Feb. 15, 1944. J. F. ATKINSON 2,341,519

PORTABLE HOT LINE CARRIER CURRENT COUPLING DEVICE

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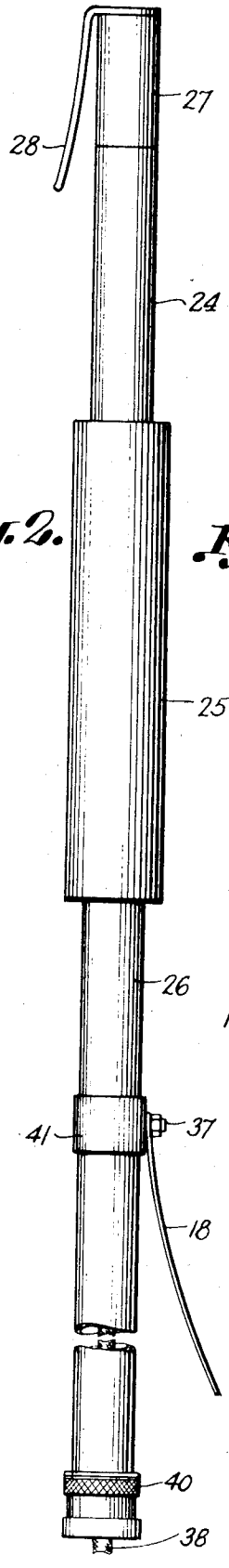


Fig. 2.

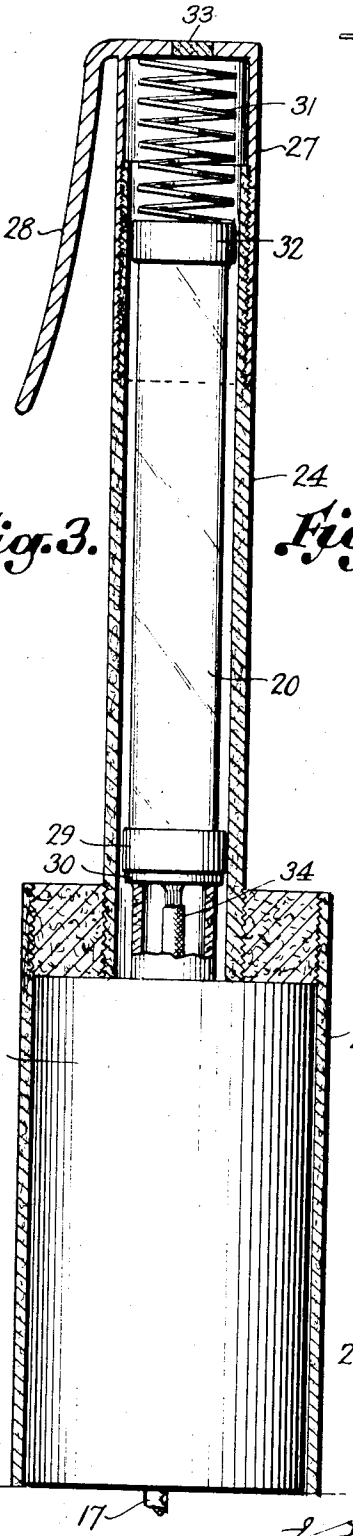


Fig. 3.

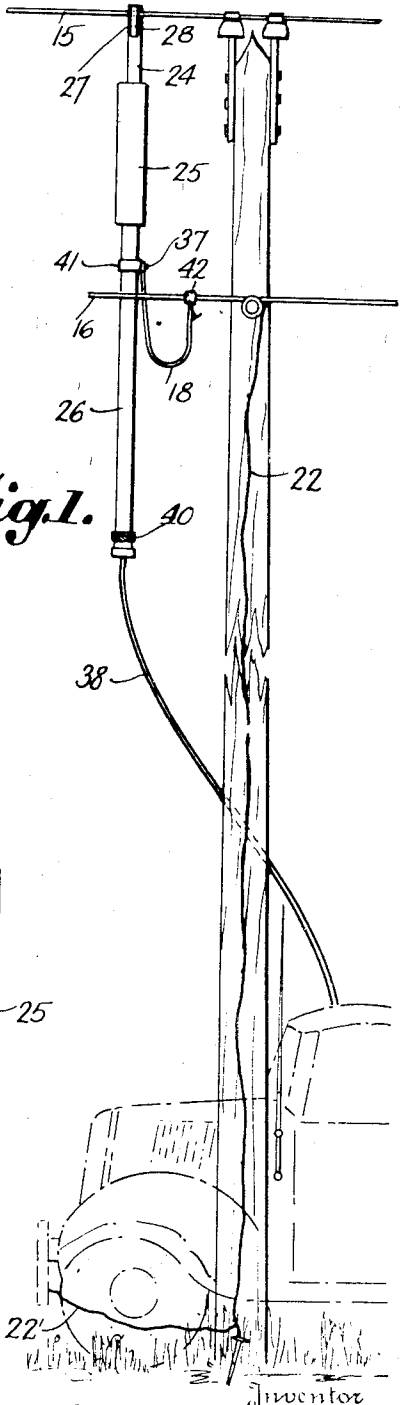


Fig. 1.

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Fig. 4.

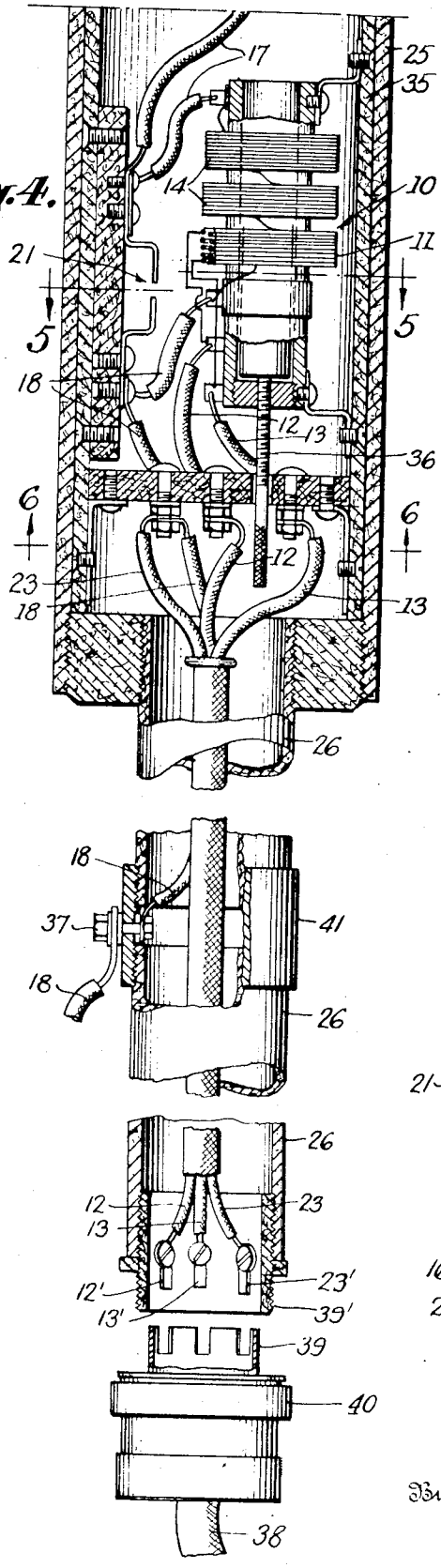


Fig. 5.

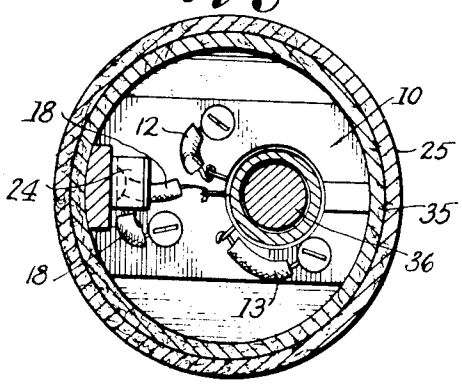


Fig. 6.

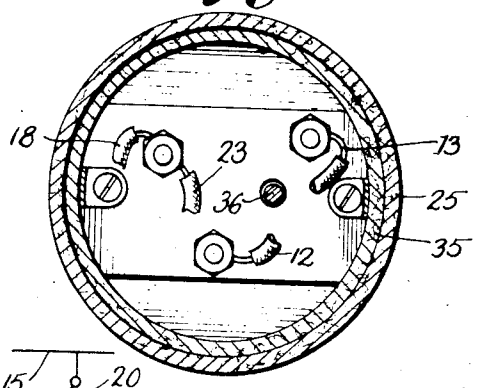
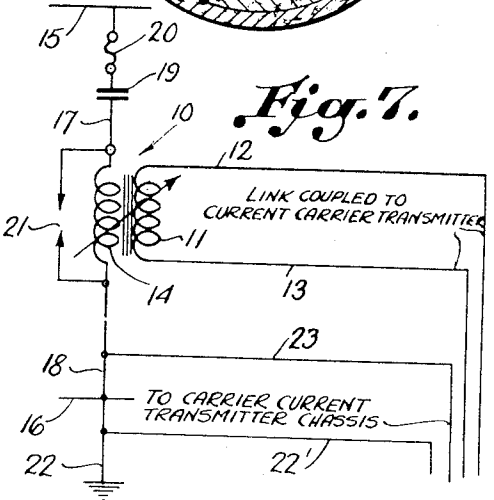


Fig. 7.



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UNITED STATES PATENT OFFICE

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PORTABLE HOT LINE CARRIER CURRENT COUPLING DEVICE

John F. Atkinson, Lake City, Fla.

Application October 31, 1941, Serial No. 417,351

5 Claims. (Cl. 177—352)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (Ch. 460, 45 St. L. 467).

The invention pertains to a coupling device for carrier current communication and more particularly to a portable coupling device which may be quickly and safely attached to a power line for the purpose of transmitting or receiving messages without drainage of, interruption to or effect upon the voltage normally impressed upon or energy transmitted over the power line.

It is a known fact that electromagnetic and electrostatic fields are set up in the vicinity of a power line due to an impressed carrier current on the line. It is further known that these electromagnetic and electrostatic fields can be utilized to convey intelligence to nearby moving and stationary vehicles that are equipped with suitable receivers tuned to the frequency of the carrier current. Communication by these known means and methods is but a one-way system.

Impressing a high frequency carrier current on a power line can be accomplished by means of a suitable coupling capacitor or a suitable antenna erected near the power line.

It is the purpose of the present invention to provide a portable coupling device that can be attached quickly and safely to a power line in order that two-way communication may be established between some fixed point and any other point on the power system.

Broadly, the present invention aims to accomplish a system of two-way carrier current communication whereby a fixed or permanently located conventional carrier current station can communicate with suitably equipped vehicles that are sufficiently close to the power line to make use of the high frequency electromagnetic and electrostatic fields for satisfactory receiver operation. In order for the suitably equipped vehicle to communicate with the permanently located conventional carrier current station it is necessary to make use of a portable coupling device in order to quickly and safely establish an electrical coupling to the power line for transmitting the high frequency carrier current from the vehicle to the permanently located station, or vice versa.

The present invention also aims to facilitate two-way communication between two or more suitably equipped vehicles or two or more portable carrier current stations located at any desired points along the power line by providing the aforesaid means as a portable, readily attachable and detachable coupling device.

The foregoing and other objects of the invention will become apparent from a reading of the following specification and appended claims. An embodiment having the characteristics of my invention and by which the same may be practiced is illustrated in the accompanying drawings, in which:

Figure 1 is an elevational view of the assembly illustrating an adaptation of the device;

Figure 2, an enlarged elevational view of the assembly;

Figure 3, a section in elevation of the upper portion of the device illustrating the interior assembly of elements of that portion;

Figure 4, a section in elevation of a portion of the device continuing from that of Figure 3 and illustrating the circuits and arrangement of elements thereof;

Figures 5 and 6, cross sectional views taken along lines 5—5 and 6—6 respectively of Figure 4; and

Figure 7, a wiring diagram illustrating the electrical circuits of the device.

It will become apparent to those versed in the art that the device described and claimed herein may be used, alternately, for transmitting and receiving intelligence by connecting the same to a transmitter or receiving equipment. For a fuller understanding of the invention, however, the same will be described for use primarily in connection with a transmitter.

In the accompanying drawings the invention is illustrated as incorporated in a practical embodiment which includes a permeability tuned matching transformer 10, the primary 11 of which is adapted to be connected by leads 12 and 13 to a carrier current transmitter, not shown, and the secondary 14 of which is adapted to be connected between the low side of a coupling capacitor or condenser 19 and the neutral wire 16 of a power transmission line by leads 17 and 18, respectively. The condenser 19 is interposed in series between the secondary 14 of the transformer 10 and the point at which it is adapted to be connected to a phase conductor 15. For safety purposes a liquid fuse 20 is placed in series between the condenser 19 and the point at which the coupling device is adapted to be hooked to the phase conductor 15. Further for safety purposes, leads 17 and 18 are connected to a spark-gap 21 whereby excessive voltages, such as surges due to lightning, switching, etc.,

will by-pass the secondary 14 to the neutral wire 16 through conductor 18 and to ground by the customary ground lead 22. The system additionally contemplates the grounding of the chassis of the transmitter or receiver by the provision of a lead 23 which is grounded directly to neutral wire 16 or coupled to the ground lead 22 by means of a conductor 18.

In order that the foregoing system may be utilized as a portable unit and in order that the same may be readily and safely connected as well as disconnected at and from desired points along a power line, I propose to utilize a portable carrier current transmitter, or receiver, such as may be installed in a truck or other vehicle or means of conveyance, and propose installing the aforesaid system in a safe and easily handled housing with appropriate connections for connecting the system to desired points in a power transmission line. With these aims in view I provide a housing of insulating material, which for assembly convenience comprises coupled tubular members 24, 25 and 26. By reference particularly to the detailed showings of Figure 3, it will be seen that at the free end of housing member 24 is mounted a metal cap 27 from which extends suitable means, such as a clip 28 into which a conductor may be removably wedged, for electrically engaging a power transmission line. Any suitable liquid fuse 20, well understood in this art, is inserted within the housing member 24 and one end 29 thereof held in good electrical contact with a metal plate 30, also mounted within the latter housing member 24, by means of a spring 31 which serves as a conductor between the metal cap 27 and the other end 32 of the fuse. The metal cap 27 may be provided with a safety plug 33 for the escape of liquid and gases in the event of a breaking of the fuse seal. The safety plug is of the character as will be removed by slight compressional force within the housing 24 to prevent a bursting thereof.

The condenser 19 is mounted within the housing 25 which is coupled to housing 24 at its end opposite the metal cap 27 and the condenser is in turn connected to the fuse contact plate 30 such as by conductor 34.

For assemblying convenience the matching transformer may be mounted within a casing 35, see Figure 4, whereby it may be inserted, or removed, as a unit into and from the housing member 25 beneath the condenser and connected thereto by lead 17. The matching transformer is adapted for permeability tuning by means of adjustment 36, Figure 4, or by any suitable means well understood in the art.

The carrier current leads 12 and 13 from the primary 11 of the transformer, for connection to a transmitter, or receiver, as well as ground leads 18 and 23 extend from the transformer casing 35 and housing member 25 into housing member 26 and with the exception of lead 18 are secured to terminals 12', 13' and 23', respectively, adjacent the free end of the housing member 26. Lead 18 for connecting the secondary 14 and spark-gap 21 to the neutral wire 16 of a power transmission line passes, by connection 37, through the side wall of housing member 26 at a point spaced from the clip 28 to a distance substantially that of the distance between the customary spacings between the phase and neutral wires of a power transmission line for reasons pointed out more specifically hereinafter.

For connecting and disconnecting the transmitter or receiver to the assembly described, I provide a three-wire cable 38 having a plug 39 at the end thereof adapted to engage the terminals 12', 13' and 23'. For securing the plug 39 to the base of the housing member 26 in contact with the terminals I provide a locking band 40 which may be rotated into overlapping engagement between the end of member 39' of the housing and the plug itself. Two of the wires of the cable 38 are of course the link wires for the transmission of the carrier current from a transmitter to the coupling device or from the coupling device to a receiver and the third wire of the cable may be connected directly to the transmitter or receiver chassis which is mounted on and grounded to the vehicle. The vehicle may be grounded by a separate lead 22' directly to the ground or by a connection, as shown in Figure 1, to the customary ground lead 22.

The tubular housing member 26, of insulating material, is preferably of such length as will serve as a handle or hot-stick for raising, lowering and holding the device during application and removal to and from an energized power transmission line.

In applying and operating the device I prefer for safety reasons to first ground the vehicle to which the transmitter or receiver chassis is grounded, as indicated in Figure 1, by lead 22'. The portable coupling assembly may then be temporarily supported by clip 28 from the neutral wire 16 of the power transmission system during the time that lead 18 is secured to the power system neutral wire 16 by means of clamp 42. Clip 28 may then be disengaged from the neutral wire 16 and the device elevated, by means of the insulating handle forming housing portion 26, into engagement with the power line phase conductor 15. Should such steps be followed it would be immaterial from a safety point as to whether the transmitter or receiver plug 39 were placed in engagement with the coupling device terminals before or after the aforesaid steps of installation.

For further reasons of safety I prefer that the length of so much of the lead 18 as extends from the housing be inadequate for connection to the power line phase conductor 15 while the assembly is suspended by clip 28 from the neutral wire 16 of the power system, thereby tending to limit the connection of lead 18 to the neutral wire 16.

For still further reasons of safety a band 41 of metal or other material may be placed about the handle serving portion of the housing member 26 above the normal grasping position of the handle as a marker or visible warning as well as a warning to the feeling senses of the operator as to the danger zone of the device when in contact with the power line conductors. The band 41, if formed of metal, will also divert any charge, which may be conducted by moisture along the surface of the housing, to ground through lead 18 and prevent conduction to the handle portion of the device.

As a still further feature of safety I prefer to employ some special form of clamping means for securing the lead 18 to the neutral conductor 16, special in the sense that it cannot be engaged by ordinary or conventional tools or hot-sticks but must be engaged with the hands as a reminder that the connection is to be made to the neutral wire.

In case of coupling capacitor failures the safety spark-gap 21 will break down.

While the device described in connection with the specific embodiment illustrated is suitable as a coupling device for either a transmitter or re-

ceiver, the primary and secondary windings may be exchanged in the hook-up without departing from the spirit or scope of the invention. Such an exchange may be preferred, though not necessary, in coupling devices for connection to a receiver.

Having described my invention, what I claim is:

1. A portable device for coupling a carrier current transmitter or receiver to a power line comprising: a rod-like member having a handle portion adjacent the lower end thereof, a conductive spring clamp at the upper end of said member for engaging a live conductor of a power line and suspending said member therefrom, a transformer, a fuse and a capacitor connected in series between one terminal of one winding of said transformer and said spring clamp, means for grounding the other terminal of said winding, leads from the other winding of said transformer for connection to a carrier current transmitter or receiver, said transformer, capacitor, and fuse being carried by and extending lengthwise of said member with said fuse disposed adjacent said spring clamp, with said transformer in a position intermediate said fuse and the lower end of said member, and with said capacitor in a position intermediate said fuse and said transformer.

2. A portable device for coupling a carrier current transmitter or receiver to a power line comprising: a rod-like member having a handle portion adjacent the lower end thereof, a conductive spring clamp at the upper end of said member for engaging a live conductor of a power line and suspending said member thereform, a transfomer, leads from one winding of said transformer adapted for connection to a carrier current transmitter or receiver, a capacitor having one terminal connected to one terminal of the other winding of said transformer, means for grounding the other terminal of said other winding, a fuse having one terminal connected to the other terminal of said capacitor, the other terminal of said fuse being connected to said spring clamp, and safety-gap means across said other winding, said transformer, capacitor, fuse and safety gap means being carried by and extending lengthwise of said member with said fuse disposed adjacent said spring clamp, with said transformer in a position intermediate said fuse and the lower end of said member, and with said capacitor in a position intermediate said fuse and said transformer.

3. A portable device for coupling a carrier current transmitter or receiver to a power line comprising: a hollow, sectional, rod-like member having an insulator portion adjacent the lower end forming a handle, a conductive spring clamp at the upper end of said member for engaging a live conductor of a power line and suspending said member therefrom, a fuse within the hollow member end section adjacent said spring clamp, a transformer and a capacitor within said hollow member and below said end section, said fuse and said capacitor being connected in series between one terminal of one winding of said transformer and said spring clamp, means for grounding the other terminal of said winding, and leads from the other winding of said transformer and extending axially from the lower end of said member for connection to a carrier current transmitter or receiver.

4. A portable device for coupling a carrier current transmitter or receiver to a power line comprising: a hollow, sectional, rod-like member having an insulator portion adjacent the lower end forming a handle, a conductive spring clamp at the upper end of said member for engaging a live conductor of a power line and suspending said member therefrom, a fuse within the hollow member end section adjacent said spring clamp, a transformer and a capacitor within said hollow member and below said end section, said fuse and said capacitor being connected in series between one terminal of one winding of said transformer and said spring clamp, means for grounding the other terminal of said winding, leads from the other winding of said transformer and extending axially from the lower end of said member for connection to a carrier current transmitter or receiver, an exposed conductor ring incorporated in said member above said handle portion and connected to said grounding means to conduct any leakage current to ground from the member portion above said ring, and safety gap means across said one winding.

5. A portable device for coupling a carrier current transmitter or receiver to a power line comprising: a tubular, sectional rod-like insulator member, a conductive spring clip carried at the tip of the tubular section at the upper end of said member for removably engaging a live conductor of a power line, a removable fuse within said end tubular section and having one of its terminals connected with said spring clip, a removable coupling capacitor unit within a second tubular section adjacent said end section and having one of its terminals connected with the other terminal of said fuse, a removable transformer unit including a permeability tuned matching transformer and a casing therefor within said second tubular section, a third tubular section forming the lower end of said member and providing a handle, an exposed conductor ring encircling said member intermediate said handle and said second tubular section to conduct any leakage current to ground from a point above said ring, a lead from said ring to a terminal of one winding of said transformer, said fuse and said capacitor being connected in series with said spring clip and the other terminal of said winding, and leads from the other winding of said transformer extending within said member and through said handle forming section for connection to a carrier current transmitter or receiver.

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