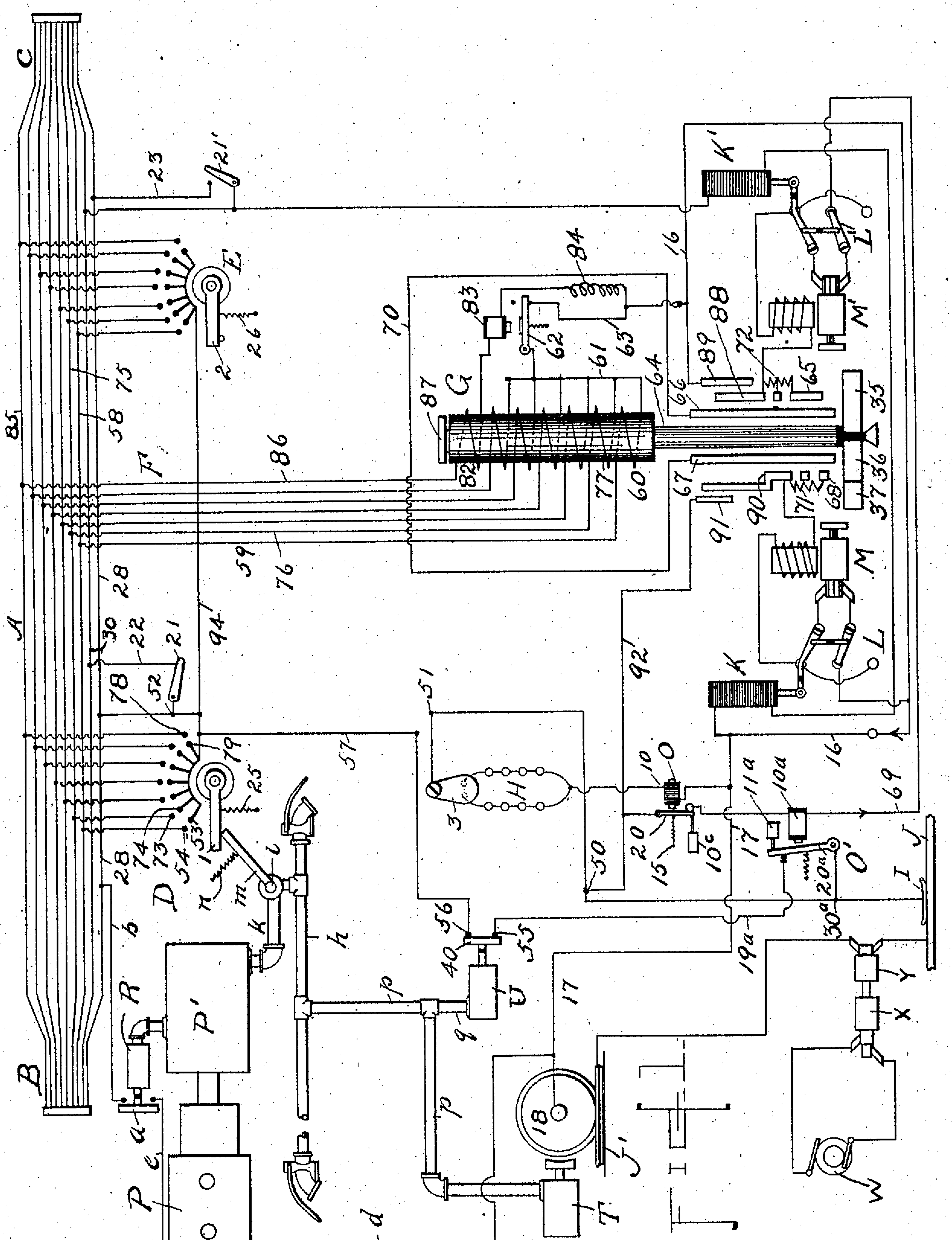
No. 837,022. PATENTED NOV. 27, 1906.

G. T. & L. WOODS.

SAFETY APPARATUS FOR RAILWAYS.

APPLICATION FILED OCT. 5, 1904.

3 SHEETS—SHEET 1.



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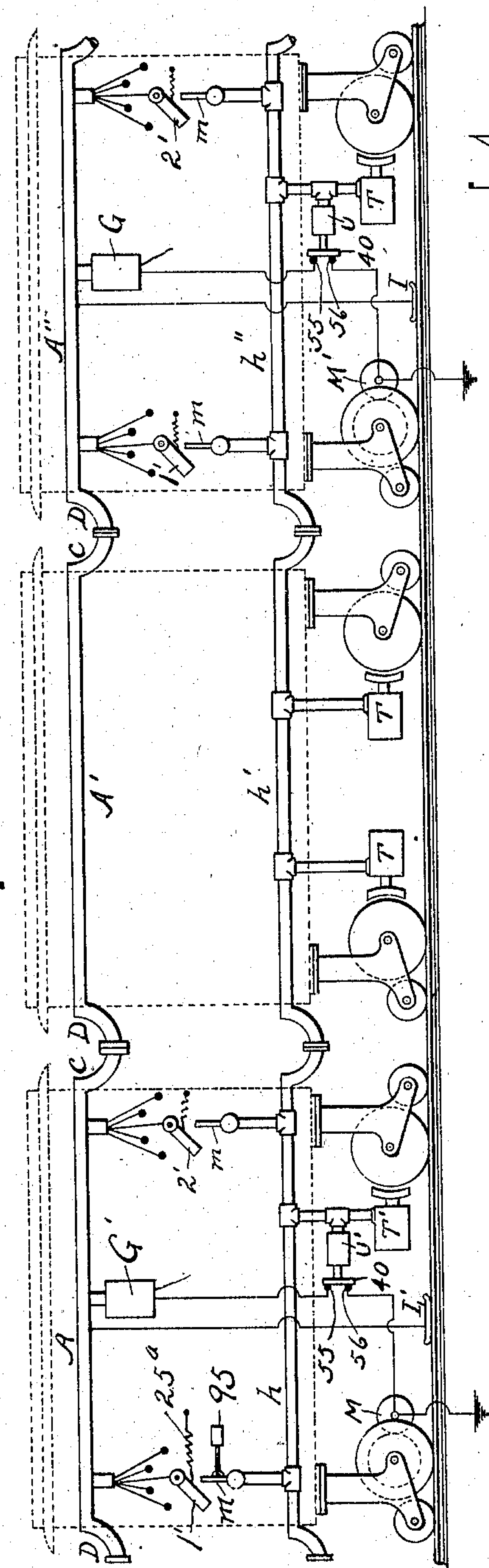

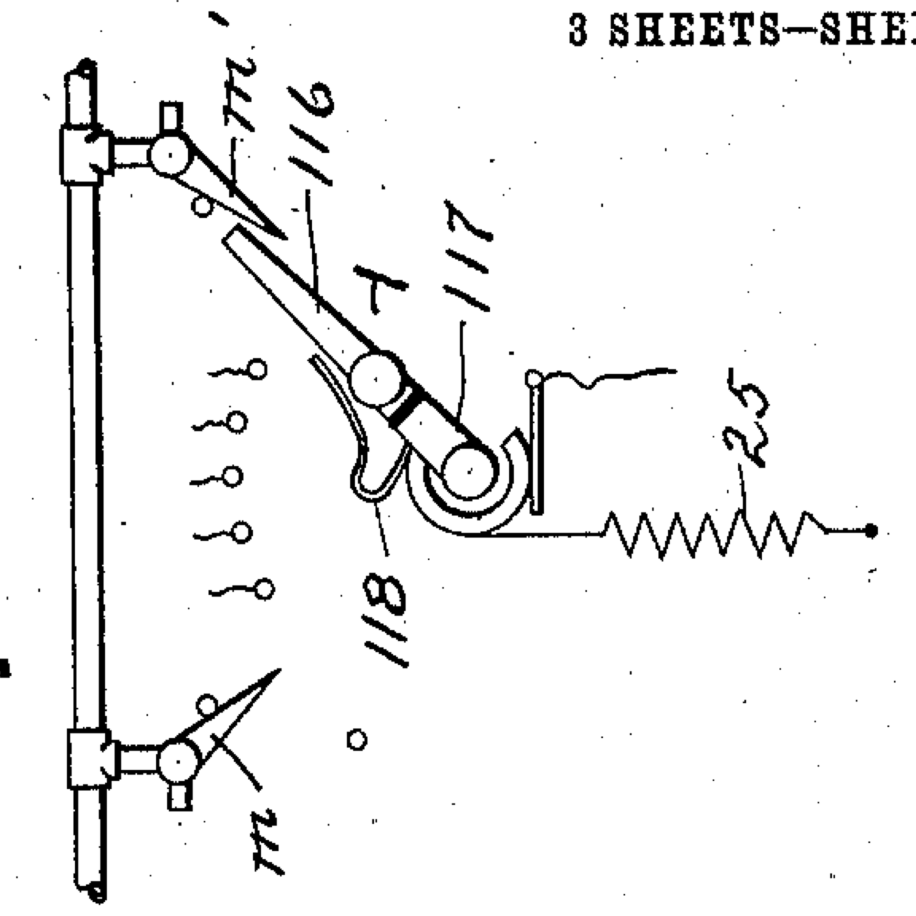

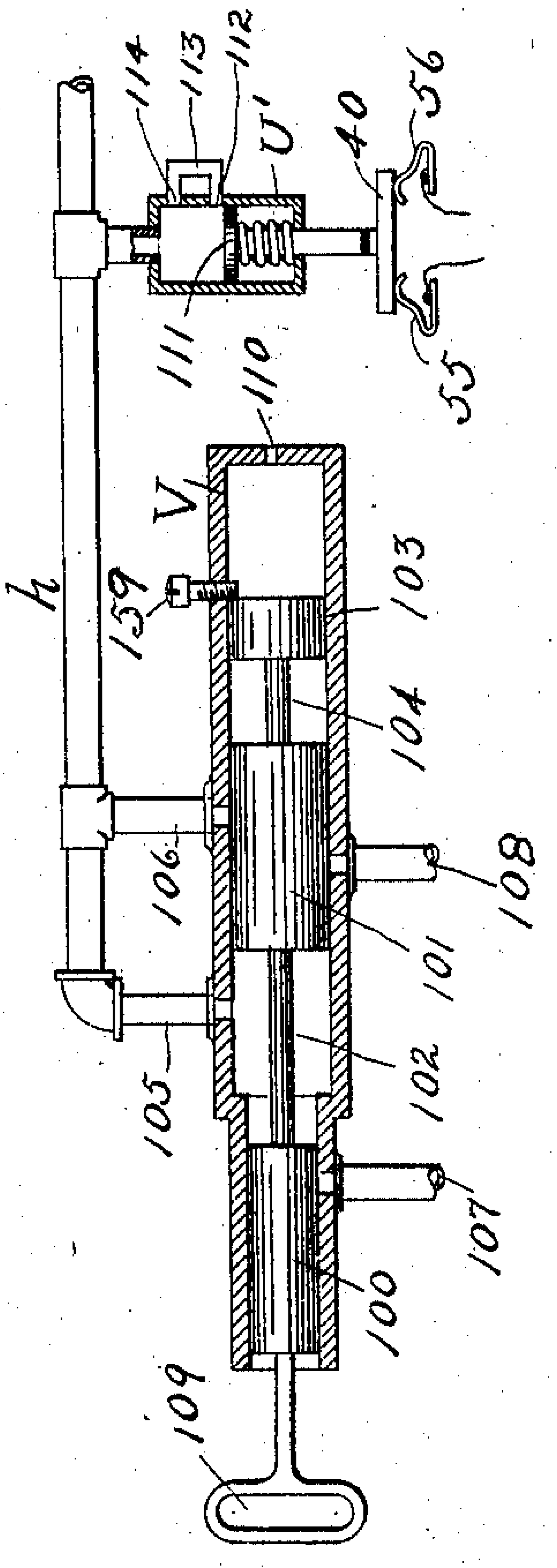

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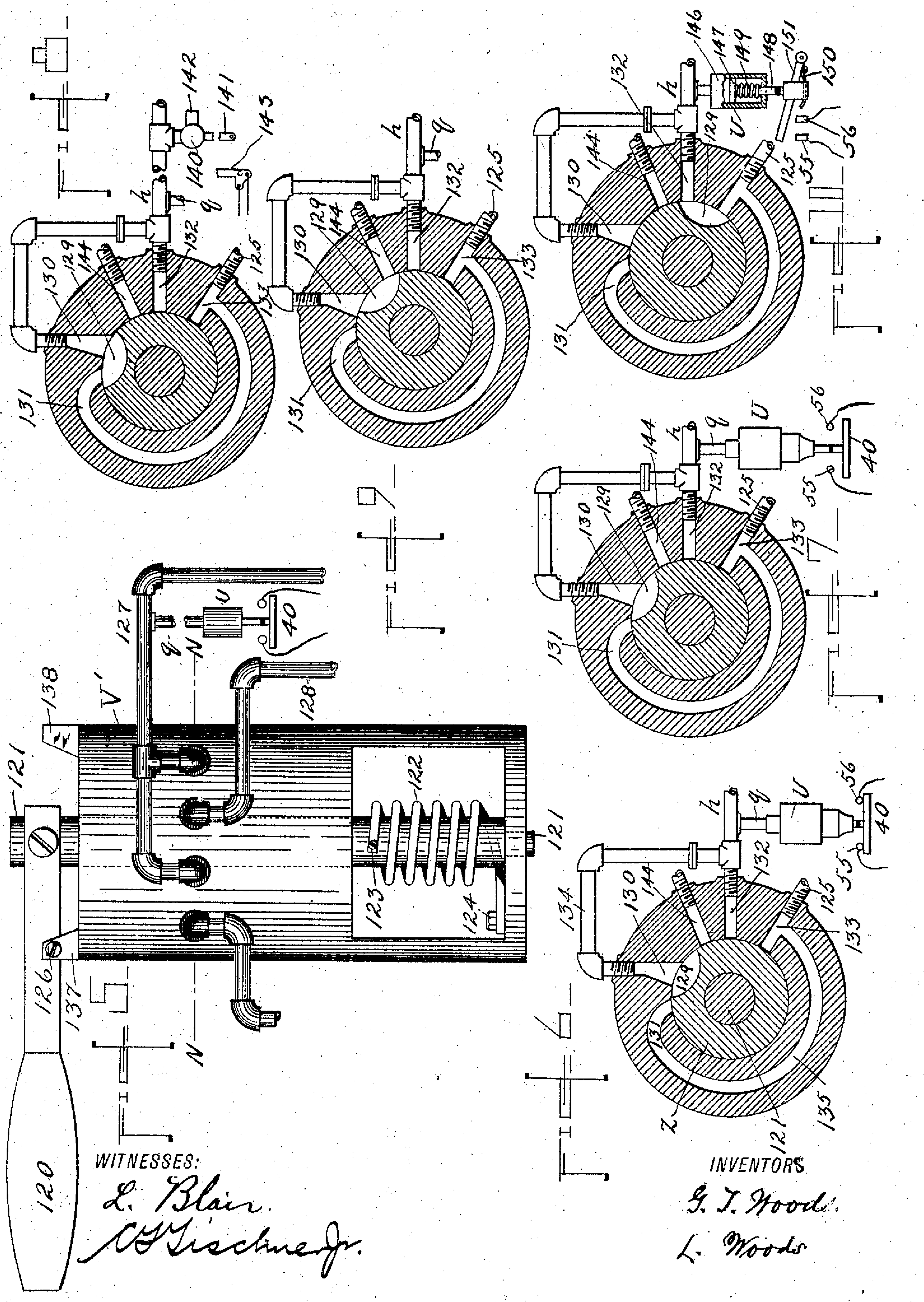
3 SHEETS—SHEET 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

GRANVILLE T. WOODS AND LYATES WOODS, OF NEW YORK, N. Y., ASSIGNORS TO GENERAL ELECTRIC COMPANY, OF SCHENECTADY, NEW YORK, A CORPORATION OF NEW YORK.

SAFETY APPARATUS FOR RAILWAYS.

No. 837,022. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed October 5, 1904. Serial No. 227,212.

To all whom it may concern:

Be it known that we, GRANVILLE T. WOODS and LYATES WOODS, citizens of the United States, and residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Safety Apparatus for Railways, of which the following is a specification.

The most important object of our invention is to provide new and improved apparatus whereby a power-driven car or a train of cars will have the driving energy instantly and automatically cut off and the brakes automatically set approximately simultaneously with the discontinuance of said energy in case the motorman or engineer becomes disabled in any manner—that is to say, if the motorman drops dead (while the train is in motion) and falls either backward or forward while his hand still retains its hold upon the lever adapted to cause the brake to set either of such movements of the dead body will instantly cause the power to be cut off and the brakes to set. If anything whatever causes the hand of the motorman or engineer to release its hold upon the said lever, then such lever will be moved instantly and automatically, and the brakes will thus be caused to set. If the motorman suddenly becomes insane, he will be sure to make a false movement of the said lever, and thereby cause the power to be cut off instantly and the brakes to go on immediately.

Another object of our invention is to automatically cut off the current and set the brakes if any one of the car-wheels jumps the track.

Still another important feature of our present invention is that a flagman or station-agent may stop such car or train of cars by adjusting a trip device along the roadway so that the power will be cut off and the brakes applied independently of the motorman if he attempts to pass a stop-signal. Any suitable kind of signal apparatus adapted to be operated from a distance may be so coupled to said trip device that the movement of said signal apparatus may cause the trip device to move in conjunction therewith, or, if so desired, the latter device may be constructed and arranged to be actuated by any suitable power and in any suitable way independently of said signal apparatus. Another way of utilizing the trip device is to arrange the same so as to be operated from a distance and by any suitable power and in any suitable way to cause the movement of the trip device and said signal apparatus to be made simultaneously.

Another important feature of the present invention is that in case the line-current fails the motor-circuit will be opened automatically and instantly and the brakes may be caused to go on immediately.

The present system is such that electrical energy is preferably used as the propelling agent and compressed air is preferably employed to apply the brakes. When a number of cars are equipped with our system, they may be coupled together at will to form a train. The coupling at one end of a car being a duplicate of that at the other end of the car, no trouble will be experienced when the cars are to be coupled or uncoupled.

It may be necessary to couple up a train which will include one or more cars which are not equipped with driving-motors. In such case it will be necessary to use couplings long enough to span across the unequipped cars, so that the entire number of equipped cars may be brought into use and under the control of the motorman. The said couplings may be a part of a wire or set of wires termed a "train-line" or "cable." A more detailed description of the construction of the couplings herein mentioned may be had from our patent, Serial No. 697,767, granted April 15, 1902.

Our present application is as to some of its main features a continuation of our application Serial No. 194,449, filed February 19, 1904.

Many of the important features of our present invention will be more clearly set forth hereinafter and all pointed out in the claims.

To more fully appreciate the improvements hereinafter claimed, reference is made to the accompanying drawings, in which similar reference characters indicate corresponding parts.

Figure 1 is a diagrammatic view of one electrical converter and one car-equipment arranged according to one form of our invention. Fig. 2 illustrates a diagrammatic view of a train of cars, some of which are equipped with both an electrical system and an air-brake system, while one of the cars of said train is equipped with the air-brake system only. An independent train-line is also upon this car, whereby electrical communication may be made between the electrically-equipped cars, one of which is shown at the respective ends of the train. Fig. 3 is a partially-sectioned side view of one form of an engineer's or motorman's air-brake-valve device, showing portions of the pipes, the ports, the relay or leading device, and the valve within its case. Fig. 4 diagrammatically represents a motor-speed controller which is so arranged that if moved to either end of its path it will automatically open an air-brake valve, and thereby set the brakes. Fig. 5 is a side elevation of another form of engineer's or motorman's air-brake-valve device, the relay or pilot device, &c. Figs. 6, 7, 8, 9, 10 are diagrammatic cross-sectional plan views taken at line N, Fig. 5, showing portions of the pipes, the ports, and valve Z.

Referring now to Fig. 1, A is a set of circuit-wires having four sets of terminal contacts at B C D E and a set of branch wires F, which connect each one with the appropriate coil of the inductive-motor speed-controller. The terminal contacts B C when not in use are normally open; but they are adapted to be coupled up to other cars to form a train-line, so that the entire train of cars may be controlled through said train-line. The terminal contacts D E (of the master-controllers) are arranged at the respective ends of the car and are connected by branch wires to the set of circuit-wires or independent train-line A. The terminal contacts D E are maintained in open circuit until one master-controller or commuting switch-lever is brought into use, at which time master-controller or switch-lever 1 will move over the terminal contacts at D. When either of such controller or switch levers is moved, such movement will effect the inductive-motor speed-controller G. At H a set of lamps represent signal devices of any kind and adapted to indicate the failure of the line-current. The said lamps are shown connected up in series multiple by switch 3, which is adapted to cut out either series of the set. At I is shown the ordinary shoe, which makes connection with the "contact" or "third" rail J. K K' are reversing magnets or solenoids, which are connected in series and act through their cores to control the upward or "one-way" movement of the reversing-switches L L', respectively, the downward movement of said switches being accomplished by gravity. M M' are car-driving motors. The inductive-motor speed-controller G, as shown in Fig. 1, has the terminals of its coils (except one) electrically connected together and then connected, by means of conductor 63, to conductor 16, which leads to the return-rail J', over conductor 17, and car-wheel 18. At 10^a is an "overload-magnet" in series with the driving-motors M M' and having its armature 20^a arranged between point 30^a and conductor 19^a. The latter conductor connects armature 20^a to contact 55, which communicates with relay U. It will be noted that master-controller levers 1 and 2 are shown open-circuited. Such condition is normally maintained by the use of springs 25 26, respectively. One of such springs will automatically cause the appropriate one of said controller-levers to open the circuit when the motorman ceases to manually control said lever. At O is illustrated an automatic electromagnetic relay device which is adapted to cause the circuits to be opened automatically and instantaneously upon the failure of the line-current and after quite an interval to automatically close said circuits. The interval between the opening and the closing of the circuits by said devices is for the purpose of permitting the motorman to move the controller-lever to the "off" position before the line-current is reëstablished. It is obvious that such device may be so coupled up to the mechanism that the brakes may be set and the circuits opened approximately simultaneously upon the failure of the line-current. It will be observed that the magnet 10 is in series with the signal-lamps at H, while the armature 20 and its contacts are in the motor-circuit. To armature 20 a dash-pot device 10^c is so connected and arranged that when the line-current fails the magnet 10 releases its armature 20. Then spring 15 quickly forces armature 20 to open the circuit. The dash-pot being provided with a valve which opens outward offers practically no resistance to the action of said spring; but when the line-current is reëstablished the magnet 10 will then become energized and begin to draw the armature toward its front or circuit-closing contact. At such time the dash-pot valve closes, and thus causes the dash-pot piston to resist the action of said magnet, and thereby causing a delay in the closing of the circuits. At 21 21' are illustrated single-point switches, which cause solenoids K K' to be energized when either of such switches is connected to the appropriate one of the branch conductors 22 23. The contact-bar (the lower part of the motor-speed controller G) is divided into several parts 35 36 37. Part 35 controls the contacts of motor M', while parts 36 37 control the contacts of motor M. At P an electrically-operated air-compressor is shown in tubular communication with main reservoir P'. The operation of said air-compressor forces air into said reservoir P' until the air-pressure therein is sufficiently powerful to operate the air-brakes. Thus it will be seen that the electrical energy received by the motor of the air-compressor is transferred to a suitable medium for operating the brakes. The motor of the air-compressor is provided with a pneumatically-actuated relay or circuit controller R, the contacts of said compressor-motor being in series with the contacts of the piston mechanism *a* of the relay or circuit controller R and communicating between the current-supply wire 28 and return-conductor 17 by means of branch wires *b c d*, which are in series with said mechanism *a*. The train-pipe is in tubular communication (through valve *i* and pipe *k*) with reservoir P′. Valve *i*, of which the lever *m* is the handle, controls the openings or ports between the pipes *h k* and the exhaust and may replace the commonly-used engineer's or motorman's valve. Valve *i* is preferably provided with a spring *n* or other suitable means, whereby such valve may be made automatic or self-closing. It may be opened by means of a hammer-like blow struck by controller-lever *l* when the latter is released from manual control. After the effects of the blow given to lever *m* by lever *l* then spring *n* closes the valve *i*. The opening of the latter valve reduces the pressure in the train-pipe so as to set the brakes T, which are in tubular communication (through pipe *p*) with train-pipe *h*. At U is shown an automatically-actuated relay device for rendering the motors inoperative. This device is in constant tubular communication (through pipes *p q*) with the train-pipe *h*. The contact apparatus 40 of device U controls the contacts 55 56 of the controller-circuit. The arrangement being such that when the train-pipe pressure is reduced to put the brakes on, said apparatus 40 moves, and thereby opens the master-controller circuit, the inactivity of which renders the motors inoperative, and thereby assists the train to come to rest. The details of the automatically-actuated device U will be more clearly set forth hereinafter. The apparatus at W is an alternating-current generator adapted to generate currents of high voltage, which are led to a converter X Y, where said currents are or may be transformed into energy adapted to be employed in the operation of the system. The present invention is applicable to electrically-propelled cars of any type, whether direct or alternating current.

The operation of the system is as follows: Suppose that the motor-controllers at D E are open and energy passing from generator W over converter X Y, contact-rail J, and shoe I to point 50, where the energy divides, a portion passing to point 51, thence over switch 3, signals H, magnet 10, conductor 17, wheel 18, return-rail J′, back to the converter. Another part of the energy moves from point 30^a over 20^a 19^a 55 40 56 57 52, where it divides, a portion passing to train line-wire 28, while the other part passes over reversing-switch 21 to train line-wire 30, which distributes current to all of the reversing-solenoids K K′ on the car or train of cars. In the meantime the energized magnet 10 has caused its armature 20 to close the circuit between reversing-switch L′ and point 50. To start the car—say to the left—controller-lever 1 is moved in the direction of the hands of a watch, and thereby connecting contacts 53 54, thus permitting the energy to divide at point 30^a, a portion passing over armature 20^a, conductor 19^a, contacts 55 40 56, wire 57, contacts 53 54, train line-wire 58, branch wire 59, coil 60, wire 61, armature 62, wires 63 16 17, wheel 18, rail J′, to converter X Y. The energy in coil 60 causes the controller-core 64 to be moved one step, thus causing the part 35 of the contact-bar to connect contacts 65 66, and part 36 to connect contacts 67 68. More energy is then fed over shoe I, point 50, armature 20, and its contacts, wire 69, switch L′, motor M′, contacts 66 35 65, wire 70, contacts 67 36 68, motor M, switch L, wires 16 17, wheel 18 to the converter. It will be noted that said step of the controller-core 64 placed the driving-motors M M′ in series with each other and with the dead resistances 71 72. If controller-lever 1 is progressively moved, so as to connect the next two appropriate serial contacts 73 74, the current will be shifted from contacts 53 54 and will then flow over contacts 73 74, train-wire 75, branch wire 76, coil 77, wire 61, from which point it passes over the return-circuit described in connection with the energizing of coil 60. As controller-lever 1 is progressively moved the pairs of master-controller contacts are brought into the circuit in sequence until the final contacts 78 79 are reached, at which time branch wire 86, the top coil 82, magnet 83, and resistance 84 are connected in series with each other and receive current through contacts 79 78, train-wire 85, branch wire 86, and returns such current over wire 16 and its circuit connections already described. In the meantime core 64 has been drawn to its highest point of travel and held there by the electromagnetic plug 87, which acts as a stationary core for a portion of the coil 82. As magnet 83 is cut into the circuit it causes its armature 62 to break connection with wire 63, and thereby cutting out the low-resistance circuit through 63. As the contact-bar moved along step by step, following the indications of the master-controller lever, it first cut out resistance 71. Then resistance 72 was cut out. Then contact part 35 connected 88 and 89, thus connecting motor M′ to ground through conductors 16 17, wheel 18, rail J′, to converter X Y. Part 36 cut out motor M by passing from the circuit at offset 90. The continued movement of the contact-bar caused contact part 37 to electrically connect offset contact-piece 90 to the brakes to go on practically simultaneously. Fig. 9 shows valve Z in the brake-release position, the train-pipe port 130 being connected, through valve-port 129, to the main reservoir port 144. Fig. 10 illustrates valve Z in another emergency position, the train-pipe port 132 being connected through valve-port 129 to exhaust-port 133.

The relay or leading device U, Fig. 10, consists of a cylinder 146; a piston-head 147; a connecting-rod 148, which is attached to said head; a spring 149, which surrounds rod 148, and a spring 150; a knife or bar contact 151; which is controlled by rod 148, and spring 149. Contact 151 is adapted to make and break the circuit through contacts 55 56. Spring 150 suddenly throws contact-bar 151 away from the contacts 55 56 after spring 149 causes the contact-bar to move a certain distance because of the reduction of the air-pressure in the train-pipe. To move valve Z from the position shown in Fig. 5 to the position shown in Fig. 10, the valve-lever 120 must be turned in the direction of the hands of a watch. Such movement winds spring 122. It will be noted that the devices illustrated by Figs. 3, 4, and 5, respectively, are so constructed and arranged that when either of the handles thereof is moved (in either direction) beyond a critical point the current will be cut off and the brakes will go on.

Screw 126, which passes through stop 137, is to be employed to cause valve Z to assume the postion shown in Fig. 6, when such valve is not on the pilot-car and the exhaust-port is to be maintained closed. The stopping or resting position of lever 120 and valve Z is governed by the adjustment of said screw.

While we have shown only one magnet to each reversing-switch, it is obvious that we may employ two magnets to each such switch—one magnet for each direction in which the switch is to be moved. If so desired, we may use a reversing arrangement, such as that illustrated in our Patent No. 755,825 and dated March 29, 1904.

It should be understood that our present invention is not limited to any of the various types of motor-control apparatus now invented.

The trip mechanism 140 141 143, Fig. 8, is perfectly arranged so that the train-pipe valve 140 may be caused to be opened by the trip 143 independently of the direction of movement of said car or the piloting end of such vehicle.

We do not limit ourselves to the details of construction, because many changes may be made in the arrangement of the apparatus without departing from the spirit of our invention. We may adjust the relay U to operate at any desired reduction of the train-pipe pressure. When we employ a plurality of controllers provided with separately-energized coils, all of the controllers are caused to start simultaneously and move with a synchronous step-by-step motion to vary the speed or work of the driving-motors or translating devices.

We preferably use a motor-winding, which permits the employment of an alternating current at one time and a direct current at another time.

The apparatus may be employed in connection with any of the present air-brake systems.

We claim as our invention—

1. The combination of an electrically-propelled car, driving-motors thereon, a motor-controller for the motors, a master-controller apparatus for governing the motor-controller, and air-brake apparatus; the master-controller apparatus and the air-brake apparatus being so constructed and related that the brake apparatus may be brought into action by the movement of said master-controller apparatus and independently of the direction of such movement.

2. In combination, a motor or group of motors, a motor-controller, a controller-handle, the parts being so arranged that a movement of the controller-handle to either extreme position causes the motor-circuit to be opened, brake apparatus, and means controlled by the controller-handle in each of its extreme positions for causing the brakes to be applied.

3. In an electric railway wherein the track-rails are employed as the return-conductor for the current, a car provided with a current-collecting device and arranged to deliver current to the track-rails through the car-truck, a switch located between the current-collecting device and the car-truck for connecting the propelling-motors to said collecting device, and an electromagnet for operating said switch arranged in a circuit which connects the collecting device and car-truck in shunt to the motors.

Signed at New York, in the county of New York and State of New York, this 16th day of September, A. D. 1904.

GRANVILLE T. WOODS.
LYATES WOODS.

Witnesses:
LOTTIE BLAIR,
J. JONES.

UNITED STATES PATENT OFFICE.

OTTO LIEBKNECHT, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR TO THE ROESSLER & HASSLACHER CHEMICAL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROCESS FOR THE MANUFACTURE OF GLYCOLIC ACID.

No. 837,083. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed June 14, 1906. Serial No. 321,669.

To all whom it may concern:

Be it known that I, Otto Liebknecht, a subject of the German Emperor, and a resident of Frankfort-on-the-Main, Germany, have invented a certain new and useful Process for the Manufacture of Glycolic Acid, of which the following is a specification.

This invention relates to an economical, easy, and effective process of manufacturing glycolic acid.

The processes heretofore practiced of manufacturing glycolic acid are not adapted for the technical manufacture of the same. For instance, it is known that glycolic acid can be manufactured on a large scale from monochloracetic acid; but this process is not an easy one and is very expensive. As a further illustration, it is impossible to economically produce glycolic acid from oxalic acid and zinc-dust because the yield is poor and the zinc-dust very expensive.

I have discovered that oxalic acid in sulfuric-acid or hydrochloric-acid solution is reduced electrolytically nearly quantitatively and with a very good current yield. In practicing my process I have found it most satisfactory in reducing the oxalic acid electrolytically to use electrodes having a high cathodic overvoltage—as, for instance, lead electrodes—and to use a diaphragm to separate the anodic and cathodic liquors. Both of these features are important, as well as the use of a not too dilute acid. An electrode not having a high cathodic overvoltage would give insufficient yields, and a too dilute acid would cause the oxalic acid, being highly ionized, to take too great a part in the conductivity of the current and to cause it to go to the anode, where it would be oxidized.

As an example illustrative of my process I give the following: Seven hundred parts of crystallized oxalic acid are dissolved in about three thousand three hundred parts of water and eleven hundred parts of thirty-per-cent. sulfuric acid are added while stirring. This solution forms a cathodic liquor, which it is of advantage to keep warm during the process of electrolyzation. The cathodic liquor should be placed in the cathodic compartment of a suitable electrolytic apparatus provided with a suitable diaphragm, and the anodic liquor, comprising a thirty-per-cent. sulfuric acid, should be placed on the other side of the diaphragm. The density of the current at the cathode may vary greatly—for instance, from twenty-five to two hundred and fifty amperes per square meter of surface of cathode. The presence of the diaphragm in connection with the use of a not too dilute acid largely prevents the anodic oxidation of the oxalic acid. On completion of the electrolysis the anodic solution may be used in preparing a fresh charge of the cathodic liquor.

It is preferable to stir the cathodic liquor during the electrolyzing, and, furthermore, to add fresh acid in case the acid in the cathodic liquor becomes too weak, a too concentrated solution, however, being avoided at the cathode on account of the resulting low conductivity. It is advisable not to use sulfuric acid of a strength below fifteen parts concentrated sulfuric acid to one hundred parts of water, as otherwise the current yield and the nature of the product will be affected. The sulfuric acid can in the examples given be substituted for by about a twenty-per-cent. hydrochloric acid. In place of lead electrodes carbon or graphite can be used; but in using carbon a proportionately larger amount of current will have to be provided. Besides this other undesirable reactions seem to take place simultaneously.

In order to produce glycolic acid from the electrolyzed solution in case sulfuric acid has been used, the solution is neutralized with lime, best added while stirring, until all the sulfuric acid and oxalic acid present is neutralized by the lime. In order to remove the last traces of sulfate of calcium, I use barium carbonate and oxalic acid in the usual way. In case hydrochloric acid has been used instead of the sulfuric acid during the electrolysis it is only necessary to evaporate the hydrochloric acid in order to get glycolic acid. The glycolic acid obtained by this process may be used for technical as well as pharmaceutic purposes.

As it is obvious that the process may be practiced in a number of different ways with considerable variation, I do not restrict myself to the steps or proportions described; but

What I claim, and desire to secure by Letters Patent of the United States, is—

1. A process for the manufacture of glycolic acid from oxalic acid consisting in the

electrolytic reduction of oxalic acid in the cathode-compartment of an electrolytic apparatus in the presence of electrodes having a cathodic overvoltage, the oxalic acid being dissolved in a suitable dilute acid kept warm during the reduction and of such a degree of concentration that it excludes the oxalic acid from substantial participation in the conductivity.

2. A process for the manufacture of glycolic acid consisting in the electrolytic reduction of oxalic acid in the cathode-compartment of an electrolytic apparatus in the presence of lead electrodes, the oxalic acid being dissolved in a dilute sulfuric acid kept warm during the reduction and of such a degree of concentration that it excludes the oxalic acid from substantial participation in the conductivity.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

OTTO LIEBKNECHT.

Witnesses:
HORST ZIEGLER,
JEAN GRUND.