

J. H. REINEKE.
TELEPHONY AND TELEGRAPHY FOR MINING CAGES.
APPLICATION FILED AUG. 24, 1912.

1,098,528.

Patented June 2, 1914.

3 SHEETS—SHEET 1.

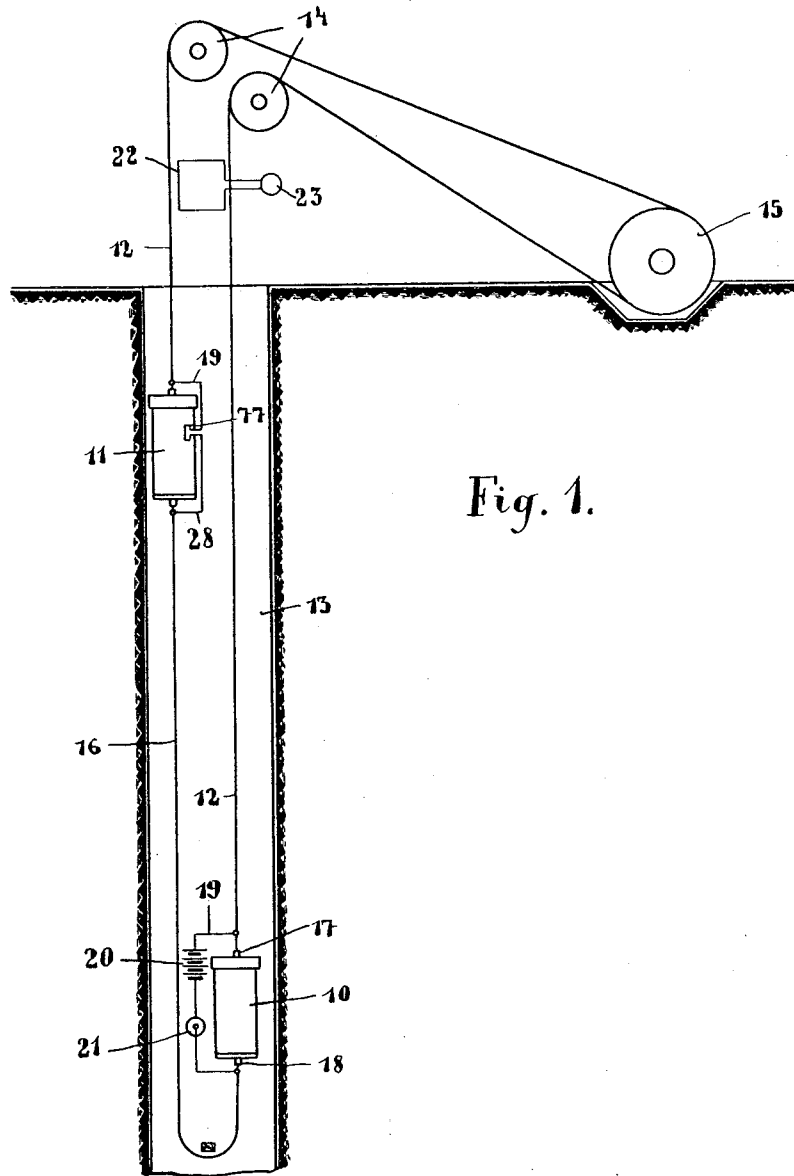


Fig. 1.

Witnesses:

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Daniel Holmgren.

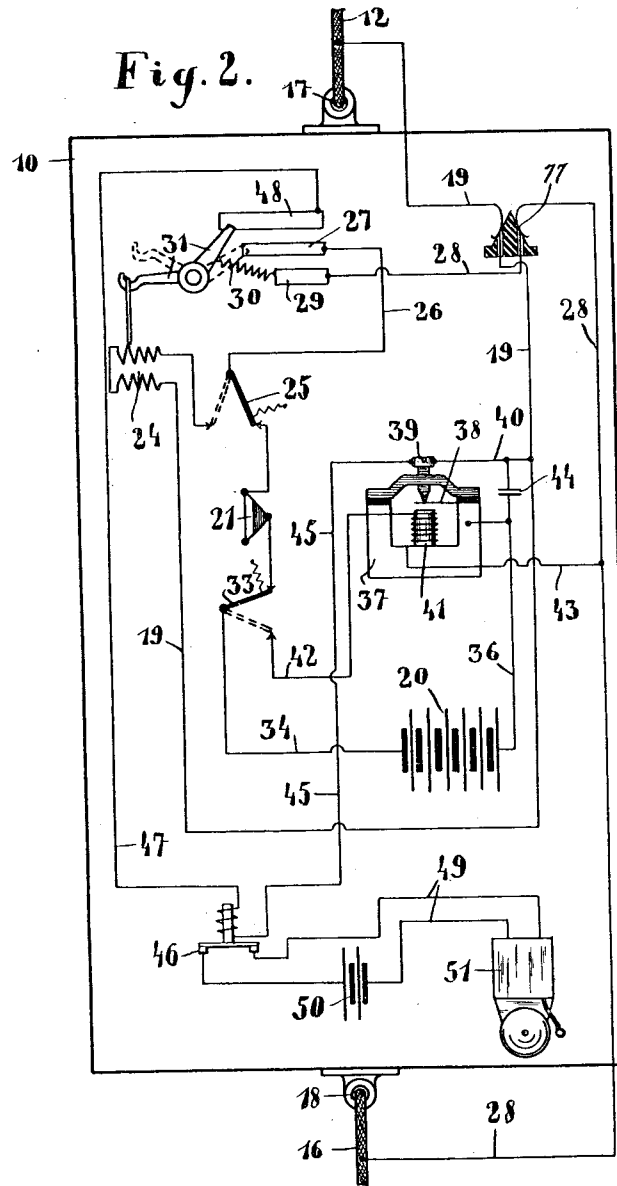
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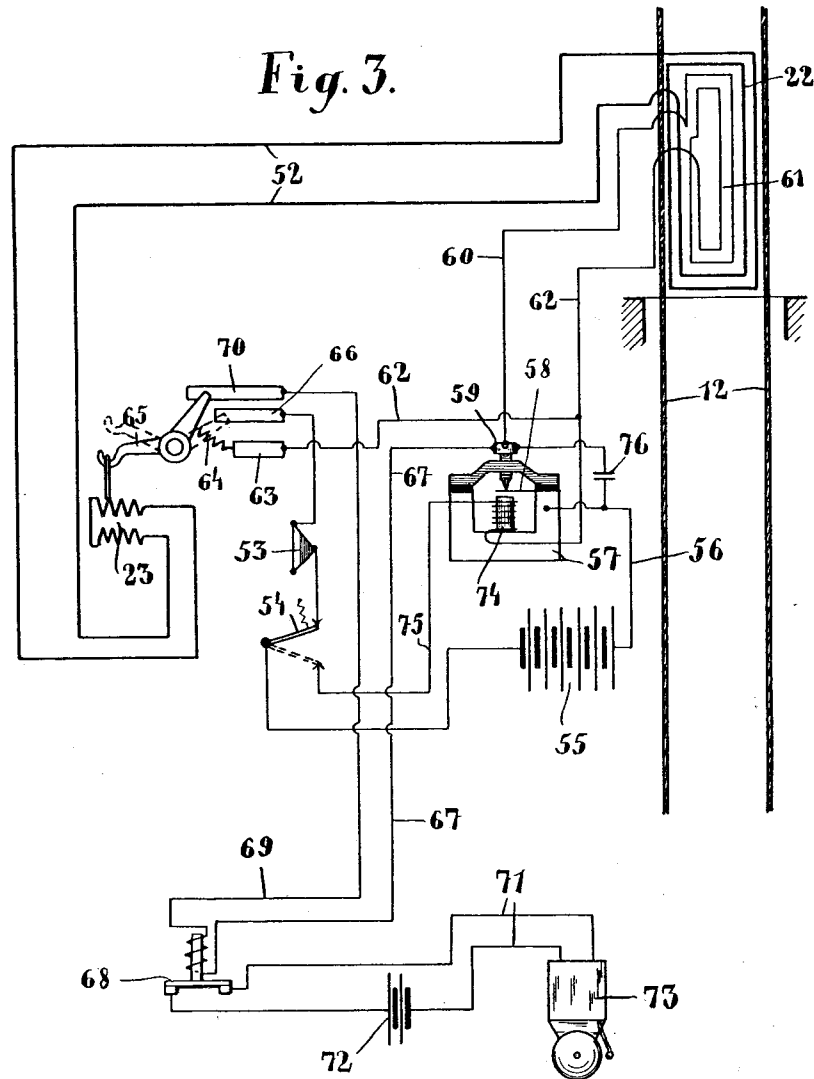
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TELEPHONY AND TELEGRAPHY FOR MINING-CAGES.

1,098,528.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOSEF HEINRICH REINEKE, engineer, residing at Graf-Engelbert strasse 33, Bochum, in Westphalia, Germany, have invented a certain new and useful Telephony and Telegraphy for Mining-Cages, of which the following is a specification.

The invention relates to apparatus for transmitting signs, especially for telephoning, from and to cages in mines while using the cage hoisting cables as conductors.

It has been previously proposed in connection with hoisting plant to use the cables thereof as conductors of current, by carefully insulating the cable from the cage, the pulleys and the winding engine, and using it as one conductor, the circuit being completed by a return conductor with which the cage is maintained in constant connection by means of a collector. It has also been proposed to use in connection with a sparking telegraphic device the hoisting or haulage cable as an electrical conductor of waves. Both of these arrangements are however useless in practice owing to the necessary careful earth insulation of the hoisting cable not being consistent with the practical requirements of a hoisting plant; the second device is also disadvantageous inasmuch as it only allows of telegraphic understanding, while the use of a sparking telegraph apparatus in a shaft is obviously undesirable in view of the danger of fire damp explosions.

The feature of the invention consists essentially in providing the cable passing from the cages to the winding engine where it is short circuited, with a continuation in the form of a conducting loop suspended from the cages to the bottom of the shaft, so that a closed coil is formed which serves the purpose of an induction coil by coacting with another stationary coil which is arranged in space. In using the cable as an induction coil, the current produced by induction has no inclination to go to earth, since even in the event of the engine or the pulleys over the shaft not being insulated, this will only result in a short circuit at this point which will insure the passage of electrical currents to the cable depending loosely in the shaft.

In all those cases where a lower rope connected to the bottom of the cages and adapted to compensate the weight which already

exists, it is unnecessary to provide a special conducting loop passing down to the bottom of the shaft, the existing loop being used in lieu thereof. Further, as the transmitting and receiving apparatus on the cages are arranged in parallel to the cage connecting the cable ends, or in other words, as they bridge the connections of the upper rope and lower rope with the cage, it is also unnecessary to insulate these connections of the rope to the cage; such insulations would be in any case unreliable in wet shafts and would be extremely difficult to attend to under certain circumstances. This arrangement in shunt is absolutely reliable in transmitting signs, by reason of the small amount of current passing through the bridged part in proportion to the great resistance at the points of connections of the cable to the cages.

Theoretically the fixed induction coil co-operating with the coil represented by the cable, may be arranged anywhere near the latter, it is however advisable to connect the transmitting and receiving apparatus above ground to an induction coil acting upon the cable underneath the rope pulleys. It is then unnecessary to insulate the pulleys although this would not offer any great difficulty, since the whole current will pass along the cable underneath the pulleys whether the circuit is closed at the pulleys or at the winding engine.

The apparatus necessary for transmitting messages between the cages and above ground, and particularly for giving calls will be further described hereinafter with reference to the apparatus shown in the accompanying drawings.

In the drawings illustrating the invention Figure 1 is a diagrammatic section showing the general arrangement. Fig. 2 shows the arrangement of the transmitting and receiving device in one of the cages to a larger scale. Fig. 3 shows the arrangement of the stationary transmitting and receiving station as provided above ground for example in the engine room.

Similar reference characters denote like parts in all the figures.

The hoisting cable 12 carrying the cages 10 and 11 is suspended in the shaft 13 and runs over the pulleys 14 to the winding engine 15. The latter may either be provided with a pulley around which the endless rope

travels or with a drum on which the two ends of the rope are wound, in the latter case it is necessary that the ends of the rope fixed to the drum should be in good conductive connection with one another. The winding engine 15 may also be arranged, as is now usual, with pulley drive in a housing above the shaft 13, in which case of course the pulleys 14 would be omitted. The cages 10 and 11 are further connected with each other by a conducting loop 16 which descends to the bottom of the shaft, and may also be represented by the known lower rope hereinbefore referred to. The points 17 and 18 at which the rope is connected to the cage are bridged by a conductor 19 in which is arranged a source of current 20 and a microphone 21. Arranged above ground between the mouth of the shaft and the disks 20 14 is a fixed coil 22, to which is connected a telephone 23.

In speaking into the microphone 21 high frequency alternating currents are produced which transmit to the cable loop arranged in series thereto. The current produced naturally uses the rope 12, 16 as a conductor, and owing to the closed circuit which practically corresponds with the line of least resistance has no tendency to go to earth. In the event of a partial short circuit taking place at the pulleys 14, the current will still practically only flow in the rope 12, 16 underneath the pulleys 14 in the shaft. The induction effects produced by the induction coil represented by the cable are taken up immediately by the coil 22 and transformed by the telephone 23 into sound waves.

Figs. 2 and 3 show the form of transmitting and receiving stations as employed in practice.

The conductor 19 is connected to the haulage rope above the point of connection of the latter to the cage 10, and leads to the telephone 24 and thence to a switch 25, which, under the influence of a spring or weight, has the tendency to move into the position shown. A conductor 26 connects the switch 25 with the terminal 27. Leading from the lower cable 16, below the point of connection 18 of the latter to the cage 10, is a conductor 28 which is connected at the other end to the terminal 29 which is conductively connected by a spring 30 to the bell crank lever 31 on which the telephone 24 is hung in the usual manner when not in use. The microphone 21, connected in the usual manner to the telephone, is connected by a switch 33, similar to the switch 25, to the conductor 34 which leads to a battery 20. From the latter a conductor 36 passes to the housing 37 of a buzzer which is connected by the armature spring 38 to the screw 39. The latter is connected by a conductor 40 to the conductor 19. The second pole of the microphone is connected

to the conductor 26 by the switch 25. The electromagnet winding 41 of the buzzer is connected by a conductor 42 to the switch 33, the other pole of the buzzer being connected by a conductor 43 to 28. The conductors 40 and 36 are also connected by a condenser 44.

Another conductor 45 leads from the screw 39 to an alternating current relay 46—not forming a subject of the present invention—the second pole of which is connected by a conductor 47 to the terminal 48 on which the lever 31 rests when in its normal position. The relay 46 is connected by a conductor 49, to which the battery 50 is connected with a signaling appliance, as for instance the bell 51.

The same arrangement is used for the transmitting and receiving apparatus erected above ground according to Fig. 3. The telephone 23 is connected by conductors 52 to the coil 22, these parts forming a separate closed circuit. The microphone 53 is connected by a switch to a battery 55, from which a conductor 56 leads to the frame 57 of a buzzer, the spring armature 58 of which contacts with the contact screw 59. Thence a conductor 60 leads to the coil 61, which is arranged adjacent the coil 22 beneath the pulleys 14 and adjacent the cable 12. The coil 61 is connected by conductor 62 to the terminal 63 which latter is connected by a spring 64 to the double armed lever 65 carrying the telephone 23. The terminal 66 is connected to the second pole of the microphone 52. A conductor 67 connects the contact screw 59 to the alternating current relay 68 whose second pole is connected by a conductor 69 to the terminal 70, with which the lever 65 makes contact when in its position of rest.

The relay 68 is by conductors 71 connected to a battery 72, and a bell 73; one pole of the winding 74 of the electromagnet of the buzzer is connected to the conductor leading to the coil 61, the other pole being connected by conductor 75 to the switch 54. A condenser is placed between the contact screws 59 and the conductor 56.

The mode of calling and mutual understanding between the cage and the engine room will now be more particularly described.

Calling.—By depressing the switch 54 the circuit of the battery 55 is closed over the electromagnet winding 74 of the buzzer, the coil 61, the contact screw 59, the spring 58 and the buzzer frame 57. Alternate attraction and return of the armature spring 58 results in a rapid sequence of interruptions in the known manner and thereby current fluctuations in the coil 61. The condenser 76 serves hereby to prevent sparking between the contact screw 59 and the spring 58 as well as to compensate the correspond-

ing extra currents. The rapid fluctuations of current in the coil 61 have an inducing effect on the cable 12, 16. The current passes hereby from the lower rope 16 through a conductor 28, terminal 29, spring 30, lever 31 to the terminal 48, and thence through conductor 47 to the relay 46. The latter is connected by conductor 45, contact screw 39, conductors 40 and 19 to the upper cable 12. The circuit through the relay 46 is thus closed, and consequently the bell 51 is rung.

A call from the cage to above ground is given in exactly the same manner, the switch 33 being depressed and the circuit closed over the buzzer 41 to the cage 10 and the cable 12, 16. The electric vibrations induced in the coil 61 above ground are conducted over the conductor 62, terminal 63, spring 64, lever 65 and terminal 70, conductor 69, to relay 68, the other pole of the latter being connected by conductor 67, contact screw 59, and conductor 60 to the coil again. Actuation of the relay 68 operates the signal appliance 73.

Conversation.—By lifting the telephone 23 off the lever 65 the spring 64 pulls the latter into the position indicated by broken lines, whereby it makes contact with the terminal 66. By now talking into the microphone the resultant vibrations will be transmitted by way of the switch 54, battery 55, conductor 56 to the frame 57 of the buzzer, and thence through the spring 58, contact screw 59, and conductor 60 to the coil 61. The latter is connected by conductor 62, terminal 63, spring 64 and lever 65 to the terminal 66 which is connected to the other pole of the microphone 53. In this manner a circuit is closed again, so that vibrations are set up in the coil which have an induction effect on the cable 12, 16.

Conversation from the cage 10 is effected in exactly the same manner. The microphone 21 is connected by the switch 33 to the battery 20 and past the buzzer to the upper cable 12. The second pole of the microphone 21 is connected by the switch 25 to the terminal 27 against which the lever 31 is held by the spring 30 after removal of the telephone 24; the lever 31, spring 20 and conductor 28 make the connection to the lower rope 16. The microphone 21 is thus arranged in the coil represented by the cable 12, 16 in such manner that the fluctuations of speech are transmitted as electrical excitations to the microphone.

Hearing.—Hearing above ground is rendered very easy by the separate coil 22, since the connection is direct. The vibrations produced in the cable loop 12, 16 have an inducing effect upon the coil 22 and can be easily heard as sound waves in the telephone 23. By reason of it being difficult to produce a separate circuit of this description in

the cage 10, a special connection is provided for hearing. When the switch 25 is depressed the current coming from the lower cable 16 through the conductor 28 passes through the spring 30, lever 31 to the terminal 27 and into the telephone, thence through the conductor 19 to the upper cable 12. For hearing it is therefore necessary to depress the switch 25 and to release the latter. The provision of the separate loop 24 is adapted to prevent as far as possible the currents passing to the telephone from being weakened, which would be the case should the current vibrations to be received also have to pass through other appliances. The conductors 19 and 28 are short circuited on the cage 11 in order to complete the cable loop while cutting out the resistances of the connections of the cable to the cages. This is preferably effected by providing a switch in the junction box 77 for the transmitting and receiving apparatus on the cage, said switch being switched off when the apparatus are in circuit, and adapted when the latter are removed to automatically short circuit the conductors 19 and 28.

It will be understood that the invention is not limited to the particular arrangement herein described, various modifications being possible without departing from the spirit of the invention.

I claim:

1. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop constituting jointly a movable induction coil, a stationary coil mounted in proximity to the path of said movable coil, transmitting and receiving apparatus operably connected to the movable coil, and transmitting and receiving apparatus operably connected to the stationary coil.

2. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop constituting jointly a movable induction coil, a shunt circuit bridging the cage and conductively connecting the cable and loop at points located beyond the cable and loop connections with the cage, transmitting and receiving apparatus interpolable within said shunt circuit, a stationary coil located in proximity to the path of said movable induction coil, and transmitting and receiving apparatus operably connected to said stationary coil.

3. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and

pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop constituting jointly a movable induction coil, a stationary coil mounted in proximity to the path of said movable coil, a buzzer operably connected to each of said coils, said buzzers being adapted to produce current fluctuations having a frequency that corresponds approximately to the average frequency of the sound vibrations, an alternating current relay in circuit with each buzzer, and signaling means operably connected to each relay.

4. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop constituting jointly a movable induction coil, a stationary coil mounted in proximity to the path of said movable coil, a buzzer, a microphone and an alternating current relay in circuit with each of said coils, said buzzers being adapted to produce current fluctuations having a frequency that corresponds approximately to the average frequency of the sound vibrations, and signaling means operably connected to each relay.

5. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop constituting jointly a movable induction coil, a stationary coil mounted in proximity to the path of said movable coil, a switch-controlled buzzer, a microphone and an alternating current relay in circuit with each of said coils, said buzzers being adapted to produce current fluctuations having a frequency that corresponds approximately to the average frequency of the sound vibrations, and signaling means operably connected to each relay.

6. In a telephone and telegraph system for a mine cage, a hoisting pulley, a conductive hoisting cable connected to said cage and pulley, a conductive loop depending from the cage and connected to said cage and hoisting pulley, said cable and loop consti-

tuting jointly a movable induction coil, a shunt circuit bridging the cage and conductively connecting the cable and loop at points located beyond the cable and loop-connections with the cage, transmitting and receiving apparatus interpolable within said shunt circuit, means for automatically closing said shunt circuit upon the removal of said apparatus, a stationary induction coil located in proximity to the path of said movable induction coil, and transmitting and receiving apparatus operably connected to said stationary coil.

7. In a telephone and telegraph system for twin mine cages, a pair of conductively connected hoisting pulleys, a conductive hoisting cable connected to both of said cages and pulleys, a conductive loop depending from said cages, a shunt circuit bridging each cage and conductively connecting the cable and loop at points located beyond the cable and loop-connections with the cage, and transmitting and receiving apparatus interpolable within said shunt circuits.

8. In a telephone and telegraph system for twin mine cages, a pair of conductively connected hoisting pulleys, a conductive hoisting cable connected to both of said cages and pulleys, a conductive loop depending from said cages, said cable and loop constituting jointly a movable induction coil, a shunt circuit bridging each cage and conductively connecting the cable and loop at points located beyond the cable and loop-connections with the cage, transmitting and receiving apparatus interpolable within said shunt circuits, a first stationary coil and a second stationary coil, both of said stationary coils being mounted above ground in proximity to the path of the movable induction coil, a microphone, a switch-controlled buzzer and an alternating current relay operably connected to the first stationary coil, a telephone in circuit with the second stationary coil and having a removable receiver, and means actuated upon a removal of said receiver for connecting the relay with the microphone.

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Witnesses:

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