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FLUID PRESSURE BRAKE.

APPLICATION FILED AUG. 29, 1902. RENEWED NOV. 5, 1904.

Fig. 1

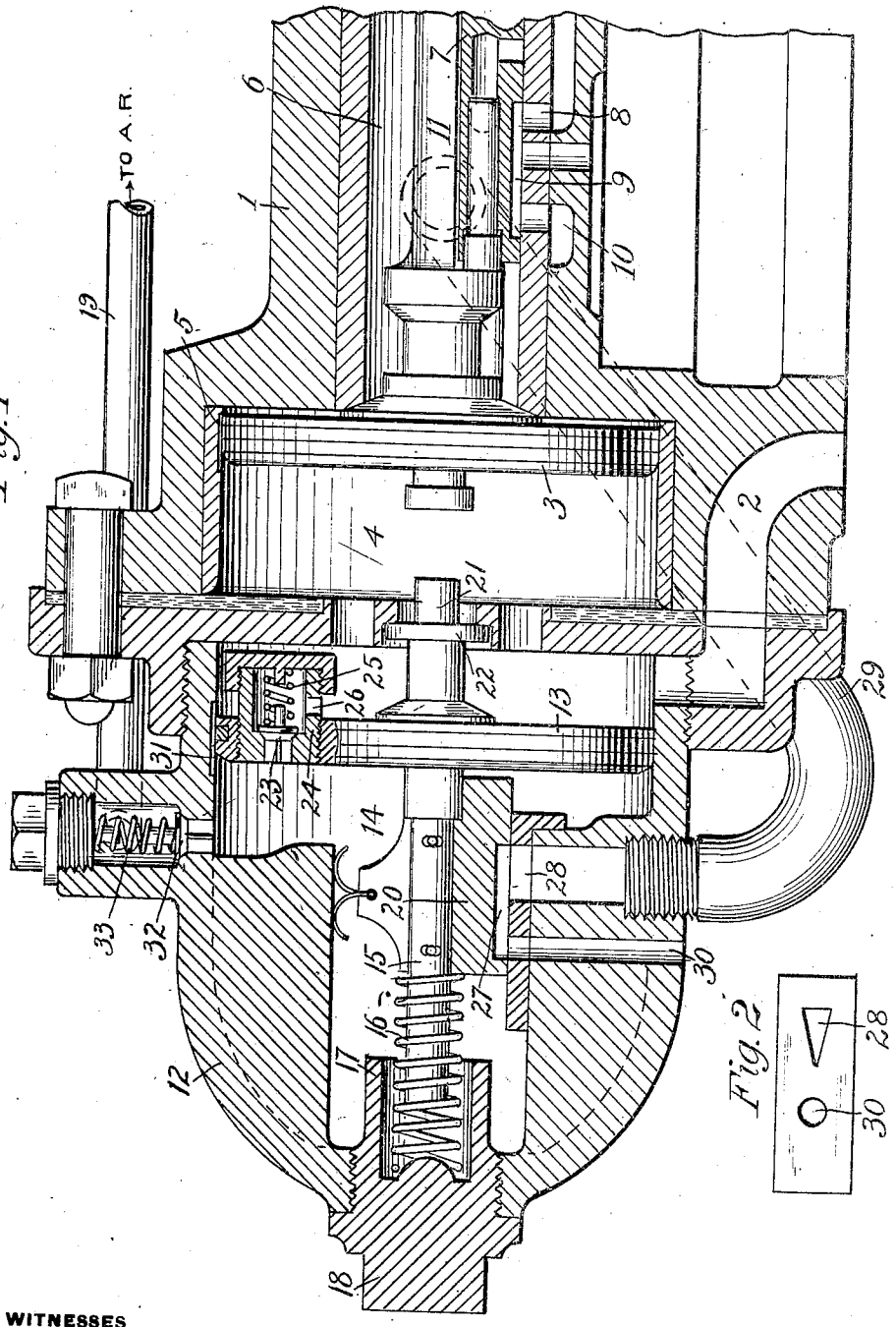

Fig. 2

WITNESSES

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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE BRAKE.

No. 825,990. Specification of Letters Patent. Patented July 17, 1906.

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To all whom it may concern:

Be it known that we, WALTER V. TURNER and DAVID M. LEWIS, citizens of the United States, and residents of Raton, Colfax county, Territory of New Mexico, have invented certain new and useful Improvements in Fluid-Pressure Brakes, of which the following is a specification.

Our invention relates to fluid-pressure railway-brakes, and more especially to such brakes which embody means for varying the pressure in the train-pipe to apply and release the brakes, comprising as essential elements an engineer's valve, a train-pipe, brake-cylinder, auxiliary reservoir, and a controlling-valve, commonly known as a "triple-valve," the latter of which is automatically operated to admit compressed fluid, such as air, from the auxiliary reservoir to the brake-cylinder to apply the brakes upon a reduction of pressure in the train-pipe and to exhaust such fluid from the brake-cylinder when the train-pipe pressure is restored to release the brakes.

The principal object of our invention is to retard the release of brakes at the head end of trains, particularly long trains, thereby preventing to a great extent the accidental breaking apart of trains which sometimes occurs in the use of brake mechanism heretofore used. This accidental breaking apart of trains, especially long ones, has often been due to the slow, or failure in, release of brakes on the rear end, and our invention overcomes this objection by providing means whereby the release of the fluid-pressure from the brake-cylinders may be retarded or blocked proportionately to the variations in pressure in the train-pipe at the head and rear end of the train, such retardation being greatest at the head end and diminishing proportionately toward the rear end.

Another object is to retard the recharging of the auxiliary reservoirs at the head end of the train for a limited period and at the time that the train-pipe pressure is increased for the purpose of releasing the brakes, thereby utilizing the full volume and pressure of the increase at the head end to overcome the frictional resistances of the pipe and to cause a rapid transmission of the increased wave of pressure to the rear of the train for effecting a release of the rear triple valves. With the present standard air-brake system the feed-grooves of the head triple valves are immediately opened upon an increase of train-pipe pressure which moves these triples to release position, so that the auxiliary reservoirs upon the forward cars draw off compressed air from the train-pipe and to that extent diminish the force and effect of the pressure-supply toward raising the pressure at the rear end of the train, with the consequence that the release of the brakes upon the rear cars of long trains is delayed and often effected only with great difficulty. It also often happens that the auxiliary reservoirs at the head end of the train become overcharged when the engineer's brake-valve is left in full, release position a sufficient length of time to release the rear brakes, thereby causing an undesirable reapplication of the head-brakes when the engineer's brake-valve is brought back to lap or running position. These objections are entirely overcome by this feature of our invention, which comprises means operated by an increase in train-pipe pressure for temporarily closing or restricting the communication through which the auxiliary reservoir is charged from the train-pipe, the amount of restriction varying according to the variation in the train-pipe pressure from the head end to the rear end of the train. While this feature of our invention and the feature of retarding the release of the head-brakes are adapted for use either independently of the other, yet according to the preferred construction we contemplate using these devices conjointly and have so illustrated the same.

In the present quick-action triple-valve device there is nothing to prevent the valve from being shifted to emergency position and suddenly reducing train-line pressure when only a service application is required if from any cause within the system and not controlled by the engineer's valve there is a pressure created on the auxiliary side of the triple valve piston in considerable excess of that in the train-line. Such abnormal difference of pressure may be created in the event of obstruction or stoppage of the ports, a broken graduating valve-post, or a restriction of the flow of fluid from the auxiliary reservoir to the brake-cylinder, and as the graduating-spring only requires from three to three and a

half pounds to compress it to allow the triple valve to register in quick-action or emergency position the triple valve will be suddenly forced to emergency position whenever such a pressure is created from any cause, such as those above indicated on the auxiliary side thereof in excess of the train-line pressure, thereby making sudden reduction, in the train-line to the empty brake-cylinder which will cause other quick-action valves to apply in emergency, thus often resulting in the breaking in two of the train and damage to the equipment.

Our further object, therefore, is to provide means in a triple-valve mechanism of the character indicated for preventing the movement of the triple valve to emergency position under any circumstances except when an emergency application is desired and is made by the proper movement of the engineer's valve, thus placing the operation for the different applications completely under the control of the engineer, and we attain this latter object by combining with the ordinary triple-valve structure of the quick-acting type means so constructed and arranged that movement of the triple valve to emergency position will be prevented when said triple valve is moved suddenly by excess of pressure above the train-line pressure on its auxiliary side, created from some accidental cause, such as above noted, during a service application of the brakes.

We have illustrated our invention as applied to the triple valve of a Westinghouse quick-acting automatic air-brake mechanism; but it is to be understood that our invention is not limited to this type of brake mechanism or to an attachment therefor, as it may be applied to other forms of brake mechanism and may be embodied in a separate device. It is especially applicable, however, to the type of triple-valve mechanism employed in the Westinghouse brake, and we have therefore shown so much of the triple-valve mechanism of such a brake as to clearly illustrate the connection of our invention thereto.

In the drawings, Figure 1 is a longitudinal section of a triple valve, showing one form of our invention applied thereto; and Fig. 2 is a plan view of the valve-seat, showing the brake-cylinder release ports or passages.

Referring now to the drawings, the numeral 1 indicates the casing of a standard Westinghouse triple-valve structure containing the triple-valve piston 3, working in the chamber 4, in one wall of which a feed-groove 5 may be located for charging the auxiliary reservoir (not shown) through the slide-valve chamber 6, in which latter is the slide-valve 7, governing the port or passage 8, leading to the brake-cylinder, the cavity 9 of said valve adapted to connect said brake-cylinder with the exhaust-port 10, the latter of which communicates with the exhaust port or passage of the triple valve. The numeral 11 indicates the graduating-valve, mounted on the slide-valve of the triple valve. These parts operate in the usual way and coöperate with the auxiliary reservoir and the train-pipe to effect the application and release of brakes upon the operation of the engineer's valve, as understood by those skilled in the art.

Our invention may be applied in various ways; but according to the form shown the cap of the triple valve is removed, and in place thereof we apply a supplementary casing comprising a cylinder cap or case 12, which contains the various features of our invention. This cap or case is bolted or otherwise secured to the triple-valve casing and communicates with the train-pipe passage 2 and the piston-chamber 4 in the usual way.

Within the chamber formed in the casing 12 is a movable abutment or piston 13, which may be provided with a suitable packing-ring and which divides the casing into a receiving-chamber communicating with the train-line and with the triple-piston chamber 4 and an equalizing-chamber 14, communicating with the auxiliary reservoir-conduit 19. This piston has a stem 15, around which is coiled a graduating-spring 16, with one end bearing against the end of the spring-case 7, the latter of which is preferably formed on the nut 18, having screw-threaded engagement with the case 12, by means of which the tension on the spring 16 may be regulated. The other end of said spring 16 bears against a fixed part on the stem 15—as, for example, on the end of the slide-valve 20, secured upon the stem, and more particularly described hereinafter. Extending from the opposite side of the piston 13 is a graduating-stem 21, adapted to receive the impact of the projection on the triple-valve piston when the latter is moved suddenly on an emergency or quick-acting application. A collar or flange 22 or other suitable abutment contacting with the base of the cap-section limits the movement of the piston 13 toward the triple-valve chamber. Mounted in the piston 13 is an emergency reduction-valve 23, confined in a casing 24, having screw-threaded attachment with the piston and provided with a spring 25 for normally holding the valve seated, the casing having one or more openings or ports 26, through which when the valve 23 is unseated by excess of pressure in the equalizing-chamber 14 over that on the opposite side of the piston 13 communication is established between the chambers on the opposite sides of said piston, and thus between the train-pipe and the equalizing-chamber 14.

Mounted upon the stem 15 is a slide-valve 20, having an exhaust-cavity 27 for establishing communication between the port 28, the latter of which is connected through the conduit or pipe 29 with the brake-cylinder-

exhaust port in the triple valve and the final release-port 30, located adjacent thereto and leading to the atmosphere. The port 28 is preferably made of triangular cross-section, (shown in Fig. 2,) so that its area gradually decreases from one end to the other, and hence as the valve 20 moves toward the apex the area of the opening is more effectively restricted in proportion to the variations in pressure in the system.

The mechanism thus far described relates to the feature of our invention which effects the retarding and blocking of release, and we will now describe our improved means for charging the auxiliary reservoirs which may be supplementary to or exclusive of the ordinary charging devices of the triple-valve structure, in which latter event the feed-groove of the triple valve may be eliminated, or it may be greatly reduced.

The chamber 14 communicates with the auxiliary reservoir through a pipe or passage 19, in which passage is located a check-valve 32, having a light spring 33 for normally holding said valve seated. In the wall of the chamber around the piston 13 is formed a feed-groove 31, which is normally open, but is adapted to be restricted or cut off when the piston 13 is forced outward to its retarded release position.

The operation of our improved device is as follows: Compressed air from a main reservoir or other source is supplied to the train-pipe for charging the same and passes through the feed-grooves 5 and 31 to charge the auxiliary reservoir, or if the feed-groove 5 of the triple valve is dispensed with the air will flow only through feed-groove 31, chamber 14, check-valve 32, and pipe 19 to the auxiliary reservoir. In the triple-valve devices at the head end of the train the high pressure entering from the train-line will move the piston 13 over to a position in which the feed-groove 31 is more or less restricted according to the degree of train-pipe pressure, thereby retarding the rate of charging the auxiliary reservoirs at the forward end of the train while a greater volume and pressure are exerted toward the rear of the train to hasten the charging of the auxiliary reservoirs on the rear cars. Owing to the frictional resistance to the flow of air in the train-pipe, it has been found impossible to increase the train-pipe pressure at the rear part of a long train at any greater rate than the air can feed from the train-pipe into the auxiliary reservoirs. Consequently while a difference in pressure between the train-pipe and the auxiliary reservoir occurs at the front end of the train when charging up, due to the greater head or degree of pressure close to the source of supply, still it is found that the difference diminishes toward the rear of a train and practically disappears at the end of about twenty-five or thirty car lengths of train-pipe, so that at the rear end of trains of this or greater length the pressure in the auxiliary reservoir rises at substantially the same rate as that of the train-pipe in charging up the system either primarily or in restoring the pressure after a release of the brakes. The time required to raise the pressure and charge the auxiliary reservoirs at the rear end of the train therefore determines the time necessary to bring the entire system up to the standard normal pressure, and this time is shortened by means of our improvement, in which the feed to the forward auxiliary reservoirs is temporarily restricted, since the pressure then accumulates more rapidly toward the rear of the train-pipe, where the feed-grooves are fully open. Then at about the time that the rear auxiliary reservoirs are partially or nearly charged the pressure in chamber 14 and the auxiliary reservoir on the head cars is sufficient, with the aid of the spring 16, to move the piston 13 back toward its normal position and open wider the feed-groove, thereby securing a substantially uniform and quicker charging of the auxiliary reservoirs throughout the train and effectually preventing the overcharging of the head auxiliary reservoirs and the consequent irregular action of the brakes. When the brakes are to be applied, the train-pipe pressure is reduced in the ordinary way, causing the triple valve to operate to supply air from the auxiliary reservoir to the brake-cylinder in the usual manner. During this operation the piston 13, with valve 20, remains in normal position, with the collar 22 of the stem 21 resting against the casing, while the air from chamber 14 equalizes with that of the train-pipe through the feed-groove 31 or through the valve 23 in case the reduction is heavy enough to cause this valve to open against the spring 25, the check-valve 32 in the meantime being closed and preventing backflow from the auxiliary reservoir and pipe 19 to the chamber 14. In releasing the brakes compressed air from the main reservoir at high pressure is turned into the train-pipe, and the increased wave of pressure at the head end of the train not only moves the triple valve to release position, but also moves the piston 13, with valve 20, to retarded release position, in which the port 28, communicating with the triple-valve exhaust, is wholly or partially closed by the valve 20, thereby blocking or retarding the release of air from the brake-cylinder and at the same time closing or restricting the feed-groove 31 for temporarily preventing a rapid recharge of the auxiliary reservoir. The movement of the piston 13 and valve 20 varies according to the position of the triple valve in the train and the corresponding variation in the head of increased train-pipe pressure, being greatest at the front end, where the release-port may be nearly or entirely closed, and grad-

ually diminishing toward the rear of the train as the effect of the wave of increased pressure diminishes until at the end of about twenty-five to thirty car lengths the movement amounts to very little or nothing and the exhaust-port remains wide open, so that the air is released from the brake-cylinder as soon as the triple-valve moves to release position. In the meantime the pressure is slowly equalizing into the chamber 14 and into the auxiliary reservoir around the pistons and also through the restricted feed-grooves until the pressure therein is sufficient with the aid of spring 16 to return the piston 13 and valve 20 to normal position, thereby fully opening the exhaust-port 28 and the feed-groove 31. The interval of time during which the valve 20 remains in its retarded release position is designed to be about equal to that required to transmit the increased wave of pressure to the rear part of the train and effect the release of the last triple valves, so that as the release-ports open up at substantially the same time a nearly simultaneous release of all the brakes throughout the train will be effected. In this way the surging ahead of the front portion of the train and consequent violent shocks often resulting in break-in-twos, owing to the earlier release of the head-brakes while the rear brakes are still applied, is entirely prevented and a much smoother and more uniform action of the brakes is secured. While this feature of our invention relating to retarding the release of the head-brakes may be used independently with good results, it is believed to be of greater advantage to also employ in connection therewith the feature of temporarily closing or restricting the feed groove or grooves for delaying the recharging of the auxiliary reservoir, since by this means the retarded release-valve at the head end of the train may be held in its retarding position a greater length of time, while at the same time the full volume or head of pressure turned into the train-pipe is utilized to effect a rapid transmission of the wave of increased pressure to the rear of the train-pipe, thereby securing a quicker release of the rear brakes. Another advantage derived from the feature of temporarily restricting the feeding up of the auxiliary reservoirs on the front end of the train when the brakes are released is that it prevents the danger of overcharging these auxiliary reservoirs, which often happens with the present standard equipment and results in a reapplication of the head-brakes when the brake-valve handle is returned to running position. Furthermore, with our improvement should occasion require an application of the brakes to be made immediately after a release the triple valves throughout the train will respond promptly to a reduction in train-pipe pressure, since the pressure in all the auxiliary reservoirs is nearly or substantially equal to that of the train-pipe, while in the standard apparatus as now used the pressure at the head end of the train-pipe may be very much higher than that of the auxiliary reservoirs and must be blown down by discharging through the brake-valve to the atmosphere before the brakes can be applied, thereby causing a waste of compressed air.

As we have indicated, the recharging and retarding elements may be used together or separately; but if the recharging element is omitted the feed-groove of the ordinary triple valve must be retained; otherwise the said groove may be greatly reduced in size or entirely eliminated, as hereinbefore indicated.

The arrangement and disposition of the piston 13 and its coöperating parts enable us to derive an important advantage over the present quick-acting valves, because by these features of our invention it is possible to prevent the movement of the triple valve to emergency position in all cases except when the emergency application is desired and made by the proper movement of the engineer's valve under the complete control of the engineer. If a pressure in excess of the train-line pressure is created on the auxiliary side of the triple-valve piston from any cause, such as those hereinbefore indicated, the present triple valve will suddenly fly to emergency position, thereby causing an undesired quick action of all the triple valves through the train; but with our valve mechanism the graduating-spring 16 would not only have to be compressed, but the air in the equalizing or expansion chamber 14 would have to be compressed by the piston 13, since the air in said chamber could only reduce as the train-line pressure is reduced through the feed-groove 31 or the check-valve 23. In emergency application, however, this checking of the movement of the piston 13 and that of the triple valve could not occur, because the train-line pressure being suddenly reduced by the engineer or automatically by a bursted hose or break-in-two the pressure in the expansion-chamber 14 would also be reduced, and the feed-groove 31 and the valve 23 would permit the reduction of pressure in the expansion-chamber as quickly as the train-line reduction. The piston 13 may in that case be moved back without encountering the resistance due to compressing the air in chamber 14, and the triple-valve piston will therefore engage the graduating-stem 21 and compress the spring 16 as it moves back to emergency position, so that the addition of the piston 13 will in no way interfere with the proper function of the triple-valve device.

When an ordinary reduction in train-pipe pressure is made for a service application, the train-pipe pressure reduces more slowly, so that if a triple-valve piston tends to go to emergency position the resistance offered by

the air in chamber 14 on the opposite side of piston 13 checks the further movement of the triple-valve piston and prevents the same from reaching its emergency position and causing an objectionable quick-action application of the brakes.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a fluid-pressure brake, the combination with a train-pipe and brake-cylinder of a valve for controlling the brake-cylinder-exhaust port, a movable abutment operated by an increase in train-pipe pressure for moving said valve to restrict said port and yielding means for returning said valve to open said port.

2. In a fluid-pressure brake, the combination with a train-pipe and brake-cylinder, of a valve for controlling the brake-cylinder exhaust and having a normal open position, and a movable abutment operating under an increase in train-pipe pressure for temporarily holding said valve in a position for restricting the exhaust-port.

3. In a fluid-pressure brake, the combination with a train-pipe and brake-cylinder, of a valve for controlling the brake-cylinder exhaust and having a normal open position, and another position for retarding the release, and a movable abutment subject to opposing fluid-pressures for operating said valve.

4. In a fluid-pressure brake, the combination with a train-pipe, triple valve and brake-cylinder of a valve device operating under an increase in train-pipe pressure for temporarily closing or restricting the triple-valve exhaust.

5. In a fluid-pressure brake, the combination with a train-pipe, triple valve and brake-cylinder, of a valve device operated by an increase in train-pipe pressure to restrict the exhaust from the triple valve in proportion to the variation in pressure in the train-pipe from the head to the rear end.

6. In a fluid-pressure brake, the combination with a train-pipe, triple valve and brake-cylinder of a valve for controlling the triple-valve exhaust, and having a normal open or full-release position, a movable abutment operated by an increase in train-pipe pressure for moving the valve to retarded release position and a spring for returning said valve to normal full-release position.

7. In a fluid-pressure brake, the combination with a train-pipe and auxiliary reservoir, of means operating under an increase in train-pipe pressure for temporarily restricting the feed-passage from the train-pipe to the auxiliary reservoir.

8. In a fluid-pressure brake, the combination with a train-pipe and auxiliary reservoir of means operated by an increase in train-pipe pressure for restricting the rate of feeding the auxiliary reservoir in proportion to the variation in pressure in the train-pipe from the front to the rear end.

9. In a fluid-pressure brake, the combination with a train-pipe and auxiliary reservoir of means operated by an increase in train-pipe pressure for temporarily retarding the recharging of the auxiliary reservoirs at the head end of the train.

10. In a fluid-pressure brake, the combination with a train-pipe, triple valve, auxiliary reservoir and brake-cylinder of a valve device for controlling the exhaust from the triple valve and operated by an increase in train-pipe pressure to restrict said exhaust-port and to restrict the feed-passage from the train-pipe to the auxiliary reservoir.

11. In a fluid-pressure brake, the combination with a train-pipe, triple valve, auxiliary reservoir and brake-cylinder of a valve for controlling the exhaust from the triple valve, a piston subject to train-pipe pressure for operating said valve, a feed-groove around said piston for supplying air to the auxiliary reservoir.

12. In a triple-valve device, the combination with the triple-valve piston and graduating-stem of means acting under a slow or gradual reduction in train-pipe pressure for imparting an additional resistance to the movement of the graduating-stem for preventing the movement of the triple-valve piston to emergency position.

13. A triple-valve device having means operating under a slow or gradual reduction in train-pipe pressure in service applications for preventing the movement of the triple-valve piston to emergency position, but adapted to permit such movement under a sudden reduction in train-pipe pressure.

14. A triple-valve device comprising in combination with the triple piston and spring graduating-stem, a piston carried by said stem and subject to the opposing pressures of the train-pipe and an equalizing-chamber.

15. In a triple-valve device, the combination with the triple piston and graduating-stem of a piston mounted on said stem and subject to the opposing pressures of the train-pipe and an equalizing-chamber, a small groove or passage for equalizing the pressures upon opposite sides of said piston, and a larger equalizing passage or port containing a check-valve.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WALTER V. TURNER.
DAVID M. LEWIS.

Witnesses:
JOHN W. FARLEY,
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