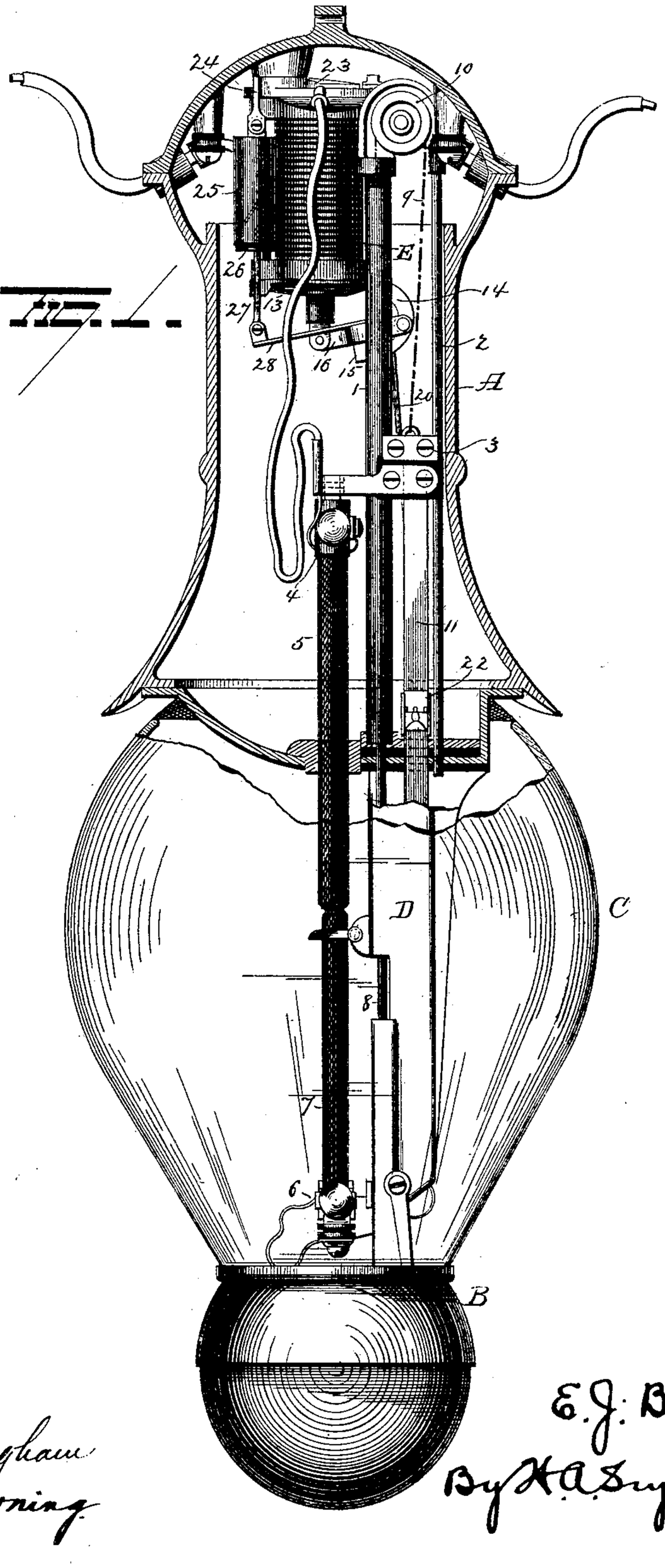
(No Model.) 3 Sheets—Sheet 1.

E. J. BAGNALL.

ELECTRIC ARC LAMP.

No. 560,387. Patented May 19, 1896.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

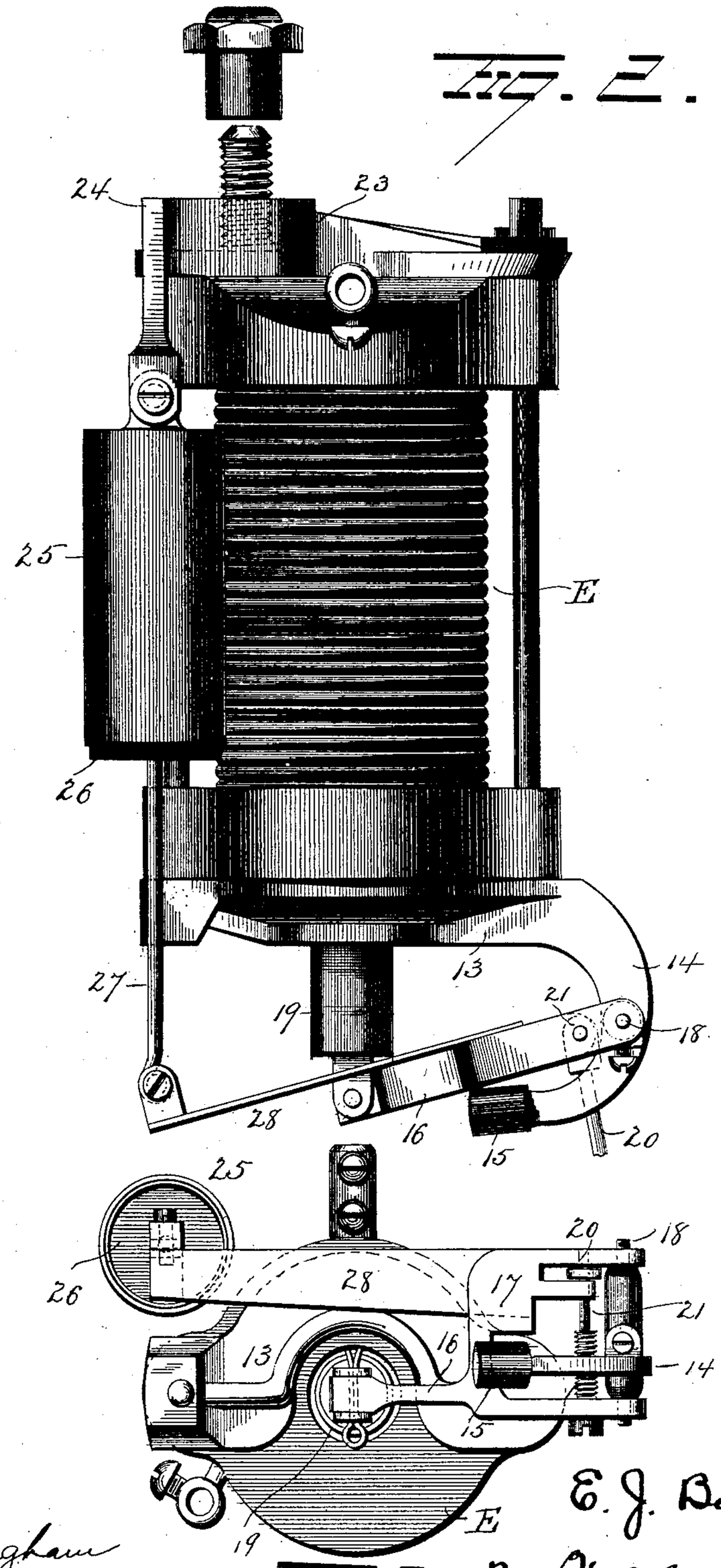

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

E. J. BAGNALL.

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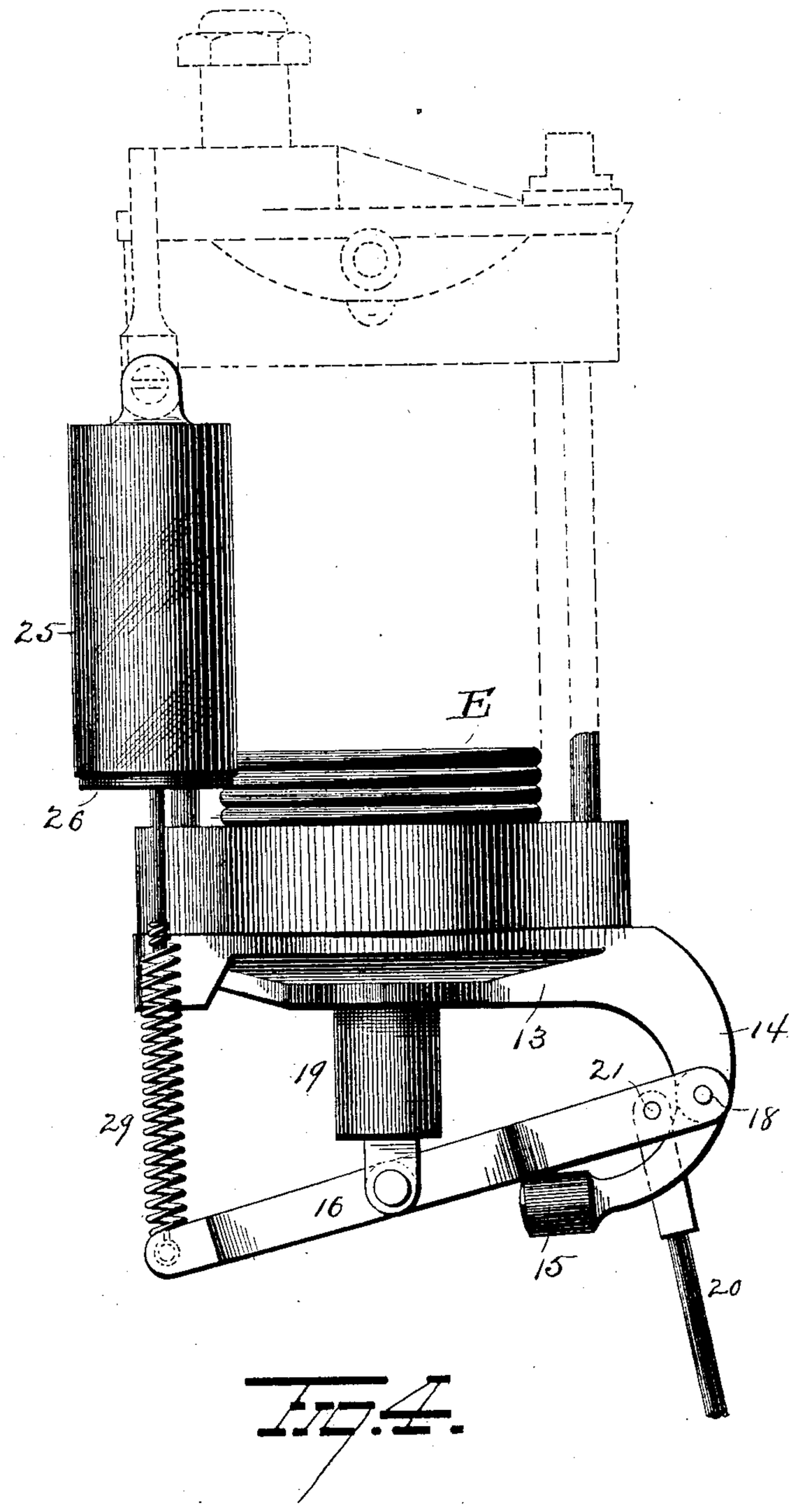

FIG. 4.

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UNITED STATES PATENT OFFICE.

ERNEST J. BAGNALL, OF CLEVELAND, OHIO, ASSIGNOR TO THE ADAMS-BAGNALL ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 560,387, dated May 19, 1896.

Application filed December 14, 1895. Serial No. 572,140. (No model.)

To all whom it may concern:

Be it known that I, ERNEST J. BAGNALL, a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Alternating-Current Arc-Lamps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in electric-arc lamps, and more particularly to such as are adapted for use with alternating electric currents. Electric-arc lamps for use with alternating currents are constructed with a single coarse-wire magnet arranged in series with the carbons, so that when the current enters the lamp the full current flows through the helix of said magnet and the carbons, which latter are of course normally in contact when no current is passing through the lamp. The current finding, when it first enters the lamp, an unobstructed path through the helix of the magnet, the latter will be energized to a great extent and, if no means be provided to prevent it, will attract its armature so vigorously that the carbons connected with said armature will be violently separated to their full extent for the normal arc. When an arc-lamp is operated with an alternating current, it is very essential that the carbon points be heated to a proper extent before the normal arc can be maintained. With lamps as heretofore constructed this has not been accomplished, and the result has been that when the current first entered the lamp the carbons were violently separated to their full extent, as above explained, and the carbon points not having been sufficiently heated to maintain the normal arc the latter was destroyed almost instantaneously with its formation, thus breaking the circuit through the lamp, deënergizing the magnet, and permitting the carbons to come together and again complete the circuit. The carbons will then be again violently separated as before, and this separating and coming together of the carbons will continue until they shall have become sufficiently heated to maintain the normal arc, during which time the rapid and violent movements of the parts will keep up an annoying chatter, to say nothing of the excessive wear on the mechanism of the lamp. It is a matter of great importance to the successful operation of arc-lamps employing alternating currents, especially when the lamp is first started, that the slightest variations in the strength of the magnet be promptly and accurately transmitted to the carbons. In other words, the movements of the carbons relatively to each other should be coincident with every movement of the armature of the magnet or core of the solenoid however slight the variations may be, and it is also important that the separation of the carbons to their full extent be so retarded as to permit them to become sufficiently heated to maintain a normal arc before such arc shall have been formed; otherwise the chatter and wear above alluded to will be the inevitable result.

It is the object of my invention to so construct an alternating-current arc-lamp that the variations of the separating and feeding magnet will be accurately transmitted to the carbons and so that the separation of the carbons to their full extent to form a normal arc shall be sufficiently retarded to permit the carbons to become properly heated to maintain the normal arc when formed.

With this object in view the invention consists in the combination, with the solenoid of an alternating-current arc-lamp and a clutch, of means forming a direct connection without interposed yielding devices between the core of the solenoid and said clutch, whereby the slightest variation in strength of the solenoid will be promptly and accurately transmitted to the carbons, a retarder and a non-limited yielding connection between said retarder and the core of the solenoid whereby to retard the separation of the carbons in forming the normal arc when the lamp is being started.

The invention also consists in the combination, with the separating and feeding magnet of an alternating-current arc-lamp and the carbons, of an armature-lever connected directly with the armature of said magnet and with the carbons without interposed yielding devices, a retarder, and a yielding device forming the sole connection between said retarder and armature-lever.

The invention also consists in the combination, with a solenoid and the carbons of an alternating-current arc-lamp, of a pivoted armature-lever pivotally connected directly to the core of said solenoid, a clutch for the carbons connected directly with said armature-lever, an air-pot, and a spring secured at one end to the armature-lever and attached at the other end to the plunger of said air-pot, said spring constituting the sole connection between the armature-lever and plunger of the air-pot; and the invention further consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of an electric-arc lamp, showing the application of my improvements. Fig. 2 is an enlarged view of the separating and feeding magnet and parts connected therewith. Fig. 3 is a view of certain details. Fig. 4 is a view of a modification.

A represents the lamp-casing; B, the globe-holder; C, the globe, and D the hollow lamp-arm projecting downwardly within the globe. A tube 1 and a rod 2 are disposed parallel with each other within the casing A, and between them a vertically-movable cross-head 3 is guided. The holder 4 for the upper carbon 5 is secured to and projects laterally from the cross-head 3, and the holder 6 for the lower carbon 7 is connected with the lower end of a rod 8, which passes upwardly through the lamp-arm and terminates within the tube 1. A chain 9 is connected at one end with the rod 8 and after passing over a pulley 10 is connected at its other end to the cross-head 3. A clutch-blade 11 is also secured to the cross-head 3 and projects downwardly into the hollow lamp-arm. A coarse-wire solenoid E is secured to the enlargement 12 on the under face of the roof of the casing A. To the lower head of the solenoid a plate 13, having a curved arm 14, is secured, said arm preferably having an enlargement 15 at its free end to serve as a stop for an armature-lever 16. The armature-lever is preferably made with a yoke 17, through the arms of which a pin 18 passes, said pin also passing through the arm 14 and pivotally connecting the said armature-lever thereto. The free end of the armature-lever 16 is pivotally connected directly to the core 19 of the solenoid E, and to said armature-lever at a point in close proximity to its pivotal support a rod 20 is pivotally connected by means of a pin or screw 21. The rod 20 depends from its connection with the armature-lever and at its lower end is connected directly with a clutch 22 of any preferred form of construction, which clutch is adapted to grasp the clutch-blade 11 above alluded to and separate and feed the carbons when the armature-lever is actuated. A plate 23 is secured to the upper end of the solenoid E and provided with an arm 24, to the free end of which an air-pot 25 is pivotally connected. A comparatively loose plunger 26 operates in the air-pot, and to said plunger a rod 27 is secured. The lower end of the plunger is pivotally connected to the free end of a flat spring 28, the other end of said spring being secured to the armature-lever 16.

From the construction and arrangement of parts above described it will be seen that the core of the solenoid is connected with the clutch without the intervention of any springs whatever, so that the slightest movement of the said core or armature will be transmitted to the carbons and there reproduced, so that the movements of the carbons will be exactly coincident with the movements of the core of the solenoid, the said core answering promptly and accurately to the slightest variations in strength of the solenoid, and, as has been demonstrated by actual experiment, this is a matter of much importance in the successful operation of the arc-lamps with alternating currents.

With my improvements when the current first enters the lamp the solenoid will have a tendency to quickly pull up its core and suddenly separate the carbons, but this will be prevented by the retarding action of the air-pot. Sufficient movement of the core and the carbons connected therewith will, however, be permitted by the resilience of the flat spring 28 to allow the carbons to separate enough to form a small arc, which will serve to heat their points. The cold carbon points constitute a great resistance to the formation of the normal arc in an alternating-current lamp, and with my improvements this resistance will gradually decrease as the carbon points become heated, and when they shall have reached such a temperature as to no longer form such a resistance the normal arc will be formed and maintained without interruption.

I am aware that devices have been proposed for effecting the successful starting of alternating-current arc-lamps, in which springs have been interposed between the core of the solenoid and the carbons, but such constructions have not, as a rule, met with complete success, principally because the movements of the core of the solenoid could not be accurately transmitted to the carbons. With such prior constructions when the core rises the spring connected therewith will yield before the movement of the core will be transmitted to the carbons, and consequently the rapid reciprocations of the core will be entirely out of time with the movements which are transmitted to the carbons, thus delaying and complicating the starting of the lamp and the subsequent feeding of the carbons. With my improvements all this is obviated and the starting of the lamp as well as the subsequent feeding of the carbons are successfully accomplished without the accompanying chatter and wear of the parts heretofore experienced. I have demonstrated by practical ex-

periment that with the improvements above described the lamp will start in a remarkably short time, and that subsequent flickering, so common to alternating-current lamps as heretofore constructed, is entirely avoided.

In the form of the invention shown in Fig. 4 the armature-lever 16 is pivotally connected directly to the core of the solenoid, and the free end of said lever is connected with the plunger of the air-pot through the medium of a coiled spring 29.

Other modifications in details of construction might be made so long as the core of the solenoid is connected with the carbons without intervening yielding devices and the armature-lever connected with the plunger of the air-pot through the medium of a spring.

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

1. In an alternating-current arc-lamp, the combination with a solenoid and a clutch, of means forming a direct connection, without interposed yielding devices, between the core of the solenoid and said clutch, whereby the slightest variation in strength of the solenoid will be promptly and accurately transmitted to the carbons, a retarder and a non-limited yielding connection between said retarder and the core of the solenoid whereby to retard the separation of the carbons in forming the normal arc when the lamp is being started, substantially as set forth.

2. The combination with the separating and feeding magnet of an alternating-current arc-lamp and the carbons, of an armature-lever connected directly with the armature of said magnet and with the carbons, a retarder and a spring forming the sole connection between said armature-lever and the retarder, substantially as set forth.

3. The combination with the separating and feeding solenoid of an alternating-current arc-lamp and the carbons, of a pivoted lever attached directly to the core of said solenoid and with the carbons without interposed yielding devices, a retarder, and a spring forming the sole connection between said pivoted lever and the retarder, substantially as set forth.

4. In an arc-lamp, the combination with the separating and feeding solenoid, of an arm secured to the frame of said solenoid, a lever pivoted to said arm and connected to the core of said solenoid, an air-pot supported by the frame of the solenoid and a spring secured at one end to said armature-lever and attached at the other end to the plunger of said air-pot, substantially as set forth.

5. In an arc-lamp, the combination with a separating and feeding solenoid, and a curved arm secured to and depending from the frame thereof, of a lever pivoted between the ends of said arm and pivotally connected to the core of the solenoid, the free end of said arm constituting a stop for said lever, an air-pot, and a spring secured at one end to said lever and attached at its other end to the plunger of said air-pot, substantially as set forth.

6. In an alternating-current arc-lamp the combination with the separating and feeding magnet, of a vertically-movable cross-head, guides for said cross-head, an upper-carbon holder carried by the cross-head, a movable lower-carbon holder, flexible connections between the lower-carbon holder and said cross-head, a clutch-blade secured to the cross-head, a clutch to grasp said clutch-blade, a pivoted armature-lever connected directly with the core of the solenoid and with the clutch, an air-pot and a spring secured at one end to the armature-lever and attached at the other end with the plunger of the air-pot, substantially as set forth.

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

ERNEST J. BAGNALL.

Witnesses:
LEWIS F. ROGERS,
ISABEL MCCLELLAN.