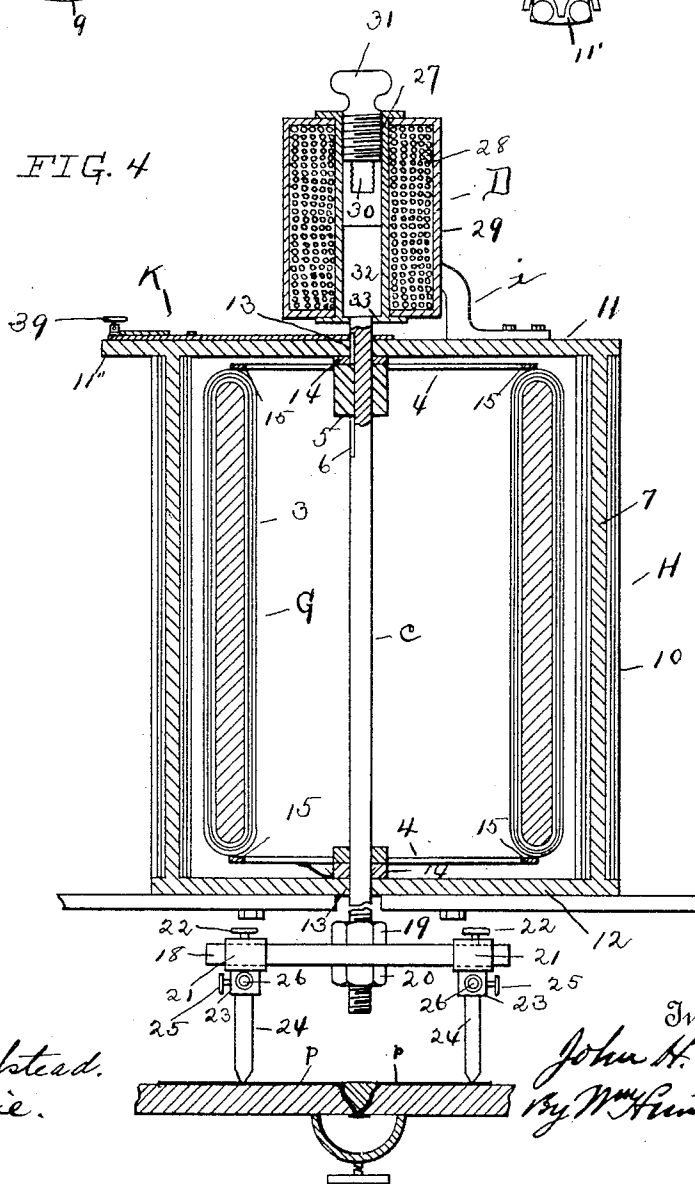


FIG. 4



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FIG. 6

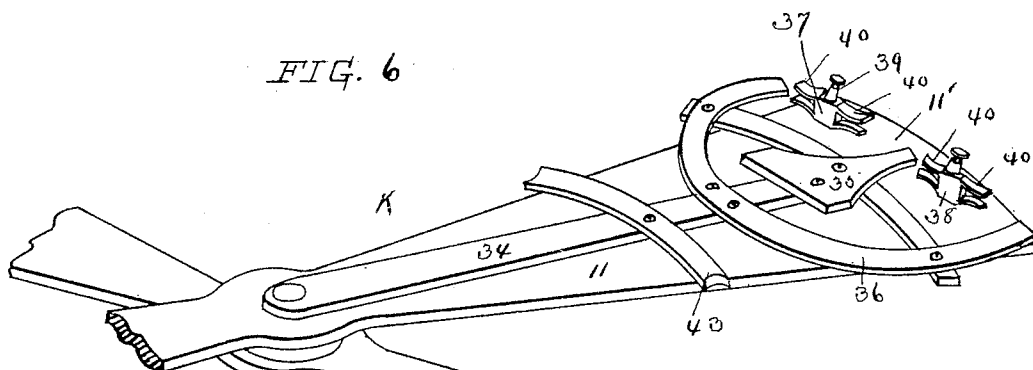


FIG. 7

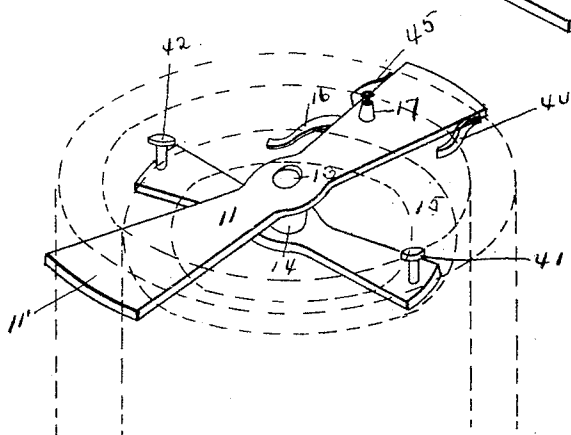
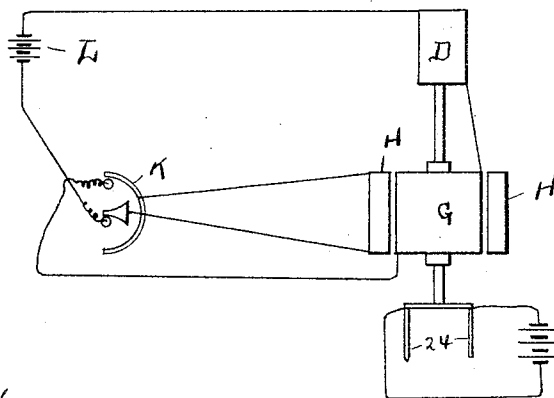


FIG. 8



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR UNITING METALS.

SPECIFICATION forming part of Letters Patent No. 499,277, dated June 13, 1893.

Application filed December 1, 1892. Serial No. 453,716. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. BASSLER, a citizen of the United States of America, residing at Myerstown, in the county of Lebanon and State of Pennsylvania, have invented certain new and useful Improvements in Methods of and Apparatus for Uniting Metals, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to an improved method of and apparatus for uniting metals.

The invention consists, broadly, in placing a fillet of aluminum or an alloy of aluminum in the joint of the materials to be united, then passing an electric current through the materials to be united and through the fillet until the fillet is fused.

The invention consists, further, in placing a fillet of aluminum or an alloy of aluminum in the joint of the materials to be united, and then passing an electric current transversely through the joint until the fillet is fused.

The invention consists, further, in placing a fillet of aluminum or an alloy of aluminum in the joint of the materials to be united, and then fusing the fillet by an electric arc on each side of the joint and by a current passing transversely through the joint.

The invention consists, further, in coating the materials to be united with a layer of carbon, then placing a fillet of aluminum or aluminum alloy in the joint of the materials to be united, and finally fusing the aluminum.

The invention consists, further, of an apparatus well adapted for carrying out my improved method.

In carrying out my method in its preferable form, I first coat the materials to be united with a layer of carbon, which consists of pulverized gas-carbon mixed into a paste with molasses or other similar sticky substance to hold the carbon to the materials. I next place a fillet of aluminum or a suitable alloy of aluminum in the joint, and then fuse the fillet by a pair of arcs, one on each side of the joint, the current passing from one electrode to the other transversely through the joint. I find it better in practicing my process to give the pair of carbons a vibratory movement in a direction at right angles to their lengths, which changes the positions of the arcs and at the same time alternates the

direction of the current through the joint. This will be more fully understood from the description of the apparatus hereinafter contained.

As aluminum is a good conductor of electricity, is not easily volatilized, cannot be sensibly affected by oxygen and is therefore capable of being melted in the air with impunity, it is peculiarly adapted for the purposes of my invention.

The edges of the materials, in practice, do not contact at every point with the fillet, and the conductive area is therefore limited, so that the resistance along the edges of the materials is great enough to cause the edges to become heated, which increases the resistance until finally the materials arrive at so high a temperature that the fillet fuses from conductive heat, after which the current continues to heat the edges hotter until the fusing point is reached by an infinitesimal portion of the materials along the edges. The current in flowing through the materials and through the fillet carries the materials into the fused fillet and vice versa, it being better for this reason to alternate the current so that the mutual interpenetration of the particles will be assured. At the moment of fusing the fillet the aluminum will unite with the materials to form an alloy of such remarkable tenacity as to resemble a chemical union (if indeed it be not actually such), so that the strength of the joint, when completed, depends entirely upon the tensile strength of the fillet and not upon the mere adhesive or cohesive power, as in common solders, welding, &c. And as the tensile strength of the fillet depends entirely upon the alloy used, and as it is possible to make an alloy of aluminum whose tensile strength is greater than that of the strongest steel, and whose fusing point is less than the steel, it is therefore possible to unite the strongest steel in this way by a joint stronger than said steel without increasing the sectional area of the joint. Furthermore, the aluminum while in the fused condition keeps the air from the edges of the material while the transportative effect of the current on the molecules of material and fillet is taking place, thereby acting as a flux and permitting the action of the current to be carried on indefinitely, if de-

sired, without injuring the material along the edges. Moreover, the carbon-paste along the edges of the materials forms an additional resistance, which, if used with any other metal than aluminum, would tend finally to carbonize the edges of the material, and injure the union; but in combination with an aluminum fillet, the latter, on arriving at the fusing point, drives off the said carbon and unites firmly with the material. The carbon-paste on the other portions of the materials serves to protect said materials, when heated, from the oxidizing effect of the air. And as the transportative effect of an arc is very great, the material might be injured by the continued use of electric arcs in the manner I prefer, were it not for the fact that the carbon coating forms the volatilizing medium which keeps up the arc, thereby saving the metal.

In order that the above-described method of uniting metals may be carried into effect in an economical and expeditious manner on a large scale, I have devised an apparatus well adapted for my purpose, which I will now describe.

Figure 1 of the drawings is a side elevation of my complete apparatus. Fig. 2 is an end elevation of the same. Fig. 3 is a plan view of the motor and electro-magnet. Fig. 4 is a vertical section of the same, taken through the center of Fig. 3. Fig. 5 is a horizontal section of the motor. Fig. 6 is a detail perspective view of the current-reverser. Fig. 7 is a perspective view of the upper end of the motor. Fig. 8 is a diagrammatic view showing the wiring of the circuits.

Referring to the drawings, A is an overhead track on which runs a carriage B, adapted to support the motor C and electro-magnet D. Beneath the movable carriage is a frame E on which the materials to be united may be placed, a trough F, filled with sand or other refractory material being placed beneath the joint as shown.

The motor C is adapted to rotate its armature-shaft *c* nearly half a revolution in one direction, and then back again in the other direction. This motor is provided with a hollow cylindrical armature-core G, having two poles 1 and 2, between which the armature-coils 3 are wound vertically. The armature is secured to the shaft by means of chord-pieces 4 through the center of which the shaft loosely passes. To permit a vertical reciprocation of the shaft independent of the armature for a purpose hereinafter described, the upper chord-piece 4 is provided with a feather 5 engaging a slot 6 in the shaft. Surrounding the armature is the field-magnet H, consisting of a hollow cylindrical ring 7 having poles 8 and 9 between which the field-magnet coils 10 are wound vertically and parallel to the armature coils. The field-magnet ring is provided with chord-pieces 11 and 12 having bearings 13 in which the armature-shaft revolves. Chord-piece 11 is extended at one

end as shown at 11' for a purpose hereinafter described. Between the chord-pieces of the armature and those of the field-magnet are placed collars 14, loose upon the shaft and serving to prevent vertical movement of the armature. Secured to the armature chord-pieces 4 and insulated therefrom are contact-rings 15, against which press springs 16 secured to and insulated from the field-magnet chord-pieces 11 and 12, and in connection with binding-posts 17, which are also insulated from the chord-pieces. One end of the armature-coil is connected with one contact-ring and the other end with the other contact-ring. Near the lower end of the armature-shaft is a cross-bar 18 of insulating material through which the shaft passes, the shaft being threaded above and below the cross-bar for the reception of nuts 19 and 20 by means of which the cross-bar may be adjusted on the shaft. To this cross-bar are attached slides 21 having clamping-screws 22 and electrode-holders 23 in which are secured electrodes 24 by means of thumb-screws 25. Binding-posts 26 are attached to the electrode-holders so as to be in electrical communication with the electrodes.

Above the motor is an electro-magnet D, having a central tube 27 surrounded by coils 28, outside of which is a casing 29 carried by a support *i* mounted on the upper chord-piece 11 of the field-magnet ring. Within the upper portion of the central tube is screwed a plug 30 having a thumb-piece 31 for adjusting it up or down in the tube. In the lower portion of the tube is a vertically-movable core 32 attached to the upper end of the armature-shaft *c*. To limit the downward movement of the armature-shaft the movable core 32 is made larger in diameter than the shaft *c* and the lower end of the central tube 27 is flanged as shown at 33. The upward movement of the shaft is limited by the plug 30.

K is a current-reverser attached to the motor and consisting of an arm 34 of insulating material which swings loosely on the armature-shaft *c* just above the chord-piece 11, and has a contact-plate 35 and a contact-arc 36 secured to its outer end. To the extended end 11' of chord-piece 11 and insulated therefrom are attached contact-posts 37 and 38, provided with binding-posts 39 and spring-jaws 40 as shown. These contact-posts are so located that when the arc 36 is in contact with the outer jaws of post 37, the contact-plate 35 will engage with the jaws of the other post 38, and vice versa, as will be understood from the drawings.

To the armature chord-piece 4 are secured two pins 41 and 42, one at each end, which alternately engage a segment 43 of insulating material attached to the arm 34, whereby the arm is vibrated from side to side when the motor C is in operation.

Springs 44 and 45 are secured to the edges of chord-piece 11 for engagement with pins 41 and 42 respectively to aid in overcoming the

inertia of the armature as it changes from one phase of its oscillation to another.

L is a battery or other source of electricity for the purpose of actuating the motors and
5 electro-magnets.

M is a battery or other source of electricity for furnishing the heating current to the electrodes.

The wiring of my apparatus is clearly shown
10 in Fig. 8 where the motor-battery L, the electro-magnet, and the armature coils are all in series with each other on a constant-current circuit which ends at the binding-posts of the current reverser. The field-magnet coils are
15 in circuit with the current-reverser by means of which the current is alternated through them. The electrodes are in circuit with battery M, as shown.

The operation of my apparatus is as follows:
20 The materials to be united are placed edge to edge upon the sand-trough, the edges being preferably first roughly beveled to form a trough-like recess to hold the fillet of aluminum or an alloy of aluminum, as shown, although the edges may be left vertical with a
25 space between them, into which the fillet may be inserted. The electrodes are then brought above the joint, one electrode on each side, and the heating current turned on, the current flowing from one electrode through the
30 material and fillet transversely of the joint and then back through the other electrode. The motor current is then turned on, actuating the electro-magnet, drawing the electrodes away
35 from the materials and forming two arcs, one on each side of the joint, the materials forming one electrode of each arc, and a current of electricity flowing through the metal while the arcs are in existence, the path of the current
40 being indicated by the small arrows in Fig. 2. At the same time the electro-magnet is energized the motor is started, oscillating the electrodes, causing them to mutually interchange their positions, and thereby alternating the
45 current which traverses the joint. At the moment that the electrodes have interchanged places, the current-reverser is thrown, which first breaks the circuit, permitting the electrodes to drop onto the metal, and then reverses the current through the field-magnet
50 coils, moving the armature in the opposite direction until the electrodes reach their first position when the operation is repeated. In this way the electrodes are alternately oscillated
55 and reciprocated, so that the two arcs are alternately moved about on the metal and then interrupted, although the current is continually flowing through the material and the fillet, excepting at the instant when the electrodes are in a plane parallel to the joint, and even this may be avoided if desired, by placing the materials with their joint at one side of the center of oscillation. As materials are
60 united at one point, the electrodes may be moved along by means of the carriage until the entire joint is completed. It is apparent, of course, that the sand in the sand-trough

prevents the melted aluminum from running down through the joint.

Before commencing operations it is preferable to place a layer of carbon-paste upon the material, as shown at *p* in Fig. 4, for the purposes hereinbefore stated, the carbon forming a coating which protects the metal until the
70 fillet is fused, whereupon the aluminum expels the carbon from the joint and unites directly with the materials as soon as the edges of said materials are sufficiently heated.

In uniting materials whose fusing-point is lower than that of pure aluminum it is necessary to use an alloy of aluminum whose
80 fusing-point will be such that the fillet will fuse before the materials do.

The apparatus shown and described in this application is of a construction similar to that
85 shown, described, and broadly claimed in my application for patent on electric welding apparatus, filed August 23, 1892, Serial No. 443,888, the difference being in the manner of wiring the electrodes. In this application a
90 single armature shaft is used, and the pair of electrodes, instead of being one above and one below the material, are both above the material.

Having thus fully described my invention,
95 what I claim as new, and desire to secure by Letters Patent, is—

1. A method of uniting metals, which consists in placing a fillet of aluminum or aluminum alloy in the joint of the materials to be
100 united, and then passing an electric current through the materials and through the fillet until the fillet is fused.

2. A method of uniting metals, which consists in placing a fillet of aluminum or aluminum alloy in the joint of the materials to be united, and then passing an electric current
105 through the materials and through the fillet transversely of the joint until the fillet is fused.

3. A method of uniting metals, which consists in placing a fillet of aluminum or aluminum alloy in the joint of the materials to be united, and then passing an alternating
110 electric current through the materials and through the fillet transversely of the joint until the fillet is fused.

4. A method of uniting metals, which consists in placing a fillet of aluminum or aluminum alloy in the joint of the materials to be united, and then fusing the fillet by the
115 combined effect of an electric arc and a current of electricity passing through the materials and through the fillet.

5. A method of uniting metals, which consists in first coating the materials to be united with a layer of carbon, then placing a fillet of aluminum or aluminum alloy in the joint, and finally passing an electric current through
120 the materials and through the fillet until the fillet is fused.

6. A method of uniting metals, which consists in first coating the materials to be united with a layer of carbon, then placing a fillet of

aluminum or aluminum alloy in the joint, and finally passing an electric current through the materials and through the fillet transversely of the joint until the fillet is fused.

5 7. A method of uniting metals, which consists in first coating the materials to be united with a layer of carbon, then placing a fillet of aluminum or aluminum alloy in the joint, and finally passing an alternating current of
10 electricity through the materials and through the fillet transversely of the joint until the fillet is fused.

8. A method of uniting metals, which consists in first coating the materials to be united
15 with a layer of carbon, then placing a fillet of aluminum or aluminum alloy in the joint, and finally fusing the fillet by the combined effect of an electric arc and an electric current passing through the materials and
20 through the fillet transversely of the joint.

9. In an electric apparatus of the class described, a shaft, a cross-bar attached to the shaft, a positive electrode at one end of the cross-bar and a negative electrode at the other
25 end of said bar, a heating circuit in which both electrodes are included, means for energizing said circuit, and mechanism for vibrating the electrodes.

10. In an electric apparatus of the class described, a shaft, a cross-bar attached to the shaft, a positive electrode at one end of the cross-bar and a negative electrode at the other
30 end of said bar, a heating circuit in which both electrodes are included, means for energizing the same, and mechanism for vibrating the electrodes in a direction at right-angles
35 to their lengths.

11. In an electric apparatus of the class described, a shaft, a cross-bar attached to the shaft, a positive electrode at one end of the cross-bar and a negative electrode at the other
40 end of said bar, a heating circuit in which both electrodes are included, means for energizing the same, and mechanism for interchanging the positions of the electrodes.
45

12. In an electric apparatus of the class described, a shaft, a cross-bar attached to the shaft, a positive electrode at one end of the cross-bar and a negative electrode at the other
50 end of said bar, a heating circuit in which both electrodes are included, means for energizing the same, and mechanism for reciprocating the electrodes.

13. In an electric apparatus of the class described, a shaft, a cross-bar attached to the shaft, a positive electrode at one end of the cross-bar and a negative electrode at the other
55 end of said bar, a heating circuit in which both electrodes are included, and means for reciprocating and oscillating the electrodes.

14. In an electric apparatus of the class described, an electro-motor, an armature shaft, a cross-bar at the lower end of said shaft, a pair of electrodes attached to the cross-bar, a heating circuit in which both electrodes are
60 included, means for energizing the heating circuit, a motor circuit, means for energizing the same, and a current-reverser included in the motor circuit, whereby the electrodes are oscillated in a direction at right angles to
65 their lengths.

15. In an electric apparatus of the class described, an electro-motor, an armature-shaft adapted to reciprocate, a movable core attached to one end of the shaft, an electro-
75 magnet for actuating the core, a motor circuit in which the electro-magnet is included, means for energizing the same, a current-reverser included in the motor-circuit, a pair of electrodes secured to the armature-shaft, a
80 heating circuit in which both electrodes are included, and means for energizing the heating circuit.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN H. BASSLER.

Witnesses:

WM. HUNTER MYERS,
G. W. BALLOCH.