No. 676,842. Patented June 18, 1901.

A. FERGUSON.

PENSTOCK MOTOR.

(Application filed Apr. 28, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

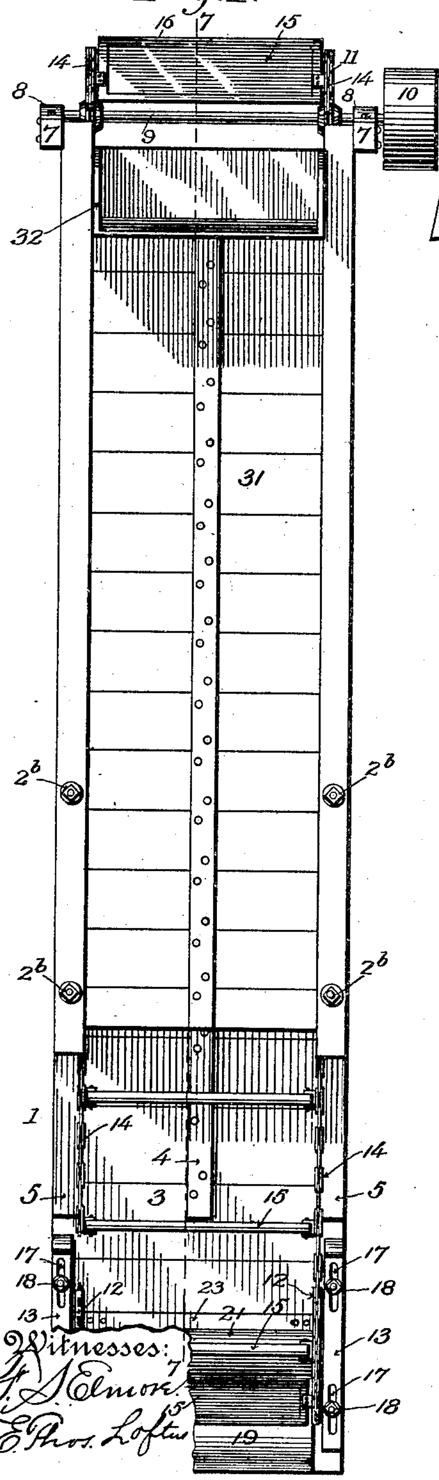
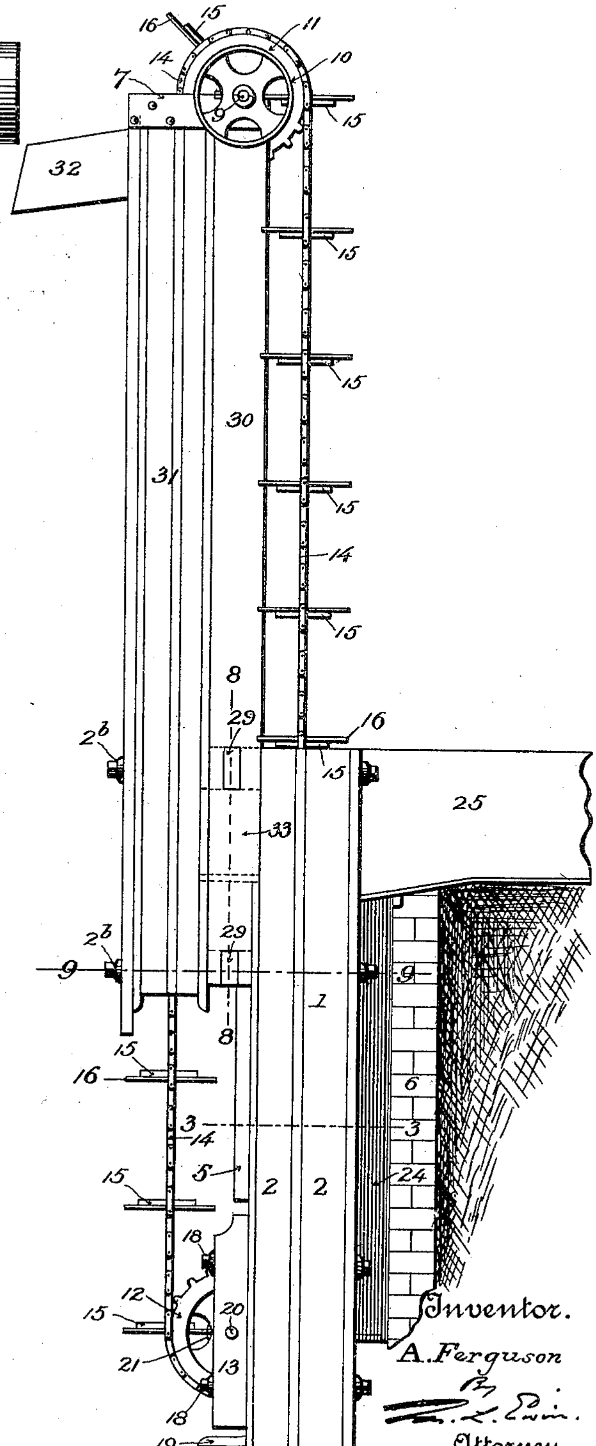


Fig. 2.



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THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

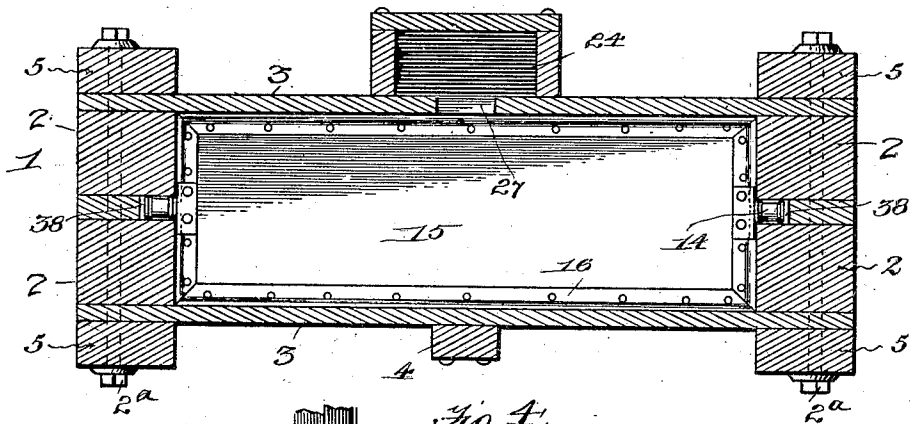

Fig. 4.

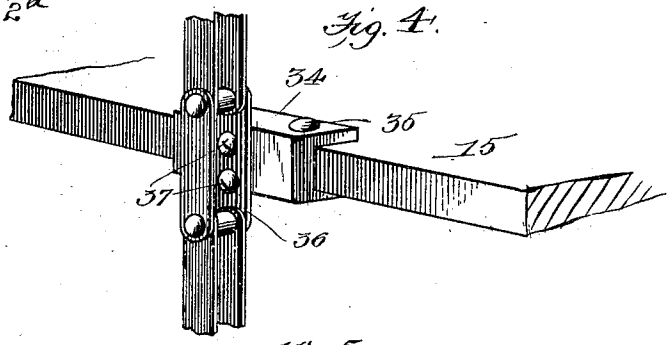

Fig. 5.

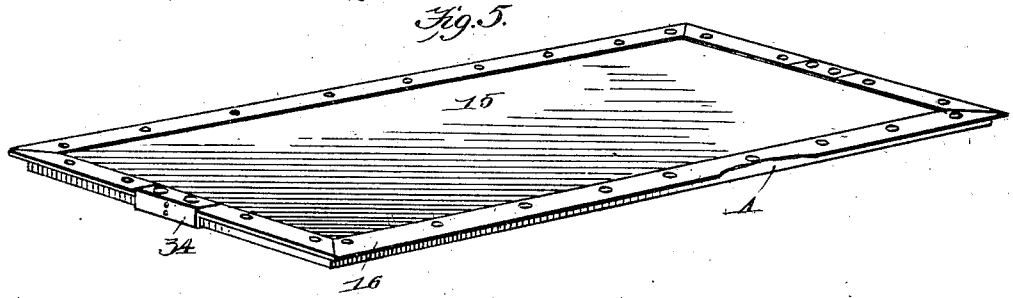

Fig. 6.

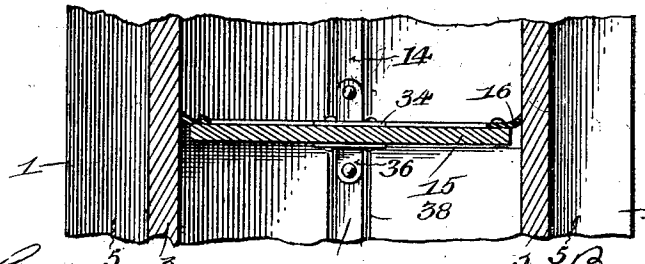

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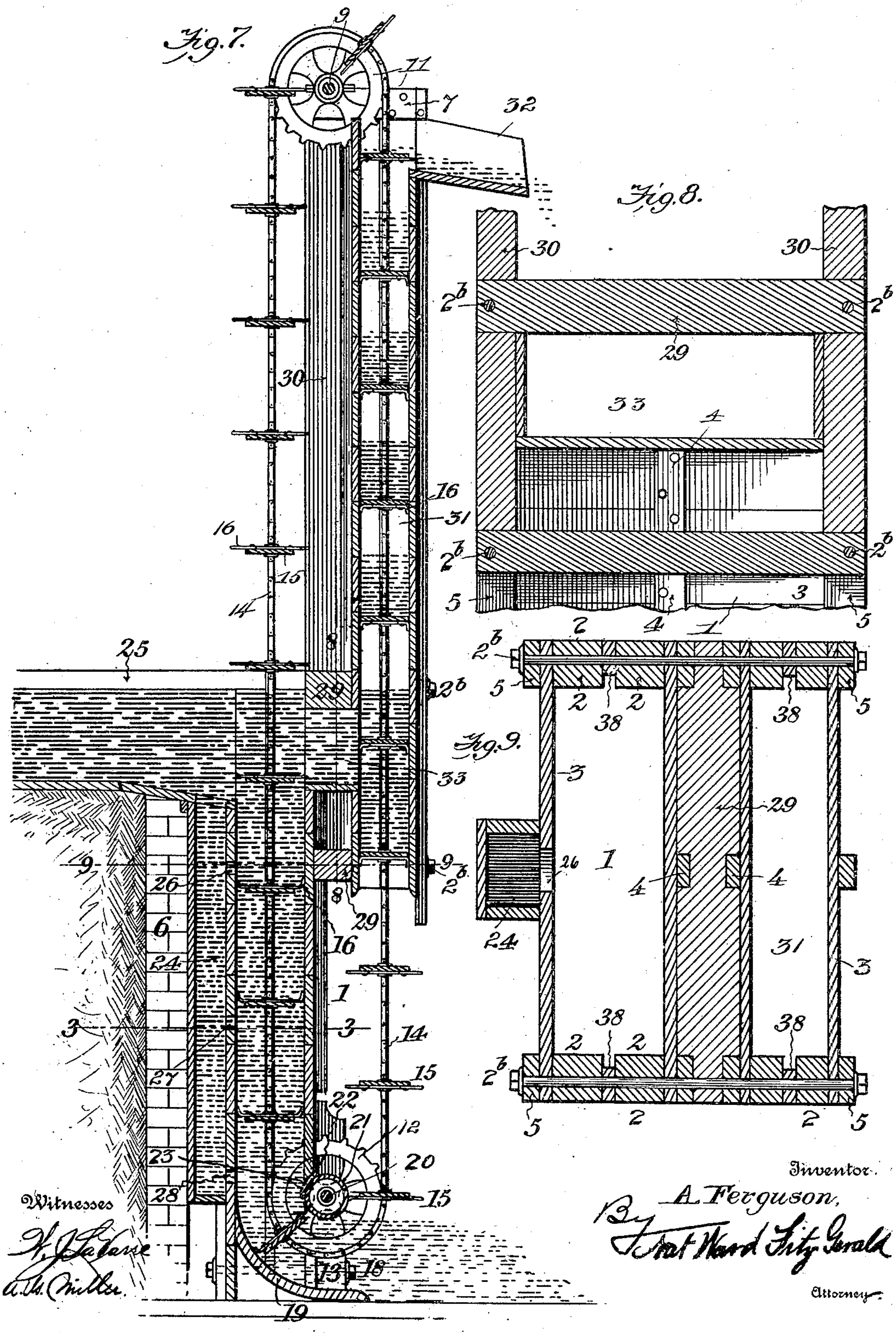
Fig. 7. Fig. 8. Fig. 9.



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UNITED STATES PATENT OFFICE.

ALLEN FERGUSON, OF ONE THOUSAND SPRINGS, IDAHO, ASSIGNOR OF THREE-FOURTHS TO BENJAMIN G. MULLINS, OF BLISS, IDAHO.

PENSTOCK-MOTOR.

SPECIFICATION forming part of Letters Patent No. 676,842, dated June 18, 1901.

Application filed April 28, 1899. Serial No. 714,813. (No model.)

To all whom it may concern:

Be it known that I, ALLEN FERGUSON, a citizen of the United States of America, and a resident of One Thousand Springs, (Hagerman P. O.,) in the State of Idaho, formerly of Glenn's Ferry, Lincoln county, have invented a new and useful Improvement in Penstock-Motors, of which the following is a specification.

My invention as hereinafter fully described and claimed relates to water-motors, and more particularly to that variety thereof whereby the weight and impetus of falling water are utilized; and my invention consists in certain novel features of construction and combinations of parts deemed necessary to utilize the momentum or force of the motor in such a way that a portion of the stream of water employed to actuate the motor will be elevated to a higher point than the point where the stream enters the motor, thereby rendering the same especially desirable for irrigation purposes, a large proportion of the stream employed being continuously and reliably lifted to a higher level and there discharged into any suitable channel prepared for its reception.

Other advantages and objects will be made fully apparent in the following description, considered in connection with the accompanying drawings, made a part of this specification, in which—

Figure 1 is a front elevation of my motor complete. Fig. 2 is a side view of Fig. 1. Fig. 3 is a horizontal section of the penstock or main water-conduit on the line 3 3, Figs. 2 and 7, showing a plan view of one of the flights. Fig. 4 is a perspective detail of the preferred means for securing the ends of each flight to the sprocket-chains with the marginal packing removed. Fig. 5 is a detail perspective view, on a reduced scale, showing one of the flights, a portion of the marginal packing being broken away, as indicated at A. Fig. 6 is a transverse section of one of the flights, showing the sprocket-chain to which it is attached in the background. Fig. 7 is a vertical section on the line 7 7, Fig. 1. Fig. 8 is a vertical section on the line 8 8, Figs. 2 and 7. Fig. 9 is a horizontal section on the line 9 9, Figs. 2 and 7, with the flights and sprocket-chains removed.

Referring to the drawings, 1 designates the main penstock, the walls of which comprise heavy edge timbers 2, Figs. 3 and 9, united by through-bolts 2^a with front and back planking 3, which is reinforced by cleats 4 and 5.

After the penstock has been produced it is located in the desired place, so as to have, preferably, a vertical position, the usual retaining-wall 6 being provided to insure that the water will be reliably directed into and through the conduit thus located.

To the upper end of the motor I secure in any preferred way bearing-seats 7, on which I locate bearings 8, Fig. 1, and journal in said bearings an upper shaft 9, having a driving-pulley 10 and sprocket-wheels 11 rigidly secured thereon. Coöperating with said sprocket-wheels are idlers 12, movable with adjustable supports 13 at the lower end of the motor, and extending from the sprocket-wheels 11 to said idlers are a pair of chains 14, which carry a series of flights 15, each flight being so constructed and provided with flexible marginal packing 16, Figs. 5 to 7, that it will exactly fit when in a horizontal position within the interior of the main penstock 1 and prevent the water from falling downward therein without moving with it the flight upon which such water rests, as will be readily apparent.

The adjustable supports 13 are provided with vertically-disposed slots 17, Fig. 1, by means of which they are rendered longitudinally movable and may be secured at any point by locking-bolts 18, thereby making it possible to take up any slack which may be in the chains 14.

The lower end of the penstock is provided upon its inner side with a curved extension 19, Fig. 7, designed to direct the flow of water outward at right angles and to compensate for the turn at this point made by the flights as they pass around the wheels 12. The wheels 12 are conveniently carried by a lower shaft 20, and secured to said shaft and located between said wheels I provide a drum 21, the office of which is to prevent the flow of water between the lower edge 22 of the outer

or front side of the penstock and said shaft 20, and in order to further insure against the escape of the water between these points I provide a flexible guard 23, made of rubber or other suitable material, attached to said lower edge 22 and coacting with the periphery of the drum 21.

It will be observed that during the passage of the flights carried by the chains 14 around the wheels 12 the curved section 19 maintains an effective engagement between the back of the penstock and the successive flights and enables the flexible packing to reliably perform its office—that is, to prevent the escape of the water until the successive flights pass the end of said curved section 19.

Designed to coöperate with the main penstock is an auxiliary penstock 24, located, preferably, to the rear of the main penstock and in communication with the flume 25 and also in communication, by means of a series of apertures 26, 27, and 28, with the main penstock, resulting in the provision of means for reliably starting the motor, as it will be clear that all the flights within the penstock will be simultaneously loaded by the passage of the water through the apertures 26, 27, and 28.

While I have shown the idlers 12 as sprocket-wheels, it will be clear that they may be smooth wheels provided with suitable flanges to hold the chains in position.

Extending above the main penstock and located slightly out of the plane thereof I provide a conduit 31, which is securely held to said penstock by through-bolts 2^b and which is of less size than the main penstock in cross-section, as indicated by Fig. 9. It will be observed that while only the extreme edges of the flexible packing 16 contact with the inner walls of the main penstock said packing is bent sharply downward at right angles to the flights 15 as said flights pass through the conduit 31 and that the effective area of each flight is thus reduced while it is lifting water, thus meeting the requirement that the quantity of water lifted must be necessarily less than the amount employed to operate the motor and by the same means tightening the packing against leakage, as is desirable. Said conduit 31 is preferably and conveniently of substantially the above-described construction of the main penstock 1. (Compare Figs. 3 and 9.)

An upright frame composed of cross-pieces 29 and side pieces 30, interposed between the main penstock 1 and the conduit 31, is united with both by the bolts 2^b and extends upward to the bearing-supports 7.

It will be observed that the conduit 31 is open at both ends and is provided at its upper end with a discharge nozzle or mouth 32, while near its lower end an inlet thereto is formed by a short horizontal trough 33, affording free communication between the interior of the conduit and the mouth of the flume.

From this construction it will therefore be clear that the water will first fill the main penstock and its auxiliary, thereby starting the motor, each of the flights successively moving downward and receiving its load, when said flights will pass the curved section 19, and thence upward into the open end of the conduit 31, receiving a fresh load of water through the trough 33 and elevating the same until it is discharged through the mouth 32, the operation being repeated and continued as long as there is a supply of water from the flume or until it is desired to check such operation.

It will be understood that any suitable means may be employed to operatively connect the ends of the flights with the sprocket-chains. As shown in Fig. 4, a simple plate of metal 34 is bent upon itself sufficiently to receive the edge of the flight, to which it may be securely attached, as by locking rivets or bolts 35, the central portion of the clip thus formed having been previously secured to a section or plate 36 of the sprocket-chain, as by rivets 37.

In order to compensate for the space occupied by the sprocket-chain at either end of the flights, I prefer to form recesses 38 in the side walls of the main penstock and conduit at these points, which recesses should be made as small as may suffice to admit of the free movement of the chains in order that a minimum quantity of water only will be lost.

Flexible rubber will probably prove the most desirable material to employ for constructing the packing 16 for the flights and the guards 23; but other materials, as leather or the like, may prove equally efficient. In the foregoing description I have described the preferred accessories deemed necessary in the embodiment of my invention, though it will be clearly apparent that the substantial equivalent thereof is comprehended by me, as departures may be made from the exact showing I have set forth without departing from the spirit of my invention. It will be clear, for example, that the penstock 1 and conduit 31, which I have shown rectangular in cross-section, may be circular in cross-section, in which case it would perhaps only be necessary to use one sprocket-chain. Various other modifications will, it is thought, be readily apparent, and I do not therefore wish to be strictly confined to the exact showing I have set forth.

The operation of my motor it is thought will be clearly apparent, though it may be well to state briefly that the water is directed from the flume into the auxiliary and main penstocks, which being filled will simultaneously load the series of flights within the main penstock, and thus cause the movement of these parts and the endless chains to which they are attached, each of the flights successively coming into operation and such operation being continued as long as the water

flows from the flume, it being understood that suitable means may be provided to discontinue such flow at the will of the operator. As the flights and chains are thus set in motion, the water being held to its work by means of the flexible packing impinging against the interior walls of the penstock, the sprocket-wheels 11 and their shaft 9 will be rotated and therewith the driving-pulley 10, thereby operating the machinery to which said pulley may be connected, and the operation of the parts will result at the same time in the elevation of a certain proportion of the water to a higher level, where it may be received by suitable flumes or canals or otherwise utilized.

Having thus described said improvement, I claim as my invention and desire to patent under this specification—

1. In a water-motor, the combination of a penstock, a conduit of less area in cross-section than said penstock, extending above the same, endless sprocket-chains, upper and lower wheels carrying said chains, a series of flights attached to said chains and traversing said penstock and said conduit, and flexible marginal packing attached to said flights, whereby the successive diaphragms thus formed will snugly fit and close said penstock and conduit.

2. In a water-motor, the combination of a main and an auxiliary penstock communicating with each other, a conduit of less area in cross-section than said main penstock extending above the same, carrying-wheels and sprocket-chains therefor, a series of flights or diaphragms attached to said chains, and flexible marginal members connected to said flights whereby the diaphragms thus formed will snugly fit and close said main penstock and conduit.

3. The combination, in a water-motor, of a penstock comprising a main vertical passage and an auxiliary space in its rear having open upper ends and communicating with one another by openings at different depths, a vertical conduit open at top and bottom and having an inlet near its lower end, upper and lower wheels mounted on horizontal shafts, endless sprocket-chains connecting said wheels, flights secured at their ends to said chains and provided with marginal rubber packing, a drum on the lower shaft, and rubber packing secured to the lower end of the main penstock and interposed between the same and the periphery of said drum.

4. The within-described water-elevating motor consisting of a main penstock having an auxiliary penstock, 24, and communicating therewith, the conduit 31 mounted upon said main penstock, having its upper and lower ends open, and having the inlet-trough 33, the sprocket-chains and upper and lower sprocket-wheels, the flights 15 having their sides and ends provided with rubber packing, 16, and secured to said chains, the lower shaft 20, the drum 21 on said lower shaft, the rubber packing 23 interposed between said drum and the lower end of the main penstock, and the curved section 19 concentric with said drum, substantially as hereinbefore specified.

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

ALLEN FERGUSON.

Witnesses:

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P. M. SULLIVAN.