

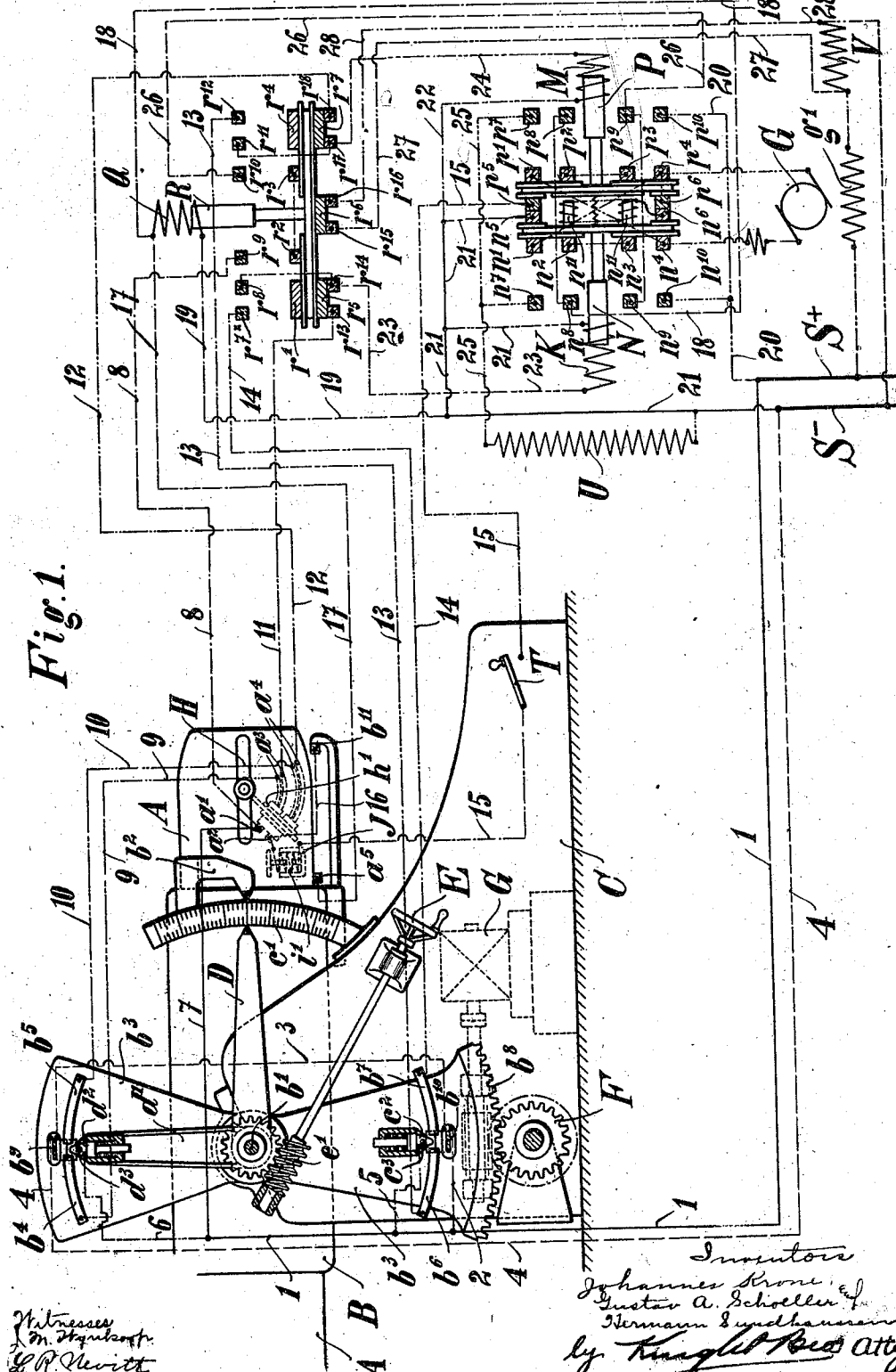
J. KRONE, G. A. SCHOELLER & H. SUNDHAUSSEN.
ELECTRICALLY DRIVEN ELEVATING MECHANISM FOR BARREL RECOIL GUNS.

APPLICATION FILED MAY 6, 1908.

Patented Aug. 24, 1909.

932,030.

5 SHEETS—SHEET 1.



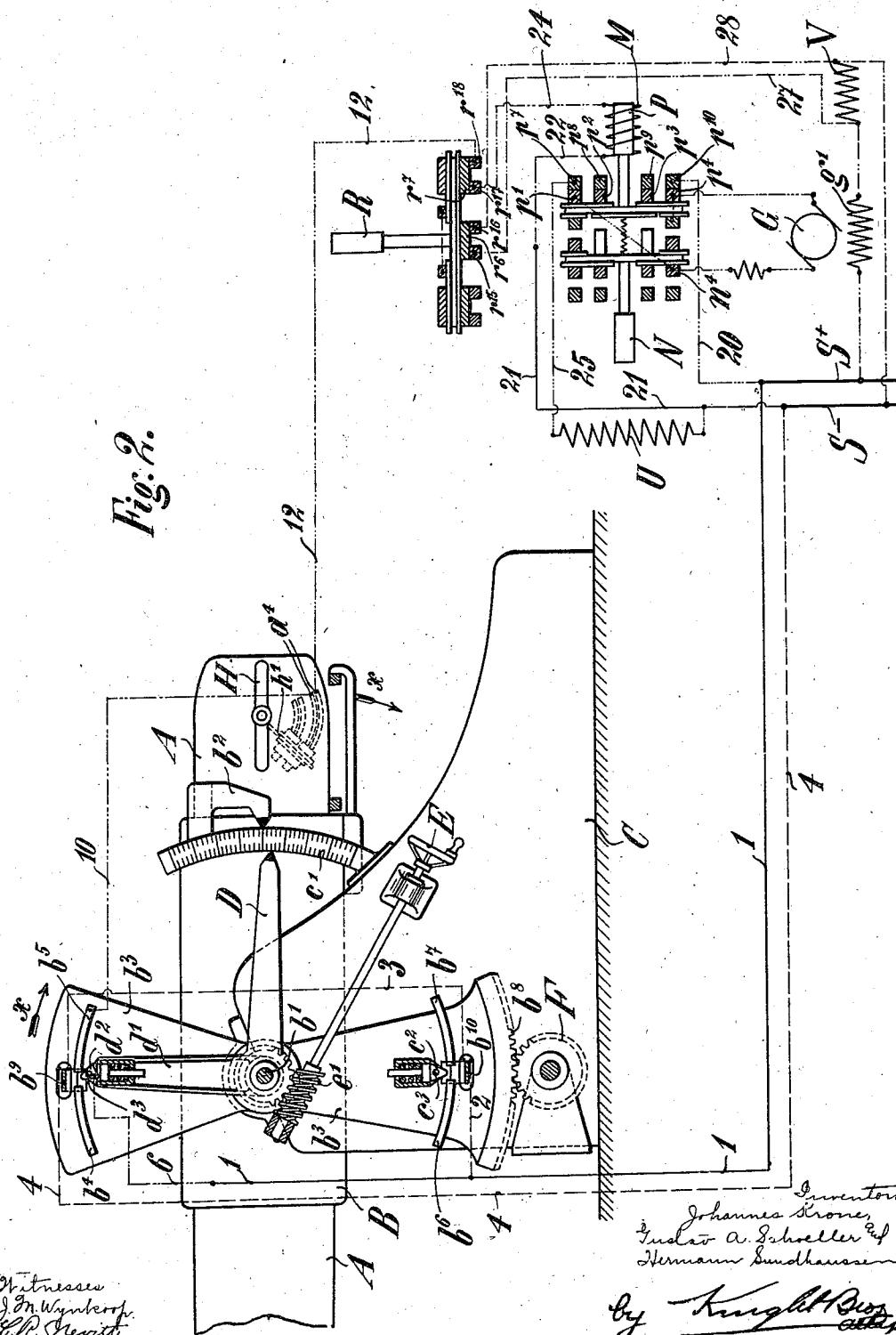
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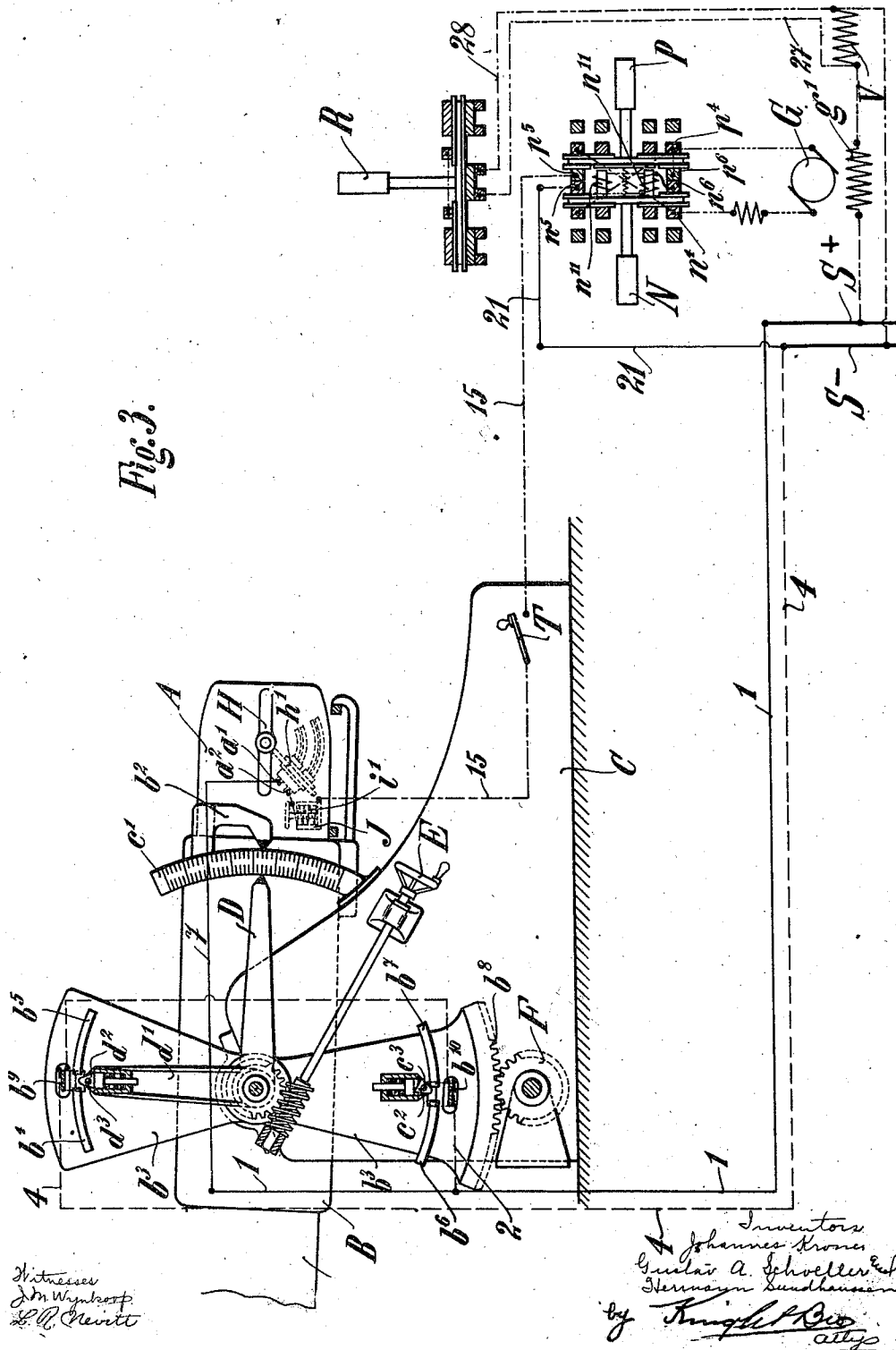
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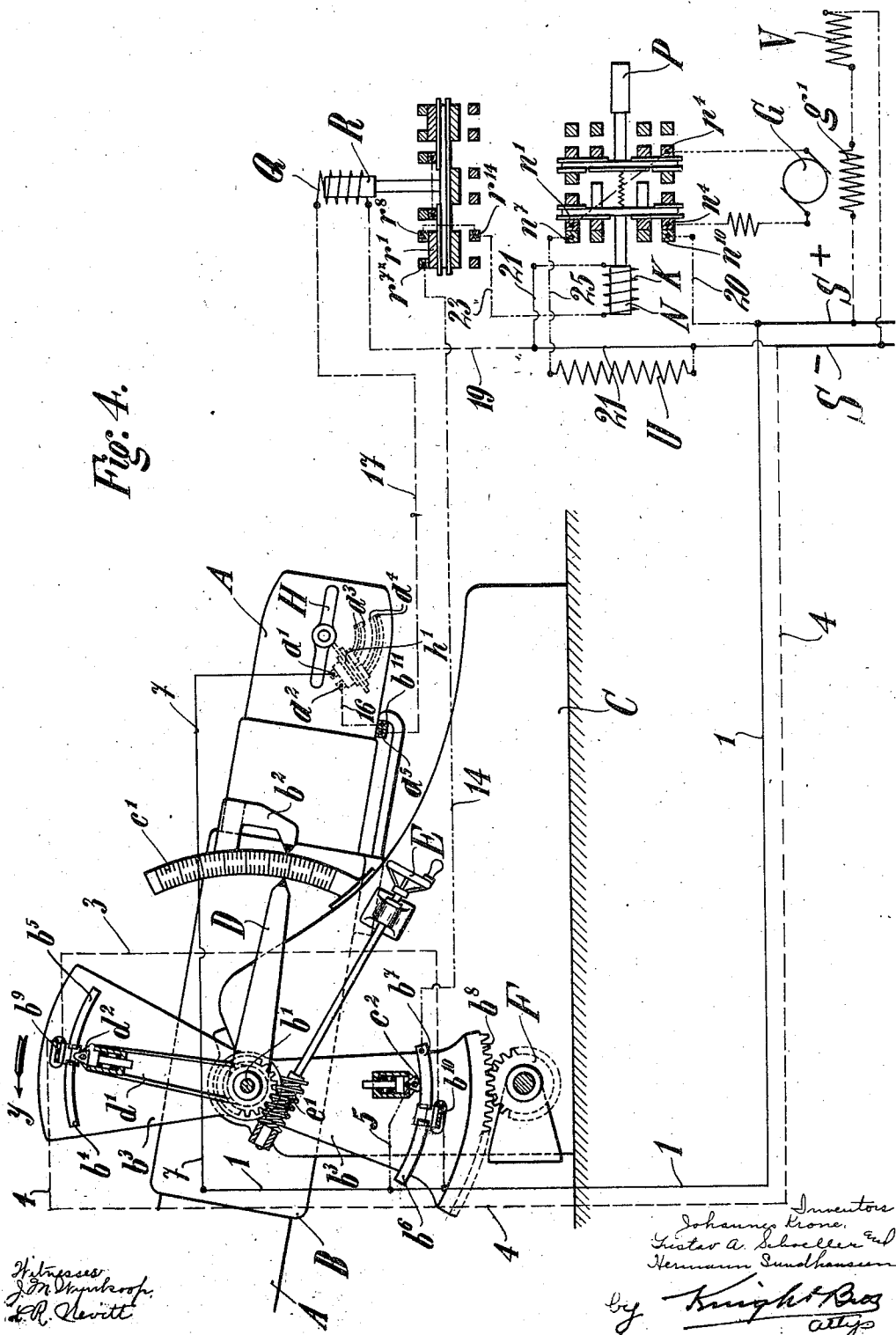
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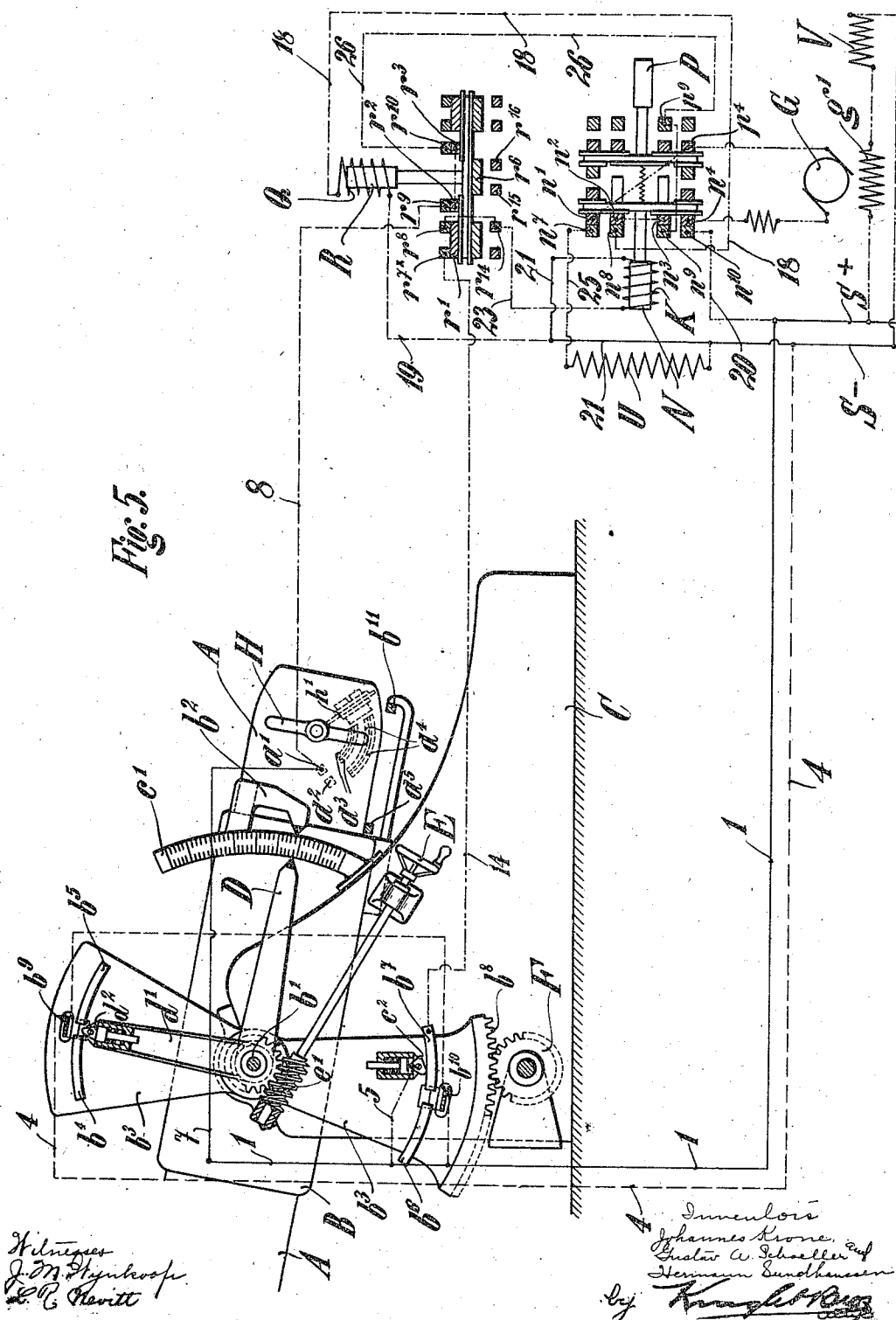


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6 SHEETS—SHEET 5.



UNITED STATES PATENT OFFICE.

JOHANNES KRONE, OF ESSEN-ON-THE-RUHR, GUSTAV A. SCHOELLER, OF MÜLHEIM-ON-THE-RUHR, AND HERMANN SUNDHAUSSEN, OF BREDENEY, GERMANY, ASSIGNORS TO FRIED. KRUPP AKTIENGESellschaft, OF ESSEN-ON-THE-RUHR, GERMANY.

ELECTRICALLY-DRIVEN ELEVATING MECHANISM FOR BARREL-RECOIL GUNS.

932,030.

Specification of Letters Patent. Patented Aug. 24, 1909.

Application filed May 6, 1908. Serial No. 431,200.

To all whom it may concern:

Be it known that we, JOHANNES KRONE, residing at Essen-on-the-Ruhr, Germany, GUSTAV A. SCHOELLER, residing at Mülheim-on-the-Ruhr, Germany, and HERMANN SUNDHAUSSEN, residing at Bredeney, Germany, all subjects of the Emperor of Germany, have invented a certain new and useful Improvement in Electrically-Driven Elevating Mechanism for Barrel-Recoil Guns, of which the following is a specification.

The subject of the present invention is an electrically driven elevating mechanism designed for barrel recoil guns, through means of which a gun barrel may be transferred, automatically, from the firing to the loading position, and vice versa.

In the drawing, one embodiment of the invention is shown schematically by way of illustration.

Figure 1 shows a side view, partly in section of those parts of a barrel recoil gun which are concerned with the invention, together with the assembled diagram. Figs. 2 to 5 are views corresponding to Fig. 1, with portions of the diagram.

The gun barrel A is slidably mounted in the cradle B. The latter rests through the medium of horizontal trunnions of which one only (b^1) is shown in the drawing, upon the carriage body C. Upon the trunnion b^1 is swingingly arranged an index hand D. By means of a hand wheel E, acting through the medium of a worm e^1 and a worm wheel meshing therewith, the index hand, together with an arm d^1 , can be swung about the axis of the horizontal trunnions. Mounted upon the carriage body C is a graduated arc c^1 over whose graduations, the index D, as well as a marker b^2 rigidly connected with the cradle B, can play. When the markers D and b^2 point to one and the same graduation of the arc c^1 , the gun barrel stands at the same angle of elevation as the marker D.

Rigidly connected with the trunnion b^1 is a carrier b^3 . Upon this carrier are arranged four insulated contact rails b^4 , b^5 , b^6 , b^7 . These contact rails lie concentric with the axis of the horizontal trunnions. The lower portion of the carrier b^3 is provided with teeth b^8 in engagement with which stands a toothed wheel F. This toothed wheel can be driven by an electric

motor G acting through the medium of a worm gear. For the sake of perspicuity, the motor G is reproduced in the controller diagram. With the parts in the positions shown in Fig. 1, there is between each pair of contact rails b^4 b^5 , and b^6 b^7 , and with slight play, a triangular contact piece d^2 or c^2 . The contact piece d^2 rests upon the arm d^1 , while the contact piece c^2 is arranged upon the carriage body C. The contact pieces d^2 , c^2 are arranged in insulated boxes, in which they stand under spring pressure with freedom to swing about the axis d^3 or c^3 . Arranged near the spaces between the contact rails b^4 b^5 , and b^6 b^7 , and mounted upon the carrier b^3 , are electrical spark blowers b^9 , b^{10} .

Connected with the hand crank H of the breech closure, is a controller lever h^1 , which in the closed position of the breech, makes electrical contact, through the medium of a contact piece, with two contacts a^1 , a^2 located upon the breech end of the gun barrel A. By turning the crank H, two additional contact pieces slide with the controller lever h^1 , over two pair of contact rails a^3 , a^4 , which are likewise arranged upon the breech end of the gun barrel. Upon the breech end of the gun barrel is furthermore provided a contact piece a^5 , which at the time of recoil of the gun barrel, contacts with the contact piece b^{11} yieldingly mounted upon the cradle B. Finally there is mounted upon the breech end of the gun barrel, an electro-magnetic firing device J provided with a pot-shaped magnet. The winding of the pot-shaped magnet is indicated by i^1 .

Two electro-magnetic relays are embodied in the arrangement, one of which is a double relay and consists in the windings K, M and the armatures N, P. With each of these armatures is connected a cross-bar, upon which are arranged insulated contact pieces n^1 , n^2 , n^3 , n^4 , n^5 , n^6 , and p^1 , p^2 , p^3 , p^4 , p^5 , p^6 , respectively. Upon the separation of the armatures N, P, the contact pieces n^1 , n^2 , n^3 , and n^4 impinge upon the fixed contact pieces n^7 , n^8 , n^9 , and n^{10} , while the contact pieces p^1 , p^2 , p^3 , and p^4 impinge upon the fixed contact pieces p^7 , p^8 , p^9 , p^{10} , and when the armatures N, P, approach each other under the influence of a tension spring, the contact pieces n^5 , p^5 and n^6 , p^6 touch. Between the

above-mentioned cross bars, are arranged electro-magnets n^{11} which are designed to arrest vibration when the relay jumps to the intermediate position.

5 The second relay consists of the winding Q and the armature R with a cross bar upon which, are mounted the insulated contact pieces $r^1, r^2, r^3, r^4, r^5, r^6, r^7$. These contact pieces touch, according to the position of the armature R, either the fixed contact pieces $r^{7*}, r^8, r^9, r^{10}, r^{11}, r^{12}$, or fixed contact pieces $r^{13}, r^{14}, r^{15}, r^{16}, r^{17}, r^{18}$.

The several parts are electrically connected with a source of current $S^+ S^-$ and with one another in the following manner: The spark plugs b^9, b^{10} are connected in series with the source $S^+ S^-$ by the conductors 1, 2, 3, 4, being thus constantly active. From the conductor 1, conductors 5 and 6 lead to the triangular contacts c^2 and d^2 . From the conductor 1 also leads a conductor 7 to the contact piece a^1 which through a conductor 8 stands in connection with the contact piece r^8 of the relay armature R. The contact rails b^4, b^5 , are connected by wires 9 and 10, each with one rail of the pair of rails a^2, a^1 . From the other rail of this pair, conductors 11 and 12 lead to the contact pieces r^{13} and r^{18} . The contact rails b^6 and b^7 are connected through wires 13 and 14 with the contact pieces r^{12}, r^{7*} of the relay armature R. The contact piece a^2 is connected with the winding i^1 of the firing magnet J. The winding i^1 is connected through the conductor 15 with the contact piece p^5 of the relay armature P. In the conductor 15 is introduced a switch T. From the contact pieces a^2 leads a conductor 16 to the contact b^{11} . The contact a^2 is connected through conductor 17 with the winding Q; the latter is, through conductors 18, 19, connected with the contact n^8 and with the pole S^- of the electrical source. With the pole S^+ are further connected by conductor 20, the contacts n^{10} and p^{10} and with the pole S^- , through conductors 21 and 22, the windings K and M, as well as the contact n^5 . From the other ends of the windings K and M, the conductors 23, 24, lead to the contacts r^{14}, p^{17} . Connected with the pole S^+ of the electrical source is a rheostat U, the other side of which is connected by conductor 25 with the contacts n^7 and p^7 . Finally, the contacts $n^2, n^3, p^3, p^2, n^5, p^5, n^9, p^9, p^4, p^4, n^2, p^1, p^1, n^4, r^2, r^3, n^8, r^{14}, r^{17}, r^{17}$, are connected in pairs by wires. From the contact piece p^9 a conductor 26 leads to the contact r^{10} . The armature G of the electric motor lies immediately at the contacts n^4 and p^4 , while the field winding g^1 together with a resistance V, is connected with the electrical source $S^+ S^-$. From the ends of the resistance V, wires 27, 28 lead to the contact pieces r^{13}, r^{16} .

As soon as the pointer D is swung through the medium of the hand wheel E, out of the

position of rest given in Fig. 1, which corresponds with the horizontal position or the loading position of the gun barrel, the contact piece d^2 on the arm d^1 which follows the movement of the pointer D, first bears upon the rail b^5 , (Fig. 2). In the further course of the movement of the pointer D, contact piece d^2 turns upon its own axis d^3 and slides on the rail b^5 . This closes a circuit $S^+ - 1 - 6 - d^2 - b^5 - 10 - a^1 - 12 - r^{18} - r^{17} - 24 - M - 22 - 21 - S^-$, which causes the armature P to be attracted by the winding M. This closes a new circuit $S^+ - 20 - p^{10} - p^4 - G - n^4 - p^1 - p^1 - 25 - U - S^-$. The motor G, whose field winding g^1 is constantly fed 80 from the source $S^+ S^-$, thereby short circuiting the resistance V through the contact pieces r^{15}, r^6, r^{13} , now begins to turn. In so doing, the motor swings the carrier b^3 through the medium of the toothed wheel F and the gearing b^8 , and with this carrier the cradle B and the gun barrel A, about the axis of the trunnions, in the direction of the arrow x (Fig. 2) until the contact piece d^2 again springs into the space between the rails b^4 and b^5 . The development of the jump spark between the contact pieces d^2 and the rail b^5 is prevented by the spark blower b^6 so that the circuit of the relay winding M will be interrupted with safety 95 as soon as the contact between d^2 and b^5 ceases. In consequence of this, the winding M releases the armature P which jumps to the intermediate position under the influence of the spring located between the cross bars of the armatures P and N (Fig. 3). By this, the armature G of the electric motor, will be immediately cut off from the source $S^+ S^-$, and short circuited by the electro-magnets n^{11} . The winding of the electro-magnets n^{11} will now be energized by the counter-electro motive force of the motor armature G and the magnets strongly attracted, so that any vibration of the armature P is prevented. At the end of the above described progression, the pointer b^2 on the cradle B stands exactly opposite that mark upon the graduated arc c^1 to which the pointer D is adjusted. The gun barrel has thus attained the elevation corresponding to the adjustment of the pointer D. 115

The contact piece c^2 mounted upon the carriage body C has contacted during the above described movement of the carrier b^3 , with the rail b^7 and by this contact, rotated about the axis c^3 , without thereby closing an electric circuit. By the movement of the armature P to the middle position, the contacts n^5, p^5 , are made to touch, so that, inasmuch as with the breech closed the controller b^1 connects the contact a^1, a^2 , by closing the switch T, a circuit will be established through $S^+ - 1 - 7 - a^1 - b^1 - a^2 - b^1 - 15 - T - 15 - p^5 - n^5 - 21 - S^-$. As soon as the switch T is closed, the winding i^1 of the firing mag- 120 125 130 135

net J is energized and the gun is fired. If the switch T has already been closed before the ending of the movement of the gun barrel, then the gun will be fired automatically the instant the gun has attained the desired position. At this moment the relay armature P springs to the middle position, whereby the contacts n^5 , p^5 , of the firing circuit are simultaneously closed. After firing, the gun barrel A recoils in the cradle B, compare Fig. 4. In this figure the gun barrel is at a higher elevation than in Fig. 3. At the time of recoil of the gun barrel, the contact piece a^5 comes into contact with the contact b^{11} of the cradle B, thus closing a circuit $S^+ - 1 - 7 - a^1 - h^1 - a^2 - 16 - b^{11} - a^5 - 17 - Q - 19 - 21 - S^-$, thus causing the relay armature R to be attracted. But since, as above set forth, the contact piece c^2 has been brought into contact with the arcuate rail b^7 , a second circuit is now closed as follows: $S^+ - 1 - 5 - c^2 - b^7 - 14 - p^7 - p^8 - p^9 - p^{14} - 23 - K - 21 - S^-$. The energizing of the winding K causes the attraction of the relay armature N, thus closing a third circuit $S^+ - 20 - n^{10} - n^4 - G - p^4 - n^1 - n^7 - 25 - U - S^-$. The electric motor then rotates the gun in a contrary direction to that in which it first rotated it, through the medium of the toothed wheel F and the gearing b^8 . The carrier b^3 and the connected cradle B as also the gun barrel A are thus moved in the direction of the arrow y (Fig. 4). The contacts a^5 and b^{11} touch only during a very short time, since the gun barrel immediately after the end of its recoil runs out again. But this short time suffices to energize the windings Q and K. The energizing of these windings causes the armatures R and N to be attracted. By this, a circuit $S^+ - 1 - 7 - a^1 - 8 - p^5 - p^2 - p^3 - p^{10} - 26 - p^0 - n^0 - n^3 - p^2 - n^3 - 18 - Q - 19 - 21 - S^-$, (Fig. 5) the existence of which is independent of the contact of the two contacts a^5 and b^{11} brought together by the recoil. This circuit is also independent of the controller h^1 connected to the breech crank H; hence, the breech can be opened immediately after completion of the running out movement of the gun barrel without breaking the circuit of the motor armature. By separation of the contacts p^{15} , p^0 , p^{10} , resulting from the attraction of the relay armature R, the thus far short circuited resistance V will be interposed in the shunt circuit of the field winding g^1 , so that the motor, in consequence of the weakening of its field energy, immediately assumes a rapid movement in returning the gun barrel to the loading position. The gun barrel continues its movement until the contact piece c^2 springs into the space between the rails b^6 and b^7 and thereby interrupts the circuit through the relay winding K. The gun barrel will have then attained the horizontal position again, that is to say, it is in the loading position. The

formation of sparks due to the passage of the contact c^2 from the rail b^7 is prevented by the spark blower b^{10} . The winding K releases the armature N, as soon as it is deenergized and the latter then springs into the middle position and cuts off the motor armature G from the electrical source $S^+ S^-$. This also causes the simultaneous interruption of the circuit which includes the relay winding Q, so that the armature R will be released.

By transferring the gun barrel A into the loading position, the contact piece d^2 will again rest upon the contact rail b^5 , since the carrier b^3 follows the movement of the gun barrel and the arm d^1 with the pointer D remains fixed in the original position corresponding to the desired elevation of the gun barrel. If now, following the loading of the gun, the breech is again closed, first the rails of the contact pairs a^3 and a^4 and then the contact pieces a^1 and a^2 will be electrically connected by the switch lever h^1 connected to the crank H. By closing the contact a^4 , there will again be established as before, the circuit $S^+ - 1 - 6 - d^2 - b^5 - 10 - a^4 - 12 - p^{18} - p^7 - p^{17} - 24 - M - 22 - 21 - S^-$, the relay armature P will be attracted, and the circuit of the motor armature will be thereby closed. The motor will then transfer the gun barrel again into the position of elevation corresponding to the setting of the pointer D.

Should the pointer be shifted upward from the intermediate position designated in Fig. 1, a proceeding similar to that described, takes place, according to which the contact piece d^2 comes into contact with the contact rail b^4 so that there is closed the circuit $S^+ - 1 - 6 - d^2 - b^4 - 9 - a^3 - 11 - p^{13} - p^5 - p^{14} - 23 - K - 21 - S^-$. The armature N will be attracted and close the motor armature circuit $S^+ - 20 - n^{10} - n^4 - G - p^4 - n^1 - n^7 - 25 - U - S^-$. After the adjustment of the gun barrel A, the contact piece d^2 springs into the space between the contact rails b^4 and b^5 and the relay circuit will be broken; the armature N springs into the middle position, breaking the motor armature circuit and simultaneously closing the firing circuit $S^+ - 1 - 7 - a^1 - h^1 - a^2 - i^2 - 15 - T - 15 - p^6 - n^3 - 21 - S^-$. At recoil, there is first established the circuit $S^+ - 1 - 7 - a^1 - h^1 - a^2 - 16 - b^{11} - a^5 - 17 - Q - 19 - 21 - S^-$, and the armature R is attracted. Thereupon there are established the following circuits, $S^+ - 1 - 5 - c^2 - b^7 - 14 - p^7 - p^8 - p^9 - p^{14} - 23 - K - 21 - S^-$, and $S^+ - 20 - p^{10} - p^4 - G - n^4 - p^1 - p^7 - 25 - U - S^-$ and immediately thereafter, the circuit $S^+ - 1 - 7 - a^1 - 8 - p^5 - p^2 - p^3 - p^{10} - 26 - p^0 - p^3 - p^2 - p^3 - n^3 - 18 - Q - 19 - 21 - S^-$. Thus in this case also, the motor brings the gun barrel A, after firing, into the loading position, and after the loading again into the firing position.

Having thus described our invention, the

following is what we claim as new therein, and desire to secure by Letters Patent:

1. In an electrically driven elevating mechanism for breech-loading barrel-recoil guns, an electric motor for moving the gun barrel to the loading and firing positions; and circuits for controlling the motor, one of said circuits being provided with means adapting it to be closed by the recoil-movement of the gun barrel, and another of said circuits having connections by which it is closed by the closure of the breech.

2. In an electrically driven elevating mechanism for breech-loading barrel-recoil guns, an electric motor for moving the gun barrel between loading and firing positions; controlling circuits for the motor, one of said circuits being provided with means adapting it to be closed by the recoil movement of the gun barrel and another by the closure of the breech; and means operated by the gun barrel when it reaches firing position, for breaking the motor circuit.

3. In an electrically driven elevating mechanism for breech-loading barrel recoil guns, an electric motor for moving the gun barrel to the loading and firing positions, having its circuit closed by a movement of the gun barrel consequent upon firing; and by the closure of the breech; the motor circuit being made up in part by conducting rails and sliding contacts located respectively upon fixed and moving parts of the gun, and located to cause the contacts to leave the rails when the gun reaches loading position but return thereto when the gun leaves the loading position.

4. In an electrically driven elevating mechanism for breech-loading barrel recoil guns, an electric motor for moving the gun barrel to the loading and firing positions, having its circuit closed by a movement of the gun barrel consequent upon firing, and by the closure of the breech; the motor circuit being made up in part by conducting rails and sliding contacts located respectively upon fixed and moving parts of the gun, and located to cause the contacts to leave the rails when the gun reaches loading position but return thereto when the gun leaves the loading position; the motor having independent circuits for causing it to rotate in opposite directions and the circuit through which it is caused to rotate in the direction of returning the gun barrel to loading position being controlled by a relay, the circuit of which embraces as a constituent part, the sliding contacts aforesaid.

5. In an electrically driven elevating mechanism for barrel recoil guns, the combination of the motor rotating in one direction to transfer the gun to firing position and in the other direction to transfer it to loading position, independent circuits through which the respective rotations of

the motor armature are induced, contact rails and sliding contacts forming part of a motor circuit arranged respectively on fixed and moving parts of the gun, out of contact when the gun is in loading position but in contact when the gun is out of the loading position, a double relay controlling the circuit through which the motor armature is rotated to return the gun to firing position, and a circuit controlling said relay which includes the sliding contacts.

6. In an electrically driven elevating mechanism for barrel recoil guns the combination of the motor rotating in opposite directions to transfer the gun to firing position and to loading position, independent circuits through which the respective rotations of the armature are induced, a relay controlling the circuit through which the motor armature is rotated in the direction to return the gun barrel to loading position, a circuit through which said relay is energized, and contacts controlling the relay circuit which are brought together by the recoil of the gun barrel.

7. In an electrically driven elevating mechanism for barrel recoil guns the combination of the motor rotating in opposite directions to transfer the gun to firing and loading positions, the independent circuits through which the motor armature is caused to rotate in the respective directions, a relay controlling the circuit through which the armature is rotated in the direction to return the gun to loading position, a circuit for said relay which is closed by the recoil of the gun, a second relay holding the first relay circuit closed after it is established by the recoil, and sliding contacts mounted respectively upon fixed and moving parts of the gun, controlling the circuit of said second relay and arranged to be separated when the gun reaches loading position whereby said second relay and the first relay are deenergized and the current supplied to the motor armature is interrupted when the gun reaches loading position.

8. In an electrically driven elevating mechanism for barrel recoil guns, the combination of the electric motor having its field winding in shunt with the main circuit and its armature suitably connected for transferring the gun between loading and firing positions; a resistance coil provided with contact pieces by means of which it may be introduced into series with said field winding; and a relay by means of which said series connection between the resistance and field-winding is made when the gun is to be returned to loading position, said return movement being thereby caused to be more rapid than the elevating movement.

9. In an electrically driven elevating mechanism for breech-loading barrel recoil guns the combination of the electric motor

for moving the gun barrel to and from firing and loading positions, a suitable circuit for controlling said motor, the breech opening and closing mechanism of the gun, a switch moving with the opening and closing mechanism of the breech, a relay controlling the motor circuit and a relay circuit controlled by the switch lever.

10. In an electrically driven elevating mechanism for barrel recoil guns the combination of the electric motor for moving the gun barrel to and from firing and loading positions, a suitable circuit for controlling said motor, the breech opening and closing mechanism of the gun, a switch moving with the opening and closing mechanism of the breech, a relay controlling the motor circuit and a relay circuit controlled by the switch lever; said parts being arranged to cause the motor to move the gun to firing position when the breech is closed.

11. In an electrically driven elevating mechanism for barrel recoil guns the combination of the electric motor for moving the gun barrel to and from firing and loading positions, a suitable circuit for controlling said motor, the breech opening and closing mechanism of the gun, a switch moving with the opening and closing mechanism of the breech, a relay controlling the motor circuit and a relay circuit controlled by the

switch lever; said parts being arranged to cause the motor to move the gun to firing position when the breech is closed; said gun being provided with electrical firing mechanism, and the circuit of said firing mechanism being broken until the breech is closed.

12. In an electrically driven elevating mechanism for guns, the combination with an electric motor having its armature suitably connected to transfer the gun between loading and firing positions and its field winding in shunt with the main circuit through the armature; of a resistance coil provided with suitable contacts whereby it may be brought into series with said field winding; and means operated by the movement of the gun barrel whereby said resistance is thrown out of circuit throughout the elevating movement of the gun barrel and again brought into series therewith during the return to loading position.

The foregoing specification signed at Düsseldorf, Germany, this fourteenth day of March, 1908.

JOHANNES KRONE.
GUSTAV A. SCHOELLER.
HERMANN SUNDHAUSSEN.

In presence of—

PETER LIEBER,
WILHELM FLASCHE.