No. 780,222. PATENTED JAN. 17, 1905.

G. E. PALMER.

ELECTRIC LIGHTING SYSTEM.

APPLICATION FILED JUNE 1, 1903.

4 SHEETS—SHEET 1.

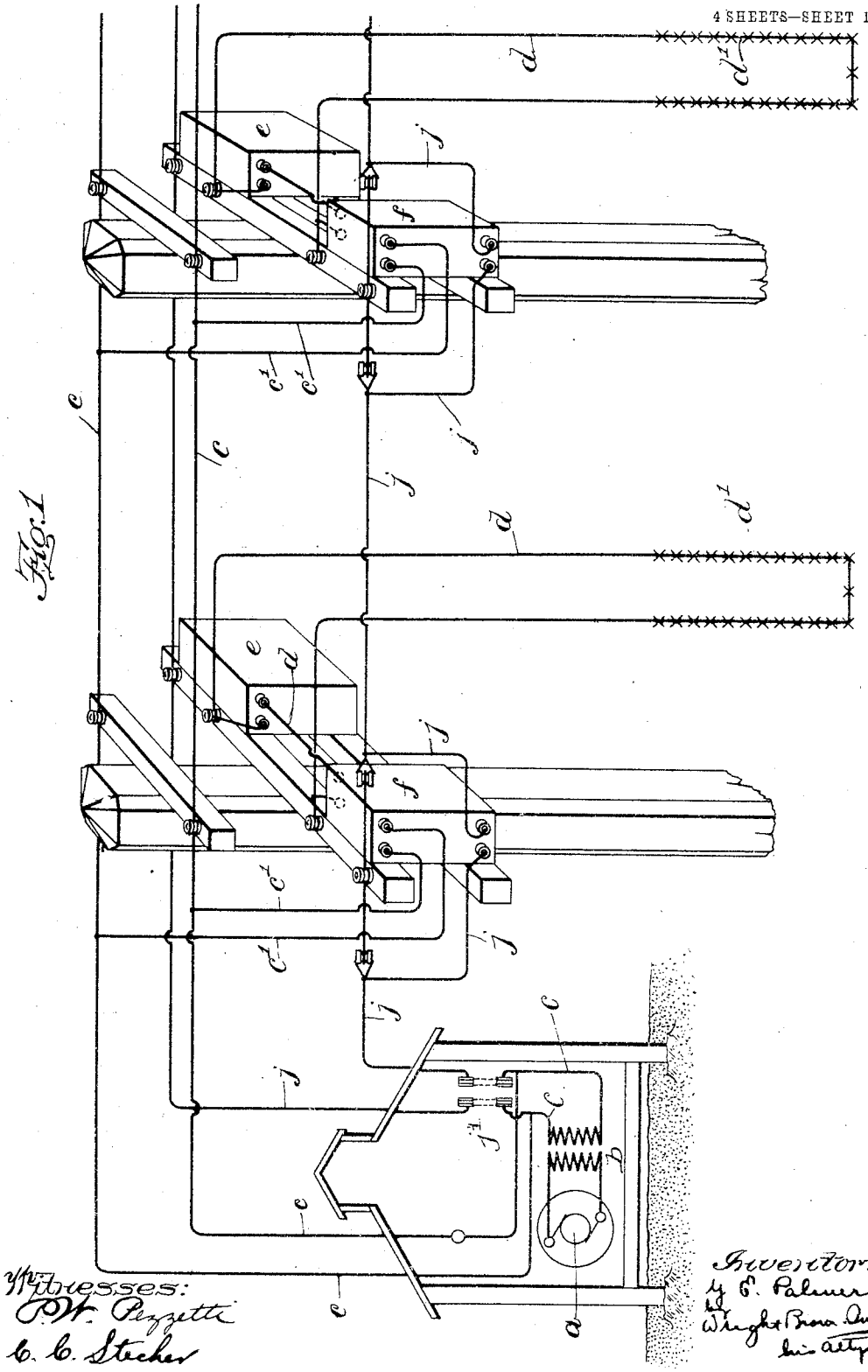


Fig. 1

Witnesses:
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C. C. Stecher

Inventor:
G. E. Palmer
by Wright Brown Quinby & Alley

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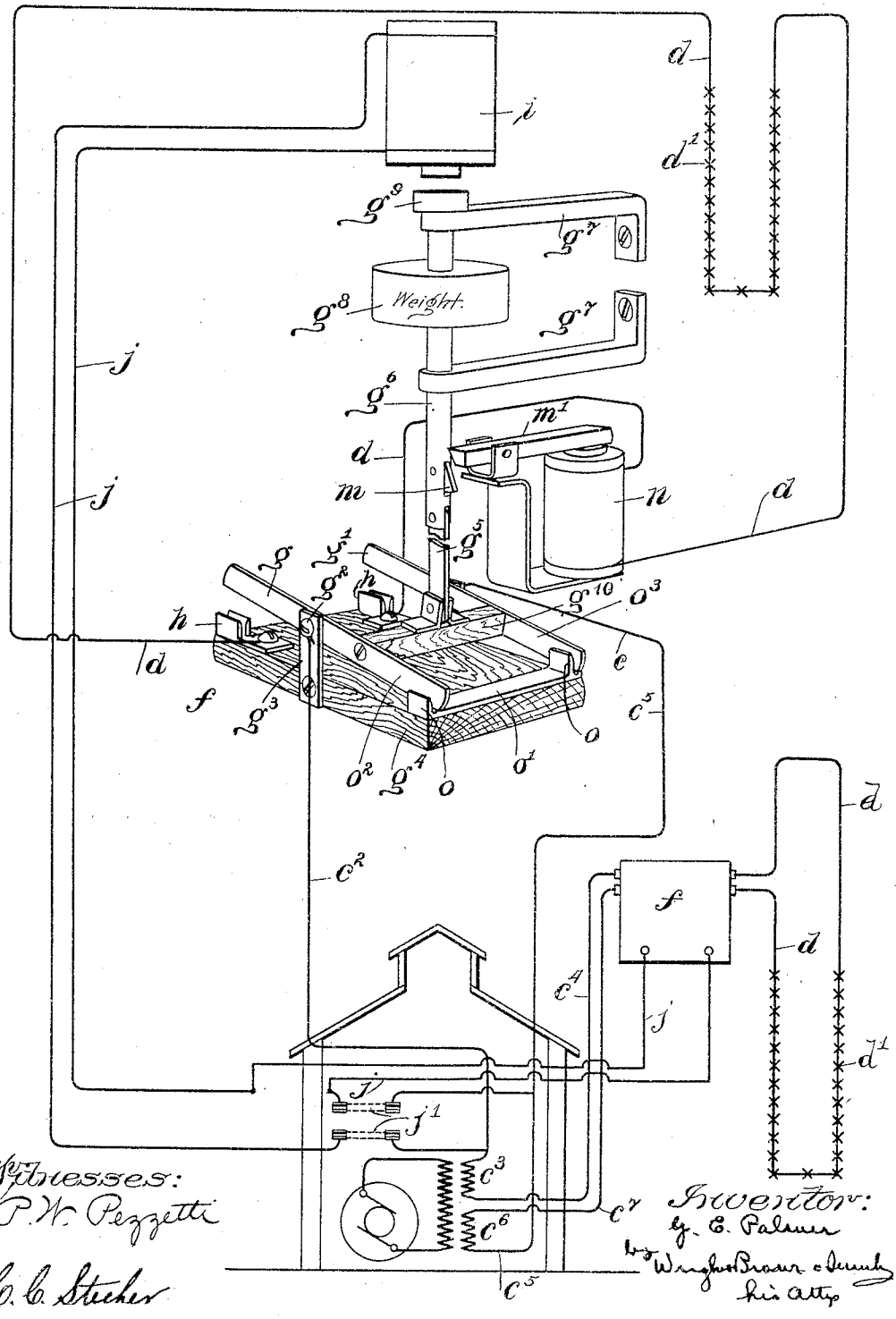
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4 SHEETS—SHEET 2.

Fig. 2



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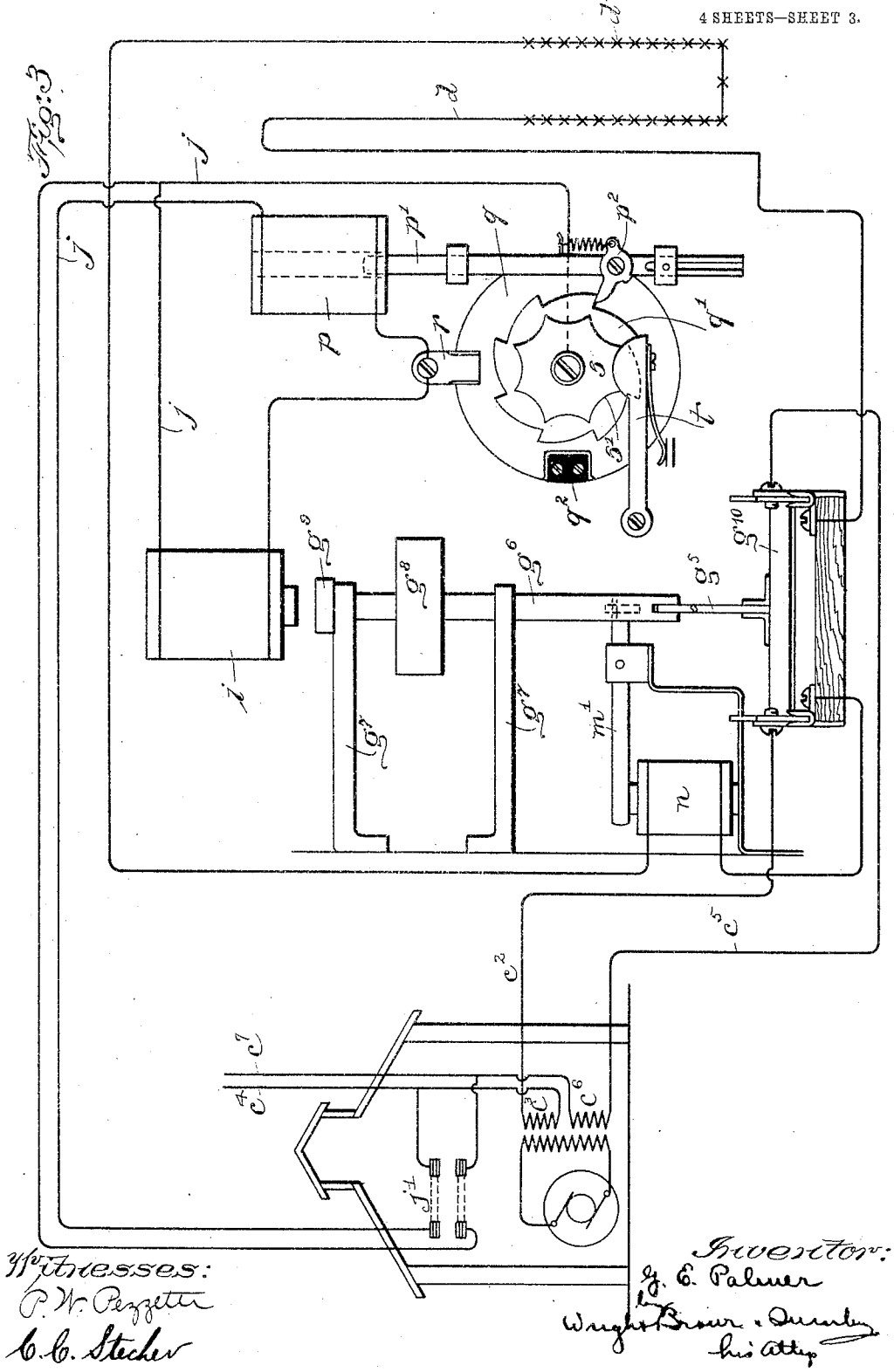
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4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

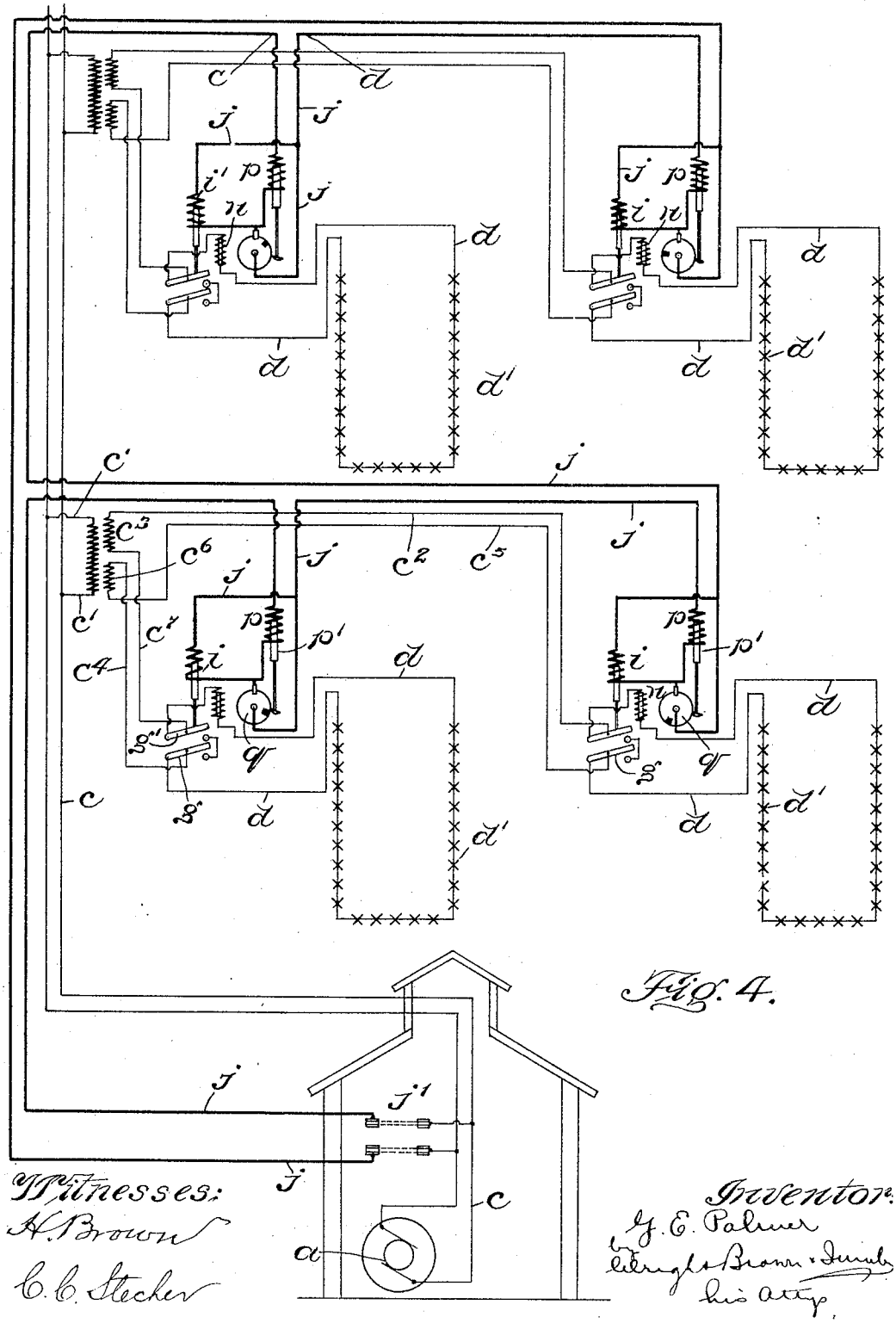


Fig. 4.

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No. 780,222. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

GRANVILLE E. PALMER, OF BOSTON, MASSACHUSETTS.

ELECTRIC-LIGHTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 780,222, dated January 17, 1905.

Application filed June 1, 1903. Serial No. 159,471.

To all whom it may concern:

Be it known that I, GRANVILLE E. PALMER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electric-Lighting Systems, of which the following is a specification.

This invention has relation to systems of electrical distribution, and has for its object the provision of remotely-controlled selective mechanism for actuating independent switches and for automatically effecting the actuation of each of said switches upon the opening or rupturing of a branch circuit controlled thereby.

The invention is illustrated as embodied in a lighting system in which there are a plurality of arc-lamp circuits with the lamps of each circuit arranged in series and a controller for each lamp-circuit operatable from a central station, so that an operator at said station may switch on any desired lamp-circuit, each lamp-circuit having its origin either adjacent to or remote from said central station, and in the illustrated embodiment of the invention there is an electromagnetic mechanism for each lamp-circuit, which effects the opening of said circuit in the event of its rupture without affecting the remainder of said lamp-circuit.

The recent vast increase in the mileage of copper wire, due to the more general use of series arc-lamps for street-lighting, has seriously embarrassed the operators of electric-light plants on account of the municipal restrictions placed on the erection of aerial wires and the high cost of building and maintaining underground ducts constructed to carry conductors of high-tension currents. In operating series arc-lines a potential of five thousand volts is considered a maximum working voltage, this voltage representing a series of fifty lamps, with two wires for each series. As there are numerous cities in which the number of series arc-lamps exceed four thousand, this involves the centralization of one hundred and sixty wires where power is furnished from one station. The economical operation of electric-lighting systems demands the centralization of generating apparatus and involves the use of large units, which may not from their character always be placed at the nearest point to the center of electrical distribution. At present nearly all electrical-lighting plants are being equipped with alternating dynamos which involve the employment of series alternating lamps.

According to the present invention a system is provided which readily admits of a flexible manner of distribution from substations with a corresponding reduction in copper mileage, thereby permitting a material reduction in the network of small wires carrying current of high potential which previously led from the central power-house and also permitting of the main feeder-conductors to be used through the entire twenty-four hours. This is an improvement of importance, as a capital invested in independent lines for street-lighting is idle during the day-time.

One of the most important features of the present invention is the employment of a under-load release-switch especially designed to open or short-circuit the alternating series arc-circuit upon the breaking of its conductors, since upon such breaking of its conductors the potential of the circuit increases from fifty to one hundred per cent., rendering hanging wires extremely hazardous to the safety of the general public and tending to break down the installations of the line and lamps, which ordinarily have no great factor of safety in this regard. The underload release-switch protects the regulator and the lamps from an immense rush of current in the event of the line closing after accidental rupture, a thing which often occurs in the operation of series arc-lines.

The conditions which the present invention is designed to meet are not found in the operation of series direct systems, as they are supplied with current from series constant-current dynamos, the potential of which falls to zero the moment the circuit is opened.

Referring to the accompanying drawings, Figure 1 represents a diagrammatic view of a system embodying the invention in which the current of the circuit is governed by inductive regulators. Fig. 2 represents, partially in perspective and partially in diagram, the details of the controlling-switch for a series of lamps

in which the current of the circuit is governed by "tub" transformers. Fig. 3 represents another embodiment of the invention, showing the selective feature thereof. Fig. 4 illustrates the invention illustrated by a diagrammatic view as embodied in a system having four lamp-circuits.

On the drawings, and referring particularly to Fig. 1, a indicates a source of current, b a static transformer, and c the conductor by which the alternating current is carried to the two lamp-circuits d d. Two series of arc-lamps are indicated, respectively, at d' d', there being twenty-five lamps in each circuit. Interposed between the circuit c c, which may be referred to as the "main" circuit, and the lamps are constant-current regulators (indicated at e) and the remote controller and automatic release mechanism, (indicated as a whole at f.) No attempt is herein made to illustrate or describe the constant-current regulator, as it is well known. The conductors c' c' lead from the conductors of the main circuits to the switch mechanism f, and from the opposite side of said switch mechanism leads one of the conductors, forming a portion of the lamp-circuit d, the other conductor forming a portion of said circuit, extending from said switch mechanism f to the automatic regulator e. It will be seen that said mechanism f comprises an electromagnetic switch consisting of two bars g g', respectively pivoted by pivots g^2 to uprights g^3, arising from a base g^4, formed of insulating material. These two bars g g' form movable contacts, and to them are connected the conductors c' c', as shown. The stationary contacts are indicated at h h. They are mounted upon the base g^4 and electrically connected to the conductors of the lamp-circuit d. The part of the switch mechanism that opens and closes the main circuit c c' is immersed in an oil-bath, as illustrated in my copending application and suitably designed to handle the circuit. The two movable contacts g g' are connected by a cross-bar g^{10} of insulating material, in turn connected by a link g^5 to a vertical plunger g^6. This plunger is adapted to move in suitable guides g^7, and when it drops by reason of the weight g^8 it moves the contacts g g' to inactive position, as shown in Fig. 2. To the upper end of the plunger is secured a cup-shaped armature g^9, placed in potential relation to the starting-magnet i. The coils of this magnet form a part of a circuit j in multiple with the main circuit c c. At the power-house, which is indicated conventionally in all the figures, there is a duplex switch j', by means of which the circuit j may be closed so as to energize the magnet i to attract the armature g^9 and raise the plunger g^6 so as to depress the contacts g g' into electrical and mechanical engagement with the contacts h h, and thus close the lamp-circuit d.

It will be observed that the plunger g^6 is formed with a spring-pressed pawl m, which when the plunger is raised passes by a lever m', pivoted between its ends. The pawl or latch m is adapted to snap over the shorter end of the lever when the armature g^9 rises to its upper limit of movement. The longer end of the pawl m serves as an armature for a magnet n, placed in series in the lamp-circuit d. When the magnet n is deënergized, the weight g^8 is sufficient to cause the latch m to depress the shorter end of the lever m', so as to permit the plunger to drop to the position shown in Fig. 2. As soon, however, as the circuit is closed by the operator through the medium of the switch j' through the circuit j the plunger is raised to close the lamp-circuit d, the coils of the magnet n are immediately energized, so as to hold the lever m' against movement, and the operator may thereupon open the circuit j, and the plunger will be maintained in a raised position by the engagement of the latch with the lever m', so as to prevent the breaking of the circuit d. In case, however, the circuit d becomes broken from any cause, as by breakage of the conductor-wire, the magnet n is immediately deenergized and the weight g^8 causes the plunger to drop, so as to completely cut out the lamp-circuit d. The electromagnetic mechanism thus described as being in each lamp-circuit d holds the switch in closed position and automatically effects the opening of said circuit upon the rupture or breaking of said circuit.

In Fig. 1 the lamp-circuits d are all shown in multiple with the main circuit c; but in Fig. 2 a transformer is shown of the so-called "tub" type, in which it is desirable to cut out one lamp-circuit without affecting the other circuit. In the last-mentioned figure one of the switches, f, is shown conventionally as in a casing substantially as in Fig. 1, whereas the mechanism of the other switch, f, is illustrated in perspective view. In this case the conductor c^2 passes from one end of the secondary c^3 to one switch, f, while the conductor c^4 from the other end of said secondary passes to the other switch, f, shown conventionally as stated. The conductor c^5 passes through one end of the other secondary c^6 to the first-mentioned switch f, whereas the conductor c^7 from the other end passes to the second switch f. In this instance it is desirable that upon the base g^4 there should be placed stationary contacts o o, electrically connected by a cross-bar o'. The contacts g g' are provided with extensions o^2 o^2, which when the plunger is depressed will be caused to electrically and mechanically engage the contacts o o, so as to close the circuit between the conductors c^2 and c^5, so as not to affect the second lamp-circuit d. It is likewise desirable to control the starting-switches independently. This is accomplished by a mechanism illustrated in Fig. 3. Interposed in the controlling-circuit j in

multiple with the starting-magnet i there is a solenoid-magnet p, a rotative electrically-conducting disk or member q, and a brush r, bearing against said disk. This disk is rotatively mounted and is provided with the ratchet q'. The armature or plunger p' of the magnet carries a spring-tension pawl p^2, adapted to engage the teeth of said ratchet and move the ratchet and disk one space when the solenoid p is energized by the closing of the circuit j. The disk is preferably formed of copper with a wooden backing and is provided with an insulated section q^3. The current j is normally short-circuited through the solenoid p, which has a relatively low resistance, the brush r, and the disk q, except when the insulated section q^3 has engaged the brush r, in which event the circuit will be closed through the magnet i, so as to energize said magnet and effect the operation of the switch mechanism. A stop mechanism comprising a plate s, having notches s' affixed to the disk q, in combination with a spring-pressed dog t, adapted to enter said notches, is utilized for centering the disk and holding it against movement, except when actuated by the pawl on the plunger p'. By virtue of these devices each lamp-circuit may be independently controlled, so that it is possible to connect one lamp-circuit with the main circuit without connecting another.

It will be understood that the switch mechanisms f will all be in series in the starting-circuit, as shown in Fig. 4, the starting-circuit being illustrated by the black lines, and that for the several lighting-circuits, of which there may be as many as there are teeth on the ratchet, the disks q will be in different positions with relation to each other and their respective switches, no two of them at one time being in position to effect the closing of a circuit through the starting-magnet i, and although each time the starting-circuit is closed all of the rotative disks q will be advanced one step, yet only one starting-magnet i will be energized at a time, so as to cut in the series of lamps controlled thereby. As soon as one series of lamps is cut in the operator may break the circuit j and again close it by the switch j'', so as to effect another partial rotation of all of the disks and cut in another i, so as to throw in another lamp-circuit. This may be done successively until all of the lamp-circuits are thrown in. As soon as any one of the lamp-circuits is ruptured, however, the lamps are automatically cut out by the mechanism previously described.

The switch-operating magnets are normally deënergized, but their energization is selective, although all of them are singly energized from a single controlling-circuit. In this respect a simpler arrangement of elements and a cheaper, more durable, and better construction are provided than if the switch-magnets were energized by one circuit and the disk-operating magnets were energized by another circuit or if it were attempted to energize all the switch-magnets simultaneously and selectively prevent the actuation of all of the armatures or switches save the particular one to be actuated.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. An electric-lighting circuit comprising a main circuit having a plurality of lamp-circuits in multiple branches, each branch circuit having a switch therein, means independent of said lamp-circuits and operatable remotely from said switches for closing them, and means for automatically opening each switch independently of the other or others upon the breaking or opening of the lamp-circuit containing said switch.

2. An electric-arc-lighting system comprising a main circuit, a plurality of lamp-circuits in multiple with the main circuit, each lamp-circuit having a plurality of arc-lamps in series, a switch in each lamp-circuit, means independent of the lamp-circuits and controlled remotely from said switches for closing them, and means controlled by said lamp-circuits for automatically opening each switch independently of the other or others upon the breaking or opening of said lamp-circuit containing said switch.

3. An electric-arc-lighting system comprising a plurality of lamp-circuits in multiple branches, a switch in each lamp-circuit, said switch consisting of quadruple poles connected together and adapted to make contact alternately with a pair of separated contacts in said lamp-circuit or with two electrically-connected contacts, means independent of said lamp-circuit and controlled at a point remote from said switch for causing each switch to close its lamp-circuit through the first-mentioned contacts, and means for causing each switch to automatically engage said second-mentioned contacts independently of any other of said switches, upon the opening or breaking of its lamp-circuit.

4. An electric-arc-lighting system comprising a plurality of lamp-circuits in multiple branches, an independent switch in each circuit for opening and closing said circuit, electromagnetic mechanisms controlled at a point remote from said switches for operating them, there being an electromagnetic mechanism for each switch, and a controlling-circuit independent of said lamp-circuits in series with all of said electromagnetic mechanisms, said controlling-circuit having selective means in series for energizing and actuating said electromagnetic mechanisms singly or one at a time.

5. An electric-arc-lighting system comprising a circuit having a plurality of arc-lamps in series, a switch in said circuit adapted to close

it through said lamps, an independent circuit, electromagnetic mechanism in said circuit and controlled at a point remote from said switch for closing said switch, and electromechanically-actuated means in said independent circuit for electrically cutting out said electromagnetic switch-closing mechanism.

6. An electric distributing system comprising a plurality of circuits in multiple branches, each having a switch for opening or closing it, an independent circuit having in series electromagnets for actuating said switches, and simultaneously-operated controllers, one for each actuating-electromagnet, said controllers consisting of movable circuit-changing elements all differently arranged with respect to their several actuating-electromagnets, and adapted to cut in or cut out their respective electromagnets whereby any one of said electromagnets may be energized to actuate its switch while the remainder of said electromagnets remain deënergized, and electromagnetic devices in series in said independent circuit for moving said movable elements.

7. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches each having a switch in series for opening and closing it, and a single remotely-controlled circuit independent of said lamp-circuits having means for selecting and actuating said switches independently of each other and one at a time.

8. An electric-lighting system comprising a plurality of lamp-circuits each having a switch, and means controlled remotely from said switch for selectively actuating said switches independently of each other and one at a time to close said switches, said means including a single circuit, a series of switch-actuating electromagnets in series in said circuit, and a series of electromagnetic controllers in series in said circuit which cause the selective energization of said switch-actuating electromagnets.

9. An electric-lighting system comprising a plurality of lamp-circuits each having a switch for opening or closing it, a circuit independent of said lamp-circuits and controlled remotely from said switches, said independent circuit having in series mechanism for selecting said switches and mechanism for actuating the selected switch, in combination with means in consequence of which each switch is automatically operated to open each lamp-circuit independently of the other or others upon the opening or breaking of the said lamp-circuit.

10. An electric-lighting system comprising a lamp-circuit having a switch and electromagnetic mechanism in series in said lamp-circuit for holding said switch in closed position, and an independent circuit controlled remotely from said switch and having electromagnetic mechanism for moving said switch to closed position.

11. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches, each branch circuit having a switch and also having electromagnetic mechanism in series for holding said switch in closed position, and an independent circuit having electromagnetic mechanism for moving said switch to closed position, in combination with selective mechanism for automatically closing the circuit through said last-mentioned electromagnetic mechanism.

12. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches each having a switch, and electromagnetic devices in said multiple branches for holding said switch in closed position, and an independent circuit having an electromagnetic mechanism for each switch to move it to closed position and also having means whereby said electromagnetic mechanisms are selected for operation.

13. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches, each lamp-circuit having a switch and also having electromagnetic devices in series for holding said switch in closed position, and an independent circuit having an electromagnetic mechanism for each switch to move it to closed position and also having means for cutting out each electromagnetic mechanism independently of the others.

14. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches each having a switch for opening and closing it, and an independent circuit having in series an electromagnetic device for each of said switches to actuate the same, and also having a series of selectors for selectively cutting in and out said electromagnetic devices, each selector including an electromagnet, a rotary member actuated thereby and a stationary member associated with said rotary member.

15. An electric-lighting system comprising a series of lamp-circuits in multiple branches each having a switch, and a controlling-circuit independent of the lamp-circuits and having in series a plurality of switch-operating mechanisms one for each switch and a selector for each switch-operating mechanism.

16. An electric-lighting system comprising a series of lamp-circuits in multiple branches, each having in series a switch and an electromagnetic latch to hold said switch in one position, in combination with a controlling-circuit independent of said lamp-circuits and having for each lamp-circuit a magnet for moving said switch to said position, and a series of selectors in series in said independent circuits for selecting said magnets.

17. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches, each having a switch, in combination with an independent circuit having a normally deënergized electromagnet for actuat-

ing each switch, and means for effecting the selective energization of said electromagnets.

18. An electric-lighting system comprising a plurality of lamp-circuits in multiple branches, each having an independent switch in combination with an independent circuit having electromagnets in series for actuating said switches, and means for selectively cutting in and out said electromagnets independently of each other.

19. An electromagnetic mechanism comprising a plurality of lamp-circuits in multiple branches each having a switch, in combination with an electromagnetic actuator for each switch, a selector for each actuator, an independent electric circuit in which said actuators are placed in series, and mechanism in consequence of which said selectors are simultaneously operated but said electromagnetic actuators are energized one at one time.

20. An electric distributing system comprising a plurality of lamp-circuits in multiple branches, each branch circuit having in series therein an automatically-opening switch, and also an electromagnet; and a latch controlled by each of said electromagnets for holding one of said switches in closed position while said electromagnet is energized, whereby when said electromagnet is deënergized by the rupture of said circuit, said switch automatically opens, in combination with remotely-controlled means independent of said circuits for closing said switches to effect the initial energizing of said electromagnet and the consequent latching of said switch in closed position by said latch, means for selecting said switch-closing means, and a single independent circuit having said switch-closing means and said selecting means therein.

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

GRANVILLE E. PALMER.

Witnesses:
MARCUS B. MAY,
J. J. DWYER.