July 21, 1936. W. G. H. FINCH 2,048,604

ELECTROMAGNETIC COUPLING DEVICE

Original Filed Feb. 26, 1936

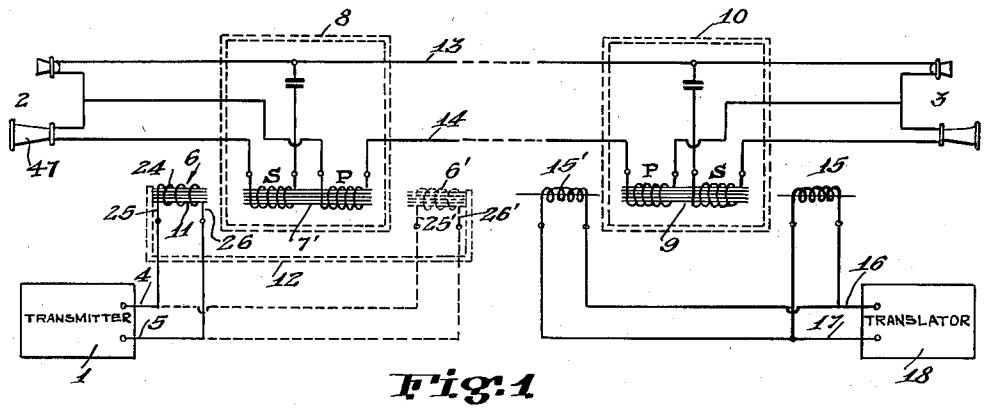

Fig. 1

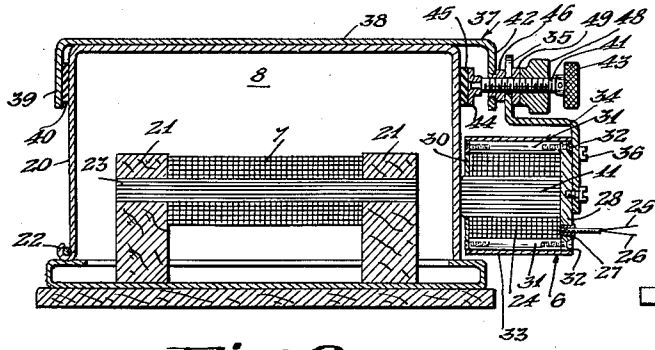

Fig. 2

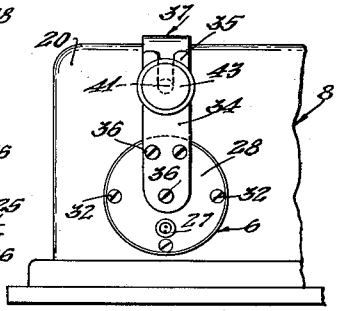

Fig. 3

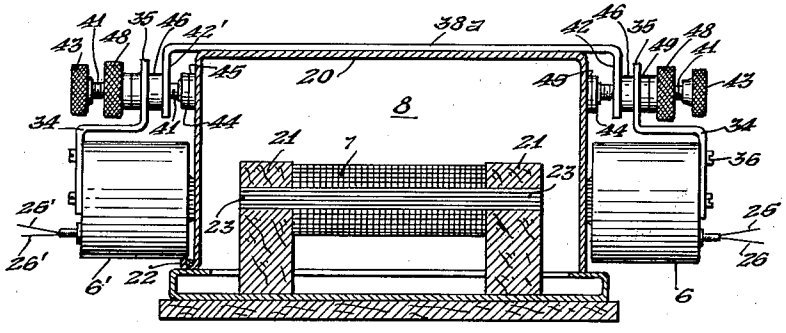

Fig. 4

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ELECTROMAGNETIC COUPLING DEVICE

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Original application February 26, 1936, Serial No. 65,869. Divided and this application March 24, 1936, Serial No. 70,591

9 Claims. (Cl. 179—2)

This invention relates to magnetic coupling, and more particularly relates to novel methods of and apparatus for inducing telepicture signals into a telephone system and receiving the signals, and is a division of my co-pending application Serial No. 65,869, filed February 26, 1936.

The widest use which telepicture systems today enjoy is in connection with newspaper service where pictures of important news events are transmitted from or near its source to newspaper offices for publication. For such use, it is highly desirable that the picture be transmitted as near to the scene as practicable. Heretofore, it has been proposed to use telephone lines which are usually available at almost any place for the transmission of pictures. Inasmuch as the telephone company, however, does not permit any interconnection by a subscriber to its lines, it has been necessary to find some other than physical connection means for transmitting picture signals over the telephone lines. It has been proposed that this might be accomplished by acoustic coupling to the telephone line. Such a system comprised a loud speaker unit which transformed picture signals into corresponding sounds which in turn were impinged on the usual telephone microphone.

Although the acoustic method of inducing picture signals into the telephone line has still been proposed as recently as within the past few years, it has many inherent defects which render it impractical. The more serious of the many drawbacks of such an arrangement are the distorted frequency response characteristic of the usual loud speaker, and the even more distorted frequency response characteristic of the carbon microphone ordinarily used in telephone systems. Although for the transmission of speech, poor frequency characteristics are not material, as the ear tends to correct for audible distortions, they are serious in connection with telepicture systems where distortion would be visually evident on the received picture.

As disclosed in my co-pending application referred to, I contemplate inductively inducing telepicture signals into the telephone line by a novel portable member which may be applied to any telephone subscriber station box. By employing a suitable compensation network, the overall frequency transmission characteristic of such a communication system may be made linear at the receiver; a similar portable coupling member is applied at the other end of the telephone line for "picking-up" the transmitted signals. It is to be understood that other classes of electrical signals in the audio frequency range may be transmitted with the novel apparatus of my present invention, for example, telegraphy, printing telegraphy, multi-channel audio frequency carrier operations and the like.

In applying the novel coupling member to a portable transmitter or receiver, it is desirable to have a simple, light, efficient device which is readily engaged with the telephone box and adjustable to the optimum position.

It is accordingly an object of this invention to provide a novel method of and apparatus for inductively inducing telepicture signals into a telephone system and receiving the signals.

A further object of this invention is to provide novel electromagnetic coupling apparatus engageable with a telephone box that is readily adjustable to the optimum position.

These and other objects of this invention will appear in the following description taken in connection with the drawing in which:

Figure 1 is a schematic illustration of a preferred embodiment for electromagnetically inducing and receiving telepicture signals over a telephone system.

Figure 2 is a cross-sectional illustration of a preferred electromagnetic coupling member in position on a telephone station box.

Figure 3 is an end view of the coupling unit in position on the telephone box.

Figure 4 is a side elevation of a modification of the coupling unit in position on a telephone box which is indicated in section.

Referring to Figure 1, transmitter 1 generates the audio signal to be transmitted over the telephone system 2—3. Transmitter 1 may be a portable or stationary transmitter. If telepicture signals are to be transmitted over telephone system 2—3, it is preferable to employ an audio frequency tone or carrier in a manner described in my application referred to above.

The output 4—5 of transmitter 1 is connected to the solenoid 6 which is placed in operative relation with the induction coil 7 in the telephone system transmitter station phone box 8. Transmitter solenoid 6 preferably has an iron core 11. Solenoid 6 is adjusted to be co-axial with induction coil 7 for optimum coupling condition. Another solenoid 6' may be connected in parallel with solenoid 6 for inducing signals into both sides of induction coil 7 in phase or additive relation. Common yoke 12 mechanically supports both coils.

The signals to be transmitted produce a mag-

netic field about solenoid 6. This magnetic field is induced in the induction coil 7 for transmission across the telephone lines 13—14 connecting transmitting station 2 and receiving station 3.

The telephone circuit between telephone stations 2 and 3 is established through an automatic telephone connection or through an operator in the usual manner. The telepicture signals electromagnetically induced by solenoid 6 into induction coil 7 are impressed upon lines 13—14. The receiver station induction coil 9 within phone box 10 is correspondingly impressed with the transmitter 1 signals, inducing a corresponding magnetic field about induction coil 9. The receiver solenoids 15 and 15' placed co-axially with induction coil 9 have a voltage induced therein by the magnetic field and impress a corresponding signal upon the input 16—17 of translator 18 to which they are connected. In my preferred embodiment, receiving solenoids 15 and 15' have air cores.

Figure 2 is a cross-sectional illustration of a preferred coupling unit 6 clamped in position on the metal cover 20 of phone box 8. Metal cover 20 is hinged at 22. The induction coil 7 is supported within the phone box 8 by wooden uprights 21. The core of induction coil 7 generally comprises laminated metal strips 23 which project into the wooden uprights 21.

Solenoid 6 comprises windings 24, the ends 25—26 of which project through a bushing 27 set in the bakelite end plate 28. Leads 25—26 are connected to the output 4—5 of transmitter 1. The core 11 is preferably of laminated magnetic iron and projects through the front plate 30 contacting the corresponding side of phone box cover 20. Four brass bushings 31 pass between the plates 28 and 30 which are held together by screws 32 which are screwed into the ends of bushings 31. A circular bakelite housing 33 encloses the solenoid 6 structure and is rigidly held in position between the plates 28 and 30.

A bracket 34 having a slotted end portion 35 is secured to end plate 28 by screws 36. The slotted portion 35 of bracket 34 is adapted to be rigidly secured in the clamping structure 37. Clamp 37 comprises member 38, one end 39 of which is bent over a corner of phone box cover 20 and contains a washer 40 which presses against the corresponding side of cover 20. A threaded rod 41 passes through a hole in the opposite end 42 of member 38. A thumb screw 43 is attached to one end of rod 41, and a metallic washer 44 is riveted to the opposite end thereof. A composition washer 45 is secured to washer 44.

An internally threaded metal washer 46 is attached to end portion 42 of member 38 and engages the threaded portion of rod 41. By properly turning thumb screw 43, composition washer 45 will press against corresponding side of cover 20 and end 42 of member 38 will be forced outwardly until washer 40 at end 39 firmly presses against cover 20. Clamping member 38 will accordingly be rigidly secured to the phone box cover 20. The phone box cover 20 will not be scratched or otherwise marred if washers 40 and 45 are made of composition material. Clamp 37 is situated directly over the position of inductance coil 7 within phone box 8.

Solenoid 6 is now readily and rigidly positioned by inserting the slotted end portion of bracket 34 over rod 41 adjacent washer 46. The optimum vertical position of solenoid 6 is determined by listening to the loudness of the transmitted signal preferably an unmodulated signal carrier tone with the transmitter station 2 ear phone 47. The optimum position of solenoid 6 with respect to induction coil 7 is determined when the loudest signal is heard in ear phone 47 and corresponds to the maximum electromagnetic signal induction to the telephone system. Small transverse adjusting of solenoid 6 is also possible around pin 41 as pivot if the clamp member 38 is not vertically above the core 23 of induction coil 7 without repositioning clamp 37. Lock nut 48 having a knurled portion is turned against the end portion 35 of bracket 34. A metallic washer 49 is preferably placed between nut 48 and bracket end 35. The bracket 34 is thereby rigidly secured in the optimum position upon telephone box 8 and the solenoid 6 is in position for transmission of the telepicture signals.

Figure 3 is an end view of the solenoid 6 clamped upon the cover 20 of phone box 8. No physical interconnection is made with the telephone system. The signals are electromagnetically induced across metal cover 20 into the induction coil 7 for transmission over the telephone system.

The hereinabove described embodiment of the electromagnetic coupling unit comprises one solenoid. Many telephone installations have their phone box placed in a corner so that only one side is available for attachment of a solenoid. Solenoid 6 of Figures 2 and 3 is readily mounted upon such a phone box, upon the open or accessible portion. However, where the sides of the phone box composing the opposite ends of induction coil 7 are accessible, a double solenoid unit may be employed for more effectively inducing the telepicture signals therein.

Figure 4 is a side elevation of a double solenoid coupling unit which is essentially a duplication of the right hand or solenoid 6 section of Figure 2. Clamp member 38*a* is symmetrical and contains two bent over end portions 42 and 42' similar to end portion 42 of member 38. The other elements of the clamping mechanism are similar to the correspondingly numbered parts of clamp 37 of Figure 2 and is operated in a similar manner to effectively and rigidly clamp solenoids 6 and 6' into their proper position on metal cover 20 of phone box 8. Clamp member 38*a* is fixedly secured to cover 20 by operating the opposed thumb screws 43—43. The solenoids 6 and 6' are independently adjusted to their optimum position with respect to induction coil 7 in a manner already described.

The solenoids 15 and 15' at receiving station 3 are preferably of similar construction to the transmitter solenoids 6 and 6' except that an air core instead of a laminated iron core is used. A single or double solenoid unit having a similar clamp construction is used for "picking-up" the transmitted telepicture signals from induction coil 9 to impress them upon the telepicture translator 18 for reproducing the picture in a manner well known in the art.

Although I have described a preferred structure for the electromagnetic coupling unit, it will be evident to those skilled in the art that modifications falling within the broader spirit and scope of the present invention may be made and accordingly I do not intend to be limited except as set forth in the following claims.

I claim:

1. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a solenoid secured to said telephone box and ar-

ranged to be co-axial with said induction coil; means for inducing picture signals across said solenoid; and means for adjusting sail coil in the coaxial line with said induction coil to obtain optimum coupling condition.

2. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; and means for inducing picture signals across said solenoids.

3. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; means for impressing picture signals in phase across said solenoids; and a common yoke for mechanically supporting said coils.

4. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; means for impressing picture signals in phase across said solenoids; and a U-shaped yoke extending from one to the opposite side of said telephone box and secured thereto for supporting said solenoids.

5. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a solenoid secured to said telephone box and arranged to be co-axial with said induction coil; means for inducing picture signals across said solenoid; an iron core for said solenoid; and means for adjusting said solenoid axially with respect to the induction coil for optimum coupling adjustment.

6. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; means for inducing picture signals across said solenoids; and means for adjusting said solenoids axially with respect to the induction coil for optimum coupling adjustment.

7. A transmitter for telepicture systems comprising a telephone box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; means for impressing picture signals in phase across said solenoids; a common yoke for mechanically supporting said coils; and means for adjusting said solenoids axially with respect to the induction coil for optimum coupling adjustment.

8. A transmitter for telepicture systems comprising a telepicture box for housing telephone apparatus of a telephone system including an induction coil connected in the telephone system; a pair of solenoids connected in parallel and secured to said telephone box; means for impressing picture signals in phase across said solenoids; a U-shaped yoke extending from one to the opposite side of said telephone box and secured thereto for supporting said solenoids; and means for adjusting said solenoids axially with respect to the induction coil for optimum coupling adjustment.

9. In a telepicture system employing a telephone line having a telephone box including an induction coil, electromagnetic means for coupling to said induction coil; means for securing said electromagnetic means on said telephone box; and means for adjusting said electromagnetic means in substantial coaxial relation with said induction coil for optimum coupling condition.

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