No. 774,717. PATENTED NOV. 8, 1904.

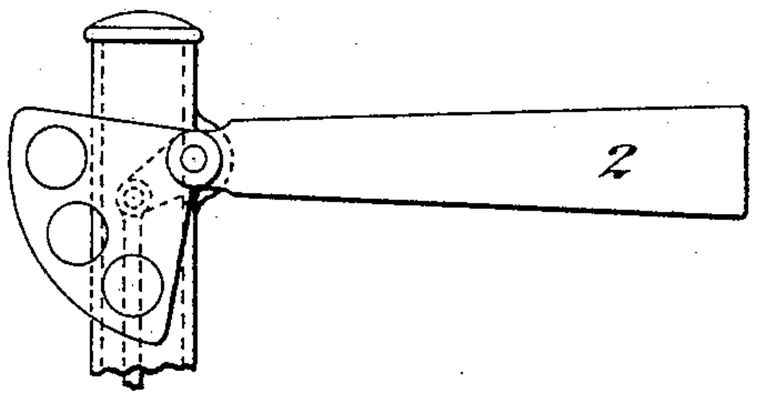
C. J. COLEMAN.

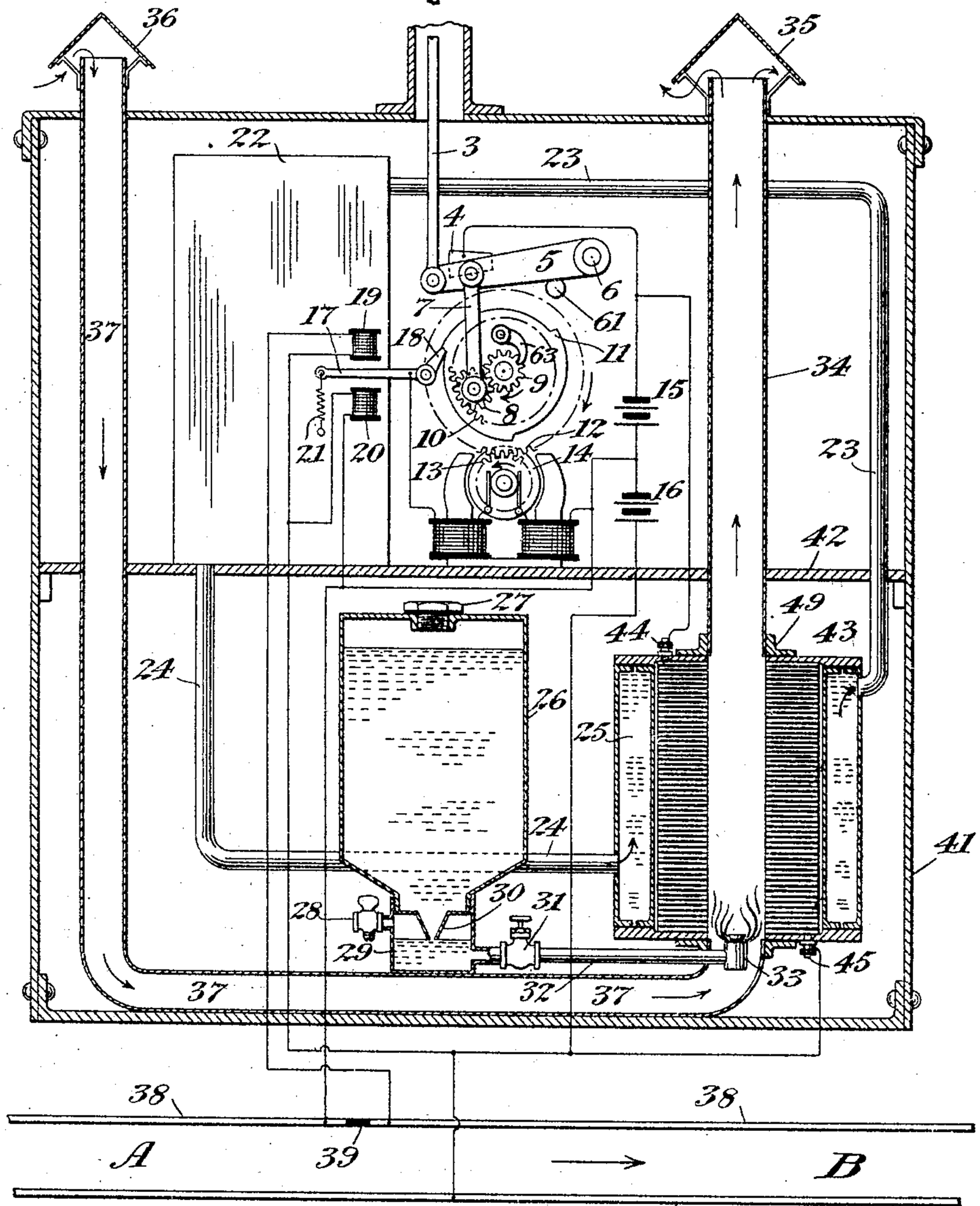
RAILWAY TRAFFIC CONTROLLING APPARATUS.

APPLICATION FILED APR. 11, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1





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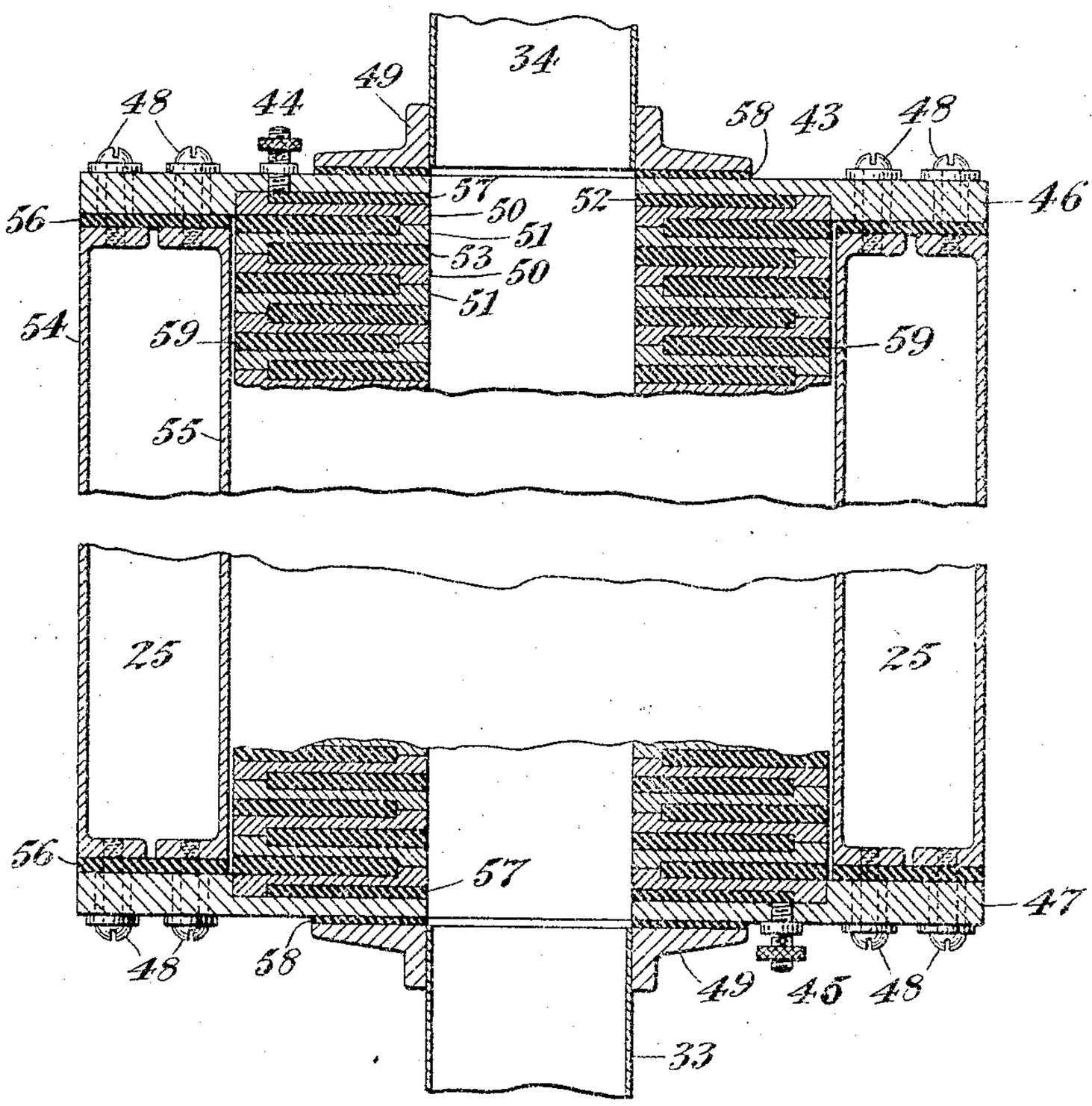
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2



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UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF ROCKAWAY, NEW JERSEY, ASSIGNOR TO THE HALL SIGNAL COMPANY, A CORPORATION OF MAINE.

RAILWAY TRAFFIC-CONTROLLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 774,717, dated November 8, 1904.

Application filed April 11, 1904. Serial No. 202,536. (No model.)

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Railway-Traffic-Controlling Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to railway traffic-controlling apparatus, including railway signaling apparatus, and to the source of energy in such apparatus.

One object of my invention is to utilize as a source or generator of energy for actuating such traffic-controlling or signaling apparatus a source or generator of thermal energy, and another object is to make such source of thermal actuating energy also a source of heat, whereby the apparatus which it actuates may be kept in a warm condition and protected from frost and other adverse conditions incident to the extreme low temperatures to which such apparatus is ordinarily exposed in service.

To these ends my invention comprehends a source or generator of thermal energy—such, for instance, as a supply of suitable fuel cooperative with a suitable burner—means for effecting a transmutation of the thermal energy into electrical energy available for actuating the traffic-controlling or signaling apparatus and when desirable a casing or inclosing device to protect the apparatus and retain a portion of the thermal energy or heat for maintaining the apparatus in warm condition, and in various of its forms my invention comprehends as its transmuter of thermal energy a continuously-operating energy-transmuting apparatus for effecting transmutations of the thermal energy into any other form, such as electrical or mechanical, available for control or actuation of the traffic-controlling or signaling apparatus.

Another object of my invention is to utilize for actuating such traffic-controlling or signaling apparatus a source or generator of energy—for instance, a source or generator of thermal or electrical energy of relatively small power and incapable of yielding or delivering energy at the rate necessary to actuate such apparatus directly.

To this end my invention comprises means to conserve the energy yielded by such a source of relatively small power and to deliver the conserved energy to the traffic-controlling or signaling apparatus at a rate sufficient to actuate the same when it is required to be actuated.

Another object of my invention is to supply energy for actuating local traffic-controlling or signaling apparatus, such as traffic-controlling or signaling mechanisms disposed at local points along a railway-line and generally so far isolated from one another and from any common center as to involve considerable difficulty or expense in supplying actuating energy to such apparatus from a common source of energy, and thus generally incurring the necessity of providing a local source of energy for each local traffic-controlling apparatus, such local sources of energy having been heretofore generally of insufficient capacity and lasting power.

To accomplish this end and to overcome these difficulties, my invention comprises a source of energy local to the local traffic-controlling apparatus and including means for the storage of potential energy in comparatively large quantities and comparatively small compass—such, for instance, as a tank which may contain fuel holding a comparatively large quantity of potential caloric or thermal energy.

Another object of my invention is to utilize a thermo-electric generator—for instance, a thermopile—as a source of electrical energy in railway traffic-controlling or signaling apparatus which is electrically controlled or actuated.

To this end my invention includes the organization of a suitable thermo-electric generator with suitable apparatus, such as a source of fuel and burner, for affecting the temperature differentiations necessary in such a generator to cause it to generate electricity.

My invention comprises various other objects, among which may be mentioned in gen-

eral terms reliability and economy of operation, economy in construction, and maintenance and saving in personal attendance; and to these ends my invention comprehends various features already mentioned and various other features which will appear in the light of the description which follows.

I will now describe that embodiment of my invention which is illustrated in the accompanying drawings and will thereafter point out my invention in claims.

In the accompanying drawings, Figure 1 is a partially-diagrammatic vertical sectional view of a railway signal-indicating apparatus in which my invention is embodied; and Fig. 2 is a vertical central enlarged sectional view of a portion of a thermo-electric generator employed in the apparatus shown in Fig. 1, the thermo-electric generator in this particular instance being a thermopile of special construction invented by me.

The signaling apparatus illustrated in the drawings is an electrically controlled and actuated normal danger block-signal semaphore type, and in order to illustrate for the sake of clearness a simple and somewhat rudimentary form of my invention I have shown in the drawings a signaling apparatus having only one semaphore, which is a home-signal semaphore and indicates only the condition of the block immediately in advance of the signal. By obvious modification my invention may be adapted to home and distant signaling apparatus.

The drawings show traffic-controlling apparatus disposed at a local point along or upon a railway-line, thus illustrating that embodiment of my invention which may be termed a "local traffic-controlling or signaling apparatus."

The motive portions of the apparatus shown in the drawings are contained within a suitable casing or box, such as 41. A suitable horizontal shelf 42 is secured to the sides of the casing and supports the signal-clearing motor 14. A tank 26, which may contain kerosene or other suitable fuel, is closed over at the top and provided with an opening through which it may be filled. The opening is normally closed by a plug 27. The lower end of the tank terminates in an inverted conical nozzle, open at its apex, and is suitably supported in a subreservoir 29, into which the conical nozzle downwardly projects. An air-vent valve 28 is normally open and affords communication between the main casing and the upper part of the subreservoir. According to well-known principles the conical nozzle automatically feeds fuel to the subreservoir, so as to maintain a constant level of fuel therein about at the elevation of the opening of the nozzle.

Within the main casing is mounted the thermopile proper, 43. The generative elements of this thermopile proper consist in annular disk-shaped members, such as 50 and 51. These elements are of duplicate form, and each is provided with a concentric annular contact-boss or juncture-boss upon one of its plain faces and immediately surrounding its inner periphery and with another concentric annular juncture-boss upon its opposite plain face and immediately within its outer periphery. The thermopile-disks are arranged concentrically one upon the other and with the positive and negative elements alternating. The inner bosses of the positive and negative elements, which may be assumed to be the elements 50 and 51, respectively, abut and form a set of annular junctures. The outer bosses of the positive and negative elements likewise abut to form another set of annular junctures. The spaces intervening between adjacent elements are filled by suitable insulating disks or washers, such as 53. The entire series of thermopile elements is clamped firmly between the upper and lower end plates 46 and 47 by means of screws, such as 48, suitably insulated from the end plates and inserted into annular flanges upon the ends of the inner and outer water-jacket cylinders 55 and 54, respectively, which form a concentric water-jacket 25 around the thermopile. Suitable insulating-gaskets, such as 56, are interposed between the end plates and the water-jacket cylinders and serve both to insulate the connection between the end plates and cylinders and to make such connection water-tight. The extreme elements of the thermopile lie within annular recesses in the inner surfaces of their respective end plates. The outer boss of each extreme element abuts against and makes electrical contact with its respective end plate, and an insulating-washer is interposed between each end plate and that portion of the thermopile element which comes within the contacting or juncture boss. The circular apertures in the annular thermopile elements are clamped in register, forming a central flue through the thermopile. Suitable binding-posts 44 and 45 are secured in the upper and lower end plates, respectively. The thermopile is arranged with its central flue in vertical position.

From the lower portion of the subreservoir 29 a fuel-pipe 32 leads to a burner 33 of any suitable design and located at the lower end of the central flue of the thermopile. A feed-valve 31, which is normally open, is interposed in this fuel-pipe.

An inlet air-flue 37 leads from the outer air through the top of the casing downwardly to the bottom thereof and thence to the lower end of the central flue of the thermopile, where it incloses the burner 33. The upper or outdoor end of this inlet air-flue is provided with a suitable cover 36 to exclude rain, dust, &c. From the upper end of the central flue of the thermopile a combined discharge-flue and heating-flue 34 leads upward through

the casing and through the top thereof and to the outer air. The upper end of this flue is provided with a suitable cover 35, similar to the cover 36 and having the same purpose. The inlet and discharge flues 37 and 34 are connected to the lower and upper end plates of the thermopile, respectively, by means of suitable flanged collars 49, secured to the end plates and insulated therefrom by insulating-washers, such as 58.

A water-tank 22 is supported upon the shelf 42. A cold-water-supply pipe or circulating-pipe 24 leads from the bottom of the tank to the bottom of the water-jacket 25 of the thermopile, and from the top of the water-jacket a return circulating-pipe 23 leads back to the water-tank and discharges into the top thereof.

The motor-armature 14 impels a gear 13 upon one shaft with the armature and meshing with another gear, 12, mounted above the gear 13 upon a common shaft with a pinion 9. An orbital or planet pinion 8 is interposed between and meshes with the pinion 9 and an internal gear 10, concentric therewith. A number of escapement-teeth 11, formed on the outer periphery of the internal gear 10, are engaged and retained by the retaining-arm 18 of a pivotally-mounted escapement-lever having also an actuating-arm 17 located between and jointly controlled by the two controlling-magnets 19 and 20, which exert opposing tractive forces upon the actuating-arm and tend to move the escapement-lever in opposite directions about its pivotal center. A retractive spring 21, secured to the actuating-arm, tends always to move the escapement-lever out of its position for retaining the internal gear.

An upwardly-extending link 7 connects the spindle or axle of the planet-pinion 8 with a signal-actuating rock-arm 5 between the pivot 6 of the rock-arm and its extreme swinging end. This swinging end is connected by an upwardly-extending signal-actuating rod 3 with the signal proper or semaphore 2 in a well-known manner.

In the normal or danger position of the signal the signal-actuating rod 3 and its rock-arm 5 are in their lowermost positions, where they are held by a suitable stop, such as the stop 61, engaged by the rock-arm. In this position of the parts the rock-arm is in contact with a contact-plate 4, included in the circuit of the motor.

A battery-charging circuit leading from the binding-posts or terminals of the thermopile includes the two storage batteries 15 and 16 in series. The battery 15 is the motor-battery. The battery 16 is the track-battery. The motor-battery actuates the motor through a circuit traceable as follows: from one pole of the battery through wire connection to one terminal of the motor, thence through the motor-fields and armature, thence through wire connection to the escapement-lever 18, and when the escapement-lever is in retaining position from the escapement-lever through its contact with the escapement periphery of the internal gear 10 to such internal gear and thence through the planet-pinion 8 and link 7 or through the metal portions and framework of the apparatus generally to the signal-actuating rock-arm 5 and thence when the rock-arm is in its normal position through the contact-plate 4 and wire connection back to the other pole of the battery.

One rail, 40, of the railway-track is conductively continuous. The other rail, 38, is divided into blocks or sections by suitable insulations, such as 39, interposed in the rail at or near each signal-indicating apparatus along the railway-line.

The track-battery 16 is bridged across the rail-circuit of the block A at the advance end of such circuit, one pole of the battery being connected to the conductively-continuous rail and the other pole being connected to the advance end of the block-A section of the conductively-discontinuous rail. The rear-block-controlling magnet 20 is likewise bridged across the advance end of the rail-circuit of the block A in rear of the signal. The advance-block-controlling magnet 19 is similarly bridged across the rear end of the rail-circuit of the block B in advance of the signal, one terminal of such magnet being connected to the conductively-continuous rail 40 and the other terminal being connected to the rear end of the advance-block section of the section-rail 38. A track-battery comprised in a signaling apparatus at the advance end of the section B, corresponding to the track-battery 16 at the advance end of the section A, normally energizes the advance-block-controlling magnet 19 through the rail-circuit of the block B. A controlling-magnet corresponding to the advance-block-controlling magnet 19 and comprised in a signaling apparatus at the rear end of the block A is similarly bridged across the rear end of the rail-circuit of the block A and is normally energized through such rail-circuit by the track-battery 16.

Normally the attraction of the rear-block-controlling magnet 20, together with the retractive effort of the spring 21 and the attraction of gravitation upon the actuating-arm 17 of the escapement-lever, preponderates over the opposing tractive effort of the advance-block-controlling magnet 19, and the escapement-lever is normally held away from its retaining position. When, however, a train enters the rear end of the rear block A, the wheels and axles of the train form a short circuit, which bridges the rail-circuit of that block and greatly reduces the current flowing from the track-battery 16 through the rear-block-controlling magnet 20. Thereupon, providing there is no train present in the advance

block B to short-circuit the rails of such advance block, and thus short-circuit the current normally flowing through such block to and through its controlling-magnet 19, the attraction of this controlling-magnet upon the actuating-arm of the escapement-lever will preponderate and raise that arm until the retaining-arm 18 thereof is brought into contact with the outer toothed periphery of the internal gear 10. Such contact between the retaining-arm and the internal gear closes the motor-circuit already traced. Thereupon the motor is started and impels the pinion 9 in the direction indicated and through the gears already described. Rotation of the pinion 9 effects a partial orbital movement of the planet-pinion 8 within its internal gear 10. By such orbital movement the planet-pinion is raised and through intermediation of the link 7 raises the signal-actuating rock-arm 5 until such rock-arm breaks contact with its contact-plate 4, thus opening the motor-circuit, whereupon the motor stops. The signal has now been moved to position indicating "clear," but tends always to return to danger position under force of suitable counterweights which are provided.

During the impulsion of the pinion 9 by the motor one of the escapement-teeth, 11, on the internal gear 10 engages and is retained by the retaining-arm 18, thus resisting rotation of the internal gear and permitting the planet-pinion to be raised or to climb within the internal gear under the impulse of the pinion 9. After the motor stops the retaining-arm still retains the internal gear, and a retaining-pawl 63, engaging the pinion 9, prevents the latter from being rotated backward under force of the tendency of the signal to return to "danger." Thus the signal is maintained in clear position as the train advances toward it from the rear and so long as the escapement-lever is maintained in retaining position. Should another train back into or otherwise enter the block B in advance of the signal, however, the advance-block-controlling magnet 19 would be deënergized by the short-circuiting effect of such train upon the rail-circuit of such block through which such controlling-magnet is normally energized, and the escapement-lever would be retracted by its retractive spring 21 away from its retaining position. Thereupon the internal gear 10 would be released and would permit the signal to be moved by its counterweight to the danger position, such movement causing the signal-actuating parts to assume their normal or danger positions and carrying the planet-pinion 8 rotatively downward about the pinion 9, and thus rotating the internal gear 10, which has been released.

Should the advance block B be occupied at the time the train enters the rear block A, then also the advance-block-controlling magnet 19 would be deënergized and would fail to place the escapement-lever in retaining position to clear the signal upon entrance of the train into the block A in the manner already described. Assuming, however, that the advance block B is clear and remains clear until the train enters such block from the rear block A, the signal will be cleared and will remain clear until such entrance of the train into the advance block, whereupon the signal will go to "danger" in the manner already described and will remain at "danger" until cleared by entrance of another train into the rear block A.

When filling the fuel-tank, the air-vent valve 28 and the feed-valve 31 are both closed before removing the plug 27 to open the refilling-aperture. After refilling the tank the plug 27 is replaced, both valves are opened, and the fuel is ignited at the burner.

The hot gases from the burner induce a convection-current of fresh air from the outer atmosphere, which passes into the top of the inlet air-flue 37 and thence to the burner from which the heated gases rise through the central flue of the thermopile and through the combined discharge and heating flue 34 and into the outer air at the top of such discharge-flue. The heated gases radiate their heat to the heating-flue 34, and the heating-flue in turn radiates heat to the air and to the apparatus inside the main casing 41, thus maintaining such apparatus in relatively warm condition, preventing the batteries from freezing, and avoiding other ill effects of low temperature.

The inner annular thermopile junctures immediately surrounding the central flue of the thermopile are heated economically by the hot gases which pass through such flue, while the outer annular junctures are effectually cooled by radiation to the water-jacket immediately surrounding them. Thus the temperature differences necessary to cause the thermopile to generate are effectually and economically maintained. A convection current of water circulates through the water-tank, water-jacket, and connecting-pipes and is cooled during its passage through the tank and pipes which radiate heat to the surrounding air and apparatus and assist the heating-flue in discharging its function.

It will be apparent that my invention and its various features may be embodied in diverse systems and structures, all coming, however, within its present scope and spirit.

What I claim, and desire to secure by Letters Patent, is—

1. Railway traffic-controlling apparatus comprising a local source of thermal energy, continuously-operating energy-transmuting apparatus, and traffic-controlling means, the thermal energy being continously converted by the transmuting apparatus and the traffic-controlling means being in coöperative relation to the transmuting apparatus and operatable by its converted energy.

2. Railway traffic-controlling apparatus

comprising a local source of heat energy, thermo-electric energy-transmuting apparatus coöperative therewith to convert the heat energy into electrical energy, and traffic-controlling means coöperative with the transmuting apparatus and operatable by its electrical energy.

3. Railway traffic-controlling apparatus comprising a local source of heat energy, continuously-operating energy-transmuting apparatus, and traffic-controlling mechanism, the heat energy being convertible by the transmuting apparatus into mechanical energy, and the traffic-controlling mechanism being coöperative with the transmuting apparatus and being operatable by such mechanical energy.

4. Railway signal-indicating apparatus comprising a local source of thermal energy, continuously-operating energy-transmuting apparatus, and signal-indicating means, the thermal energy being continuously converted by the transmuting apparatus and the signal-indicating means being in coöperative relation to the transmuting apparatus and operatable by its converted energy.

5. Railway signal-indicating apparatus comprising a local source of heat energy, thermo-electric energy-transmuting apparatus coöperative therewith to convert the heat energy into electrical energy, and signal-indicating means coöperative with the transmuting apparatus and operatable by its electrical energy.

6. Railway signal-indicating apparatus comprising a local source of heat energy, continuously-operating energy-transmuting apparatus, and signal-indicating mechanism, the heat energy being convertible by the transmuting apparatus into mechanical energy, and the signal-indicating mechanism being coöperative with the transmuting apparatus and being operatable by such mechanical energy.

7. Railway traffic-controlling apparatus comprising a local source of heat, a thermopile electric generator coöperative therewith and operatable thereby, and electrically-operatable traffic-controlling means operatable by the energy generated by the thermopile.

8. Railway signal-indicating apparatus comprising a local source of heat, a thermopile electric generator coöperative therewith and operatable thereby, and electrically-operatable signal-indicating means operatable by the energy generated by the thermopile.

9. Local railway traffic-controlling apparatus comprising a continuously-generative source of energy, an energy-conserver for receiving and conserving the energy generated by such source, and traffic-controlling means actuatable by the energy thus conserved.

10. Railway traffic-controlling apparatus comprising a traffic-controller proper actuatable by a given power, a continuous generator of energy adapted to continuously deliver energy for actuating the traffic-controller proper but at a rate less than the given power required to actuate such traffic-controller proper, and a conserver of energy in coöperative relation with the continuous generator and with the traffic-controller proper and operative to receive and conserve the energy delivered by the generator at the lesser rate and to deliver energy to the traffic-controller proper at the rate required to actuate it.

11. Railway traffic-controlling apparatus comprising traffic-controlling means proper actuatable by a given power, a continuously-productive electrical generator having a power less than that required to actuate the traffic-controlling means proper, and apparatus for conserving the energy generated by the electrical generator and for delivering to the traffic-controlling means proper the amount of power necessary to operate it.

12. Railway traffic-controlling apparatus comprising electrically-actuatable traffic-controlling means proper actuatable by a given power, a thermopile-generator adapted to continuously deliver less power than that required to actuate the traffic-controlling means proper, and a storage battery adapted to conserve the energy delivered by the thermopile-generator and to deliver to the traffic-controlling means proper the amount of electrical power required to actuate it.

13. Local railway traffic-controlling apparatus comprising energy-generating means including a source of potential energy, an energy-conserver for receiving and conserving the energy generated by such energy-generating means, and traffic-controlling means actuatable by the energy thus conserved.

14. Railway traffic-controlling apparatus comprising a traffic-controller proper actuatable by a given power, a generator of energy adapted to deliver energy for actuating the traffic-controller proper but at a rate less than the given power required to actuate such traffic-controller proper, and a conserver of energy in coöperative relation with the generator and with the traffic-controller proper and operative to receive and conserve the energy delivered by the generator at the lesser rate and to deliver energy to the traffic-controller proper at the rate required to actuate it.

15. Railway traffic-controlling apparatus comprising traffic-controlling means proper actuatable by a given power, an electrical generator having a power less than that required to actuate the traffic-controlling means proper, and apparatus for conserving the energy generated by the electrical generator and for delivering to the traffic-controlling means proper the amount of power necessary to operate it.

16. Railway traffic-controlling apparatus comprising electrically-actuatable traffic-controlling means proper actuatable by a given power, a thermopile-generator adapted to deliver less power than that required to actuate the traffic-controlling means proper, and a storage battery adapted to conserve the energy

delivered by the thermopile-generator and to deliver to the traffic-controlling means proper the amount of electrical power required to actuate it.

17. Railway traffic-controlling apparatus actuatable by thermal energy, a casing for such apparatus, and a source of heat local to such apparatus and casing and in coöperative relation therewith both to continuously actuate the apparatus and to maintain a relatively warm temperature within the casing.

18. Railway traffic-controlling apparatus comprising energy-transmuting apparatus actuatable by thermal energy, and heat-producing means local to such traffic-controlling apparatus and in coöperative relation therewith to warm the apparatus and to continuously actuate its energy-transmuter.

19. Local railway signal-indicating apparatus comprising a continuously-productive energy-generator, an energy-conserver for conserving the energy produced by such generator, and a signal-indicator coöperative with the energy-conserver and actuatable by the energy conserved therein.

20. Railway signal-indicating apparatus comprising a signal-indicator proper actuatable by a given power, a continuous generator of energy adapted to continuously deliver energy for actuating the signal-indicator proper but at a rate less than the given power required to actuate such signal-indicator proper, and a conserver of energy in coöperative relation with the continuous generator and with the signal-indicator proper and operative to receive and conserve the energy delivered by the generator at the lesser rate and to deliver energy to the signal-indicator proper at the rate required to actuate it.

21. Railway signal-indicating apparatus comprising signal-indicating means proper actuatable by a given power, a continuously-productive electrical generator having a power less than that required to actuate the signal-indicating means proper, and apparatus for conserving the energy generated by the electrical generator and for delivering to the signal-indicating means proper the amount of power necessary to operate it.

22. Railway signal-indicating apparatus comprising electrically-actuatable signal-indicating means proper actuatable by a given power, a thermopile-generator adapted to continuously deliver less power than that required to actuate the signal-indicating means proper, and a storage battery adapted to conserve the energy delivered by the thermopile-generator and to deliver to the signal-indicating means proper the amount of electrical power required to actuate it.

23. Local railway signal-indicating apparatus comprising energy-generating means including a source of potential energy, an energy-conserver for receiving and conserving the energy generated by such energy-generating means, and signal-indicating means actuatable by the energy thus conserved.

24. Railway signal-indicating apparatus comprising a signal-indicator proper actuatable by a given power, a generator of energy adapted to deliver energy for actuating the signal-indicator proper but at a rate less than the given power required to actuate such signal-indicator proper, and a conserver of energy in coöperative relation with the generator and with the signal-indicator proper and operative to receive and conserve the energy delivered by the generator at the lesser rate and to deliver energy to the signal-indicator proper at the rate required to actuate it.

25. Railway signal-indicating apparatus comprising signal-indicating means proper actuatable by a given power, an electrical generator having a power less than that required to actuate the signal-indicating means proper, and apparatus for conserving the energy generated by the electrical generator and for delivering to the signal-indicating means proper the amount of power necessary to operate it.

26. Railway signal-indicating apparatus comprising electrically-actuatable signal-indicating means proper actuatable by a given power, a thermopile-generator adapted to deliver less power than that required to actuate the signal-indicating means proper, and a storage battery adapted to conserve the energy delivered by the thermopile-generator and to deliver to the signal-indicating means proper the amount of electrical power required to actuate it.

27. Railway signal-indicating apparatus actuatable by thermal energy, a casing for such apparatus, and a source of heat local to such apparatus and casing and in coöperative relation therewith both to continuously actuate the apparatus and to maintain a relatively warm temperature within the casing.

28. Railway signal-indicating apparatus comprising energy-transmuting apparatus actuatable by thermal energy, and heat-producing means local to such signal-indicating apparatus and in coöperative relation therewith to warm the apparatus and to continuously actuate its energy-transmuter.

29. Local railway traffic-controlling apparatus comprising an energy-generator, continuously-operating energy transmuting and conserving apparatus coöperative with the generator to convert and conserve its energy, and a traffic-controller proper operatable by the energy conserved in the transmuting and conserving apparatus.

30. Local railway signal-indicating apparatus comprising an energy-generator, continuously-operating energy transmuting and conserving apparatus coöperative with the generator to convert and conserve its energy, and

a signal-indicator proper operatable by the energy conserved in the transmuting and conserving apparatus.

31. Railway traffic-controlling apparatus comprising a generator of thermal energy, continuously-operating energy transmuting and conserving apparatus in coöperative relation with the generator to convert and conserve its energy, and a traffic-controller proper operatable by the energy thus converted and conserved.

32. Railway signal-indicating apparatus comprising a generator of thermal energy, continuously-operating energy transmuting and conserving apparatus in coöperative relation with the generator to convert and conserve its energy, and a signal-indicator proper operatable by the energy thus converted and conserved.

33. Railway traffic-controlling apparatus comprising a traffic-controller proper, an energy-generator productive of energy for actuating the traffic-controller proper but at a rate less than the power necessary to actuate such controller, and energy transmuting and conserving apparatus coöperative with the generator and the traffic-controller to transmute and conserve the energy produced by the generator at the lesser rate and to deliver energy to the traffic-controller proper at the greater rate necessary to operate it.

34. Railway signal-indicating apparatus comprising a signal-indicator proper, an energy-generator productive of energy for actuating the signal-indicator proper but at a rate less than the power necessary to actuate such indicator, and energy transmuting and conserving apparatus coöperative with the generator and the signal-indicator to transmute and conserve the energy produced by the generator at the lesser rate and to deliver energy to the signal-indicator proper at the greater rate necessary to operate it.

35. Railway traffic-controlling apparatus comprising a source of heat, a thermopile coöperative therewith, energy-conserving means coöperative with the thermopile to conserve its energy, and electrically-operatable traffic-controlling means proper coöperative with the energy-conserving means and operatable by its conserved energy.

36. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, a local source of heat, and a thermopile coöperative with the source of heat and with the traffic-controlling means to actuate the latter and including one or more pairs of positive and negative thermopile elements united by a juncture substantially surrounding the source of heat.

37. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, a thermopile coöperative therewith to supply energy for operating the traffic-controlling means, and a source of heat coöperative with the thermopile to produce a difference of temperature in different spaces contiguous thereto, the thermopile including one or more pairs of positive and negative elements having a juncture substantially surrounding one of the said differentially-heated spaces.

38. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, a thermopile coöperative therewith to supply energy for operating the traffic-controlling means, and means coöperative with the thermopile to produce a difference of temperature in different spaces contiguous thereto, the thermopile including one or more pairs of positive and negative elements having a juncture substantially surrounding one of the said differentially-heated spaces.

39. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, a thermopile coöperative therewith to supply energy for operating the same, and means for effecting a difference of temperature in different spaces contiguous to the thermopile, the thermopile including one or more annular disk-shaped couples with annular junctures substantially surrounding one of the said differentially-heated spaces.

40. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, thermopile electric generating apparatus including a thermopile proper cooperative with the traffic-controlling means to supply energy for operating the same, and a source of cooling fluid coöperative with the thermopile proper to effect therein the differentiation of temperature necessary to cause the thermopile to generate.

41. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, thermopile electric generating apparatus including a thermopile proper coöperative with the traffic-controlling means to supply energy for operating the same, and a source of fluid coöperative with the thermopile proper to effect therein the differentiation of temperature necessary to cause the thermopile to generate.

42. Railway traffic-controlling apparatus comprising traffic-controlling means operatable by electricity, a thermopile operative to supply energy for operating the traffic-controlling means, a source of heat arranged to heat one set of junctures in the thermopile, and a source of cooling fluid arranged to cool the other set of junctures in the thermopile.

43. Railway traffic-controlling apparatus comprising traffic-controlling means proper operatable by electricity, thermo-electric generative apparatus generative by differentiation of temperature in such apparatus and organized in operative relation to the traffic-controlling means proper to supply actuating energy to such traffic-controlling means, and a source of fluid coöperative with the thermo-

electric generative apparatus to effect exchange of heat between such fluid and apparatus and induce in such apparatus the temperature differentiations necessary to cause it to generate.

44. Railway traffic-controlling apparatus comprising a local source of fuel, a burner and thermopile coöperative therewith to generate electricity, an electric motor operatable by the energy delivered from the thermopile, and traffic-controlling means proper operatable by the motor.

45. Railway traffic-controlling apparatus comprising a source of fuel, a fuel-burner and a thermopile coöperative therewith to generate electricity, a storage battery connected with the thermopile to conserve its energy, an electric motor operatable by current from the storage battery, and a traffic-controller proper operatable by the electric motor.

46. Railway traffic-controlling apparatus comprising a source of fuel and a fuel-burner coöperative therewith, a thermopile electric generator operative by the burner, a source of cooling fluid coöperative with the fuel-burner to effect temperature differentiation in the thermopile, and electrically-operatable traffic-controlling means adapted to be operated by the energy delivered from the thermopile.

47. Railway traffic-controlling apparatus comprising a source of fuel, a fuel-burner coöperative therewith, a thermopile electric generator operative by heat delivered from the burner, electrically-operatable traffic-controlling means proper operatable by the energy delivered from the thermopile, and a conduit for the heated gases from the burner and comprising a passage contiguous to the thermopile for heating the latter and a passage contiguous to the traffic-controlling means for keeping such means in warm condition.

48. Railway traffic-controlling apparatus comprising a source of fuel, a fuel-burner coöperative therewith, a thermopile electric generator operatable by heat from the burner, a traffic-controller proper, electrically-operatable actuating apparatus in operative relation to the traffic-controller proper and operatable by energy delivered by the thermopile electric generator, a casing inclosing the actuating apparatus, and a conduit leading from the fuel-burner and comprising a passage contiguous to the thermopile for heating the thermopile and comprising a flue passing through the casing to maintain its inclosed actuating apparatus in warm condition.

49. Railway traffic-controlling apparatus comprising a source of fuel, a fuel-burner coöperative therewith, a thermopile electric generator operatable by heat from the burner, a traffic-controller proper, controller-actuating apparatus in operative relation to the traffic-controller and operatable by energy generated in the thermopile, a casing inclosing the source of fuel, burner, thermopile electric generator and controller-actuating apparatus, and an air-conduit comprising a passage leading from the outer air to the burner and a passage leading from the burner contiguous to the thermopile and a heating-flue located within the casing and discharging outside the casing and arranged to conduct the heated gases from the burner through the casing to maintain its inclosed apparatus in a warm condition.

50. Local railway traffic-controlling apparatus comprising electrically-controllable traffic-controlling means, an electric circuit in controlling relation thereto, a source of electrical energy for such controlling-circuit, and continuously-generative energy-generating apparatus coöperative with the source of electrical energy to charge such source.

51. Railway traffic-controlling apparatus comprising electrically-controllable traffic-controlling means, a controlling-circuit in controlling relation thereto, a storage battery cooperative with such controlling-circuit to furnish energy therefor, a thermopile electric generator for charging the storage battery, and a source of heat for operating the thermopile.

52. Railway signal-indicating apparatus comprising a signal proper, electrically operatable and controllable signal-actuating mechanism coöperating with the signal proper, a controlling-circuit in controlling relation to the signal-actuating mechanism, a storage battery for operating the signal-actuating mechanism, a storage battery for supplying energy to the controlling-circuit, a thermopile for charging both storage batteries, and a source of heat coöperative with the thermopile to cause it to generate.

53. Railway traffic-controlling apparatus comprising electrically-operatable traffic-controlling means, a thermo-electric current-generator generative by temperature differentiations therein, a source of heat for heating the thermo-electric current-generator, a source of fluid coöperative with the thermo-electric generator to cool the same by absorption of heat therefrom and arranged to radiate such heat to the electrically-operatable traffic-controlling means to maintain the same in warm condition.

54. Railway traffic-controlling apparatus comprising a traffic-controller proper, electrically-operatable controller-actuating means in actuative relation to the traffic-controller proper, a thermopile electric generator in operative relation to the controller-actuating means, a source of heat arranged to heat the thermopile, a source of cooling fluid, and a circuit for such cooling fluid comprising a portion arranged to cool the thermopile by absorption of heat therefrom and comprising a portion arranged to warm the controller-actuating means by supplying heat thereto.

55. Railway traffic-controlling apparatus comprising a traffic-controller proper, elec-

trically operatable and controllable controller-actuating mechanism coöperative with the traffic-controller proper, a controlling-circuit in controlling relation to the controller-actuating mechanism, a storage battery for operating the controller-actuating mechanism, a storage battery for supplying energy to the controlling-circuit, a thermopile for charging both storage batteries, and a source of heat coöperative with the thermopile to cause it to generate.

56. Railway traffic-controlling apparatus comprising traffic-controlling means proper and a controlling electric circuit in controlling relation thereto and a thermo-electric generator of electricity for supplying electricity to the controlling-circuit.

57. Railway traffic-controlling apparatus comprising an electric traffic-controlling circuit and a thermopile coöperative therewith to supply electric current thereto.

58. Railway traffic-controlling apparatus comprising an electric traffic-controlling circuit, a storage battery coöperative therewith to supply electric energy thereto, and a thermo-electric current-generator for charging the storage battery.

59. Railway signal-indicating apparatus comprising a source of heat, a thermopile coöperative therewith, energy-conserving means coöperative with the thermopile to conserve its energy, and electrically-operatable signal-indicating means proper coöperative with the energy-conserving means and operatable by its conserved energy.

60. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, a local source of heat, and a thermopile coöperative with the source of heat and with the signal-indicating means to actuate the latter and including one or more pairs of positive and negative thermopile elements united by a juncture substantially surrounding the source of heat.

61. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, a thermopile coöperative therewith to supply energy for operating the signal-indicating means, and a source of heat coöperative with the thermopile to produce a difference of temperature in different spaces contiguous thereto, the thermopile including one or more pairs of positive and negative elements having a juncture substantially surrounding one of the said differentially-heated spaces.

62. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, a thermopile coöperative therewith to supply energy for operating the signal-indicating means, and means coöperative with the thermopile to produce a difference of temperature in different spaces contiguous thereto, the thermopile including one or more pairs of positive and negative elements having a juncture substantially surrounding one of the said differentially-heated spaces.

63. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, a thermopile coöperative therewith to supply energy for operating the same, and means for effecting a difference of temperature in different spaces contiguous to the thermopile, the thermopile including one or more annular disk-shaped couples with annular junctures substantially surrounding one of the said differentially-heated spaces.

64. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, thermopile electric generating apparatus including a thermopile proper cooperative with the signal-indicating means to supply energy for operating the same, and a source of cooling fluid coöperative with the thermopile proper to effect therein the differentiation of temperature necessary to cause the thermopile to generate.

65. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, thermopile electric generating apparatus including a thermopile proper cooperative with the signal-indicating means to supply energy for operating the same, and a source of fluid coöperative with the thermopile proper to effect therein the differentiation of temperature necessary to cause the thermopile to generate.

66. Railway signal-indicating apparatus comprising signal-indicating means operatable by electricity, a thermopile operative to supply energy for operating the signal-indicating means, a source of heat arranged to heat one set of junctures in the thermopile, and a source of cooling fluid arranged to cool the other set of junctures in the thermopile.

67. Railway signal-indicating apparatus comprising signal-indicating means proper operatable by electricity, thermo-electric generative apparatus generative by differentiation of temperature in such apparatus and organized in operative relation to the signal-indicating means proper to supply actuating energy to such signal-indicating means, and a source of fluid coöperative with the thermo-electric generative apparatus to effect exchange of heat between such fluid and apparatus and induce in such apparatus the temperature differentiations necessary to cause it to generate.

68. Railway signal-indicating apparatus comprising a local source of fuel, a burner and thermopile coöperative therewith to generate electricity, an electric motor operatable by the energy delivered from the thermopile, and signal-indicating means proper operatable by the motor.

69. Railway signal-indicating apparatus comprising a source of fuel, a fuel-burner and

a thermopile coöperative therewith to generate electricity, a storage battery connected with the thermopile to conserve its energy, an electric motor operatable by current from the storage battery, and a signal proper operatable by the electric motor.

70. Railway signal-indicating apparatus comprising a source of fuel and a fuel-burner coöperative therewith, a thermopile electric generator operative by the burner, a source of cooling fluid coöperative with the fuel-burner to effect temperature differentiation in the thermopile, and electrically-operatable signal-indicating means adapted to be operated by the energy delivered from the thermopile.

71. Railway signal-indicating apparatus comprising a source of fuel, a fuel-burner cooperative therewith, a thermopile electric generator operative by heat delivered from the burner, electrically-operatable signal-indicating means proper operatable by the energy delivered from the thermopile, and a conduit for the heated gases from the burner and comprising a passage contiguous to the thermopile for heating the latter and a passage contiguous to the signal-indicating means for keeping such means in warm condition.

72. Railway signal-indicating apparatus comprising a source of fuel, a fuel-burner cooperative therewith, a thermopile electric generator operatable by heat from the burner, a signal proper, electrically-operatable actuating apparatus in operative relation to the signal proper and operatable by energy delivered by the thermopile electric generator, a casing inclosing the actuating apparatus, and a conduit leading from the fuel-burner and comprising a passage contiguous to the thermopile for heating the thermopile and comprising a flue passing through the casing to maintain its inclosed actuating apparatus in warm condition.

73. Railway signal-indicating apparatus comprising a source of fuel, a fuel-burner cooperative therewith, a thermopile electric generator operatable by heat from the burner, a signal proper, signal-actuating apparatus in operative relation to the signal and operatable by energy generated in the thermopile, a casing inclosing the source of fuel, burner, thermopile electric generator and signal-actuating apparatus, and an air-conduit comprising a passage leading from the outer air to the burner and a passage leading from the burner contiguous to the thermopile and a heating-flue located within the casing and discharging outside the casing and arranged to conduct the heated gases from the burner through the casing to maintain its inclosed apparatus in a warm condition.

74. Local railway signal-indicating apparatus comprising electrically-controllable signal-indicating means, an electric circuit in controlling relation thereto, a source of electrical energy for such controlling-circuit, and continuously-generative energy-generating apparatus coöperative with the source of electrical energy to charge such source.

75. Railway signal-indicating apparatus comprising electrically-controllable signal-indicating means, a controlling-circuit in controlling relation thereto, a storage battery cooperative with such controlling-circuit to furnish energy therefor, a thermopile electric generator for charging the storage battery, and a source of heat for operating the thermopile.

76. Railway signal-indicating apparatus comprising electrically-operatable signal-indicating means, a thermo-electric current-generator generative by temperature differentiations therein, a source of heat for heating the thermo-electric current-generator, a source of fluid coöperative with the thermo-electric generator to cool the same by absorption of heat therefrom and arranged to radiate such heat to the electrically-operatable signal-indicating means to maintain the same in warm condition.

77. Railway signal-indicating apparatus comprising a signal proper, electrically-operatable signal-actuating means in actuative relation to the signal proper, a thermopile electric generator in operative relation to the signal-actuating means, a source of heat arranged to heat the thermopile, a source of cooling fluid, and a circuit for such cooling fluid comprising a portion arranged to cool the thermopile by absorption of heat therefrom and comprising a portion arranged to warm the signal-actuating means by supplying heat thereto.

78. Railway signal-indicating apparatus comprising signal-indicating means proper and a controlling electric circuit in controlling relation thereto and a thermo-electric generator of electricity for supplying electricity to the controlling-circuit.

79. Railway signal-indicating apparatus comprising an electric signal-circuit and a thermopile coöperative therewith to supply electric current thereto.

80. Railway signal-indicating apparatus comprising an electric signal-circuit, a storage battery coöperative therewith to supply electric energy thereto, and a thermo-electric current-generator for charging the storage battery.

81. An electric traffic-controlling circuit including as conductors the rails of a railway-line, traffic-controlling apparatus controllable by the controlling-circuit, and a thermo-electric electricity-generator for supplying energy to the controlling-circuit.

82. Railway traffic-controlling apparatus, a traffic-controlling electric circuit in controlling relation to the traffic-controlling apparatus and including the rails of the railway-track,

and thermopile current-generating apparatus for supplying energy to the traffic-controlling circuit.

83. An electric railway signaling-circuit including as conductors the rails of the railway-line, signal-indicating apparatus controllable by the signaling-circuit, and thermo-electric electricity-generating apparatus for energizing the signaling-circuit.

84. Railway signaling apparatus, an electric signaling-circuit in controlling relation thereto and including a rail of the railway-line, and a thermopile electric generator for supplying energy to the signaling-circuit.

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

CLYDE J. COLEMAN.

Witnesses:

ALBERT V. T. DAY,

HENRY BARNES.