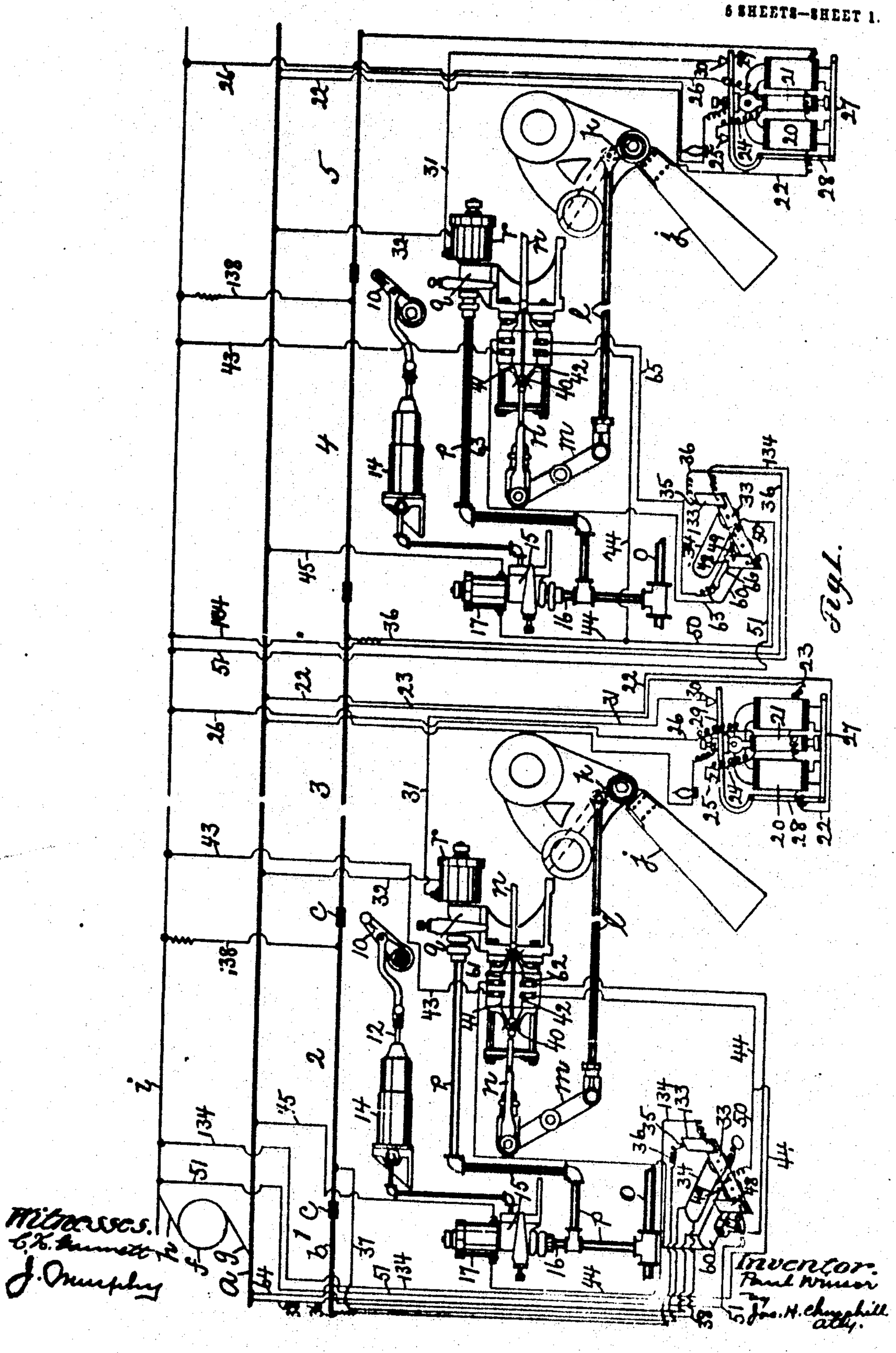
No. 898,296.

P. WINSOR. PATENTED SEPT. 8, 1908.

SYSTEM FOR CONTROLLING TRAINS.

APPLICATION FILED AUG. 12, 1905.

6 SHEETS—SHEET 1.



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6 SHEETS—SHEET 2.

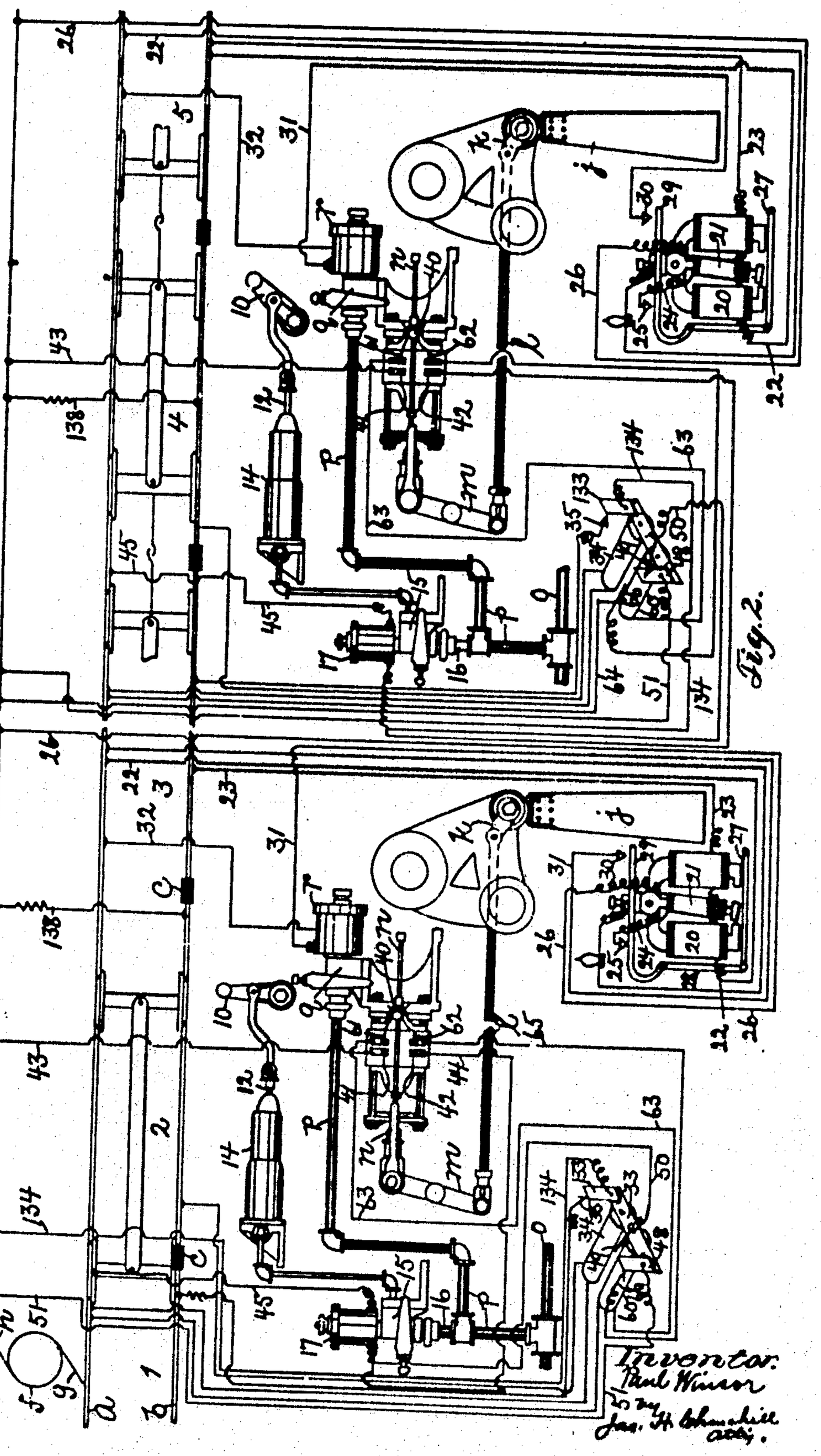

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Fig. 2.

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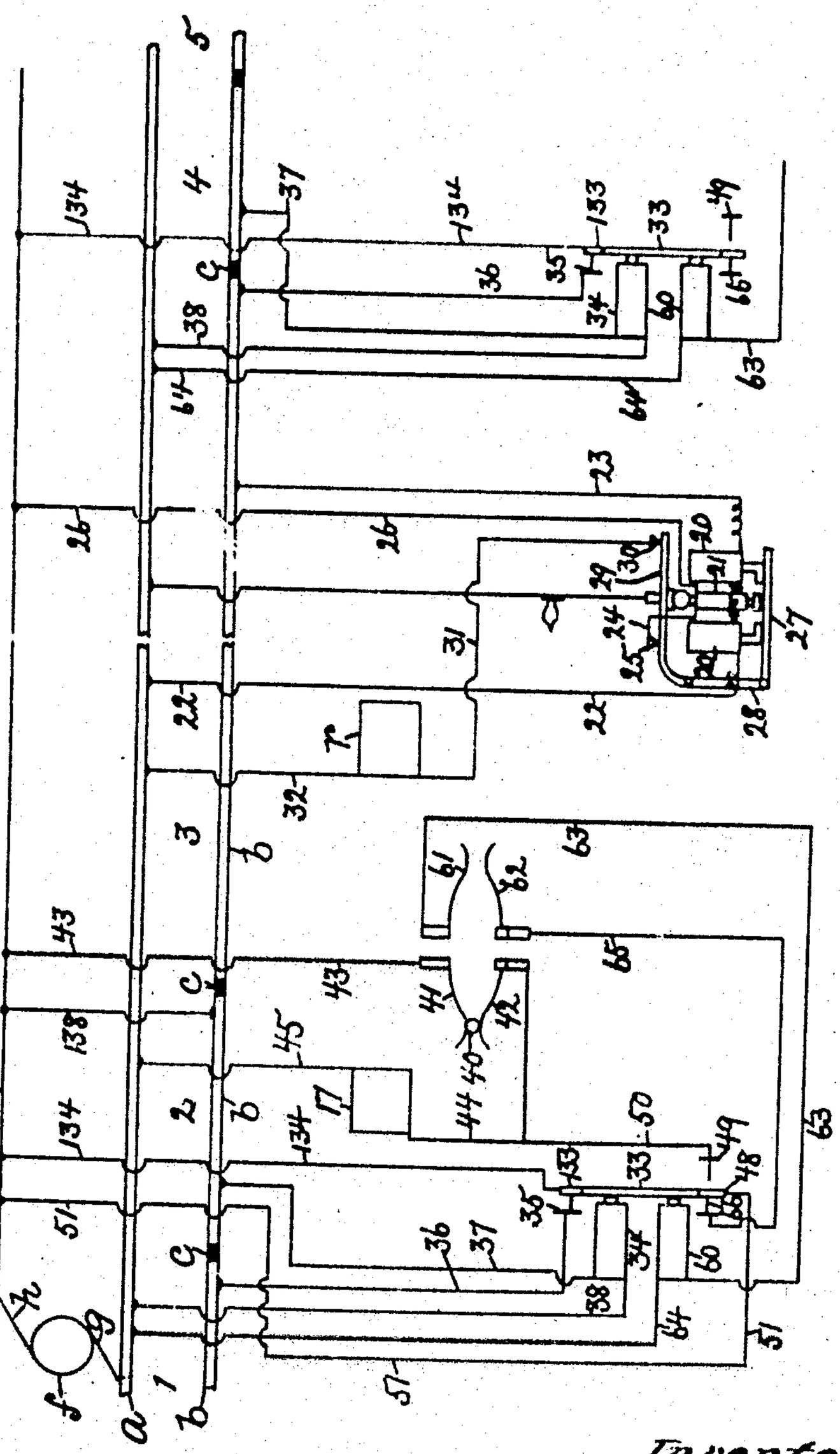
6 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

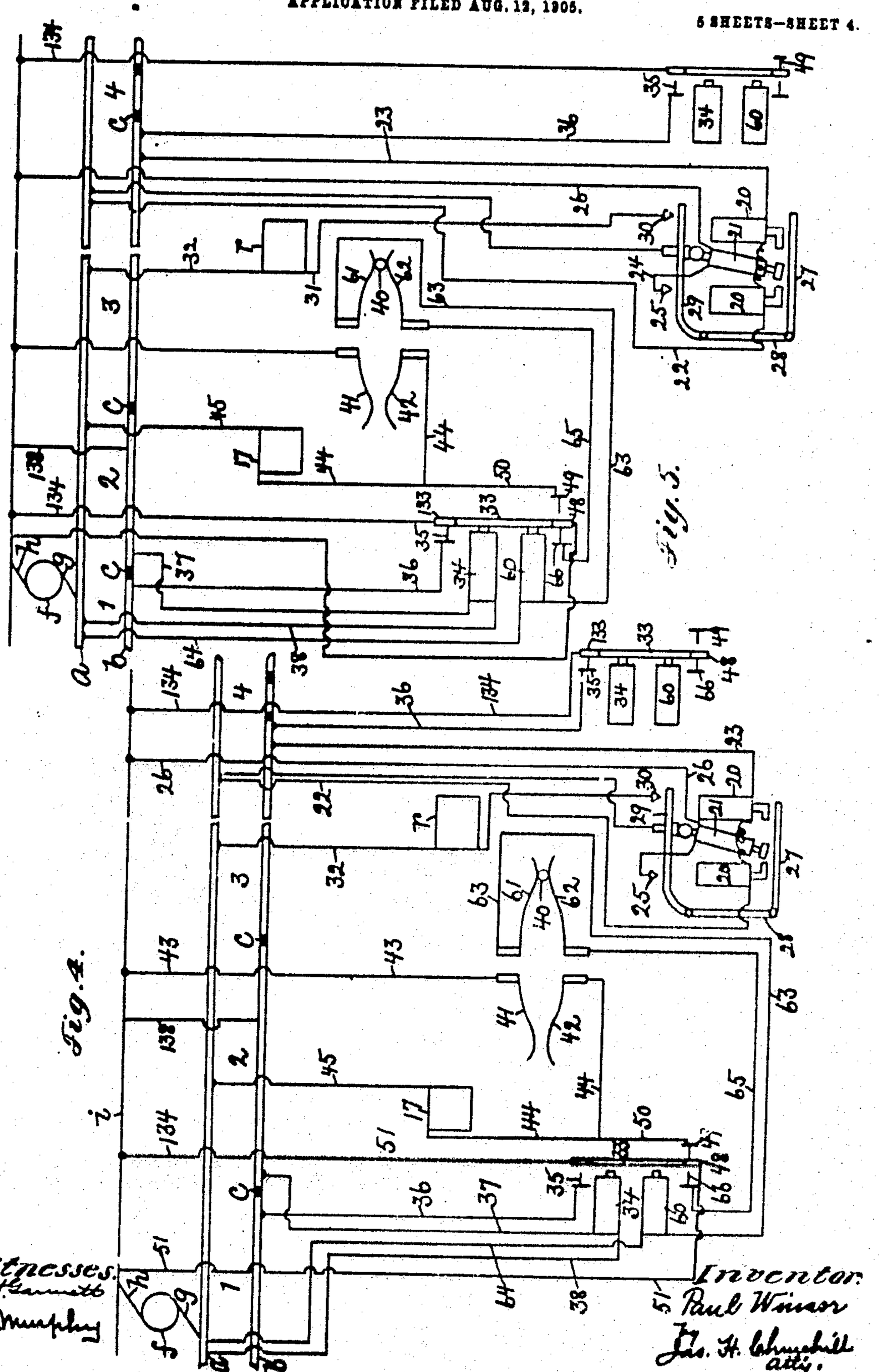

Fig. 4.

No. 898,296. PATENTED SEPT. 8, 1908.

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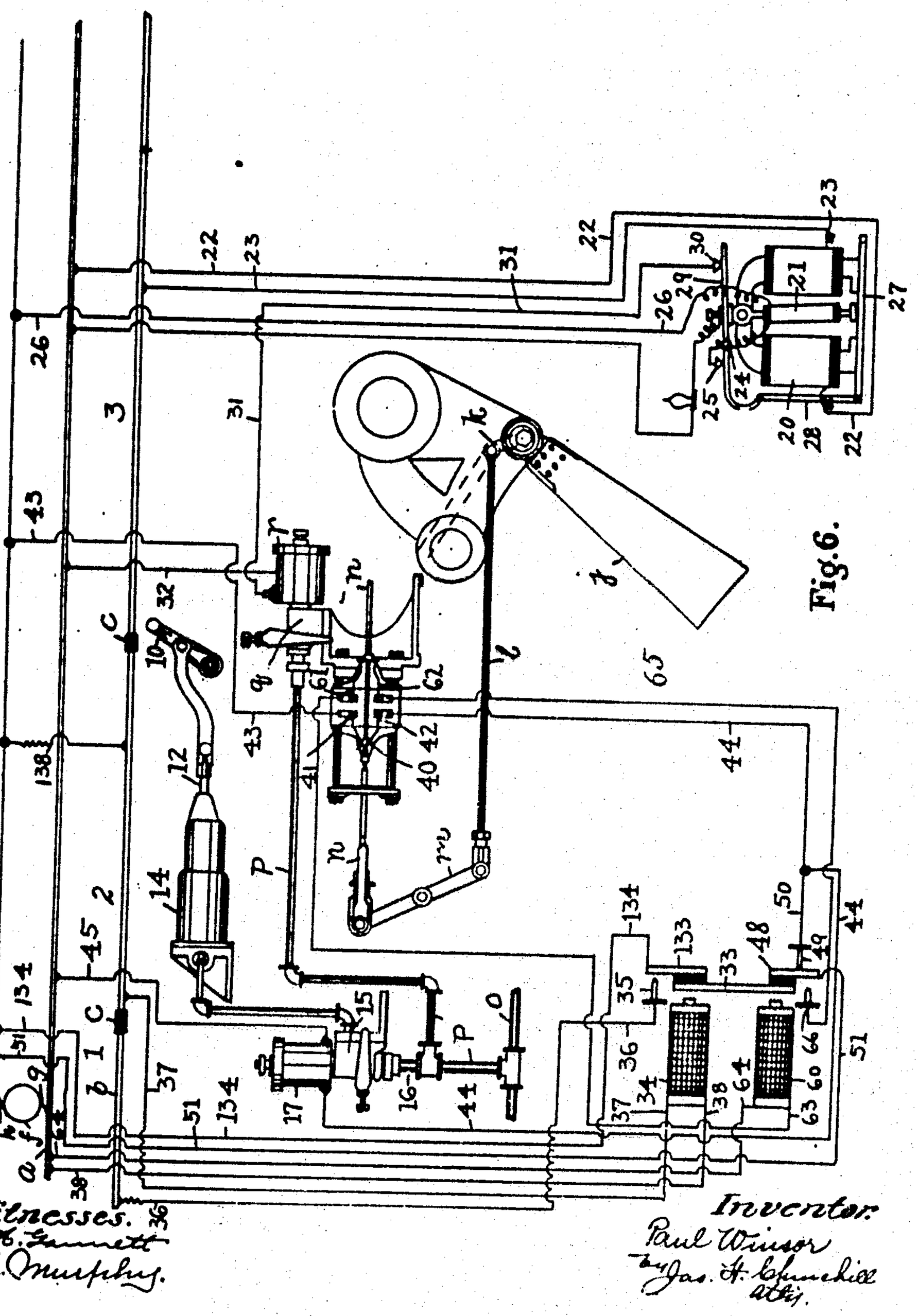
6 SHEETS—SHEET 6.



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UNITED STATES PATENT OFFICE.

PAUL WINSOR, OF WESTON, MASSACHUSETTS, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SYSTEM FOR CONTROLLING TRAINS.

No. 866,206. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed August 13, 1906. Serial No. 330,384.

To all whom it may concern:

Be it known that I, PAUL WINSOR, of Weston, county of Middlesex, and State of Massachusetts, have invented an Improvement in Systems for Controlling Trains, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The invention relates to a system for controlling the running of cars and trains of cars on railways, and is especially adapted for use on railway systems employing electricity as the motor power and provided with a block signal system.

Prior to this invention, electrically operated railway systems had been provided with a block signal system and with a system of automatic stops, the trip-arms of which are employed to engage a device carried by a car, or devices carried by all the cars of a train to set the brakes on a car or train, if it is attempted to run by a signal set against the car or train. This arrangement has the objection that considerable time is lost in the running of the cars or trains owing to the fact that the car or train waiting to enter a block cannot enter the block until the signal shows "clear", and the signal cannot show "clear" until a train already in the block has passed out of it.

An object of the present invention is to permit of a car or train passing a danger signal and the trip-arm of an automatic stop adjacent thereto, without being stopped by the trip-arm of the automatic stop, provided the car or train is moving at a slow rate of speed. It will be understood that a car, or all the cars of a train, carry a device which is adapted to be engaged by the trip-arm of the automatic stop. This engagement only occurs when the said device and trip-arm occupies certain relative positions.

In carrying out the above stated object of the invention, I provide means which when the train is moving at a slow rate of speed causes a change in the position of one of the two parts, thereby preventing an engagement between the device and the trip-arm.

In this invention provision is made for controlling the position of the trip-arm of the automatic stop, and preferably controlling the trip-arm independently of the railway signal to which the trip-arm is adjacent. With this arrangement the trip-arm can be retained inoperative by a train moving at a slow rate of speed to permit the train to enter a block section, notwithstanding the signal for said block section is in its danger position.

Provision may and preferably will also be made so that the automatic stop may be rendered operative to absolutely stop a train in one block and prevent it entering a second block, when the latter is occupied, as will be described.

These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is a diagrammatic view of a sufficient portion of a railway system embodying this invention to enable it to be understood, the signal mechanisms being in the position they occupy when the track is clear. Fig. 2, a like view with some of the signals in their danger position, and Figs. 3, 4 and 5, diagrams of circuits to be referred to, and Fig. 6, a detail on an enlarged scale to be referred to.

The invention while applicable to steam operated railroads is particularly adapted for use on electrically operated roads, and in the present instance, I have chosen to illustrate its application to an electrically operated road.

In accordance with this invention, the automatic stop is controlled separately from the block signal, so that the stop may not interfere with the progress of the train under certain conditions as will be described. For this purpose, a short block section is employed with each regular block section, and has connected with it a translating device, which may be a relay or one or more magnets, which, for sake of distinction, may be designated the stop relay. The long or regular block section has connected with it a relay or magnet, which may be designated the signal relay. The stop relay governs the operation of the automatic stop, and the signal relay governs the operation of the block signal.

In Fig. 1, *a*, *b*, represent the rails of a track, which is subdivided into block sections as by insulation *c*. In the present instance, the rail *a* is represented as a continuous rail and *b* a sectional rail forming long or regular block sections 1, 3, 5, etc., and short block sections 2, 4, etc. interposed between the said long sections. The continuous rail *a* forms part of a signaling circuit provided with a current generator *f* having one brush *g* connected

with the rail *a* and the other brush *h* connected with the line wire *i*. The regular block sections 1, 3, 5, etc. have coöperating with them block signals, which may be of any suitable or desired construction, and which are represented as semaphores *j*, each operatively connected by the crank *k*, link *l*, lever *m* to the piston rod *n* of a piston (not shown), which is located in a cylinder (not shown), but which is of usual construction and is supplied with air under pressure from a main supply pipe *o*, through a branch pipe *p* leading to a valve chest *q*, which communicates with the cylinder referred to, and contains a valve (not shown), which is operated by an electro-magnet *r*, which may be designated the signal magnet. The regular block sections 1, 3, 5, etc. also have coöperating with them an automatic stop, which may be of any usual or desired construction and consists of a rocking trip arm or lever 10, which is joined to the piston rod 12 of a piston (not shown), but which is located in a cylinder 14 supplied with air from the supply pipe *o* through the valve chest 15 and branch pipe 16. The supply of air to the cylinder 14 is controlled by a valve, not shown, but which is located in the valve chest 15 and is operated by an electromagnet 17, which may be designated the stop magnet.

The mechanical construction of the signal mechanism and of the stop mechanism, is well understood and need not be specifically described as it forms no part of the present invention, and further as its operation is well understood. It may be noted, however, that in the system herein shown, the block signal *j* is moved from its clear or safety position shown in Fig. 1 into its danger position shown in Fig. 2 by gravity and is returned to the safety position by the air pressure moving the piston attached to the rod *n*. It may also be noted, that the trip-arm 10 is moved into its inclined or inoperative position shown in Fig. 1, by the air pressure admitted into the cylinder 14, and is moved into its upright or operative position shown in Fig. 2 by a suitable spring not shown, but which is located in the cylinder 14.

For a better understanding of the invention, I have represented the signal mechanism and the stop mechanism for two long or regular block sections 3, 5 of the track, both mechanisms being shown in their clear or safety positions in Fig. 1, while in Fig. 2, the block signals are shown in their danger position, and the trip-arm 10 of the automatic stop for section 3 in its inoperative position while the trip-arm 10 of the automatic stop for section 5, in its operative position.

From the above description, it will be seen that the stop mechanism is controlled in its operation independently of the block signal, the operation of the former being controlled by the magnet 17, and that of the latter by the magnet *r*. The signal magnet *r* may be controlled by a relay included in the track circuit of a regular or long block section and comprising as shown an electromagnet 20 and a polarized magnet 21 which is pivoted to swing between the poles of the magnet 20. The electromagnet 20 is connected by the wires 22, 23 to track rails *a*, *b* (see Figs. 3 to 5). The swinging magnet 21 is connected by wire 24 to a back stop 25 and by wire 26 to the signal line wire *i*. The magnet 20 is provided with an armature 27, connected by a link 28 with a lever 29, which coöperates with the back stop 25 and with a second back stop 30, which latter is connected by wire 31 with one end of the coil of the magnet *r*, the other end of said coil being connected by wire 32 with the track rail *a*. The circuit of the electromagnet 20 is controlled by a contact member 133 (see Fig. 6) carried by the armature 33 of an electromagnet or relay 34 connected in circuit with a short block section. The contact member 133 is joined by wire 134 with the signal wire *i*, and coöperates with a front stop 35, which is joined by wire 36 to the rail *b* of a long or regular block section. The magnet or relay 34 is connected by wire 37 to the rail *b* of a short block, and is connected by wire 38 to the rail *a*. The short block section is connected with the signal wire *i* by wire 138. It will thus be seen that when the electromagnet 34 is energized, its armature 33 is attracted and closes the circuit of the signal track relay 20 for the preceding long or regular block, which circuit is opened when the relay 34 for the next succeeding short block is deënergized as will be described. The relay 34 may be designated the short block relay. For a better understanding of the invention, these circuits will now be traced in Fig. 3.

The circuit of the relay 34 may be traced as follows:—from the generator *f* by brush *h* to wire *i*, thence by wire 138, rail *b* of block 2, wire 37, magnet 34, wire 38, rail *a* and brush *g* to generator *f*.

The circuit of the relay 20 for the long block 3 is as follows:—from the positive pole of the signal generator *f* by brush *h* to the signal wire *i*, thence by wire 134 to contact member 133 of relay 34 for the short block 4, thence by back stop 35 and wire 36 to rail *b* of long block section 3, thence by wire 23 to relay 20, thence by wire 22 to rail *a* and back to generator *f* by brush *g*.

The circuit of the signal magnet *r* for block section 3 may be traced as follows:—from generator *f* by brush *h* to signal wire *i*, thence by wire 26 to polarized magnet 21 of the track relay, thence by wire 24 to back stop 25, thence by lever 29, back stop 30 and wire 31 to magnet *r*, thence by wire 32 to rail *a* and back to generator *f* by brush *g*.

It will thus be seen that when the track is clear, the relays 34, 20 are energized, and the

signal magnet *r* is also energized, thereby through the signal mechanism above described, maintaining the signal *j* in its safety or clear position shown in Fig. 1. The signal mechanism referred to, controls and operates a circuit controller which governs a circuit including the stop magnet 17. In the present instance, I have shown one form of circuit controller, which consists of a contact member 40 attached to the piston rod *n* and coöperating with contact members or terminals 41, 42, preferably spring fingers, between which the member 40 is forced when the track signal is in its clear position as shown in Fig. 1. The contact member 41 is connected by wire 43 with the signal wire *i*, and the contact member 42 is connected by wire 44 with the stop magnet 17, which is also connected by wire 45 with the rail *a*. It will thus be seen, that when the track signal *j* is in its clear or safety position, a circuit for the stop magnet 17 is completed, which may be traced in Fig. 3 as follows:—from the signal generator *f* by brush *h* to signal wire *i*, thence by wire 43 to contact member 41, thence by the member 40 to the contact member 42 and by wire 44 to the stop magnet 17, thence by wire 45 to rail *a*, and brush *g* to generator *f*. The stop magnet is thus energized, thereby opening the valve controlled by it, so as to admit fluid pressure into the cylinder 14 and move the trip-arm 10 into its inclined or inoperative position shown in Fig. 1.

Assume now that a train enters a regular block section, as for instance the block section 3. In this case, the track relay 20 for the block section 3 is short circuited, thereby deënergizing it and causing the circuit of the signal magnet *r* to be opened between the lever 29 and the back-stop 30, thus operating the valve controlled by the signal magnet *r* and permitting the signal *j* to be moved by gravity to its danger position shown in Fig. 2. The movement of the piston of the rod *n*, moves the latter into the position shown in Fig. 2, thereby removing the contact member 40 from engagement with the spring fingers 41, 42 and opening the circuit of the stop magnet 17, which immediately operates the valve controlled by it and permits the trip-arm 10 to be moved by its spring into its vertical or operative position shown in Fig. 2. It will thus be seen that as thus far described, as long as the track relay 20 remains short circuited, the track signal remains at danger, and the trip-arm 10 is retained in its elevated or operative position.

To enable the automatic stop to be placed substantially at the entrance end of a block section and not interfere with the passing of a train from one block to the other, though its trip-arm be in its operative position, thereby decreasing the minimum time between trains, I employ a short block section which has connected to it a relay 34, which, in turn, governs a second circuit for the stop magnet 17, so that the latter may be energized, even though the circuit of the stop magnet which is under control of the danger signal, is open.

The second circuit referred to includes a contact member 48 carried by the armature 33 of the relay 34, which coöperates with a back stop 49 connected by wire 50 to the wire 44. The contact member 48 is connected by wire 51 to the signal line wire *i*. It will thus be seen that when the contact member 48 engages its back stop 49, the second circuit for the stop magnet is closed as represented in Fig. 4 in connection with the relay 34 for the short block 2, which circuit may be traced as follows:—from the generator *f* by brush *h* to signal wire *i*, thence by wire 51 to contact member 48, thence by back stop 49, wires 50, 44 to magnet 17, thence by wire 45 to rail *a* and brush *g* to generator *f*.

The closure of the second circuit for the stop magnet, is effected by a train entering a short block as 2 and short circuiting the relay 34, which enables the trip-arm 10 of automatic stop to be maintained in its inoperative position, notwithstanding that the track signal *j* is set at danger.

The system as thus far described enables the automatic stop to be placed at the end of the block, and yet permit a train to pass from said block to a succeeding block when the signal for the succeeding block shows a clear track, without being automatically stopped, that is, without tripping itself by the front end of the train entering the succeeding block and setting the track signal to danger. The system as thus far described, also enables a succeeding train to enter a block section though the signal therefor be set to danger. The system as thus far described may be designated the permissive system, and may be used to advantage on railways embodying comparatively long blocks inasmuch as the car or train in a block which has set the signal for said block in the danger position has also set the trip-arm 10 in its operative position. If now a succeeding train is run at a high speed, the trip-arm 10 of the automatic stop acts to set the brakes before said trip-arm 10 has been moved to its inoperative position by the short circuiting of the stop relay. If the succeeding train however heeds the danger signal and slows down to such a rate of speed as to enable the engineer to proceed with caution, opportunity is afforded the stop to be moved into its inoperative position, for as soon as the train enters the short block, the relay for the short block is short circuited and deënergized, thereby closing the second circuit for the stop magnet, which becomes energized and operates the valve controlled by it to effect

movement of the trip-arm 10 from its operative to its inoperative position and thus permit the second train to proceed with caution.

Provision may be made for regulating the time required for the trip-arm 10 to be moved from its operative position into its inoperative position, so that if desired, the stop may be moved rapidly or may be moved more or less slowly, thereby determining the speed at which a train may enter an occupied block without being tripped or stopped. This regulation may be effected either in the stop relay or in the automatic stop mechanism, as for instance by a dash pot or otherwise, or by varying the length of the short block or both.

Another feature of the present invention consists in absolutely preventing a second train from entering a succeeding block section while the latter is occupied, which is especially desirable on systems employing relatively short block sections, such for instance as electrically operated roads, and particularly those employed in cities. For this purpose, a second magnet or relay 60 is employed, which coöperates with the armature 33 for the short block magnet or relay 34 and which may be termed the holding magnet, as its function is to keep open the second circuit for the stop magnet, and thereby prevent the latter being energized by the entrance of a train in the short block. The holding magnet 60 is controlled by the track signal and by the stop relay, and its circuit is closed when the track signal is in its danger position and the stop relay is energized. The circuit controller for the holding magnet 60 governed by the track signal comprises as herein shown two spring fingers or members 61, 62, with which coöperates the contact member 40 on the piston rod *n*. The spring finger 61 is connected by wire 63 with one end of the coil of the holding magnet 60, the other end of which coil is connected by wire 64 with the rail *a*. The other spring finger 62 is connected by wire 65 with a front stop 66 for the contact member 48 secured to the armature 33 of the short block relay.

When the stop relay is energized and the track signal *g* is in its danger position as represented in Fig. 5, the contact member 40 engages the spring fingers 61, 62 and closes the circuit of the holding magnet 60, which circuit may be traced in Fig. 5 as follows:—from the generator *f* by brush *h* to signal wire *i*, thence by wire 51 to contact member 48, thence by front stop 66, wire 65 to spring finger 62, thence by contact member 40, spring finger 61, wire 63 to holding magnet 60, thence by wire 64, rail *a*, and brush *g*, back to generator *f*. It will thus be seen that with the track signal *j* in its danger position and the short block relay 34 energized, the holding magnet 60 is energized, and the circuit for the stop magnet 17 governed by the armature 33 of the short block relay is maintained opened, irrespective of the subsequent condition of the short block relay; that is, after the circuit for the holding magnet 60 is established, the entrance of a train into the short block section, while it deënergizes the short block relay 34, does not effect the closing of the circuit of the stop magnet 17, because the armature 33 of the relay 34 is held by the magnet 60 in its attracted position, consequently the stop magnet 17 is not energized and the trip arm 10 remains in its upright or operative position and stops the train, which cannot proceed until the danger signal *j* goes to its safety or clear position shown in Fig. 1, whereupon the circuit of the holding magnet is opened at the circuit controller governed by the track signal, and the circuit of the stop magnet is closed at the circuit controller governed by the track signal, which energizes the stop magnet and effects movement of the trip-arm 10 of the automatic stop into its inoperative position.

The system provided with the holding magnet may be designated as the non-permissive system, inasmuch as permission to enter a regular block section with the track signal at danger is denied the operator of the train.

The operation of both the permissive and non-permissive systems may be briefly described as follows. Assume that the track is clear. In this case, the signal system is in the condition represented in Fig. 1, the track signal *j*, and the trip arm 10 of the automatic stop being in their inclined positions, the track relay 20 and the stop magnet 17 being energized. Assume that a train enters the short block marked 2. In this case the short block relay 34 is deënergized and its armature is retracted, and closes the second circuit for the stop magnet 17 between the contact member 48 and the back stop 49, thereby supplying current to the stop magnet, and maintaining the trip arm 10 of the automatic stop in its inclined or inoperative position and permitting the train to enter the long or regular block marked 3. When the armature 33 is retracted, it opens the circuit of the track relay 20 for the track signal of the block section 1, thereby maintaining that signal at danger. As soon as the train enters the block section 3, it short circuits the track relay 20 and deënergizes the signal magnet *r* for the block section marked 3. The track signal *j* for the block section 3 is moved into its danger position shown in Fig. 2, thereby opening the first circuit of the stop magnet between the contact members 40, 41, 42. The stop magnet, however, is not deënergized, because its second circuit is closed by the armature 33 of the short block relay while the train is passing from the short block 2 onto the succeeding block 3. This condition is represented in Fig. 4. As

soon as the train has passed from the short block 2, its relay 34 is energized, which attracts its armature and opens the second circuit of the stop magnet 17 as shown in Fig. 5, and as its first circuit is opened between the contact members 41, 42, the stop magnet 17 connected with the short block 2 is deënergized and the trip arm 10 of the automatic stop is moved into its upright or operative position. Suppose that a second train approaches the signal *j* for block 3 under these conditions and with the system not provided with the holding magnet 60. In this case, the train on its entrance into the short block 2, short circuits the relay 34, whose armature is retracted and again closes the second circuit of the stop magnet, which causes the trip-arm 10 to assume its inclined or safety position, thereby permitting the train to enter the block 3 notwithstanding that the signal for said block is set at danger, providing, however, that the speed of the train is not sufficient to carry it over the short block 2 before the trip-arm 10 has had time to be returned to its safety position. If the speed of the train is excessive, sufficient time for the trip arm to be returned to its safety position may not elapse, and in this case the trip-arm would operate to stop the train. If however the train approaches with caution the signal set against it, sufficient time will have elapsed to permit the trip-arm to be moved into its safety position. This condition is represented by the trip-arm 10 for section 5 in Fig. 2. Assume however that the signal system is provided with the holding magnet 60. In this case, the second train approaching the signal set at danger for block 3, enters the short block 2 and deënergizes the relay 34, but the stop magnet is not energized because of the holding magnet maintaining its armature in its attracted position, and consequently the trip arm 10 remains in its operative position and stops the train.

While I may prefer to use the holding magnet, I do not desire to limit the invention in this respect. I have herein shown one embodiment of my invention, but I do not desire to limit the same to the particular arrangement herein shown.

I have not deemed it necessary to illustrate a car or train carrying a device or apparatus to be engaged by the trip-arm 10 to apply the brakes or otherwise stop the car or train. Such devices are well known in the art. They usually comprise an arm which is connected with a valve, the valve being located in the train pipe or a branch thereof. When the arm is engaged by the trip-arm 10, the valve is moved to vent the train pipe to the atmosphere, and thereby through the brake system of the car or train automatically apply the brakes. If desired, the device carried by the car or train, when moved, may be made to control the motive power.

I have herein described the invention as embodying a device which automatically sets the brakes on the cars and stops the train, but I do not desire to limit the invention in this respect, for instead of the trip arm 10, any other form of device or signal may be used to offer an obstruction to the passage of the train, such, for instance, as an arm, which, in its operative position, is extended into the path of movement of the train so as to be engaged thereby, and if the train proceeds, to cause the arm to be broken or to damage some part of the train so as to put distinctly on record the fact that the engineer has disobeyed the signal.

The relays 20 governing the signal magnet *r* may be of any usual construction and in the present instance a polarized relay 21 is shown which is employed when the automatic stop system is used on electric railways, as represented herein, but on other railway systems the polarized relay 21 is not required. The polarized relay 21 is employed to prevent the power current from backing up as it is technically called, and operating the signal magnet *r*. In the absence of the faulty power current, the signal magnet *r* is controlled by the relay 20, which operates in the usual and well-known manner, and inasmuch as the polarized relay 21 is not essential to the operation of the present invention, which relates to the control of the automatic stop, it is not deemed necessary to more fully describe the action of the polarized relay 21.

Claims.

1. The combination with a track provided with substantially long and substantially short block sections, of a track signal, a magnet controlling the operation of said signal, a relay connected with a substantially long block section and governing the operation of said signal magnet, an automatic stop, a magnet controlling the operation of said stop, a relay connected with a substantially short block, an armature for said short block relay governing the operation of said stop magnet, a circuit controller governing the operation of said stop magnet and itself governed by said track signal, a holding magnet coöperating with said armature, and a circuit controller governed by said track signal and controlling said holding magnet, substantially as described.

2. The combination with a track provided with substantially long and substantially short block sections, of a track signal, a magnet controlling the operation of said signal, a relay connected with a substantially long block section and governing the operation of said signal magnet, an automatic stop, a magnet controlling the operation of said stop, a relay connected with a substantially short block, an armature for said short block relay governing the operation of said stop magnet, and a circuit controller governing the oper-

ation of said stop magnet and itself governed by said track signal, substantially as described.

3. The combination with a track provided with substantially long and substantially short block sections, a track signal operatively connected with a substantially long block section, an automatic stop operatively connected with a short block section, an electro-magnet governing the operation of said stop, and a circuit controller for said electro-magnet governed by the track signal, substantially as described.

4. The combination with a track provided with substantially long and substantially short block sections, a track signal for a long block section, an electromagnet controlling the action of said track signal, a relay connected with a long block section and controlling the action of said electromagnet, an automatic stop, a magnet controlling the action of said stop, a relay connected with a short block section for controlling the circuit of said stop magnet, a circuit controller for said stop magnet governed by said relay, and a second circuit controller for said stop magnet governed by the track signal, substantially as described.

5. The combination with a track provided with substantially long and substantially short block sections, a track signal for a long block section, an electromagnet controlling the action of said track signal, a relay connected with a long block section and controlling the action of said electromagnet, an automatic stop, a magnet controlling the action of said stop, a relay connected with a short block section for controlling the circuit of said stop magnet, a circuit controller for said stop magnet governed by said relay, a second circuit controller for said stop magnet governed by the track signal, a holding magnet coöperating with the circuit controller governed by the stop relay to maintain the said circuit controller in its open position when the stop relay is deënergized, substantially as described.

6. The combination with a track provided with substantially long and substantially short block sections, a track signal for a long block section, a magnet controlling the operation of said track signal, a relay governing the operation of said magnet and connected in circuit with the long block section, an automatic stop, a magnet controlling the operation of said stop, a relay governing the operation of said magnet and connected with the short block section, a circuit controller for the stop magnet governed by said stop relay, a circuit controller connected with the said stop magnet and governed by the track signal, a holding magnet coöperating with the circuit controller governed by the stop relay, and a circuit controller for said holding magnet governed by the track signal, substantially as described.

7. The combination with a track provided with block sections, of a track signal coöperating with one of said block sections, an automatic stop coöperating with a block section, a relay connected in circuit with a block section and controlling the operation of the track signal, and a second relay connected with a block section and controlling the operation of the automatic stop, substantially as described.

8. The combination with a track having block sections, of a track signal coöperating with a block section of said track, an automatic stop coöperating with a block section, and means to operate said stop independently of said track signal, said means having provision for permitting said stop to be moved into its safety position when said track signal is in its danger position, substantially as described.

9. The combination with a track having block sections, of a track signal coöperating with a block section of said track, an automatic stop coöperating with a block section, means to operate said stop independently of said track signal, said means having provision for permitting said stop to be moved into its safety position when said track signal is in its danger position, and means for preventing said stop being moved into its safety position when said track signal is in its danger position, substantially as described.

10. The combination with a track having block sections, of a track signal coöperating with a block section, means rendered active when the block section is occupied to move said track signal to its danger position, an automatic stop coöperating with a block section of the track and normally in its safety position to permit the passage of a train from one block section into a succeeding block section, and means controlled by said track signal for maintaining the automatic stop in its safety position when said track signal is in its safety position, substantially as described.

11. The combination with a track having block sections, of a track signal coöperating with a block section, means rendered active when the block section is occupied to move said track signal to its danger position, an automatic stop coöperating with a block section of the track and normally in its safety position to permit the passage of a train from one block section into a succeeding block section, means controlled by said track signal for maintaining the automatic stop in its safety position when said track signal is in its safety position, and means rendered effective by entrance of a train in the block section with which the stop coöperates, to maintain the said stop in its safety position

when the track signal is in its danger position, substantially as described.

12. The combination with a track having block sections, of a track signal coöperating with a block section, means rendered active when the block section is occupied to move said track signal to its danger position, an automatic stop coöperating with a block section of the track and normally in its safety position to permit the passage of a train from one block section into a succeeding block section, means controlled by said track signal for maintaining the automatic stop in its safety position when said track signal is in its safety position, means rendered effective by entrance of a train in the block section with which the stop coöperates, to maintain the said stop in its safety position when the track signal is in its danger position, and means for maintaining the automatic stop in its danger position and preventing it being moved into its safety position when the track signal is in its danger position, substantially as described.

13. The combination with a track provided with substantially long and substantially short block sections, a track signal operatively connected with a substantially long block to be moved to its danger position by the entrance of a train in said block, and an automatic stop operatively connected with a short block section and rendered inoperative to stop a train by entrance of said train in said short block, and rendered operative to stop a second train entering said short block while the succeeding block is occupied, substantially as described.

14. The combination with a track provided with block sections, an automatic stop operatively connected with a block section, and means to render said automatic stop inoperative to stop a train from passing from one block section to a succeeding block section, when the latter block is occupied and to render said automatic stop operative to stop a second train entering said succeeding block when the latter is occupied.

15. The combination with a track provided with block sections, of a track signal coöperating with one of said block sections, a relay connected in circuit with a block section and controlling the operation of the track signal, a device to engage the train, and a second relay connected with a block section and controlling the operation of said device, substantially as described.

16. The combination with a series of block sections of a railway, of an automatically acting train-stop comprising a trip arm for each block-section, and two circuits for each train-stop either of which when closed prevents the trip arm from being moved to its operative position, one of said circuits being opened by the passage of a train into a block-section for which the stop is provided, and the other of said circuits being closed by the entry of a train into a block section ahead of the one for which the stop is provided.

17. The combination with a series of block-sections of a railway, of an automatically-acting train-stop comprising a trip arm for each block-section, and two circuits for each train-stop either of which when closed prevents the trip arm from being moved to its operative position, one of said circuits being opened by the passage of a train into a block-section for which the stop is provided, and the other of said circuits being closed by the entry of a train into the block-section ahead of that for which the stop is provided and being opened by the passage of the said train out of the said block-section.

18. The combination with a series of block sections of a railway, of an automatically acting train-stop comprising a trip arm for each block section, two circuits for each train stop either of which when closed prevents the trip arm from being moved to its operative position, one of said circuits being opened by the passage of a train into the block-section for which the stop is provided, and the other of said circuits being closed by the entry of a train into the block succeeding that for which the stop is provided, and a source of current supply for the said circuits.

19. The combination with a series of block-sections of a railway, of an automatically-acting train-stop comprising a trip arm for each block-section, and two circuits for each train-stop either of which when closed prevents the trip arm from being moved to its operative position, one of said circuits being opened by the passage of a train into the block-section for which the stop is provided and being closed by the passage of the said train out of the said succeeding block-section, the other of said circuits being closed by the entry of a train into a block-section preceding the one for which the stop is provided, the aforesaid automatically-acting train-stop being so located relatively to the entrance end of the block-section for which it is provided that a car moving swiftly towards the train-stop will be stopped by engagement with the trip arm before the trip arm has time to move to its inoperative position, and a car moving slowly towards the said train-stop will cause the trip arm thereof to move to its inoperative position before the car has time to engage with said trip arm.

20. The combination with a train stopping device carried by the car, a trip-arm located along the line of way and adapted when the device and trip-arm are in certain relative positions to engage with the device and thereby cause an operation of the device, and means operated when the train is traveling at a low rate of speed for causing a change

in the relative positions of the device and trip-arm to prevent an operation of the device.

21. The combination with a trip-arm located along the line of way and having an operative and an inoperative position, a train stopping device carried by a car and adapted to be operated by said trip-arm when in its operative position, and means comprising a track circuit controlled by the speed of the car for causing, when the trip is in its operative position, a movement of the trip-arm to its inoperative position thereby preventing an operation of the train stopping device.

22. The combination with a train stopping device carried by a car, a trip-arm located along the trackway having an operative and an inoperative position and adapted to engage the device when the trip-arm is in its operative position and at such times to stop the car and means for causing the trip-arm to be moved to its inoperative position, which means are actuated, when the car is moving at a slow rate of speed toward the trip-arm.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL WINSOR.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.