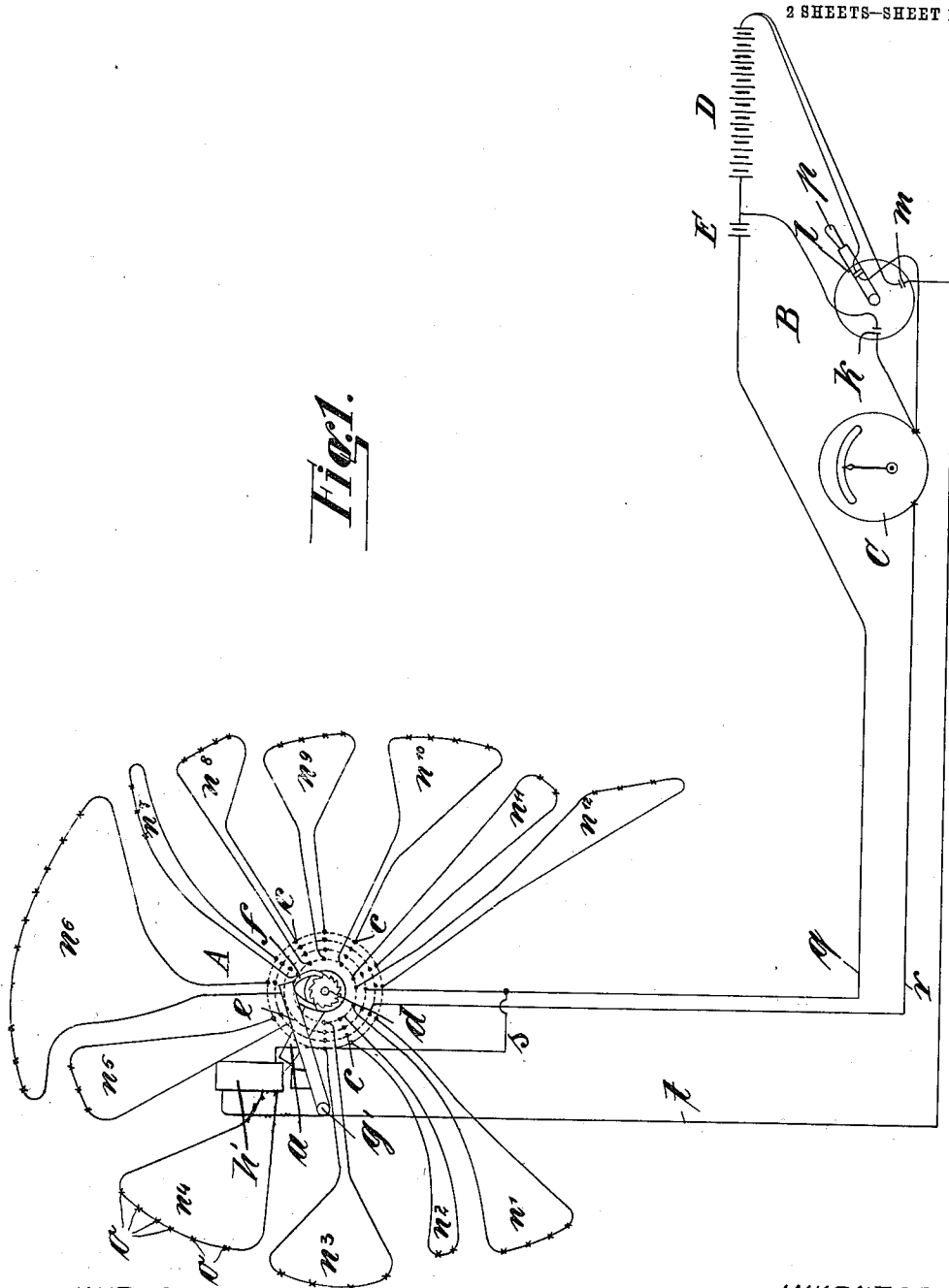


1,005,649.

2 SHEETS—SHEET 1.

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W. M. Avery
J. O. Davis

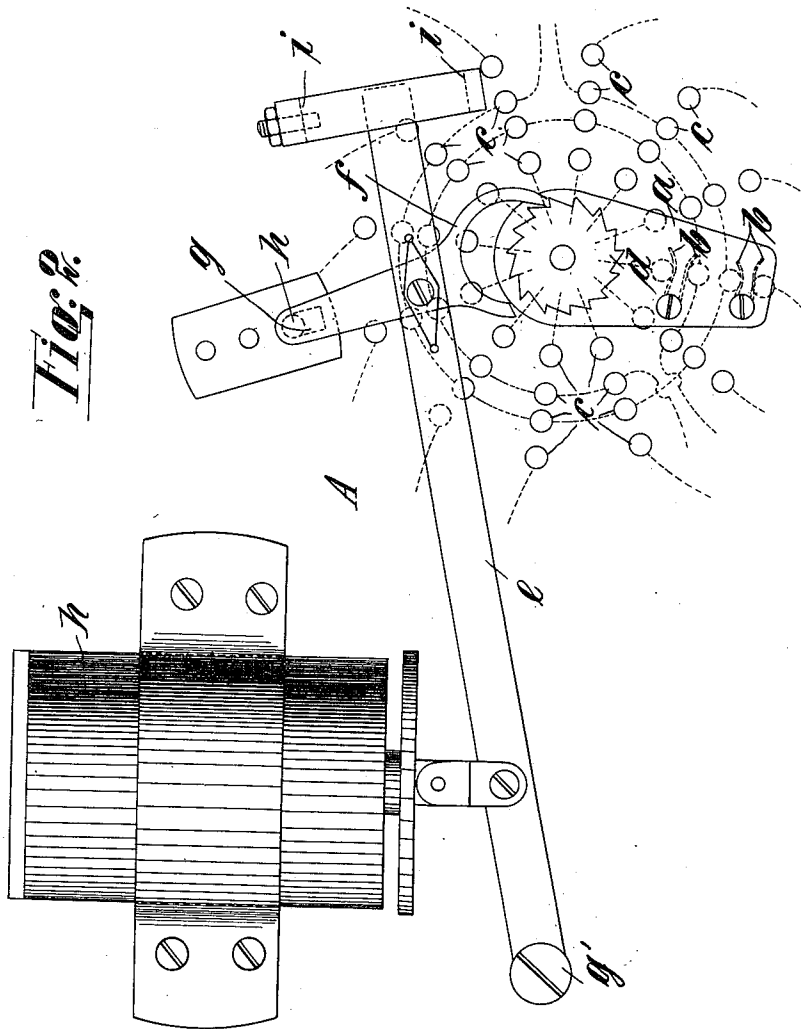
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J. KRANNICHFELDT.
 APPARATUS FOR EXPLODING MINE CHARGES.
 APPLICATION FILED FEB. 19, 1907.

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Patented Oct. 10, 1911.

2 SHEETS—SHEET 2.



WITNESSES :
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UNITED STATES PATENT OFFICE.

JOHANN KRANNICHFELDT, OF COLOGNE, GERMANY.

APPARATUS FOR EXPLODING MINE CHARGES.

1,005,649.

Specification of Letters Patent.

Patented Oct. 10, 1911.

Application filed February 19, 1907. Serial No. 358,174.

To all whom it may concern:

Be it known that I, JOHANN KRANNICHFELDT, a subject of the King of Prussia, residing at Cologne-on-the-Rhine, in the Kingdom of Prussia and German Empire, have invented a new and useful Improvement in Apparatus for Exploding Mine Charges, of which the following is a specification.

Central igniting plants for exploding mine charges have been provided with intermediate or local switches to close the separate circuits containing the explosive charges. Such intermediate switches, however, were driven by clockwork, so that in exploding all the charges in a mine one is bound to the time of the clockwork. In order to overcome this drawback and to enable the charges to be exploded at any desired interval—if necessary only after examining each circuit—the intermediate or local switch, according to my present invention, is controlled, adjusted or operated by electric means from a distant and therefore safe central station. For example, a switch lever can be turned by a ratchet wheel and pawl driven by electric means from the central station. Any desired number of such local switches can be combined with a single central station.

In the accompanying drawings illustrating my invention Figure 1 is a diagram of the exploding plant, and Fig. 2, a plan of an intermediate switch on a larger scale.

Referring to Fig. 1, A is an electrically operated intermediate or local switch, B a switch provided at a central station and serving to operate the intermediate switch A, C a galvanometer, D the source of the high tension, and E the source of the low tension, electric current.

The intermediate switch A (Fig. 2), in the example chosen, consists of a lever *a* on the underside of which two springs *b* are secured, which, on the lever *a* being turned, connect the radially arranged contacts *c*. In order to turn the lever *a*, a ratchet wheel *d* is provided in which engages the pawl *f* attached to the lever *e*. The back end of the pawl *f* is guided by a pin *h* engaging in a groove *g*, so as to permit the pawl to properly engage the ratchet wheel as the lever is moved up and down. The lever *e* fulcrumed at *g'* and carrying the pawl *f*, is so connected with the armature or core of an electromagnet that the re-

turn movement of the pawl takes place when the circuit is closed. In order to restrict the stroke of the lever, the pawl *f* is provided with a second arm, which as soon as the lever *a* arrives in the proper position, engages with the ratchet wheel *d* and prevents said wheel from turning further. Said lever *e* is guided laterally by the slot *i*. By repeatedly raising and lowering the lever *e*, the ratchet wheel *d* is continuously turned in the same direction, the springs *b* connecting the pins *c* in each position of rest of said lever, thus closing one of the circuits.

The switch B (Fig. 1) can be of any desired construction, and, in the present case, is provided with three contacts *k*, *l*, *m*, whose connections will be clear from the following description: Supposing the contact springs *b* of the distance switch A are in such a position that the circuit *n*⁴ provided with 6 charges *o* is switched in, the lever *p* is brought into contact with *k*, in order to close the circuit *k*, E, *q*, contact springs *b*, charge circuit *n*⁴, *r*, C, *l*. The galvanometer shows the resistance of the charge circuit *n*⁴, so that the latter, when the number of charges is known to the operator, can be examined as to its accuracy. The lever *p* of the switch B is placed on contact *l*, by doing which the circuit *l*, D, E, *q*, contact springs *b*, local charge circuit *n*⁴, *r*, C, *l*, is closed and the charge exploded. At the same time the galvanometer shows whether the explosion has taken place or not. Thereafter the lever *p* is turned into contact with *m*, in order to switch in the next local charge circuit *n*⁵ by means of the intermediate switch A. In this case the current passes over *m*, D, E, *q*, *s*, electromagnet *h'*, *t*, *m*. The pawl *f* is in this case raised by the electromagnet *h'* out of contact with the ratchet wheel and turns the lever *a* on falling; that is, after the circuit has been interrupted. This has the advantage that on advancing the lever no spark is formed on breaking the circuit. Said switch can however also be so constructed that the lever *a* is advanced when the electromagnet is attracted.

The construction of the intermediate switch can be modified in any desired manner.

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

1. In a centralized electric plant for exploding mine charges, the combination with

a main hand switch, an electrically operated local switch, and charge circuits connected with said local switch, of a main battery, an auxiliary battery, a galvanometer, a circuit to connect said main and auxiliary batteries through said main hand switch with said electrically operated local switch independent of said galvanometer, a second circuit to connect said main and auxiliary batteries to said charge circuits through said main hand switch and galvanometer, and means to cut said main battery out of said circuit, substantially as and for the purpose set forth.

2. In a centralized electric plant for exploding mine charges, the combination with an electrically operated local switch, and local circuits containing charges connected with said local switch, of a main circuit to operate said electrically operated local switch, a second main circuit, and two batteries adapted to be switched singly or together into said second main circuit, substantially as and for the purpose set forth.

3. A centralized electric plant for exploding mine charges, comprising in combination a three way switch at the central station, a main battery connected with two of the ways of said switch, an auxiliary battery connected with the third way of said switch, a galvanometer connected with said main battery through one of the ways of said switch and with said auxiliary battery through another way of said switch, a local switch for the circuits containing the

charges, wires connecting said local switch with said main and auxiliary batteries through said galvanometer and through said switch at the central station, electromagnetic means to operate said local switch on operating said switch at the central station, and wires connecting said means with said main battery, substantially as and for the purpose set forth.

4. A centralized electric plant for exploding mine charges, comprising in combination a three way switch at the central station, a main battery connected with two of the ways of said switch, an auxiliary battery connected with the third way of said switch, a galvanometer connected with said main battery through one of the ways of said switch and with said auxiliary battery through another way of said switch, a local switch for the circuits containing the charges, wires connecting said local switch with said main and auxiliary batteries through said galvanometer and through said switch at the central station, an electro-magnet in close proximity to said local switch and electrically connected with said switch at the central station, and a ratchet and pawl adapted to be operated by said electro-magnet to operate said local switch, substantially as and for the purpose set forth.

JOHANN KRANNICHFELDT.

Witnesses:

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