To all whom it may concern:

Be it known that I, JOSEF SCHIESSLER, subject of the Emperor of Austria-Hungary, residing at Baden, near Vienna, Austria-Hungary, have invented certain new and useful Improvements in Transmitting Apparatus for Submarine Signals; 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to an apparatus for transmitting signals through water, and has for its object to provide an improved apparatus in which instead of single strong expenditures of force being employed, as hitherto, for the production of a single, very strong, but rapidly vanishing sound, a large number of comparatively weak syntonized impulses are employed therefor, in order to operate a similarly syntonized receiver. That is to say, instead of the considerable, energy consuming and strongly damped oscillations, there are employed, as in wireless telegraphy, undamped, continuous and as nearly sine-shaped sound oscillations as possible. In this way a substantial economy in force is secured on the one hand and on the other hand the distance to which sound can be transmitted is increased, particularly when resonance is utilized.

The improved transmitting apparatus can be provided with an arrangement whereby electrical waves can be sent out simultaneously with the sound waves, and such electrical waves, on account of their extremely great velocity of transmission, may be utilized to indicate that the emission of the sound waves has actually commenced, in a suitably constructed receiver at a remotely situated signal receiving station, so that by noting the time between the emission and the arrival of the sound waves, the distance between the transmitting and receiving stations can be determined from the product of time multiplied by the velocity of transmission of sound.

The improved transmitting apparatus accordingly comprises means for generating and transmitting sound and a wireless system for sending out electrical waves.

Figure 1 of the accompanying drawing is a vertical section illustrating a construction of the improved transmitting apparatus together with the arrangement of electrical connections. Fig. 2 is a diagram showing a modified arrangement of electrical connections. Fig. 3 is also a diagram illustrating another modification of the arrangement of electrical connections wherein a separate telephone relay is employed.

Fixed to the resonance box, or the resonance plate $r$, of a solid rod $m$ of elastic metal, are two or more tuning forks 26, 27 which are actuated by electro-magnets 28, 29, energized from a source of current taken from terminals 32, 33, and each connected up in series with a microphone or telephone being preferably of the kind of a monophone 30, 31. The elastic metal rod $m$ is insulated in a sound-proof manner by an acid resisting rubber sheathing 36 and extends through a sound tube 35 which can be rotated by toothed gearing, the lower end of the rod being so arranged in a parabolic sound horn 37 connected to such sound tube that a syntonized sound plate 38 on the lower end of the rod $m$ is situated in the focal line of the parabolic horn 37. When the tuning fork 27 vibrates it strikes a contact 30 and thereby closes the oscillating circuit, which includes an adjustable self-induction coil 40 and a variable condenser 41, of a wireless telegraph apparatus, which circuit is fed from a continuous current dynamo 43 and includes an oscillation generator for example, an arc lamp 42, 43.

The sound plate 38 may in some cases be so mounted in the horn 37 in a sound proof manner by rubber rings, as to shut off the opening of the horn from the water, the plate in all constructions however being always in rigid connection with the elastic metal rod $m$.

In the system of electrical connections shown in Fig. 2 the microphone 44 is included in the primary circuit 47 which is fed from the battery 46 of a transformer, and a condenser 45 may also be included in such circuit in parallel. The electro-magnet or electro-magnets 50 are included in the secondary circuit 48 of the transformer, such secondary circuit being fed from a source of current for example a storage battery $s$ of higher tension, (220 volts or more) from the terminals 51, 52 and provided with a condenser 49 connected up in series.

The operation of the transmitting ap-
paratus is as follows:—If current be taken from the plug contacts 32, 33, Fig. 1, which are in connection with a source of current, for example a storage battery $s$ the two electro-magnets 38, 39 will be excited opposite to the microphones, telephones, or monophone 30, 31 tuned in unison. In consequence of this excitation the tuning forks 26 and 27 begin to vibrate, and to sound and the resonance box or the resonance plate $r$ vibrates with them. These vibrations however excite the microphones or the like included in series with the electro-magnets 28, 29 and the current of which then begins to fluctuate in the rhythm of the vibrations of the tuning forks. These fluctuating currents then excite in the same rhythm the electro-magnets and thereby regulate them in such way that the prongs of the tuning forks are attracted and repelled in proper time, whereby the maximum of the vibratory power for a suitable strength and tension of current is secured. By this connection of tuning fork and microphone which in itself is known and which may equally well be made between a siren and a telephone etc., maximum, continuous, sine-shaped vibrations are produced and transmitted through the resonance plate $r$, or resonance box, to the elastic metal rod $m$ and the sound plate or resonance tube 39 affixed to the lower end thereof, the vibrations of which sound plate pass through the water after being reflected from the inner wall of the parabolic horn 37 parallel to the axis in a sharply bounded ray of sound to which any desired direction may be imparted by rotating the horn 37. A harmonized tuning fork might however be used instead of the sound plate 39. In like manner flat bars of spring steel may be caused to vibrate by electro-magnets instead of the tuning forks 26, 27, or sirens or buzzers may be employed. If however a hollow sound tube is used, then the same electro-magnetically driven tuning forks will be used as sound generators, being set upon syntonized wooden resonance boxes and exciting the sound tubes at right angles to their axes as will be understood. All the tuning fork arrangements may, however, be replaced by electrically driven sirens or buzzers etc. As however the microphone will only stand weak currents, the arrangement shown in Fig. 2 serves, notwithstanding the microphones or telephones, to excite the electromagnets by stronger currents, whereby it is rendered possible to augment the mass of the tuning forks and obtain louder sounds.

In this case the excited tuning fork excites the microphone 44, which is fed from the battery 46 and the current fluctuations of which are augmented by the condenser 43 connected up in parallel. These currents which are transmitted at 47, 48 by ordinary transformer action or thereby made adjustable to resonance, produce in the secondary circuit, which is traversed by a current of higher tension taken from the terminals 51, 52, such powerful fluctuations of current that the condenser 49 begins to sound in the rhythm of the microphone currents. These powerful fluctuations now excite the electromagnet 50 of the tuning forks. At the same instant however in which the tuning forks begin to vibrate an electrical oscillating circuit is closed at 59 by a contact such as a mercury or other contact, and the vibrations of this oscillating circuit are transmitted to the antenna 51 by inductive or any other kind of coupling. Not only are the electrical oscillations transmitted wireless but also the tuning fork interruptions, so that the sound of the tuning fork can be audibly reproduced in the ordinary hearing receiver of a signal receiving apparatus. As, however, as has already been stated, the difference of time between the projection and arrival, is, in the case of electrical waves, so infinitely small as to practically coincide there will consequently be indicated at the instant of the arrival of the electrical waves in the signal receiving apparatus also the instant of the sending out of the same and the commencement of a movement is therefore notified.

The apparatus shown in Fig. 3 may also be used for the purpose stated. From the battery 53 of the telephonic relay indicated in this figure are fed two, (although it might be more) microphones, telephones or monophone 30 and 31, syntonized to the sound of the tuning forks 73, 75, and which are connected in series with two coils 56, 57 which are arranged to be accurately adjusted by a right and left hand threaded screw spindle 58 on a slide which is not shown. From terminals 60, 61, which are in connection with a source of current, for example a storage battery $s^*$, the strong current of the telephone relay passes over a regulating resistance 62 and a coil 63 rigidly mounted upon an iron core 59, over the junction points 64 and 65, as well as over electro-magnets 66, 67 and through an electric arc 68 which is arranged in a chimney and which if necessary may be of solenoid form, whereby the main circuit is closed. Parallel thereto and branching off from the junction points 64, 65, is a Thomson (Duddell) oscillating circuit, in which the variable condenser 69 and the regulatable self-inductance coil 70 are connected up in series. With this oscillating circuit are galvanically (conductively) coupled electromagnets 71, 72 of the tuning forks 73, 75 arranged on resonance boxes 74, 76. The magnets 71, 72 might however equally well be magnetically (inductively) or electrically (capacitatively) coupled to such oscillating circuit. In like manner the 130
transmission of the undulating microphone currents might be effected by coupling the microphone circuit either with the supply wires of the arc 68 or with the Thomson oscillating circuit, galvanically (conductively) or electrically (capacitively). The operation when this telephone relay is used is as follows—If current be taken from the terminals 60, 61 there is formed in the Thomson (Duddell) oscillating circuit an alternating current, the period of which is dependent upon the capacity 69 and self inductance 70. Immediately the electromagnets 71, 72 are operated the tuning forks 73, 75 begin to sound. The sound of the tuning forks, strengthened by the resonance boxes 74, 76, excites the microphones 54, 55 the undulating currents of which traverse the coils 56, 57, which are adjusted to resonance by the screw spindle 58 and allow their lines of force to pass entirely through the field of the coil 63, whereby the undulating currents of the microphone circuit are transmitted to the main circuit and farther on to the Thomson (Duddell) oscillating circuit, which then through the magnets 71, 72 attracts and repels the prongs of the tuning forks in the rhythm of the sounds of the tuning forks.

I claim—

1. In a signal transmitter, a vibrating sound producer, electro-magnetic means to maintain the vibrations thereof undamped, a resonator for the sound producer, means connected to the resonator to discharge sound waves under water and a reflector at the terminus of said means.

2. In a signal transmitter, a tuning fork, a resonating base therefor, an insulated metal rod connected to the base and terminating below water level, a rotatable sleeve in which the rod is mounted, a directing horn at the end of the sleeve in which the rod terminates, a wireless signal system including a high voltage oscillating circuit containing an electro-magnet adjacent the fork and a winding on a magnetic metal core, and a low voltage circuit including a winding adjustable on said core and a telephone transmitter adjacent the fork.

3. In a signal transmitter, a vibrating tuned sound producer, electromagnetic means to maintain the vibrations thereof undamped, a resonator for the sound producer, a conductor connected to said resonator to conduct sound waves under water and another resonator at the terminal of said conductor, and a reflector around the discharge end of the conductor.

4. In a signal transmitter, a vibrating tuned sound producer, means to maintain the vibrations thereof undamped, a resonator for the sound producer, a conductor connected to the resonator, another resonator at the terminal of said conductor and a positionable reflector around the discharge end of said conductor.

5. In a signal transmitter, a vibrating tuned sound producer, means to maintain the vibrations thereof undamped, a resonator for the sound producer, a conductor connected to the resonator, another resonator at the terminal of said conductor and a positionable parabolic reflector around the discharge end of said conductor.

6. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices, means acting on said devices to maintain the vibrations thereof undamped and to simultaneously synchronize said devices, a resonator for said sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor and a positionable parabolic reflector around the discharge end of said conductor.

7. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices and means to maintain the vibrations thereof undamped, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor, and a positionable parabolic reflector around the discharge end of said conductor.

8. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices, means acting on said devices, a microphone or a telephone transmitter in front of the vibrating sound producer and in circuit with said means, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor and a positionable parabolic reflector around the discharge end of said conductor to collect and direct the sound waves emanating under water from said conducting and resonating means.

9. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices, means acting on said devices, a microphone or a telephone transmitter standing in front of the vibrating sound producer and in circuit with said means, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor, a positionable parabolic reflector around the discharge end of said conductor to collect and direct the sound waves emanating under water from said conducting and resonating means, and a wireless transmitting mechanism controlled by said sound producing means to operate in unison therewith.

10. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices, means act-
ing on said devices, a microphone or a telephone transmitter standing in front of the vibrating sound producer and in circuit with said means, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor, a positionable parabolic reflector around the discharge end of said conductor to collect and direct the sound waves emanating under water from said conducting and resonating means, and a wireless transmitting mechanism having an oscillating circuit and means to superimpose the sound vibrations on said oscillating circuit to operate in unison therewith.

11. In a signal transmitter, a vibrating sound producer consisting of a plurality of tuned sound producing devices, means acting on said devices, a microphone or a telephone transmitter and in circuit with said means and standing in front of the vibrating sound producer including a low tension electric circuit with a condenser in parallel and connected by a transformer with an oscillating high tension circuit containing an electro-magnet operating the vibrating tuned sound producer, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor, a positionable parabolic reflector around the discharge end of said conductor to collect and direct the sound waves emanating under water from said conducting and resonating means, a wireless transmitting mechanism having an oscillating circuit and means to superimpose the sound vibrations on said oscillating circuit to operate in unison therewith.

12. In a signal transmitter, a vibrating sound producer, a resonating base therefor, an electro-magnet arranged in the oscillating circuit, a relay for strengthening weak electric currents to operate the vibrating tuned sound producer, a low tension electric current, a telephone transmitter in front of said sound producer located in said low tension electric circuit and working on said relay by an adjustable transformer to maintain the vibrations thereof undamped and to simultaneously synchronize said devices, a resonator for the sound producer, a conductor connected to this resonator, another resonator at the terminal of the conductor, a positionable parabolic reflector around the discharge end of said conductor to collect and direct the sound waves emanating under water from said conducting and resonating means, and a wireless transmitting mechanism having an oscillating circuit and means to superimpose the sound vibrations on said oscillating circuit to operate in unison therewith.

13. In a signal transmitter, a plurality of tuning forks working in unison, a resonating base therefor, an insulated metal rod, connected to the base and terminating below water level, a positionable and rotatable sleeve in which the rod is mounted, a directing horn at the end of the sleeve in which the rod terminates with another resonating body to collect and direct the sound waves emanating under water, a telephone transmitter in front of each tuning fork, a low tension electric circuit, electro-magnets adjacent the forks and included in said circuit, said telephone transmitters in series in said low tension electric circuit, a wireless transmitting mechanism having an oscillating circuit and means to superimpose the sound vibrations on said oscillating circuit to operate in unison therewith.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JOSEF SCHIESSLER.

Witnesses:

JOSEF RUBASCH,
ROBERT W. HEILGARTNER.