No. 778,343. PATENTED DEC. 27, 1904.

C. M. UNDERWOOD.

AUTOMATIC TRAIN STOPPING SYSTEM.

APPLICATION FILED JULY 24, 1903.

2 SHEETS—SHEET 1.

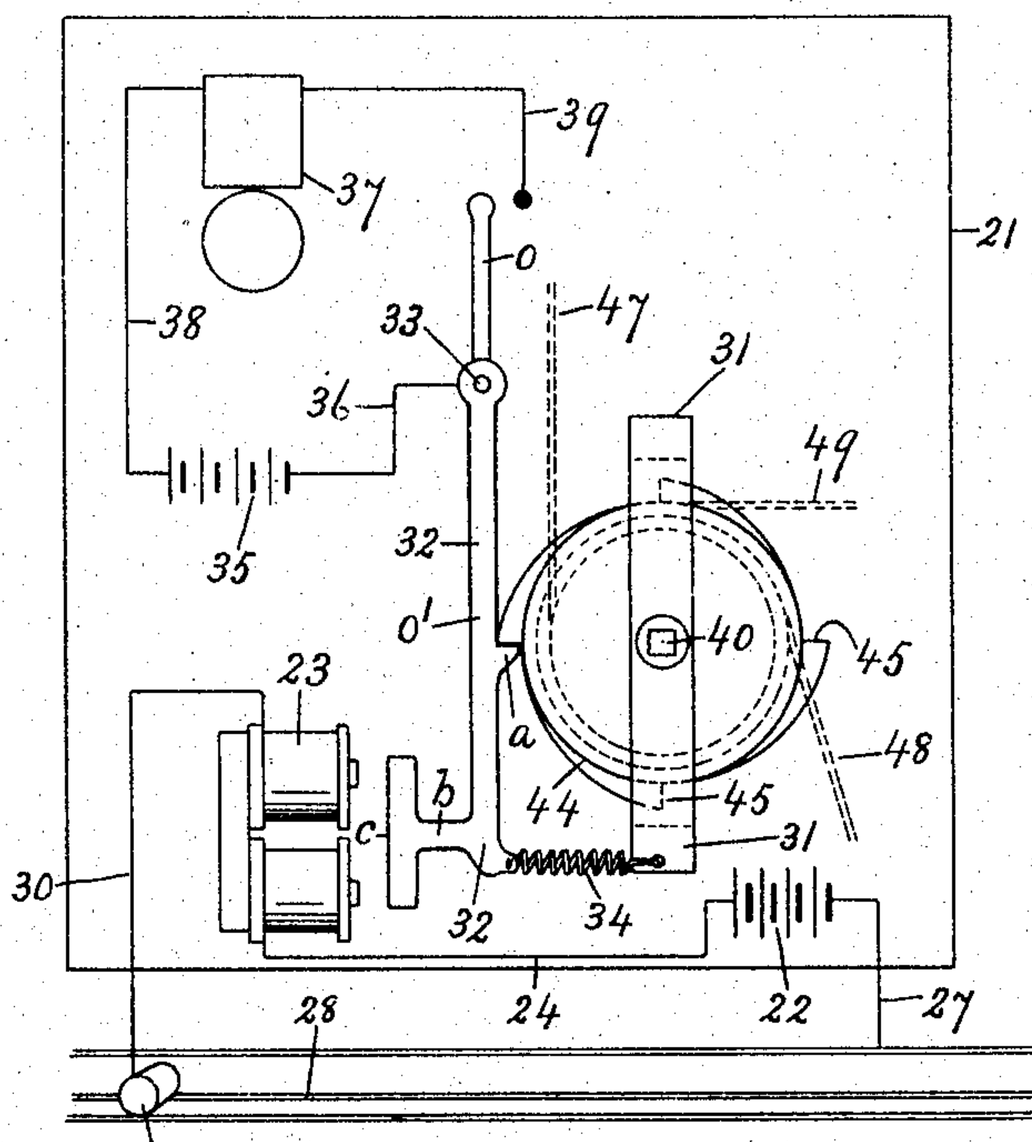

Fig. 1.

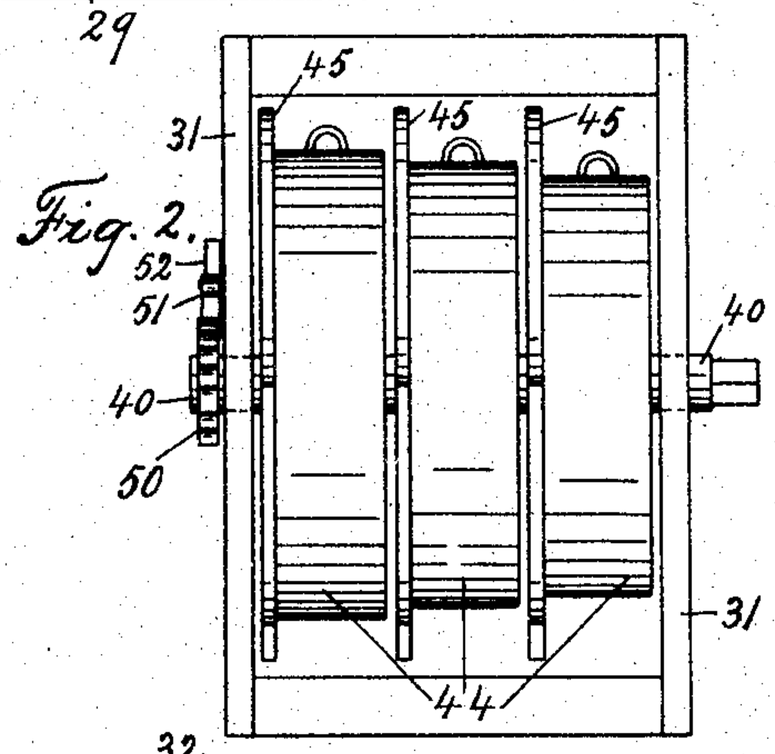

Fig. 2.

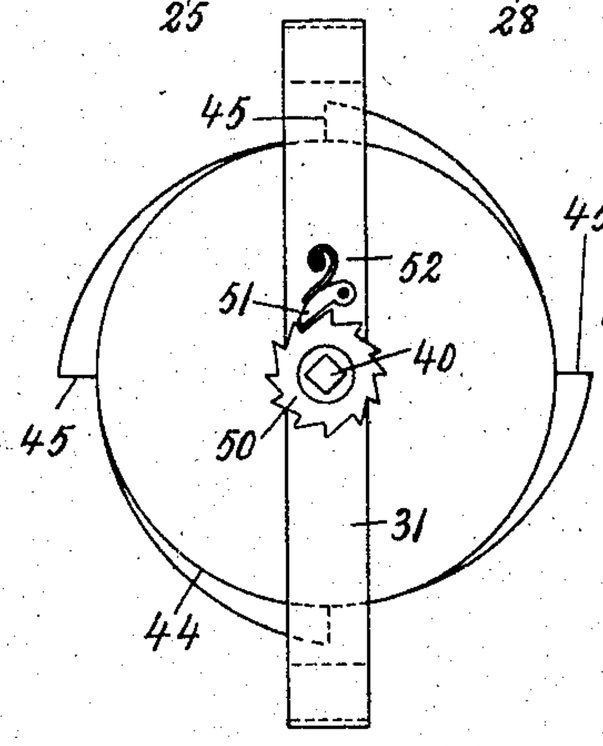

Fig. 3.

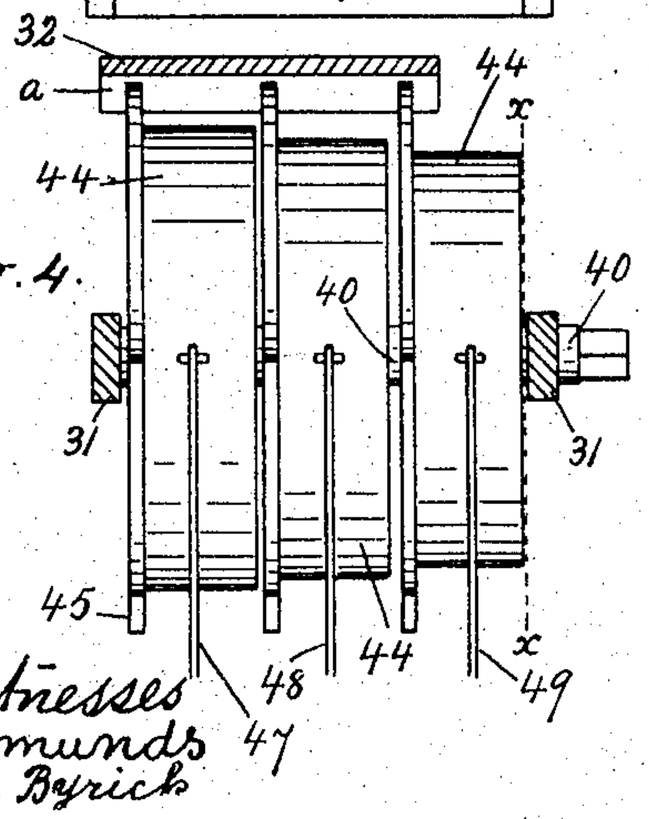

Fig. 4.

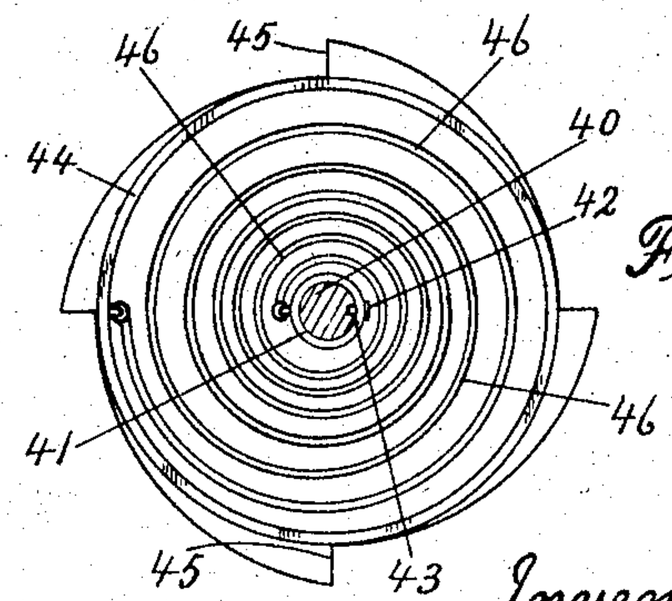

Fig. 5.

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2 SHEETS—SHEET 2.

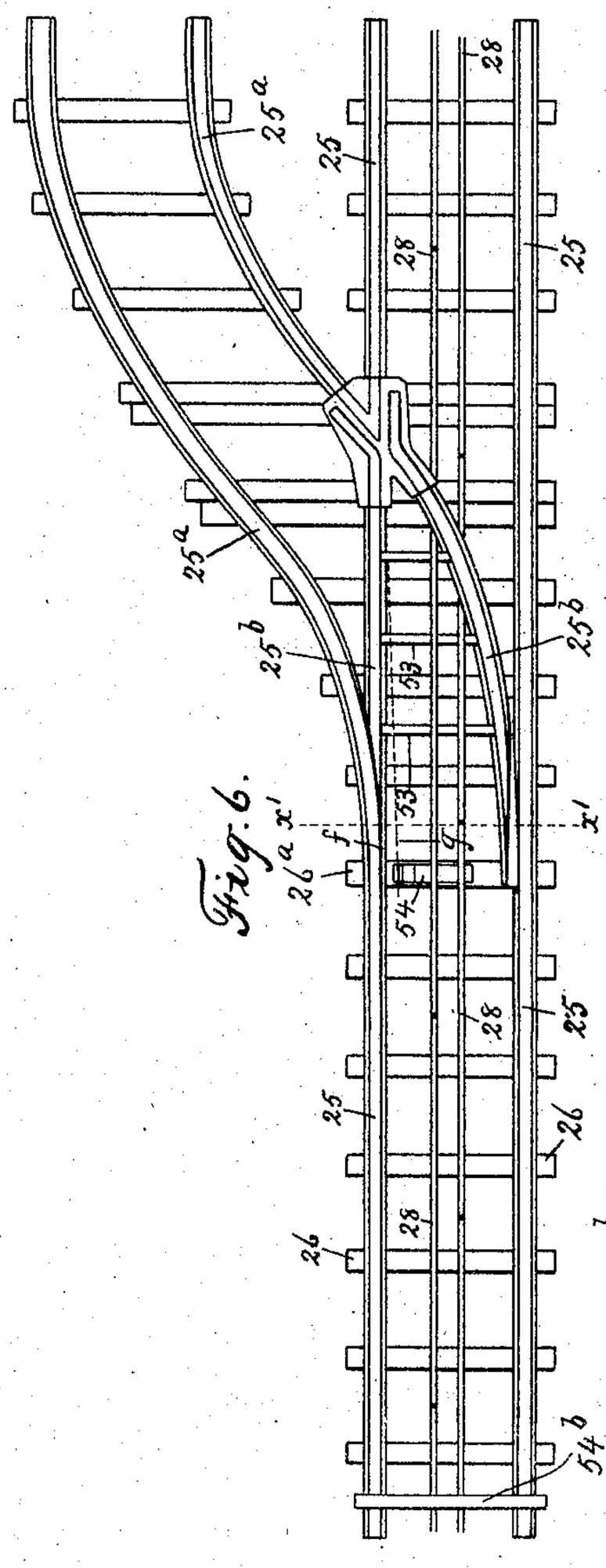

Fig. 6.

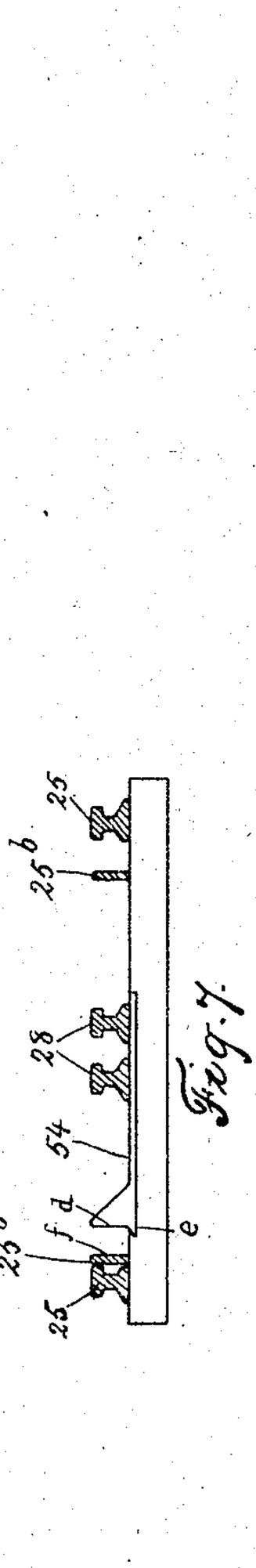

Fig. 7.

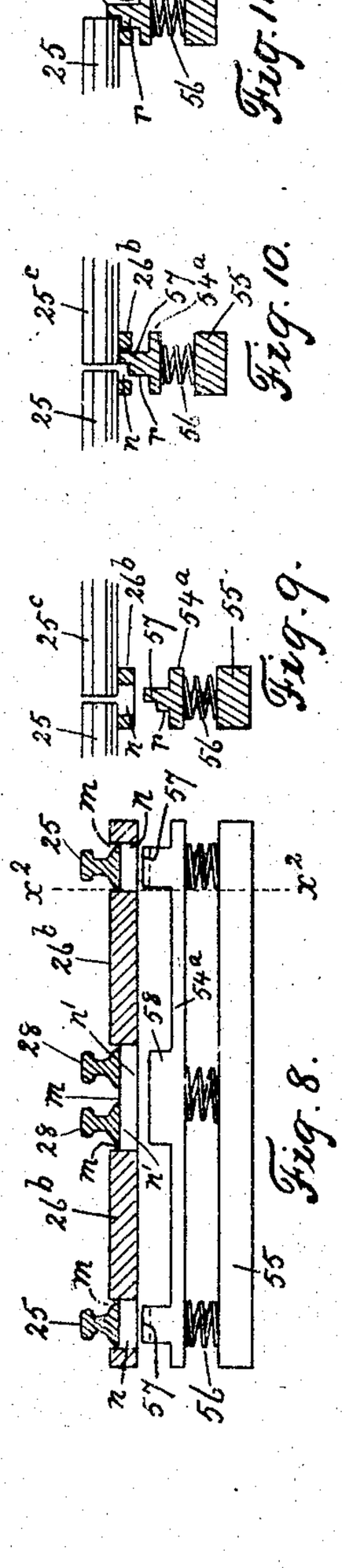

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

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No. 778,343. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

CHARLES MARCUS UNDERWOOD, OF LONDON, CANADA.

AUTOMATIC TRAIN-STOPPING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 778,343, dated December 27, 1904.

Application filed July 24, 1903. Serial No. 166,914.

To all whom it may concern:

Be it known that I, CHARLES MARCUS UNDERWOOD, a subject of the King of Great Britain, and a resident of the city of London, in the county of Middlesex, in the Province of Ontario, Canada, have invented a new and useful Improvement in Automatic Train-Stopping Systems, of which the following is a specification.

This invention relates to an automatic apparatus for stopping railroad-trains in case of danger, the object being to provide an improved apparatus which will automatically shut off the steam, apply the air-brakes, blow the steam-whistle, and ring the bell independent of one another, as well as independent of the engineer, and one that will do this when the trains are such a distance apart that they will both stop before they come together, and thus avoid all possibility of collisions or accidents from this cause; and the further object of this invention is to prevent a train from running into an open switch, an open draw-bridge, or a dangerous place in the tracks until it has been or while it is being repaired. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a front view of an apparatus embodying my invention. In this view the electrical connections of this apparatus with the rails are shown. Fig. 2 is an enlarged detail side view of the spring-barrels 44, their supporting-shaft 40, and the frame 31, in which said shaft is mounted. Fig. 3 is an enlarged detail end view of Fig. 2. Fig. 4 is a plan view of Fig. 2. In this view the top of the spring-barrel frame 31 is cut away and a portion of the lever 32, with shoulder *a* thereon, is shown. Fig. 5 is a cross-sectional view on the line $x\ x$ of Fig. 4, showing the apparatus in one of the drums or barrels. Fig. 6 is a detail plan view of a railroad-track, illustrating the alternating broken electrical conductor-rails 28, a local-electrical-circuit plate 54, and the rails 25, 25^a, and 25^b of the main line, siding, and switch-rails, respectively. Fig. 7 is a detail cross-sectional view on the line $x'\ x'$ of Fig. 6. Fig. 8 is a detail side view of a local-electrical-circuit plate 54^a, springs 56, and bed-plate 55 and a central sectional view of the abutment-tie 26^b, adjacent to a swing-bridge. In this view the local-electrical-circuit plate and the abutment-tie are slightly separated or out of their normal position and the alternating broken electrical conductor-rails 28 and track-rails 25 are shown in section and resting in recesses *m* in said abutment-tie. Fig. 9 is a cross-sectional view on the line $x^2\ x^2$ of Fig. 8. In this view the local-electrical-circuit plate 54^a and abutment-tie 26^b are also shown slightly separated or out of their normal position. Fig. 10 is another cross-sectional view on the line $x^2\ x^2$ of Fig. 8, showing the parts in their normal position and the end portions of the bridge-rails 25^c resting on the abutment-tie 26^b. Fig. 11 is another cross-sectional view on the line $x^2\ x^2$ of Fig. 8, showing the arrangement the apparatus automatically assumes to form a local electrical circuit when the rails of the swing-bridge are raised and moved off from the abutment-tie.

In the accompanying drawings the square designated by the line 21 in Fig. 1 is a box or case supported in any convenient place in the cab of the engine.

22 designates an electric battery securely held in place in said box or case 21, which battery is one of the sources of supply of electric energy required in the operation of this apparatus.

23 designates an electromagnet rigidly secured in place in said box 21, and 24 a wire or electrical connection extending from and connecting one pole of the electric battery 22 with said electromagnet 23.

25 designates the track-rails, each line of which is bonded to form one continuous electrical conductor, and said track-rails are supported by and rigidly secured to the ties 26.

27 designates a wire or electrical connection between the other pole of the battery 22 and the track-rails or continuous electrical conductors 25.

28 designates alternating broken electrical conductors or conducting-rails, two lines of which are shown and which are also rigidly secured to the ties 26 about midway between said track-rails 25, and these alternating

broken electrical conductor-rails 28 are subdivided into sections, which may be of any length; but they are preferably formed in sections of one and one-half miles long and are so arranged that the adjacent ends of the adjoining sections of one line of rails will come about midway between the ends of the sections of the opposite line, and these mile-and-a-half sections of the alternating broken electrical conducting-rails 28 are electrically bonded throughout the mile-and-a-half section; but the adjacent ends of these mile-and-a-half sections are not bonded, but are separated or insulated, so that the electrical circuit will be broken at their adjacent ends.

29 designates a trolley-wheel with which each engine is provided, and said trolley-wheel is mounted in bearings in a bracket or arm (not shown) which is secured to and extends downward from the cab of the engine, and said trolley-wheel rests on and engages with the alternating broken electrical conductor-rails 28.

30 designates a wire or electrical connection between the electromagnet 23 and the trolley-wheel 29.

31 designates a frame rigidly secured in place in said box or case 21, and 32 a soft-iron lever formed with a shoulder *a* and with a branch or arm *b* and the latter with a head or plate *c*, and said lever 32 is pivotally mounted on the pivot-bolt or fulcrum 33 between said frame 31 and the electromagnet 23, and said lever 32 is so arranged that the head or plate *c* when in its normal position will be located adjacent to and slightly separated from the electromagnet 23.

34 designates a light spring connected at one end to the frame 31 and at the other end to the lever 32 to prevent the movement of the train from accidentally disengaging the shoulder *a* from the teeth 45 of the drums 44 or swinging said lever in contact with the electromagnet 23, and said lever 32 at its center of gravity is pivotally mounted on the fulcrum 33, and the weight of the portion *o* of said lever 32 above said fulcrum 33 balances the weight of the portion *o'* of said lever below said fulcrum to assist in preventing the movement of the engine from accidentally disengaging the shoulder *a* from the teeth 45 of the drums 44 and to assist in preventing the face *c* of said lever from accidentally coming in contact with the electromagnet 23.

35 designates a second or supplemental electric battery securely held in place in said box or case 21, and 36 a wire or electrical connection between one pole of said electric battery 35 and the lever 32.

37 designates an electric bell secured in place in said box or case 21, and 38 a wire or electrical connection between the other pole of the electric battery 35 and said electric bell 37.

39 designates an electric wire which extends from the electric bell 37 to a point adjacent to the upper end of the lever 32.

40 designates a shaft supported by, held in place, and revolving perfectly free in bearings in the frame 31, and 41 designates collars or short sleeves secured on said shaft 40 by means of set-screws 42, engaging with the sockets or grooves 43, formed in said shaft.

44 designates barrels or drums, one side of which is closed, and the extension of said closed side beyond said drum or barrel is in the form of ratchet-teeth 45, and said drums are mounted and turn freely on the shaft 40.

46 designates coil-springs, one of which is secured at one end to each collar 41, and the other end of said coil-springs are secured one to the interior face of each barrel or drum 44, and three collars 41, three drums or barrels 44, and three coil-springs 46 are preferably employed, and 47, 48, and 49 designate cords or flexible bands, one of which is secured to the outer face of each drum 44, and the other ends of said cords extend to and are connected with a steam-whistle, air-brake, and steam-throttle, respectively.

50 designates a ratchet-wheel secured on the shaft 40, 51 a spring-dog pivoted on the frame 31 and adapted to engage with the teeth of said ratchet-wheel, and 52 is a spring adapted to engage with said dog to hold it in engagement with the teeth of said ratchet-wheel.

25[a] designates the track-rails of a siding or side track, and 25[b] the switch-rails, which are connected together by the cross-bars 53, so that the free ends of said switch-rails 25[b] will move together when operated by the ordinary switch-operating mechanism; but the latter is not shown, as it forms no part of my invention, and the free ends of said switch-rails 25[b] rest on the tie 26[a].

54 designates an electrical conductor or conducting-plate provided with a shoulder *d* and an extension *e* beyond said shoulder, and said plate is also secured to the tie 26[a] between the free ends of the switch-rails 25[b], and both lines of the alternating broken electrical conductors or conducting-rails 28 rest on and are in electrical contact with said electrical conducting-plate 54, and the distance between the free end *f* of one of the switch-rails 25[b] and the shoulder *d* of the conducting-plate 54 is such that when the switch is open to an engine approaching thereto from either direction the end *f* of this switch-rail will abut against the shoulder *d* and rest on the projection *e* in order to form a perfect electrical contact between said portion *f* of said switch-rail and said conducting-plate 54; but when the switch is closed or in the position shown by solid line in Fig. 6 the end of the portion *f* of said switch-rail will abut against the adjacent track-rail 25 and be entirely free from the conductor-plate 54.

26[b] designates an abutment-tie, in the upper

face of which the recesses *m m* are formed to receive the track-rails 25 and alternating broken electrical conductor-rails 28, and *n n'* designate openings formed in and extending through said tie 26[b], the openings *n* below the track-rails 25 and the openings *n'* below the alternating broken electrical conductor-rails 28 for the purpose which will be hereinafter set forth.

55 designates a supporting-sill located underneath the tie 26[b], 56 springs held in place on said supporting-sill 55, and 54[a] an electrical conductor or conducting-plate supported on said springs 56 and provided with the upwardly-projecting lugs or studs 57 and 58, and said end studs 57 project upward to a higher elevation than the central stud 58 and are each provided with a shoulder *r* of the same height as the stud 58, and 25[c] designates the ends of the track-rails extending from a swing-bridge.

54[b] designates a metal plate or bar which is placed across, rests on, and in contact with the track-rails 25 and the alternating broken electrical conductor-rails 28 for the purpose which will be hereinafter set forth.

The wire 27, extending from one pole of the electric battery 22, is electrically connected to one of the axles of one of the pair of wheels under the engine. The current thus passes to the axle and from the latter down through the wheels on said axle to both track-rails 25, and each line of track-rails being electrically bonded together two continuous electrical conductors 25 are formed, and the wire 30, extending from the electromagnet 23, is electrically connected with an arm (not shown) which extends downward from the engine and with the trolley-wheel 29, mounted on said arm, and said trolley-wheel 29 resting on said alternating broken electrical rails 28, constructed as described, alternating broken electrical conductors or conducting-rails 28 are formed.

The broken, open, or local electrical circuit formed by a single engine provided with the electrical battery 22, electromagnet 23, and trolley-wheel 29, connected together and with the continuous conductors 25 and alternating broken electrical conductors 28, as shown in Fig. 1, and the made, closed, or complete circuit formed by two engines so provided and both connected with the continuous conductors 25 and with the same mile-and-a-half section of the alternating broken electrical conductors 28 is so apparent as to require no detailed description.

Again, in the case of an open switch when the switch is open the end portion *f* of one of the switch-rails 25[b] will be adjusted in electrical contact with the electrical conducting-plate 54, as shown by dotted line *g* in Fig. 6. When so adjusted and an engine provided with the apparatus set forth in the preceding paragraph approaches this open switch from either direction, a made, closed, or complete circuit will be formed; but when this portion *f* of the switch-rail 25[b] rests against the main-track rails 25, as shown by solid lines in Fig. 6, it will be clear from the conducting-plate 54, and when an engine approaches a switch so adjusted a broken, open, or local circuit only will be formed.

Again, in the case of an open drawbridge in order to make the drawbridge operative the continuous electrical conductors or track-rails 25 and the alternating broken electrical conducting-rails 28 on the drawbridge must be and are separated from the continuation of these rails beyond the drawbridge, and the ends of said rails on said drawbridge project slightly and extend over and rest on about one half of the width and in the recesses *m* of the abutment-tie 26[b], as shown in Figs. 8 and 10, and the adjacent ends of the continuation of these rails which come up to meet the projecting ends of the rails on the drawbridge also extend over and rest on the other half and in the recesses *m* of said abutment-tie 26[b], all as shown in Figs. 8 and 10. When said rails are adjusted on said abutment-tie 26[b], as just described, and the bed or sill 55, springs 56, and the electrical conductor-plate 54[a] adjusted thereunder, as shown in Fig. 10, said springs 56 will project and hold the studs 57 and 58 in the recesses *n* and *n'*, respectively, of the tie-plate 26[b], and the studs 57 being higher than the studs 58 the former will engage with the ends of the continuous conducting-rails 25[c] on the drawbridge and the studs 58 being lower than the studs 57 the latter will hold the stud 58 away from the alternating broken electrical conducting-rails 28, and when in said position the springs 56 are compressed between the bed 55 and the electrical conducting-plate 54[a]. When so arranged and an engine passes onto or off from the drawbridge, a broken, open, or local circuit only is formed, because the drawbridge track-rails 25[c] rest on the studs 57 and compress the springs 56 and hold the stud 58 away from the alternating broken electrical conducting-rails 28. Again, on opening the drawbridge the ends of the rails 25[c] and 28 which project slightly beyond the drawbridge are raised out of the recesses *m* in the abutment tie-plate 26[b], and as said rails 25[c] are raised out of said recesses *m* the pressure is removed from the studs 57, which permits the springs 56 to expand and raise the electrical conducting-plate 54[a] until the studs 58 and shoulders *r* of the studs 57 abut against the under side of the alternating broken electrical conducting-rails 28 and conducting-rails 25, respectively, which extend up to the drawbridge, as shown in Fig. 11. When so adjusted and an engine provided with the electrical battery 22, electromagnet 23, and trolley-wheel 29 connected together and with said continuous and alternating broken electrical conductors approaches said drawbridge, a made, closed, or complete elec-

trical circuit is formed. Again, if a metal bar 54^b was placed across the track on top of and in contact with said continuous and alternating broken electrical conductor-rails and an engine provided with the mechanism described in the preceding paragraph approached said bar as soon as the trolley-wheel of the apparatus came in contact with the same mile-and-a-half section of the alternating broken electrical conductor 28, with which the said iron bar 54^b was in contact with, a made, closed, or complete electrical circuit would be formed.

When this apparatus hereinbefore described is set or arranged for operation, the drums 44 are rotated on the shaft 40 to coil the springs 46 around said shaft to form a tension thereon, which tension is maintained and the springs held coiled around said shaft by the ratchet-teeth 45 engaging with the shoulder *a* of the lever 32 and the dog 51 engaging with the ratchet-wheel 50. When so arranged, in the case where a broken, open, or local circuit only is formed the electromagnet 23 is not charged, and consequently does not attract the lower end or head *c* of the lever 32; but as soon as a made, closed, or complete circuit is formed the electromagnet 23 is charged and attracts the lower end or head *c* of the lever 32 and moves said lower end *c* in contact with said electromagnet, which disengages the shoulder *a* from the teeth 45 of the drums 44, so that the instant that a complete circuit is formed the lower end or head *c* of the lever 32 is attracted and moves toward and is held against the electromagnet 23. This moves or switches the upper end or portion of the lever 32 above the fulcrum 33 in contact with the end of the wire 39, when a complete circuit is formed which gives an alarm by ringing the bell 37. Again, the instant that the lower end *c* of the lever 32 moves toward and is held against the electromagnet 23 the shoulder *a* on said lever 32 moves away from under the teeth 45 on the barrels or drums 44. This releases or unlocks said barrels or drums and permits them to be operated by the springs 46, which springs rotate said drums and wind the cords 47, 48, and 49 around them, and said cords being attached at the other end—one to the steam-whistle, another to the air-brake, and the other to the steam-throttle, one to each device—and each barrel 44 being operated separately and independently by a separate spring the sticking of one of said devices does not affect the perfect operation of either of the others, and the operation of the air-brakes and steam-throttle is to stop the train and of the steam-whistle is to give a loud alarm and at a point at which the trains will be such a distance apart that they will be brought to a standstill long before they will meet or come together. Again, before or while the track is being repaired or in the case of a washout if a metal bar 54^b were placed across the rails at both sides of the washout or place of danger and in contact with the track and alternating broken electrical conductor-rails a local circuit would be formed, so that when an engine approached from either direction provided with the apparatus hereinbefore described a made, closed, or a complete circuit would be formed and danger avoided. Again, the continuous conductor may be a single rail and located between the track-rails and the track-rails adapted to form the alternating broken electrical conductors, and, further, it will be understood that the mechanical devices used for shutting off the steam, blowing the steam-whistle, and applying the air-brakes may be operated by energy from any other source without departing in the least from the spirit of my invention. So that all danger from collision or accidents of any kind whatever would be avoided and completely prevented by the use of this invention, because by the use of this invention it would be impossible for a train to run into an open or partly-open switch or drawbridge or into another train at rest or moving in the same or opposite directions or into a washout or a portion of a track undergoing repairs.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination in an automatic train-stopping system, with a track-circuit, of a car-circuit, with mechanism in the car-circuit for sounding an alarm, operating the air-brakes—the whistle—and steam-throttle of a locomotive, and comprising an electromagnet, a pivoted armature-lever carrying an armature, and independent spring-drums connected respectively to the air-brakes, the whistle and the steam-throttle and held normally inactive by the armature-lever, and released by the energizing of the electromagnet.

2. The combination in an automatic train-stopping system, with a track-circuit, of a car-circuit, with mechanism in the car-circuit for operating the air-brakes—the whistle—and the steam-throttle of a locomotive, and comprising an electromagnet, independent spring-drums connected respectively to the air-brakes—the whistle—and the steam-throttle of the locomotive, an armature-lever holding the drums normally inactive, and an armature carried by the armature-lever and adapted on the energizing of the electromagnet to operate the lever and release the drums, as and for the purpose described.

3. In an automatic train-stopping system, the combination of an alternating and a continuous electrical track-circuit having short-circuiting devices for switches and swing-bridges, of a car-circuit comprising an electric battery, an independent bell and bell-battery, electromagnet and a center or trolley wheel, with mechanism in the car-circuit for sounding an alarm, operating the air-brakes, the whistle, and steam-throttle of a locomo-

tive and comprising a pivoted armature-lever carrying an armature, and independent spring-drums, connected respectively to the air-brakes, the whistle and the throttle and held normally inactive by the armature-lever and released by the energizing of the electromagnet.

4. In an automatic train-stopping system, the combination of an alternating and a continuous electrical track-circuit, having short-circuiting devices for switches and swing-bridges, of a car-circuit comprising an electric battery, an electromagnet, a pivoted armature-lever carrying an armature, with mechanism in the car-circuit for operating the air-brakes, the whistle and the steam-throttle of a locomotive, and comprising independent spring-drums connected respectively to the air-brakes, the whistle, and the steam-throttle of the locomotive, an armature-lever holding the drums normally inactive, and an armature carried by the armature-lever and adapted on the energizing of the electromagnet to operate the lever and release the drums, all as and for the purpose described.

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

CHARLES MARCUS UNDERWOOD.

Witnesses:

MARGARET C. MORTIMER,

U. A. BUCHNER.