

No. 749,178.

PATENTED JAN. 12, 1904.

L. DE FOREST.
WIRELESS SIGNALING APPARATUS.
APPLICATION FILED MAR. 5, 1903.

NO MODEL.

Fig. 1.

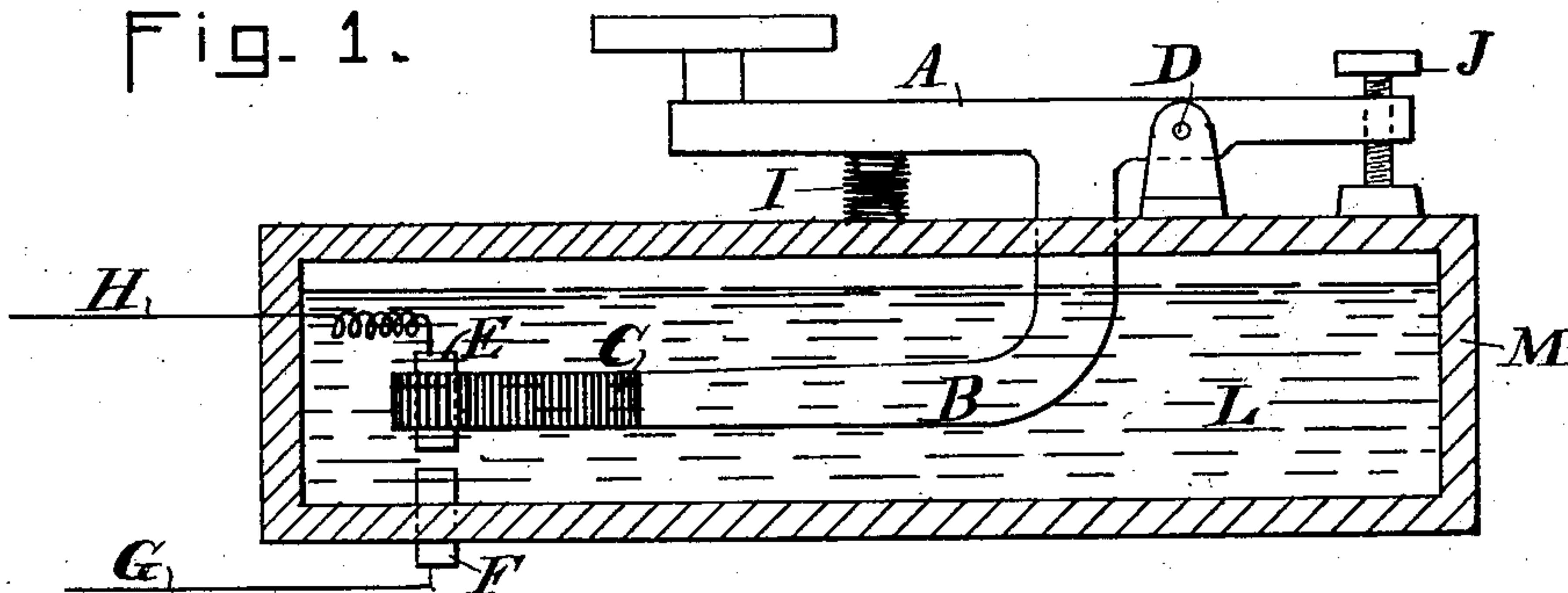


Fig. 2.

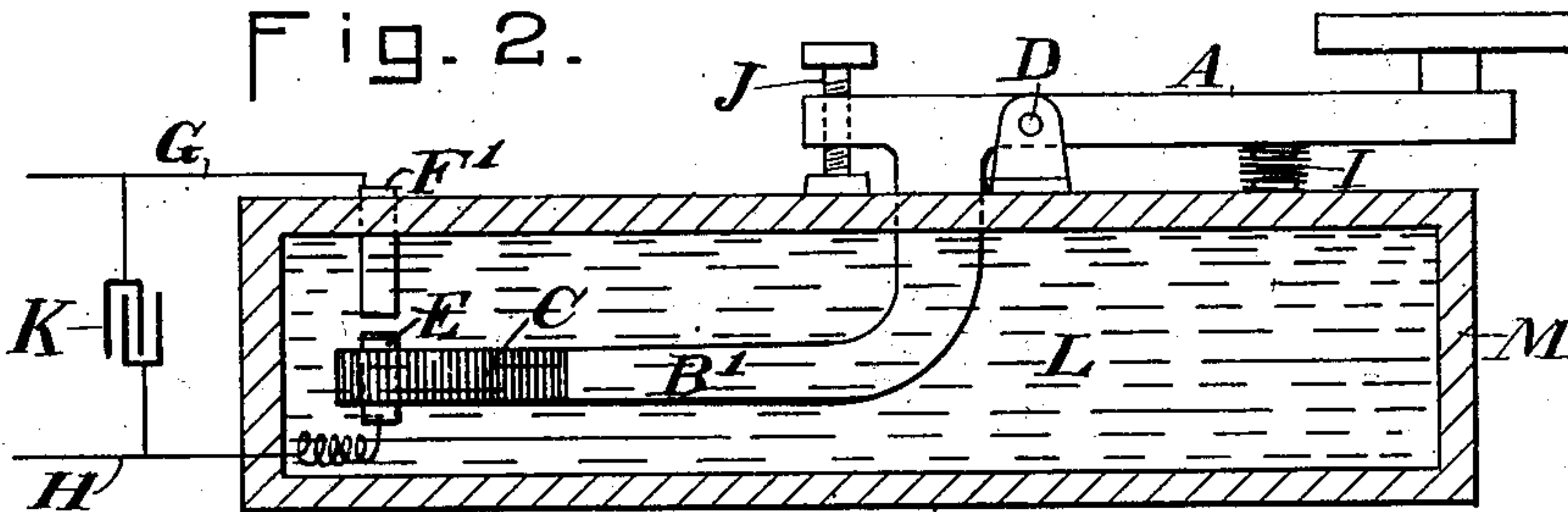


Fig. 3.

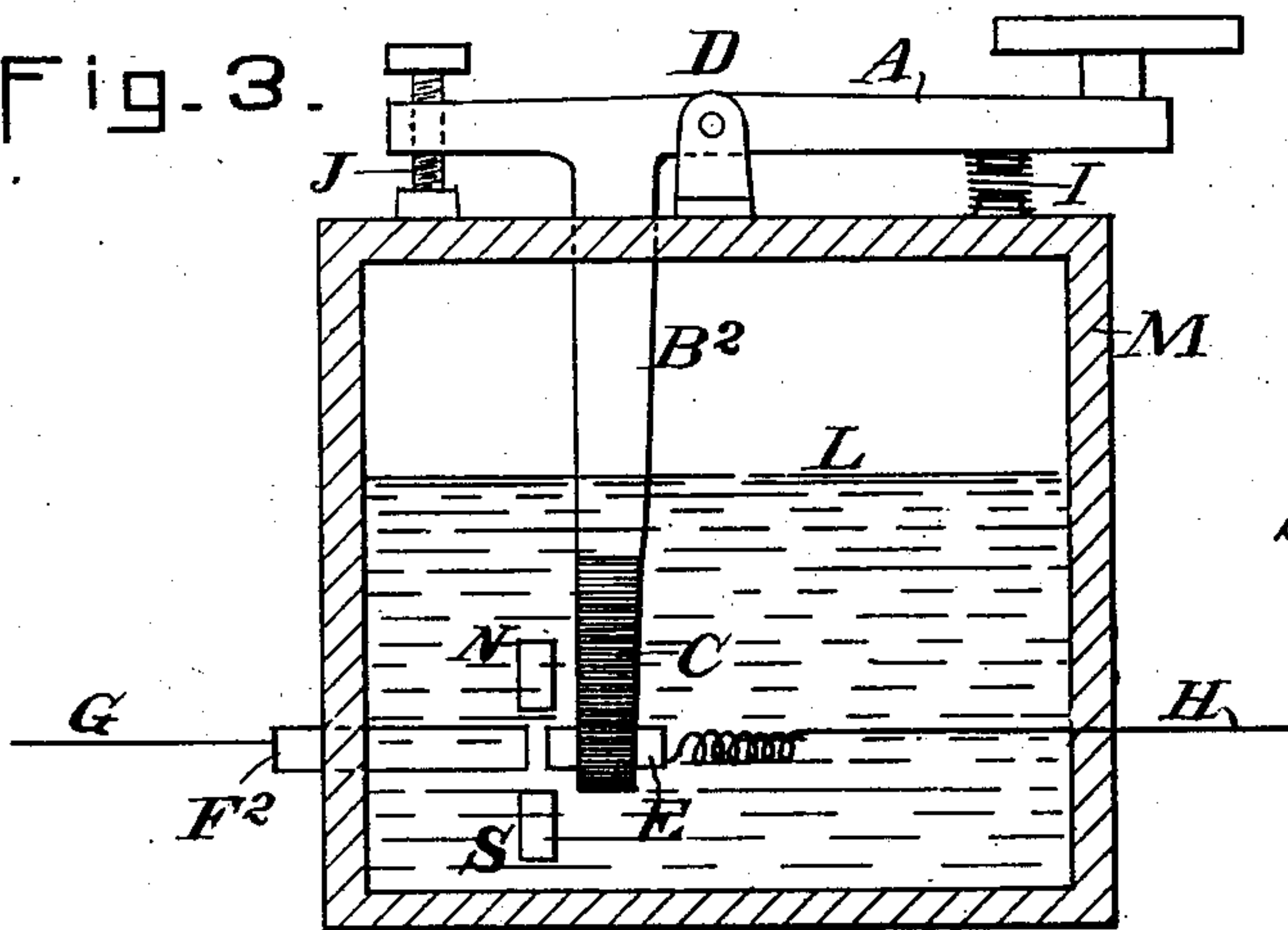
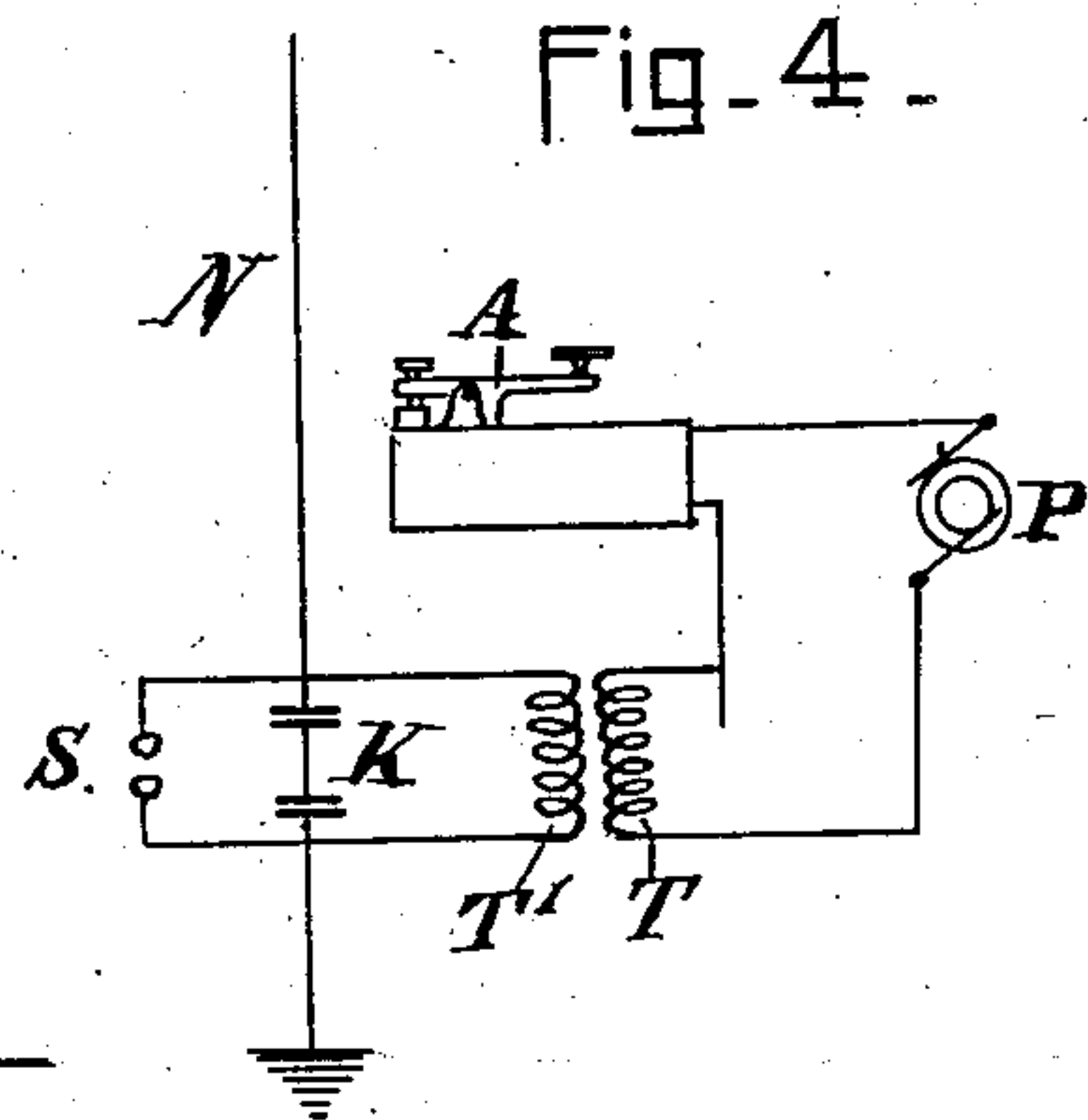


Fig. 4.



WITNESSES:

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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y.

WIRELESS SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 749,178, dated January 12, 1904.

Application filed March 5, 1903. Serial No. 146,357. (No model.)

To all whom it may concern:

Be it known that I, LEE DE FOREST, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented certain new and useful Improvements in Wireless Signaling Apparatus, of which the following is a specification.

My invention relates to an improvement in signal-keys of the Morse type, whereby they are better adapted for use under the conditions of wireless telegraphy.

My invention comprises the novel features which will be hereinafter described, and particularly pointed out in the claims.

Figures 1, 2, and 3 each represent in partial sectional elevation a special form of key embodying my invention. Fig. 4 shows a transmitting apparatus embodying my invention.

The Morse type of key as now used in ordinary telegraphy has been proved by long use to be the thing just adapted to its particular purpose—that is, to the convenient and rapid production of makes and breaks in the circuit. As the method of sending signals by wireless signaling is the same—that is, by producing makes and breaks—and also as the use of this kind of key is familiar to the entire corps of telegraph operators, it is desirable to retain the same form of key for wireless signaling.

With the ordinary unmodified Morse key it has been found that the high potentials necessarily employed to produce a disturbance of sufficient intensity to transmit the signal wirelessly produces an arc between the contact parts, and this arc must be destroyed before the next element of the signal may be produced. This both destroys the contact-points and greatly reduces the possible speed of transmission. With a Morse key modified in accordance with my invention the same speed may be obtained in wireless signaling as in ordinary telegraphy, as the production of the arc is prevented.

Referring to Fig. 1, A is one arm, and B the other arm, of the key-lever, which is pivoted at D. This lever is of a bent or recurved form, the contact-arm B being at a lower level than the operating-arm A, so that the con-

tact-arm may be immersed in oil L or other insulating fluid or dielectric having a higher insulating capacity than air and contained in the box or reservoir N, upon which for convenience the key-lever is shown as being mounted.

One of the contacting members E is carried by the contact-arm B, and the other, F, is otherwise conveniently mounted, as upon the reservoir M. I prefer that the terminal portion C of the contact-arm be composed of an insulating material, as hard rubber, within which is mounted a metal plug forming the contact member E. The contact members E and F are respectively connected with wires H and G, which form parts of the key-controlled circuit. The coil shown in wire H is simply to secure the flexibility which will permit of movement of the arm B.

I is a spring which raises the key after it has been depressed, and J an adjustable stop determining the amount of the rise.

The key shown in Fig. 2 is the same as shown in Fig. 1 except that the contact-arm B' is offset from the operating-arm and continues in the same direction. In this case the contact is made by an upward movement of the contact-arm, the contact member F' being placed above the arm. In this figure I have also shown a capacity, as the condenser K, connected between the two wires G and H.

In Fig. 3 the contact-arm B² extends downwardly, and contact is made with a stationary contact member F² by a horizontal movement. In all cases the make and break is made beneath the surface of an insulating-dielectric, whereby the formation of arcs is prevented. This key is therefore as rapid as is the usual Morse key in ordinary telegraphy and does not have the disadvantages of the usual Morse key as applied to wireless signaling.

In some cases if the tension of the current directly controlled by the key be sufficiently high there may be a tendency to arcing notwithstanding the insulating-oil. In such case a blow-out magnet or any other form of device for quickly destroying the arc may be used. The two poles of such a magnet are indicated at N and S in Fig. 3.

In Fig. 4 a complete transmitting apparatus is shown as an illustration of an embodiment of my invention. This includes an alternating-current generator P, a switch A of the type illustrated in the other figures, a step-up transformer T T', antenna N, condensers K, and spark-gap S. I preferably place the key in the generator-circuit, as shown, the same being the primary of the step-up transformer. I find it preferable to use with this key a source of alternating current, preferably of about thirty-cycle frequency or higher, and insert the key directly in the alternating circuit between the generator and the primary of a step-up high-potential transformer. With a relatively high-frequency current this type of Morse key may be operated at a very rapid rate, whereas with an induction-coil and low-frequency interrupter the key, although working well, will not allow a high speed. I have also tried all potentials on the alternating circuit operated by this key and found that for currents of, say, one hundred volts the current is relatively too great and the key-contacts tend to fuse and stick. On the other hand, with high-voltage currents, such as one thousand volts, the tendency to arc across is too great, although the current density is but one-tenth of what it was at one hundred volts. This means that the throw of the key must be too great at least one-quarter of an inch, and the ordinary skilled Morse operator finds trouble in rapidly manipulating the key. From two hundred to five hundred volts seem to be the best for making and breaking at the key and requires a throw of not more than one-tenth to one-eighth of an inch to break currents representing two-horse power of energy. With this key a Morse operator has frequently attained a speed of forty to fifty words per minute with a current of two-horsepower energy. This I believe to greatly exceed the results obtained in wireless telegraphy by any other form of key even when using currents of much smaller energy. These superior results I believe to be due to the peculiar type of key, together with the alternating current and the voltage employed.

The keys illustrated in the drawings are only given as showing preferred forms of construction and not as showing the only forms in which my invention may be embodied. It is evident that my invention may be embodied in numerous other forms. I do not, therefore, wish to be limited to the particular forms herein shown.

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

1. A signal-key of the Morse type having a bend whereby the contacting arm may be immersed in an insulating fluid while the operating-arm is free therefrom, the contacting arm having an insulating terminal-section, a

contact member carried by said terminal-section, and a coöperative contact member, said contact members being immersed in a dielectric of relatively high insulating capacity.

2. In a signal-key of the Morse type, the combination with a reservoir containing an insulating fluid, a pivoted key-lever adapted to have one arm without said reservoir and the other within said reservoir and dipping beneath the fluid therein, and two contact members one carried by the immersed section of the lever and both immersed in the insulating fluid.

3. A signal-key of the Morse type comprising a pivoted lever one arm of which is adapted to be engaged by the operator the other arm carrying one of the make-and-break members, and a coöperative make-and-break member, said make-and-break members being immersed in a dielectric of relatively great insulating capacity.

4. A signal-key of the Morse type comprising a pivoted lever the two arms thereof being bent so that one may be immersed in a fluid while the other is clear thereof, two make-and-break members one carried by the immersed arm, and a dielectric of relatively high insulating capacity surrounding said make-and-break members.

5. In a signal-key of the Morse type, the combination with a receptacle containing a dielectric of relatively great insulating capacity, of a key-lever carrying upon one arm an insulated contact member which is immersed in said dielectric, and a complementary contact member also immersed in said dielectric.

6. In a signal-key of the Morse type, the combination with a key-lever having two arms one of which is adapted to be engaged by the operator and the other arm carrying a contact member adapted to be connected with one side of the circuit and a stationary contact member coöperating therewith and adapted to be connected with the other side of the circuit, of a dielectric of relatively high insulating capacity surrounding said contact members.

7. A signal-key of the Morse type for use in wireless telegraphy and with alternating currents, having depending contact-arm operating in and breaking the current beneath the surface of an insulating fluid.

8. A signal-key of the Morse type for use in wireless telegraphy having the contacting or make-and-break members operating within an insulating fluid to make and break an alternating current of more than one hundred volts.

9. A signal-key of the Morse type for use in wireless telegraphy having the contacting or make-and-break members operating within an insulating fluid to make and break an alternating current of more than twenty-cycle frequency.

10. A signal-key of the Morse type for use

in wireless telegraphy having the contacting or make-and-break members operating within an insulating fluid to make and break a current of approximately five hundred volts.

5 11. A signal-key of the Morse type for use in wireless telegraphy comprising a pivoted lever having arms of unequal lengths, the shorter arm being adapted to be engaged by the operator, the longer arm carrying one of the
10 make-and-break members, and a coöperative stationary make-and-break member.

12. A signal-key for use in wireless telegraphy comprising a pivoted lever having a substantially horizontal arm provided with a finger-piece, the opposite arm carrying a contact member at a level materially lower than
15 the pivot.

13. A signal-key for use in wireless telegraphy comprising a pivoted lever having a substantially horizontal arm carrying a finger-piece, and a depending arm carrying a contact-point.
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14. A signal-key for use in wireless telegraphy, comprising a pivoted lever, a spring acting to throw said lever in one direction, a finger-piece carried by the lever, a stationary contact member, a coöperative contact mem-
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ber carried by the lever, and means for maintaining an insulating fluid between said contact members.

15. A signal-key for use in wireless telegraphy, comprising a lever pivoted intermediate its ends and having upon one end a finger-piece, the other end having a make-and-break or contact member, and means for maintaining an insulating fluid about the contact members.
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16. A signal-key for use in wireless telegraphy, comprising a lever pivoted intermediate its ends, a finger-piece upon one end of said lever, a spring acting upon said lever to raise the end carrying the finger-piece, a stationary contact member, a coöperative contact member carried by said lever, and means for maintaining an insulating fluid between said
40 45 contact members.

In testimony whereof I have hereunto affixed my signature, this 25th day of February, 1903, in the presence of two witnesses.

LEE DE FOREST.

Witnesses:

M. W. NOLAN,

H. L. SNYDER.