(No Model.) 4 Sheets—Sheet 1.

R. WREDEN.

MICROTELEPHONIC APPARATUS FOR DIVERS.

No. 478,493. Patented July 5, 1892.

Fig. 1.

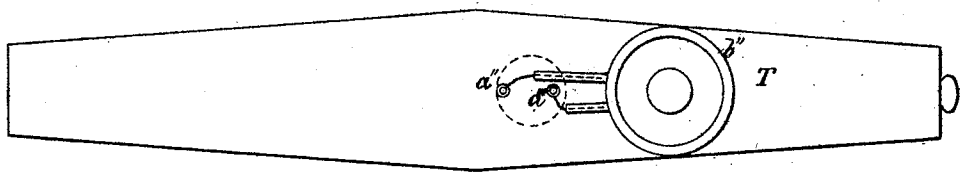


Fig. 2.

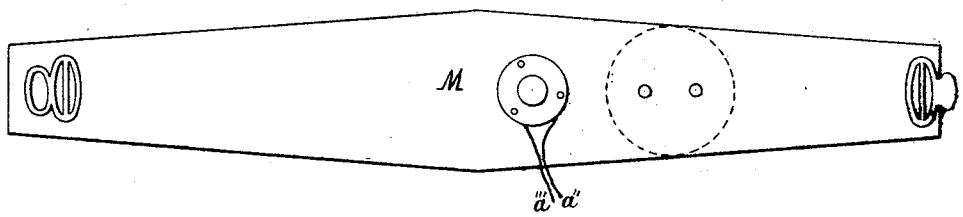


Fig. 7.

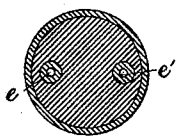


Fig. 8.

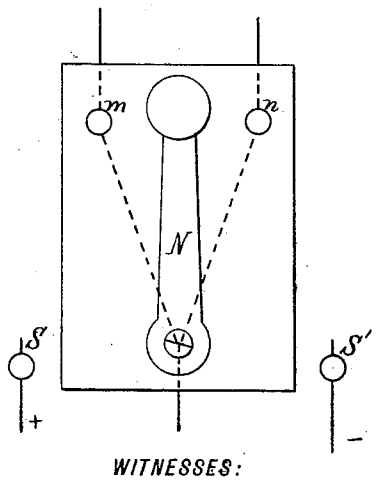
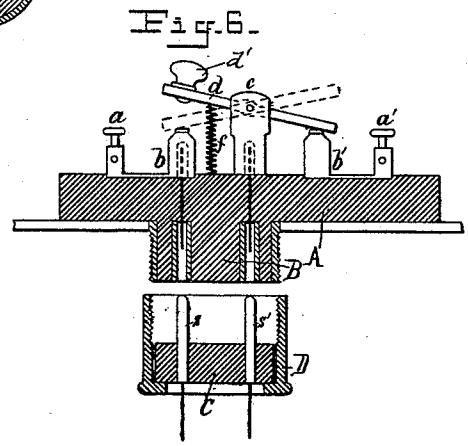


Fig. 6.



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(No Model.) 4 Sheets—Sheet 2.

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MICROTELEPHONIC APPARATUS FOR DIVERS.

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Fig. 5.

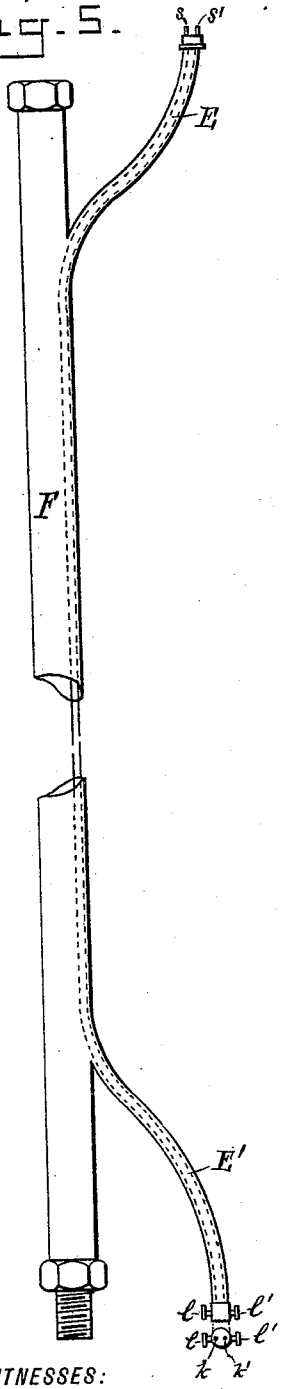


Fig. 3.

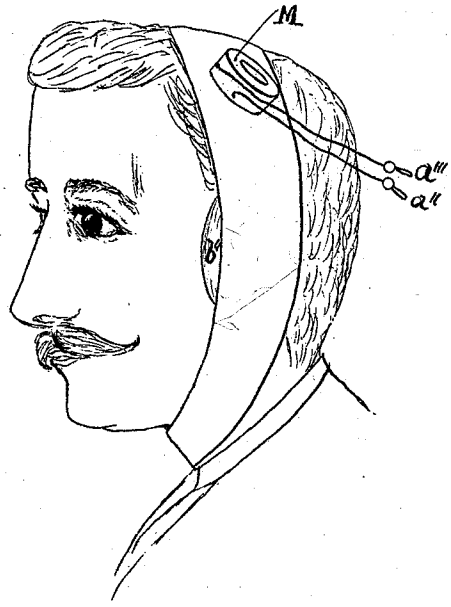
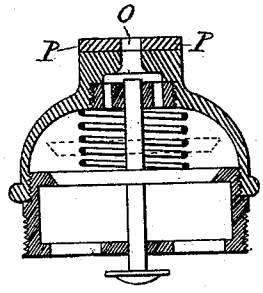


Fig. 4.



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MICROTELEPHONIC APPARATUS FOR DIVERS.

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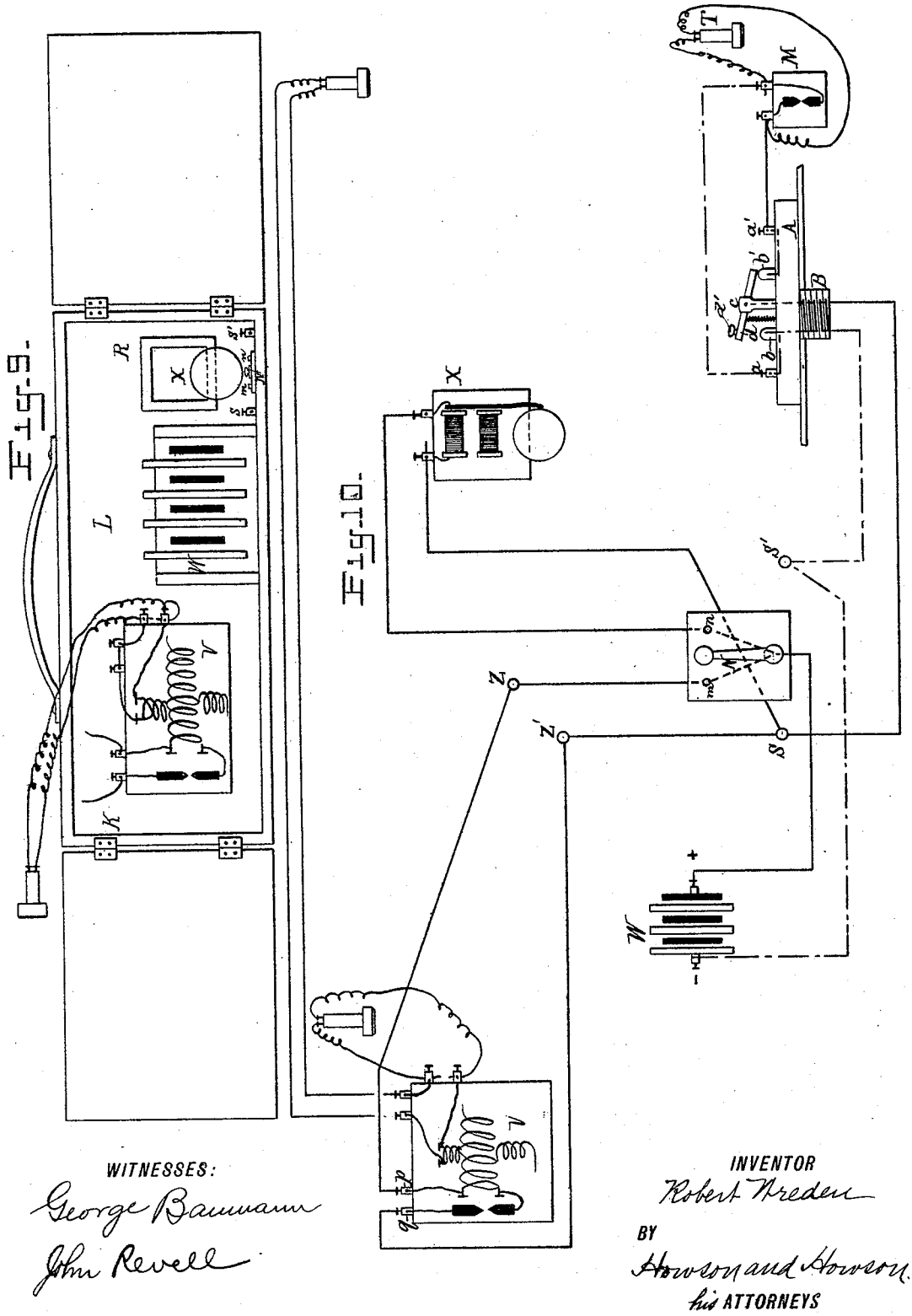

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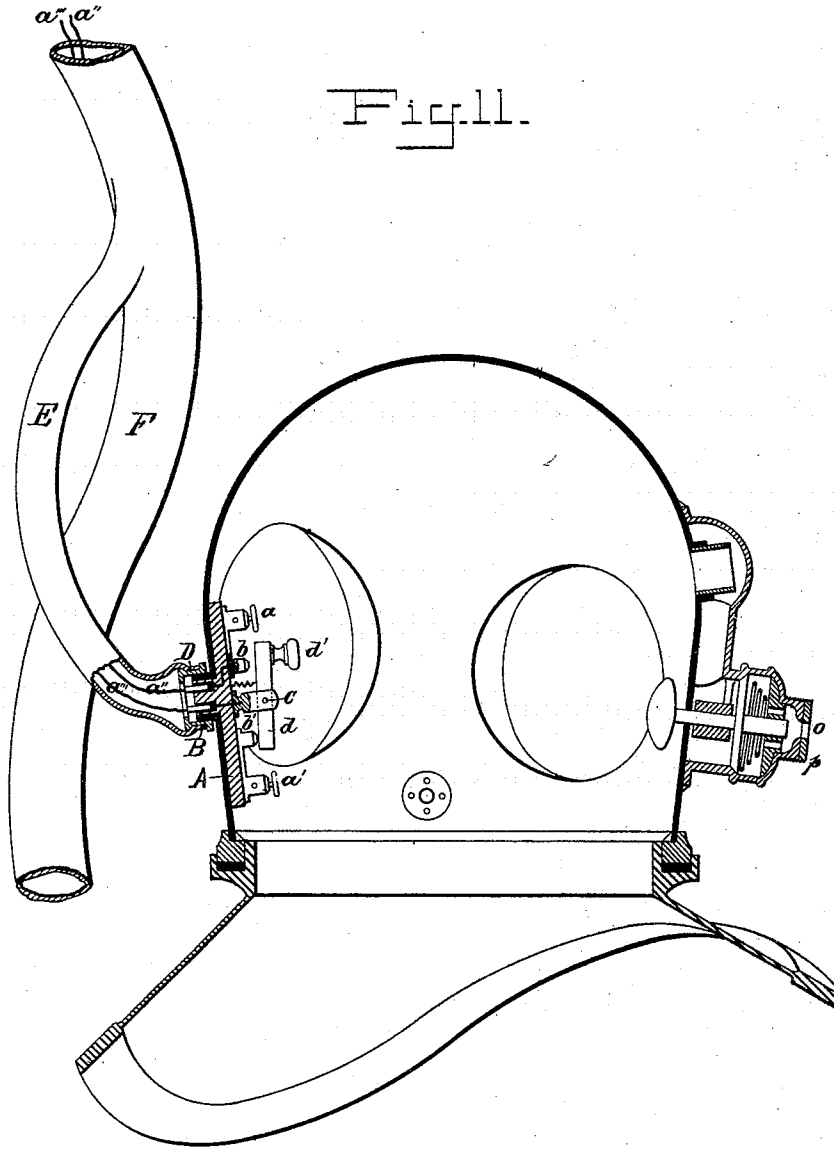
MICROTELEPHONIC APPARATUS FOR DIVERS.

No. 478,493. Patented July 5, 1892.

Fig. 11.



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UNITED STATES PATENT OFFICE.

ROBERT WREDEN, OF ST. PETERSBURG, RUSSIA.

MICROTELEPHONIC APPARATUS FOR DIVERS.

SPECIFICATION forming part of Letters Patent No. 478,493, dated July 5, 1892.

Application filed March 28, 1890. Serial No. 345,663. (No model.)

To all whom it may concern:

Be it known that I, ROBERT WREDEN, doctor of medicine and actual councillor of state, a subject of the Emperor of Russia, residing at St. Petersburg, Russia, have invented certain new and useful Improvements in Microtelephonic Apparatus for Divers, of which the following is a specification.

My invention relates to a microtelephonic apparatus which will enable a diver under any depth of water to hold a perfectly-intelligible and loud conversation with persons situated above water, either on land or on board of a vessel. It fulfills perfectly all the requirements of diving operations, as, first, it transmits in a perfectly-intelligible manner the speech either from the diver to those above water or from the latter to the diver; secondly, the diver can, if necessary, ring a signal-bell at the station above water; thirdly, the apparatus is of strong construction and can be readily used even by unskilled divers, because the electrical conductors are situated inside the air-supplying tube of the diver, while the telephone, microphone, and commutator for the signaling apparatus or bell are situated inside the helmet; also, the apparatus at the above water station is contained in a portable strong casing that can be locked, and the current-generator consists of a dry battery; fourthly, this microtelephonic diver apparatus is so constructed as to be readily adapted to any existing construction of helmets and air-tubes.

In the accompanying drawings, Figure 1 is a view of the inner side, and Fig. 2 a view of the outer side, of the microtelephonic bandage for the head of the diver. Fig. 3 shows the bandage in place. Fig. 4 is a sectional view of the air-escape valve of the helmet. Fig. 5 shows the air-tube and its branches. Figs. 6 and 7 are sectional views at right angles to each other of the terminal connection in the helmet. Fig. 8 is a view of the commutator used at the upper station. Fig. 9 shows a portable box containing the apparatus belonging to the upper station. Fig. 10 is a diagram showing the electrical connections. Fig. 11 is a cross-sectional view of the diver's helmet, showing the electrical connections, the air-tube, and the air-exit valve.

The microtelephonic apparatus consists of four principal parts: the microtelephonic head-gear, the microtelephonic apparatus of the diving-helmet, the microtelephonic devices of the air-tube, and the microtelephonic apparatus of the above-water station.

I. *The microtelephonic head-gear of the diver.*—This is shown at Figs. 1, 2, and 3 of the drawings. It consists of an elastic bandage of caoutchouc, which is placed over the top of the head and is fastened together by buttoning or otherwise under the chin. On the inner surface is the telephone T, and on the outer surface the microphone M, from which a pliable double conducting-wire leads to the pinching-screws a a' of the commutator, Fig. 6, in the helmet. The conducting connecting-wires a'' a''', which connect the microphone M with the telephone T, are on the inner surface of the bandage, as shown at Fig. 1. The microphone and telephone may be of any known construction. They must, however, be of such size and configuration that they do not interfere with the free movement of the head in the helmet. It is also essentially necessary that the telephone should be tightly pressed against the ear, so as to protect this from the great noises occurring in the helmet, for which purpose there is fixed on the edge of the ear-plate of the telephone a ring b'', Figs. 1 and 3, of caoutchouc, felt, or other non-conductor of sound. The shape of microphone head-bandage of the diver can also be varied. For example, it might be in the shape of a cap or covering with ear-lappets. The principal condition is that the telephone and microphone shall be fixed on the head of the diver and be prevented from coming in contact with the sides of the helmet, as otherwise the sound vibrations produced in the helmet by the continuous inflow and outflow of compressed air would be communicated to the microphone and destroy its proper action or render speech unintelligible. The material of which the head-bandage is made may also be greatly varied, thus it may be of caoutchouc, leather, felt, cloth, &c. It is only essential that the bandage should protect the ears as completely as possible against the noises in the helmet and should press the telephone tightly against the head in whatever position this may be placed, so that the diver may be enabled to hear every

thing that is spoken to him through the telephone, and therefore shall not require any call-signal from the station above water. If, on the other hand, the telephone were fixed on the inner surface of the helmet, the diver could not possibly keep his ear pressed against it for a considerable length of time, and could therefore not at all times answer any question that might be put to him from the upper station. It would therefore be necessary to provide a special call-signal in the helmet for calling the diver's attention to the fact that the upper station desires to speak with him, which arrangement would be very inconvenient in view of the want of space and the great noise occurring in the helmet. With the use of the microphonic head-bandage the ears are effectually closed against the noise in the helmet. The microphone is not subject to the vibrations of the helmet, and consequently transmits the diver's speech clearly to the upper station, while, as before stated, the telephone being pressed continuously against the diver's ear renders a call-signal unnecessary, as every sound transmitted from above passes direct into the ear of the diver as though it were spoken directly into the same. The fixing of the microphone on the head of the diver would also have the advantage of enabling those at the upper station to at once detect by the occurrence of unusual stillness or of sounds of snoring if the diver had gone to sleep and to wake him by making loud or shrill noises through the telephone.

II. *The microtelephonic devices in the helmet.*—These consist of a commutator, the necessary screw-terminals for the conducting-wire of the air-tube, and the modified construction of the air-discharge valve.

First. The commutator of the helmet is shown at Figs. 6, 7, and 11. It enables the diver, by depressing the button d', to cut his microphone and telephone out of the electric circuit and to cause the current which passes from the battery at the upper station along the wires of the air-tube to the commutator to pass directly back to the battery through an electric signal apparatus, so as to call the attention of the person at such station. The commutator is fixed on an insulating-plate A, of ebonite, on the inner surface of the helmet, and is so constructed that the current passing through the metal bracket c into the axis of the metallic lever d can pass in two different directions—namely, either to the right through the right contact-stud b' and the right-hand screw-terminal a', connected thereto, into the microphone and telephone of the diver, from which it passes back through the left screw-terminal a and the contact-stud b in connection therewith to the battery of the upper station, or upon the diver pressing his head against the button k of the lever d, thereby breaking the contact at b' and making it at b, the current will pass directly back to the battery of the upper station, cutting out the microphone and telephone of the helmet. As the principal use of the apparatus is to transmit speech to and from the diver, the commutator-lever is acted upon by a spring f, so as to cause it to keep in contact with the contact-stud b', and thus keep the circuit ordinarily closed through the microphone and telephone.

Second. The terminal connection of the helmet, Figs. 6, 7, and 11, for attaching the conducting-wires, is connected to the commutator-base and passes in a water-tight manner through the side of the helmet to the outside thereof. It consists of an ebonite cylinder with two internal insulated metal tubes e e', which are in conducting connection with the metal contact-stud b and support c of the commutator, respectively, and serve to receive the two metal pins s s' of the cap D, which is in connection with the branch E of the air-tube F, Fig. 5. The outer metallic covering to the block B is formed with a screw-thread for receiving the screw-cap D of the terminal block c of the air-tube. Between the two blocks B and C a caoutchouc washer is introduced to prevent the possibility of water penetrating to the conductors.

Third. The air-escape valve of the helmet, Figs. 4 and 11, has in place of a great number of escape-openings, as is customary, through which the excess of air escapes into the water, only a single comparatively large opening O, situated in the center of a lead ring P, soldered onto the end of the valve-casing. This arrangement has for its object to lessen the disturbing noise in the helmet, which is caused by the issue of the air through a large number of small openings, as a single jet of air will produce a considerably less number of vibrations in the water, and consequently in the helmet, than a number of them, and, in addition, the friction of the air in a number of small passages will be much greater than in a single large one. Lastly, the sound-vibrations will be much less in the comparatively bad sound-conductor—lead—than in the brass plate containing the number of small holes, and the transmission of such sound to the helmet will also be much less through the lead than through the brass. In place of lead any other bad conductor of sound—such as caoutchouc, cork, felt, &c.—may be used. In order to still further reduce the noise, the helmet might be lined internally with one of the above-named substances, because the transmission of the sound-vibrations of the helmet to the inclosed air would be considerably impeded thereby. This effect may be still further increased by coating the helmet both internally and externally with a bad conductor of sound.

The principal cause of noise in the helmet is the outflowing air, that caused by the inflowing air is comparatively small, and it is not even desirable to do away with this, such as by improved constructions of the air-pump and of the air-inlet passages of the helmet,

because by that means the indications at the upper station by the microphone of the sufficient and regular supply of air to the helmet would be impaired.

III. *The microtelephonic devices of the air-tube*, Fig. 5, consist in providing at both ends thereof—*i. e.*, at the helmet and at the air-pump—two lateral caoutchouc branch tubes E E′, through which the electric-circuit wires contained in the air-tube F pass out in order to avoid the air-valves at the helmet and air-pump. These two branch tubes E E′ have at their ends hermetically-secured terminals for connecting the circuit-wires of the air-tube with the commutator of the helmet and the connecting-screws S S′ of the upper station, as indicated at Figs. 9 and 10. The terminal on the air-tube for connection with the helmet consists of an ebonite cylinder C, Fig. 6, in which are bedded two projecting metal pins *s s′*, which are in conducting connection with the circuit-wires of the air-tube, and which fit closely within the metal tubes *e e′* of the commutator-terminal on the helmet. The metallic casing of the ebonite cylinder C is contained loose in a made screw-cap D, that screws on the terminal of the helmet, whereby an effectual conducting-contact between the two sets of terminals is effected. The terminal at the end of the branch E′ consists of an ebonite block containing two metal conducting-tubes *k k′*, which are in conducting connection with the circuit-wires in the tube and which have pinching-screws *l l′* for securing the connecting-wires S S′, Figs. 9 and 10, inserted into the tubes at the upper station.

IV. *The microtelephonic above-water station*, Figs. 9 and 10, consists of a transportable wooden box that can be locked up and that contains three compartments. In the first of these K is the microphone with the induction-coil and telephone, in the second L are four dry-battery elements, and in the third R is the electric signaling-bell and the commutator. This commutator (shown at Fig. 8) sends the current of the battery through the left-hand metal stud *m* into the microphone on turning the switch N to the left hand. On moving the switch to the right hand onto stud *n* the current is sent into the signal-bell, while if the switch is turned to the middle position on the insulating ebonite plate the circuit is intercepted, and consequently the battery is at rest.

The function of the microtelephonic apparatus will be seen from the diagram of the electrical connections, Fig. 10. From the positive pole of the battery W the current passes into the axis of the commutator-lever N, and by turning the latter it can either be directed into the microphone V, the lever being put upon the stud *m* or into the bell X, the lever being put upon the stud *n*. In the first case the microphone is put into circuit and the bell is out of circuit, and in the latter case the reverse is effected. For communicating with the diver the commutator-lever N is moved to the left, whereupon the current passes from the stud *m* and screw-terminal Z into the microphone V of the upper station, in passing through the screw *p* into the thick wire of the induction-coil and the carbon contact, and thence through the screws *q* and Z′ to the terminal S of the circuit-wire in the air-pipe. From the other end of this it passes into the commutator of the diver's helmet. Here the current passes through the axis *c* of the movable contact-lever *d* and contact-stud *b′* to the screw-terminal *a′*, with which the one end of the pliable conducting-wire *a″*, Fig. 2, of the diver's microphone is connected. After the current has passed through the microphone and the telephone connected parallel therewith it passes through the contact-screw *a* and stud *b* of the helmet-commutator into the circuit-wire of the air-tube F, and from the terminal S′ thereof to the zinc pole of the battery W.

The parallel arrangement of the microphone and telephone of the diver's apparatus is an essential peculiarity of the apparatus, because it produces a remarkable degree of effectiveness of the apparatus. In connecting the microphone with its telephone in series the introduction of the induction-coil of the telephone into the circuit would cause a considerable resistance to the battery-current, whereby the action of the two microphones at the diver's apparatus and upper station would be considerably weakened. To avoid this defect, it would be necessary, if the above-described parallel arrangement were not employed, to introduce another induction-coil into the diver's helmet, thereby still further reducing the space in the same, which is already very limited and causing great inconvenience. After the termination of the conversation the person at the upper station places the lever N upon the stud *n*, whereby the microphone V is cut out and the bell X is included in the circuit. This bell will, however, not ring so long as the microphone and telephone of the diver are included in the circuit, but is only brought into action after these have been cut out by the action of the lever *d*, as above described, thereby causing the current to pass from the commutator direct to the zinc pole of the battery W, whereupon the bell X, being alone in circuit, will be effectually put in action. The current then flows as follows: From lever N and stud *n* the current passes into the bell X, from thence through screw S into the circuit-wire of the air-tube F, and through this to the commutator of the helmet, where it passes through lever *d*, this being depressed by the diver, and post *b* to the other wire of the air-tube, and thence through screw S′ to the battery W.

If it is desired to use the earth or water for return-conductor instead of having a second wire, the apparatus will also act efficiently, the two microphones, two telephones, and the

electric bell being then worked by a single wire.

I claim as my invention—

1. In apparatus for the use of divers, an elastic bandage adapted to be placed on the diver's head and provided on its inner surface with a receiver to be placed near the ear and on its outer surface provided with a microphone, all substantially as set forth.

2. In apparatus for the use of divers, the combination of the helmet provided with binding-posts in electrical communication with conducting-wires with a bandage adapted to be placed on the diver's head and provided with a receiver and a microphone, and conducting-wires leading to the said binding-posts, all substantially as set forth.

3. In apparatus for the use of divers, the combination of an electric circuit, a transmitter, a receiver and an electric bell in the said circuit with a diver's helmet provided with a commutator placed in the interior thereof and adapted to be moved by the diver's head, substantially as described.

4. In apparatus for the use of divers, the combination of two sets of telephone receiving and transmitting instruments, one for the diver and one for the above-water station, an electric bell, a battery, and a switch adapted to place the bell in the electric circuit while cutting out the above-water-station telephone-instruments, and vice versa, and a commutator in the helmet and adapted to normally retain the diver's telephone-instruments in the circuit, but to cut these instruments out of the circuit at the will of the diver, substantially as and for the purposes set forth.

5. In a diver's helmet, an exhaust-air valve provided with one large opening and covered internally with lead or other poor conductor of sound, substantially as and for the purpose set forth.

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

ROBERT WREDEN.

Witnesses:
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Z. BLAU.