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M. B. McLAUTHLIN.

CONTROLLING MECHANISM FOR ELECTRIC MOTORS.

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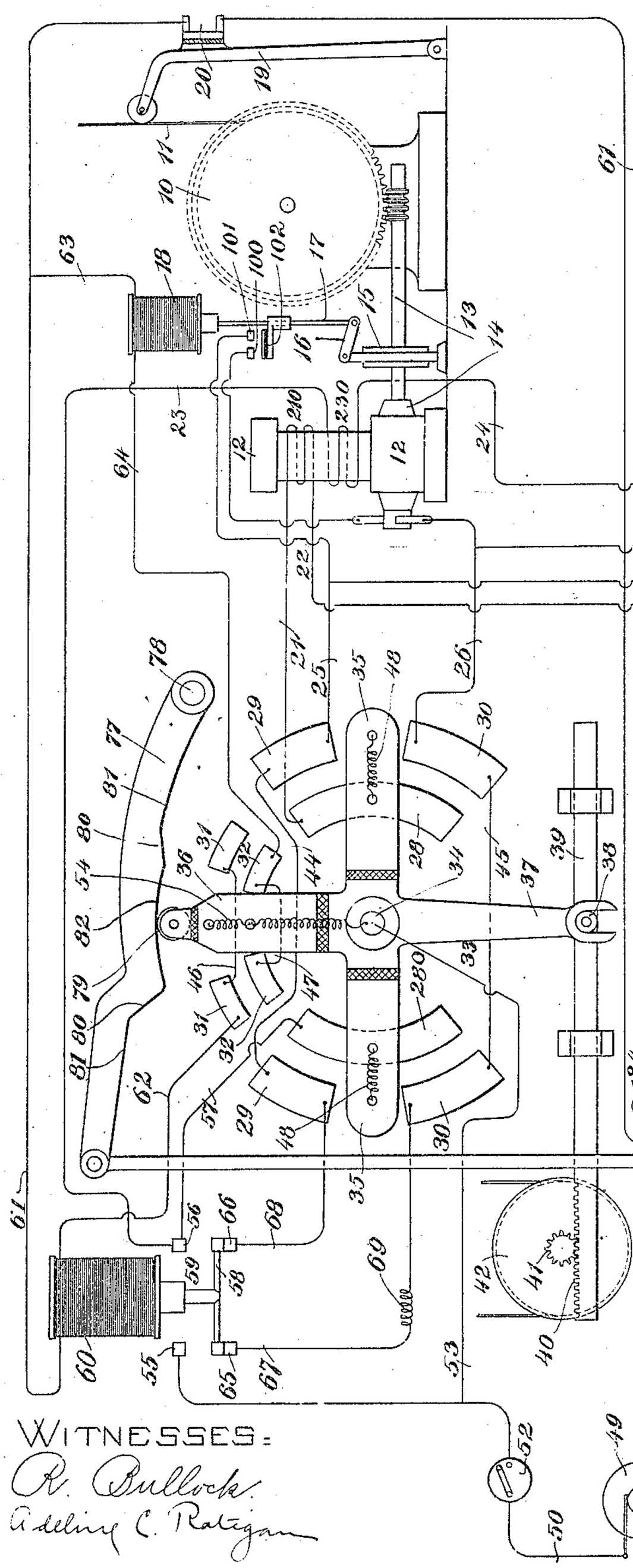

FIG. 1.

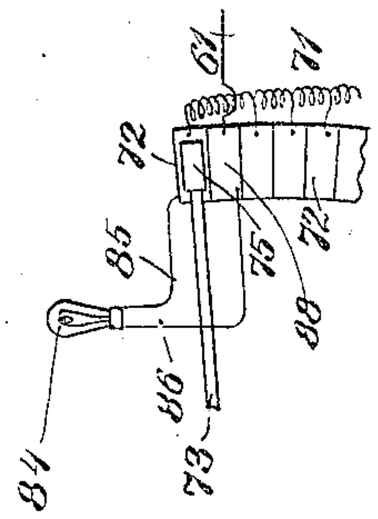

FIG. 2.

WITNESSES:
R. Bullock.
Adeline C. Ratigan

INVENTOR:
M. B. McLauthlin
by Wright, Brown & Quinby,
Attys.

UNITED STATES PATENT OFFICE.

MARTIN B. McLAUTHLIN, OF MALDEN, MASSACHUSETTS.

CONTROLLING MECHANISM FOR ELECTRIC MOTORS.

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Application filed September 22, 1902. Serial No. 124,273.

To all whom it may concern:

Be it known that I, MARTIN B. McLAUTHLIN, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Controlling Mechanisms for Electric Motors, of which the following is a specification.

This invention relates to controlling devices for electric motors and more particularly to electric elevators or hoisting apparatus.

The main object of the invention is to insure increased safety for the apparatus, and to this end the invention consists in certain appliances or mechanism for securing such added safety, and also consists in certain secondary mechanism whereby the apparatus is improved as I shall now proceed to describe and claim.

Of the accompanying drawings,—Figure 1 represents a diagrammatic view of an elevator or hoisting apparatus provided with my improvements. Fig. 2 represents a detail view showing a modification.

The same reference characters indicate the same parts in both figures.

Referring to the drawings, 10 is the winding drum of the hoist or elevator, 11 is the hoisting cable, and 12 is an electric motor having the shaft 13 of its armature 14 geared to said winding drum in the usual or any suitable manner.

15 is a brake on the armature shaft shown with a pivoted lever 16 connected by a rod 17 with the core of a solenoid 18. When said core is lifted the brake is set and when it is dropped the brake becomes released.

19 is a slack-cable controller of the usual or any suitable construction adapted to open the controlling circuit or wire at 20. This device forms no part of my present invention, but is illustrated as a usual appurtenance.

The motor herein illustrated is compound wound. 21 22 represent the terminals of the series field winding 210 of said motor, 23 24 represent the terminals of the shunt field winding 230, and 25 26 represent the armature terminals or brush terminals.

27 denotes generally a switching mechanism (which is broadly comprehended in the term "shipper mechanism") for controlling the motor, said mechanism having a series of segmental contacts 28 280 29 30 31 32 shown as arranged in pairs or two sets on opposite sides of a vertical diameter, for controlling the running of the motor in forward and reverse directions.

33 is a lever pivoted at 34 centrally of the segmental contacts and having opposite arms 35 35 controlling the contacts 28 280 29 30, and a third arm 36 controlling the contacts 31 32. The lever 33 also has a downwardly-projecting arm 37 forked at its lower edge to engage a roll 38 on a sliding rack-bar 39 having a rack 40 engaged by a pinion 41 on the shaft of a shipper-pulley 42. By the rotation of the shipper-pulley in one direction or the other the lever 33 is shifted to one side or the other of the central position which it occupies in Fig. 1.

The various contacts of the switching mechanism 27 are arranged in inner and outer concentric rows, and contacts 29 30 31 32 on each side are electrically connected across to the corresponding contacts on the opposite side, by wires 44 45 46 47. The arms 35 of lever 33 are provided with bridge-contacts 48 which continuously touch the contacts 28 280. In the median position of the lever 33 the arms 35 (that is their bridge-contacts 48) lie between the contacts 29 and 30 and on either side of said position the bridges 48 connect the contacts 28 280 with either of the contacts 29 or 30. The armature terminals 25 26 are connected to the contacts 29 30 and one series terminal 21 is connected to the contact 28.

49 is the dynamo or primary source of current and 50 51 are the line wires.

52 represents the ordinary switch on one of the line wires, as 50. A wire 53 branches from the line wire 50 to the axis of lever 33 and from thence connects with a bridge-contact 54 adapted to connect over the contacts 31 32. The line wire 50 also goes to a switch point 55 of a pair 55 56. The point 56 connects by a wire 57 with the contact 280 and also with the shunt terminal 23.

58 is a bridge-contact forming with the switch points or contacts 55 56 the "main switch" 59, said bridge-contact being connected to the core of a solenoid 60. 61 62 represent the terminals of said solenoid, the latter of which is connected to the contacts 31.

The brake magnet or solenoid 18 has a terminal 63 branching from the terminal or wire 61 and another terminal 64 connected with the contacts 32.

When the core of solenoid 60 is drawn up the bridge-contact 58 forms a connection

between the switch-points 55 56. When said core is dropped, the bridge-contact rests upon a pair of lower switch-points 65 66 connected by wires 67 68 with the contacts 29 30. The wire 67 has a resistance 69 in circuit with it. It is apparent that when the solenoid core is dropped the motor armature 14 is short circuited through wire 25, right-hand contact 29, wire 44, left-hand contact 29, wire 68, contact 66, bridge 58, contact 65 wire 67, resistance 69, left-hand contact 30, wire 45, right-hand contact 30 and wire 26.

70 denotes generally a rheostatic resistance mechanism comprising a resistance 71 connected at different points with a segment of contacts 72 72 and a resistance-varying arm 73 pivoted at 74 and having a brush, traveler or contact 75 co-acting with the segment of contacts 72. The lowermost contact 72 is connected with the series terminal 22 of the motor and the conductive arm 73 is connected with the line wire 51. The rheostat arm 73 is connected by a link or rod 76 with a cam lever 77 pivoted at 78. The under edge of lever 77 co-acts with a cam-roll 79 on the arm 36 of lever 33 and is formed with inclines 80 80, concentric portions 81 81 on either side thereof, and a raised concentric portion 82 intermediate thereof. In the central position of the lever 33 the roll 79 rests on the middle part 82 of the cam and holds the brush 75 upon the uppermost contact 72, thus putting the full resistance 71 in the series-armature circuit of the motor. When the roll 79 passes onto either of the cam portions 81 the lever 77, rheostat arm 73 and connected parts descend by gravity under control of a dash-pot 83 (except when automatically locked as hereinafter noted) and the resistance 71 is cut out of the armature circuit. The inclines 80 80 allow the brush 75 to be held at any point on the rheostat segment under the control of the shipper mechanism.

84 is a resistance having terminals 85 86 connected to contacts 87 88 adapted to be bridged across by a bridge-contact 89 carried by the arm 73, and insulated therefrom, when said arm nearly reaches its uppermost position. The contact 88 is connected to the wire 61, and the contact 87 is connected by wire 90 with the uppermost contact 72 of the rheostat.

The resistance 84 is such that it passes enough current at all times when in circuit with the solenoids 18 and 60 to hold up the cores of said solenoids, provided they are already raised, but said resistance will not pass enough current to raise the cores if they are down. This arrangement is possible because of the well-known fact that an electro-magnet takes less current to hold its armature attracted than it does to attract it in the first instance.

Fig. 2 shows a modification of the arrangements for controlling the resistance 84 which is equivalent to merging the contact 87 in Fig. 1 with the topmost contact 72 and introducing the contact 88 into the rheostatic segment. Thus in Fig. 2, 88 represents a contact introduced in the segment between the first and second contacts 72 and connected to the wires 61 and 86, while the resistance terminal 85 is connected directly to the uppermost contact 72. In this instance the topmost coil of the rheostatic resistance 71 skips the contact 88 and is connected across to the first and third contacts of the segment. When the brush 75 is nearly in its uppermost position it bridges the contact 88 and the first contact 72 and thus short-circuits the resistance 84.

91 designates a pivoted locking lever normally held by a spring 92 in the path of a projection 93 on the arm 73. Said lever 91 carries the armature of an electro-magnet 94, which, when said armature is attracted moves the upper end of locking lever 91 out of the path of projection 93. The terminals 95 96 are connected in parallel with the armature terminals 25 26. There is sufficient lost-motion between latch 91 and projection 93 to permit the bridge 89 to short-circuit the terminals 87 88 with the latch in locking position.

In the circuit of the motor armature I have shown switch-points 100 101 adapted to be connected by a bridge-contact 102 carried by the brake rod 17 when the latter is lifted to release the brake. This is to prevent current passing through the motor armature should the brake for any reason not release, for with the brake set the armature could not start, and full current passed through it when stationary would tend to its injury. This switch need not control the armature circuit directly, but might control some other motor-controlling circuit such as that of the solenoid 60.

The operation is as follows:—Assuming the parts of the apparatus to be in position to start, as represented in Fig. 1, the operator moves the shipper-pulley 42 so as to throw the lever 33 in either direction from its central position. Let it be to the left. The left-hand contacts 31 32 are bridged over and a circuit is completed as follows: starting from dynamo 49, through line wire 50, wire 53, contacts 32, wire 64, solenoid 18, wire 63, wire 61, resistance 84, wire 90, upper contact 72, brush 75, arm 73 and line wire 51 back to the dynamo. A parallel circuit is also completed from wire 53 through bridge-contact 54, contact 31, wire 62, solenoid 60 and wire 61. When the resistance 84 is short-circuited by a slight downward movement of arm 73 enough current will be passed through solenoids 18 60 to cause them to lift their cores, thereby releasing the brake 15 and connecting the switch points

55 56. The movement of the lever 33 having closed the left-hand contacts 30 280 and the right-hand contacts 28 29 the current then flows as follows: from dynamo 49 through line wire 50, contact 55, bridge-contact 58, contact 56, wire 57, contact 280, bridge-contact 48, left-hand contact 30, wire 45, right-hand contact 30, wire 26, armature-winding, wire 25, and switch 100 101 102, right-hand contact 29, bridge-contact 48, contact 28, wire 21, series winding 210, wire 22, resistance 71, brush 75, arm 73, and line wire 51 back to the dynamo. A parallel circuit passes from switch point 56 through shunt terminal 23, shunt winding 230, shunt terminal 24, and line wire 51 back to the dynamo. If when the circuit is first made between bridge-contact 54 and left-hand contact 31 whereby the switch 59 is closed, the power of the motor is sufficient to overcome the load, its armature will start rotating and the counter electro-motive force generated thereby will multiply the resistance through the series-armature circuit of the motor and cause enough current to be shunted through magnet 94 to cause said magnet to attract its armature and unlock the lever 73. Continued movement of the switch lever 33 to a full-over position then results in causing the rheostat arm 73 to descend and cut resistance from the series-armature circuit, allowing the motor to increase to full speed. If, however, at starting, the load should be greater than the motor can move, no counter electro-motive force will be generated and not enough current will flow through magnet 94 to cause it to unlock the rheostat arm. Said arm is therefore prevented from descending and cutting out the resistance 71 which would have a tendency to burn out the motor.

In shutting off the current the movement of lever 33 to the right toward its central position first restores the lever 73 to its uppermost position and then breaks contact between the bridge-contact 54 and the left-hand contact 31, thereby opening the circuit of solenoid 60 and allowing switch 59 to open and break the motor circuit. It will be noted that the contacts 32 are of greater angular extent than the contact 31. The current therefore remains on through the brake solenoid 18 after it is cut off from the main switch solenoid 60. This causes the brake to be held released until the switch 59 has opened and short-circuited the armature 14 through the switch points 65 66, the resistance 69 and the hereinbefore described connections. The motor while its armature is still rotating acts as a dynamo and the rotation of its armature 14 is arrested electro-magnetically because of the short-circuit before the brake 15 has been set. The brake is set immediately after, but much of its duty has been removed. It will be noted that the arm 73 in its uppermost position has carried the bridge-contact 89 past the contacts 87 88 in Fig. 1, and in Fig. 2 has carried the brush 75 up past the contact 88. This is with the object of having the full rheostatic resistance, including 84, in circuit when the current is broken between the bridge-contact 54 and the contacts 31 and 32, thereby cutting down the current and minimizing arcing at the contacts.

Should the rheostat arm 73 be anywhere below the position in which it short-circuits resistance 84 so that some or all of the resistance 71 is cut out of the motor circuit and should an accident, such as a blowing out of a fuse then stop the apparatus, it would be dangerous to the apparatus to start up again with the rheostat arm in this position because of the small resistance in the armature circuit. The arm might be left in this position after an accident by the elevator-man carelessly leaving his post with the shipper mechanism thrown over to a running position. After repair of the damage and closing of the switch 52 the current would then be turned on through the motor without adequate resistance in circuit if the switch 59 were allowed to close. Owing to the fact that the resistance 84 constitutes a disabling means which does not pass enough current to allow the cores of either of the solenoids 18 or 60 to rise it is apparent that the brake 15 cannot be released nor the switch 59 closed until the rheostat arm 73 has been brought back nearly to its uppermost position to short-circuit the resistance 84, at the same time putting sufficient starting resistance on the armature circuit.

The throwing of lever 33 to the right-hand of its median position makes all connections on the other set of contacts the same as previously described for its left-hand position with the exception of reversing the current through the motor armature, thereby running the motor in the opposite direction.

Various modifications may be made in the herein-described embodiment of my invention without departing from the spirit or nature thereof.

I claim:—

1. The combination of an electric motor, a brake therefor, an electro-magnetic device for operating said brake, a rheostat controlling the circuit of said motor and having a movable resistance-varying member, and a resistance switched into and out of the circuit of said electro-magnetic device by movement of said member, said resistance when in circuit preventing the establishment of said device in brake-releasing condition but permitting its retention in such condition if already established therein.

2. The combination of an electric motor, a rheostat therefor having a traveler, a motor-controlling device, a disabling circuit for said

device, and switching means for said circuit connected for operation concurrently with said traveler, said means closing said circuit near the limit of resistance-inserting movement of the traveler and opening it at the limit of said movement.

3. In an elevator-controlling apparatus, the combination of an electric motor having an operating circuit, a short circuit including the motor armature, a switching device having alternative positions in which it respectively establishes said operating circuit and said short circuit, an electro-magnet for operating said switching device, and shipper-mechanism mechanically operable from the car for controlling the operating circuit of said electro-magnet.

4. The combination of an electric motor, a brake therefor, motor-circuit-controlling and brake-controlling electro-magnets, a short-circuit for the motor armature controlled by the first-said magnet, and a shipper mechanism controlling the motor-circuit and having means for breaking first the circuit of the first-said magnet and then that of the last-said magnet during its motor-stopping movement.

5. The combination of an electric motor, an electromagnetic switching device having provisions for closing the operating circuit of said motor in one position and for short-circuiting the motor armature in another position, a brake for said motor, an electro-magnetic brake-operating device, and switching mechanism controlling the circuits of said electro-magnetic devices and having provisions for first opening the circuit of the former device and then that of the latter device when operated to stop the motor.

6. The combination of an electric motor, a rheostatic resistance for the armature circuit thereof, a movable device for varying the amount of said resistance in circuit, means for locking said device, and an electro-magnet in parallel with the armature circuit for releasing said locking means, the resistance of whose circuit is such as to render the magnet inoperative for release up to a predetermined armature-speed.

7. The combination of an electric motor, switching mechanism for controlling said motor, including a pivoted switch lever, shipper mechanism connected to operate said lever, a second lever having a cam connection with said switch lever, and a rheostat for the motor circuit including a movable resistance-varying device connected to be operated by said second lever.

8. In motor-controlling apparatus, the combination of an electric motor, an electromagnetic switch-device for making and breaking the circuit of the motor, shipper mechanism for making and breaking the circuit of said switch-device, and a resistance inserted in and removed from said circuit by movement of said shipper mechanism, arranged to be inserted in said circuit immediately before the shipper mechanism breaks the circuit and to be in the circuit at the moment of breaking the same by the shipper mechanism.

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

MARTIN B. McLAUTHLIN.

Witnesses:
R. M. PIERSON,
ADELINE C. RATIGAN.