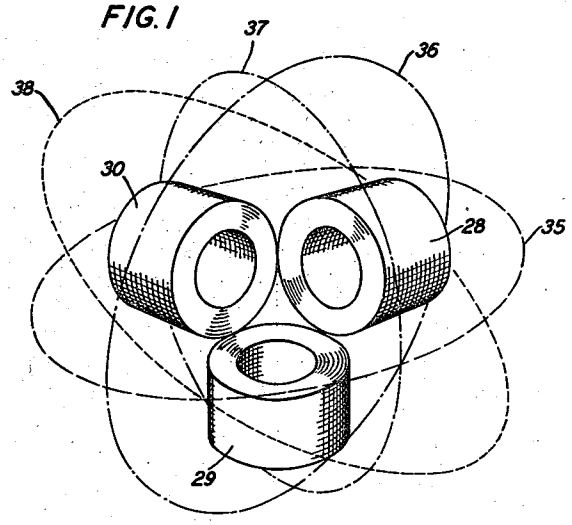
June 23, 1942. G. M. PHILLIPS 2,287,127

SIGNALING SECRECY SYSTEM

Filed June 28, 1940

FIG. 1



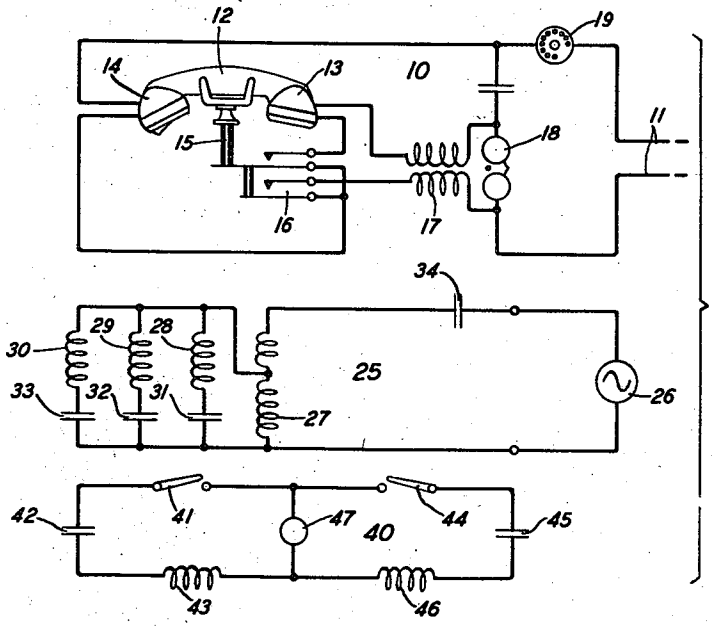


FIG. 2

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SIGNALING SECRECY SYSTEM

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8 Claims. (Cl. 179—1.5)

This invention relates to a signaling secrecy system, and more particularly to a method of and apparatus for producing noise which serves to mask signals intercepted in an unauthorized manner from signaling apparatus.

A privacy requirement arises in connection with signal apparatus which, incidentally to producing signals for transmission over a line or other medium, sets up signal fields in the vicinity of the apparatus and so makes possible the unauthorized pick-up of signals from these fields, even though access to the line itself or other transmission medium might be impracticable. In such cases noise on the line itself would not provide the required privacy. Moreover, the use of noise currents on a line to mask the signal requires a noise compensating means at the receiver to enable the signal to be received and the noise suppressed.

In accordance with the present invention privacy of the indicated type is provided by use of a masking noise field in the vicinity of the apparatus to be protected from intrusion. This use of a masking noise field requires no counterpart elsewhere in the system, such as at a distant receiving point, since the noise fields may produce substantially no effect on the transmitted currents.

The general object of the invention is to obtain secrecy in the operation of signaling apparatus.

Another object is to obtain secrecy substantially uniformly in all directions relative to such apparatus.

A further object is to utilize noise to mask signals independently of the signaling equipment.

Still another object is to provide facile means to test the operativeness of the noise during a normal operation of signaling apparatus.

One type of telephone subscriber's set includes an induction coil through which voice currents pass during the transmission thereof to and from the respective receiver and transmitter embodied therein. As a consequence a magnetic field due to such currents is set up in the vicinity of the induction coil. Under certain circumstances such magnetic field may be utilized by unauthorized persons to listen in on the conversations of a telephone subscriber.

In a preferred embodiment as specifically disclosed herein, the invention comprises a harmonic generator whose output embodies in parallel a plurality of radiating coils arranged such that the longitudinal axes thereof are mutually perpendicular. In series with each radiating coil is such capacity as to provide each harmonic current with a phase angle such that a magnetic field due thereto is caused to rotate through 360 degrees in a certain plane substantially in an elliptical manner, each magnetic field occasioned by each different harmonic current rotating in a different plane. This produces substantially a composite three-dimensional magnetic field. Accordingly, a superposition of the composite magnetic field on the voice magnetic field will allow both harmonic noise and voice currents to be picked up by the unauthorized person but the noise will predominate in such magnitude as to render unintelligible whatever speech may also be present.

A feature of the invention is that regardless of the position in space of the unauthorized pick-up device relative to the voice magnetic field of the subscriber's set, the noise will be adequately effective in all directions to mask the unauthorized picked-up speech. Another feature includes an arrangement for instantaneously testing the operativeness of one or more radiating coils by the subscriber.

The invention will be readily understood from the following description taken together with the accompanying drawing in which:

Fig. 1 represents a group of magnetic fields produced in accordance with the action of Fig. 2; and

Fig. 2 is a schematic circuit diagram of an installation according to the preferred embodiment of the invention.

Referring to Fig. 2, a telephone subscriber's set 10 including leads 11, 11 connected to a signaling transmission line, not shown, comprises a unitary handset 12 including a receiver 13 and a transmitter 14. The handset is mounted on a standard 15 which controls a switch 16 and thereby transmission of voice currents through an induction coil 17. Across the latter is disposed a ringer 18. A dial 19 may also be embodied in the subscriber's set. The operation of such arrangement is well understood, although specific mention is now made that the transmission of voice currents through the induction coil causes a production of a magnetic field in the vicinity thereof. Such magnetic field may be utilized by unauthorized persons to listen in on conversations taking place on the subscriber's set.

In the preferred embodiment shown in Fig. 2, the invention comprises a noise generator 25 embodying a source 26 of fundamental waves, preferably 60 cycles, across which is connected a

suitable wave distorting device 27. This current may be obtained from a commercial lighting circuit. This may be an autotransformer embodying, preferably, a saturable chromium Permalloy-tape core. Across the output of the distorting device is connected in parallel a plurality of radiating coils 28, 29 and 30 having connected in series therewith respective capacitors 31, 32 and 33. The radiating coils are so disposed physically that the longitudinal axes thereof are mutually perpendicular as shown in Fig. 1. In series with the wave distorting device and fundamental source is a capacity 34 to tune this circuit to the 60-cycle fundamental waves.

In the operation of Fig. 2 sinusoidal fundamental waves of 60 cycles applied to the wave distorting device occasion therein the production of a plurality of odd harmonics which are applied to the three radiating coils and the capacitors in series therewith. As the capacitors have different capacities, a given harmonic current in the three radiating coils is provided with three different phase angles. In other words, the given harmonic current has a different phase ange in each of the radiating coils. This causes a magnetic field due to each harmonic current to rotate substantially in an elliptical manner through 360 degrees in a certain plane. Any pair of radiating coils alone produces a rotating magnetic field which lies in the plane of the axes of that pair of radiating coils while the third radiating coil serves to tilt such noise rotating field into a plane in which none of the radiating coil axes lies.

Accordingly, each harmonic current produces a discrete rotating elliptical-shaped magnetic field disposed in a certain plane, each of which planes is different for the discrete rotating fields occasioned by the different individual harmonics. The resultant of all such rotating magnetic fields is substantially a three-dimensional magnetic field whose effect is substantially uniform in all directions. Referring to Fig. 1, the reference numerals 35, 36, 37 and 38 represent, for the purpose of this illustration, the rotating magnetic fields due to a few of the harmonics. It is to be understood that the harmonics produced in the distorting device effect substantially similar rotating magnetic fields in the aforementioned manner. The aforedescribed rotating magnetic fields due to the different harmonics provide noise comprising a number of frequency components extending over the entire speech band or over such portion of the band as to give effective masking.

The noise generator is physically disposed in relatively close proximity to the induction coil embodied in the subscriber's set so that the rotating magnetic fields are superposed on the voice magnetic field. This means that the unauthorized pick-up device, regardless of its orientation relative to the induction coil, will pick up therein both harmonic noise and speech currents, but the magnitude of the noise will predominate to such extent as to mask completely whatever speech may also be present. Consequently, the unauthorized picked-up speech is rendered unintelligible by the noise. This arrangement therefore defeats the unauthorized interception of speech from the subscriber's set.

The pick-up in the telephone set from the magnetic masking apparatus is too small to be audible. The operativeness of the masking apparatus may be readily tested by means of a testing circuit 40 which comprises in series in one branch a manually operated switch 41, a capacity 42 and a pick-up coil 43, and in the other branch a manually operated switch 44, a capacity 45 and a pick-up coil 46. Connected across both of these branches is a telephone receiver 47. The pick-up coil 43 has its longitudinal axis in parallel relation with respect to the corresponding axis of one of the radiating coils, and the pick-up coil 46 has its longitudinal axis similarly disposed with respect to the axis of another radiating coil.

Hence, a closing of the switch 41, for example, will enable the subscriber to hear noise from one radiating coil in the telephone receiver 47, and a closing of the switch 44 will enable the subscriber to hear noise from the second radiating coil in the same receiver. This would indicate that at least two of the radiating coils are operative from which it may be assumed that all three radiating coils are in an operative condition and, in addition, that the harmonic generator is operative. If desired, a pick-up arrangement similar to those embodying the pick-up coils 43 and 46 may be associated with the third radiating coil.

While the invention is described particularly with respect to masking speech picked up from the induction coil embodied in a subscriber's set, it is not necessarily limited thereto, and is equally applicable to any voice apparatus causing the production of voice magnetic fields such as the ringer and receiver of a subscriber's set, a voice repeater, and other signaling apparatus producing a magnetic field thereabout in response to a transmission of signaling current.

It will be further understood that the invention is capable of modification without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In combination, a signaling apparatus producing a signaling magnetic field, and means to superpose a plurality of rotating noise magnetic fields on said signaling magnetic field to defeat unauthorized detection of the signaling magnetic field, said means comprising inductances differently oriented with respect to each other to cause the rotating noise field to cover all space in the vicinity of and surrounding said apparatus, and means to energize said inductances.

2. In combination, a signaling apparatus producing a signaling magnetic field, and means to superpose on said signaling magnetic field a plurality of rotating noise magnetic fields having frequency components extending substantially over the entire signaling band and whose combined effect is substantially uniform in all directions relative to said signaling magnetic field and is of sufficient strength to effectively prevent unauthorized pick-up of the signal.

3. In combination, a telephone subscriber's set producing a voice magnetic field, and means to superpose a plurality of noise magnetic fields on said voice magnetic field, including a plurality of coils and a capacity in series with each thereof to produce a plurality of noise magnetic fields each of which rotates through 360 degrees in an elliptical manner in a different plane, said coils having mutually perpendicular axes so that said plurality of rotating noise magnetic fields will have substantially a three-dimensional effect.

4. In combination, a telephone subscriber's set including an induction coil through which voice currents are transmitted to produce in the vicinity thereof a voice magnetic field, and means disposed in physical proximity of said set and arranged to

produce independently of said induction coil a plurality of rotating noise magnetic fields, comprising a source of fundamental waves, a harmonic producer connected to said source, a plurality of radiating coils connected in parallel to the output of said harmonic producer and arranged such that the longitudinal axes thereof are mutually perpendicular, and a capacity connected in series with each of said coils to provide each harmonic current therein with a certain phase angle to cause a rotation of the magnetic field due to each harmonic current substantially in an elliptical manner in a certain plane, each magnetic field due to each harmonic rotating in a different plane, said plurality of coils serving to produce substantially a composite three-dimensional magnetic field whose effect may be made substantially uniform in all directions relative to said subscriber's set.

5. The combination according to claim 4 which also includes means to test the operativeness of at least one of said radiating coils, said testing means comprising in series a pick-up coil having the longtudinal axis thereof disposed in parallel relation with respect to the corresponding axis of the radiating coil to be tested, a capacitor, sound reproducing means and circuit closure means.

6. A protective apparatus for guarding against the unauthorized pick-up of speech signals from a speech magnetic field external of a subscriber's set, comprising a plurality of inductance coils to be positioned in physical proximity of said subscriber's set, and circuit means to energize said coils to generate a plurality of moving magnetic fields of sufficient intensity to mask effectively the speech magnetic field external of said subscriber's set said fields having a number of frequency components extending over substantially the entire speech band.

7. In combination, a telephone subscriber's set producing an external voice magnetic field in the surrounding space, and means to prevent unauthorized pick-up of the voice magnetic field comprising a plurality of differently oriented magnetic coils, and means to supply said coils with alternating currents in such phases as to produce rotating noise fields covering all space in the vicinity of and surrounding said set, to effectively mask said voice magnetic field.

8. The combination of claim 7 in which the means to supply said coils with alternating current includes sources of currents of a number of frequency components extending over substantially the entire speech band.

GEORGE M. PHILLIPS.