

UNITED STATES PATENT OFFICE

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SPEECH PRIVACY APPARATUS

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6 Claims. (Cl. 179—1.5)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention is in communications apparatus and more particularly is in speech privacy systems.

Several distinct kinds of speech privacy apparatus are known in the art. The present invention is directed especially to that type which involves division of the input signal on a time basis, with scrambling or rearrangement of the elements out of their usual order before transmission; and the principal object thereof is to provide a simpler speech scrambler of the time division type than is known in the art.

Other objects will be apparent from a reading of the following specification and claims.

In the drawings:

Figure 1 shows in diagram the principal elements of a transmitter embodying my special scrambling device;

Figure 1a is detail partly in section of one means of mounting a magnet element used in the invention; and

Figure 2 is a similar illustration of the elements of a receiving station.

Referring to the drawings and particularly to Figure 1 thereof, 10 is a disc adapted to be rotated in a clockwise direction at a predetermined fixed speed by means of a motor 11 and friction drive 11'. One sector 12 of the disc 10 is plated or otherwise provided with a magnetizable surface, whereas the disc proper is formed of non-magnetic material.

Sector 12 is shown 90° in extent. Its angular length, in fact, will depend upon the angle through which the disc rotates during one time element.

The present description will for purposes of simplicity assume a coding cycle of four elements only. It will be understood that a four-element coding cycle will provide very low security, and that normally a much longer cycle will be employed.

Arranged parallel to and adjacent one face of disc 10 are four guides, 14, 15, 16, and 17, so arranged that they divide the area of the disc into four equal sectors. The guides, of course, are not intended to rotate, but instead the disc rotates beneath them. Mounted on the guides, one to each guide, are four recording coils 20, 21, 22, and 23. Each of these coils is located at a different radial distance from the center of the disc, a distance which will be fixed during cer-

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tain intervals while recording but which should be variable at the will of an operator. A slidable spring-pressed mounting will suffice. Such a mounting is shown in Figure 1a wherein can be seen the guide member 14 together with a cooperating magnet member 20. The recording coil assembly is provided with a groove 20¹ in the interior thereof, and in one side thereof is a bent spring 20² secured in place by a pin or screw 20³. Adjustment of spring 20² is such that it will bear with sufficient pressure upon guide 14 to prevent casual displacement of the assembly while permitting intentional movement thereof.

The windings 20, 21, 22, and 23 are connected electrically in series and are energized by means of the output of amplifier 24.

With the recording coils in the positions shown, it can be seen that the leading edge of magnetizable sector 12 of disc 10 will move into the field of coil 20 just as the trailing edge of the sector moves out of the field of coil 23. There may be a slight amount of overlapping—this being immaterial—but for practical purposes one impression is made on sector 12 during any one time interval. Four impressions, however, may be made during one revolution of the disc since the several coils define separate and distinct paths.

Erasing coils 25, 26, 27, and 28 are paired with each of the recording coils, that is, each one is arranged in the path of a different one of the recording coils and adjacent the same so that each may condition a particular path on the disc before it passes beneath a recording coil. The erasing coils are mounted on guides or brackets 29, 30, 31, and 32 substantially like the guides already mentioned.

Reproducing coils, of which four are shown, are provided and bear the reference characters 33, 34, 35, and 36. They should be understood to be connected in series and to feed into output amplifier 50. They too are adjustable radially, preferably just as shown in Fig. 1a.

Each of these coils is arranged so that the path of one of the recording magnets passes directly thereunder. The exact relative order of the reproducing magnets depends upon the code which is to be used to provide privacy in communications utilizing my invention. As shown, a speech element impressed upon magnetizable sector 12 by recording coil 20 is picked up by reproducing magnet 33 135° later. A speech element impressed at 21 will be reproduced at 34 225° later. A speech element impressed at 22 is picked up again for transmission at 28, also 225° later.

A speech element impressed by magnet 23 is not reproduced for transmission until sector 12 reaches magnet 36, or 315° beyond.

It will be apparent that various codes, that is, arrangements of the speech elements relative to their normal order, are a function of the arrangement of recording and reproducing coils on their respective guides. Further, it is obvious that additional security or privacy will be obtained by using a code cycle more than four elements long, and it is entirely feasible to use a cycle much longer and then to provide means for modifying the cycle at intervals. These features form no part of the present invention.

The receiving disc 40 is in all substantial respects like sending disc 10 and comprises a disc proper with a magnetizable quadrant 41 therein. Any convenient means for synchronizing the two discs may be utilized. Recording coils 42, 43, 44, and 45 are just like coils 20, 21, 22, and 23 at the transmission station, and similar erasing coils are employed. Reproducing coils 46, 47, 48, and 49 also are like reproducing coils 33, 34, 35, and 36.

The discs normally will not be in exact phase with each other. The amount of lag will vary with several circumstances, such as transmission delay, length of coding cycle, and so forth. The four-element system herein described requires a 45° lag on the part of the receiving disc with respect to the sending disc, assuming no delay in transmission, which merely means that, as sector 12 of disc 10 reaches coil 20, sector 41 of disc 40 reaches reproducing coil 49.

Recording coils 42, 43, 44, and 45 are positioned in the same positions relative to their disc as recording coils 20, 21, 22, and 23 with respect to disc 10, and each is paired with an erasing coil, as 42'. Reproducing coils 46, 47, 48, and 49 are arranged in locations effectively converse to the locations of reproducing coils 33, 34, 35, and 36. If, for example, reproducing coil 33 (#2 in the cycle) picks up the speech recorded by coil 20 (#1 in the cycle) in the transmission station, then in the receiver, reproducing coil 46 (#1 in the cycle) must pick up the speech component recorded by coil 43 (#2 in the cycle).

The method of enciphering and deciphering speech according to a four-element code is simple. Assuming that the sending and receiving discs are synchronized and that they are properly phased, the first speech element appearing at the output of amplifier 24 will appear simultaneously on the several windings 20, 21, 22, and 23. At this time, however, only coil 20 will be effective, for the magnetizable quadrant 12 of disc 10 is just beginning to pass therebeneath. As disc 10 continues to rotate, the first speech element will be replaced in all windings by the second element just in time to be impressed upon sector 12 by coil 21. A moment later the first speech element will be picked up by winding 33, before the third element is impressed upon sector 12 by coil 22. The fourth speech element will be impressed upon the magnetizable element by recorder 23 just before the second element is reproduced at 34.

The speech element impressed at 22 remains on sector 12 until the segment reaches reproducing coil 35. It is, therefore, carried over into the second cycle, which begins when the outermost magnetizable path of segment 12, first demagnetized by erasing coil 25, has impressed thereon a new signal element by winding 20.

The enciphered signal is received at 51 and amplified and impressed upon the series-connected recording coils. Disc 40 must be so positioned

with respect to its several recording and reproducing elements that at the same instant the signal picked up by winding 36, for example, is impressed upon the recording circuit, the leading edge of magnetizable sector 41 passes into the field of winding 44. Proper adjustment of the recording and reproducing elements will provide rescrambling of the transposed speech elements so that they are put upon output circuit 60 in proper order. The coils are shown in their proper positions with respect to the positions of the pick-up and reproducing elements of the sending apparatus.

As has been explained, my apparatus is not restricted to privacy treatment involving only a four-element code, the only limitation in this respect being that of practicability in that for each coding element there must be (in the illustrated construction) a recording, an erasing, and a reproducing member. The angular width of the magnetizable disc sector will be equal to 360° divided by the number of coding elements.

Furthermore, the foregoing description has been specifically directed to the preferred embodiment of the invention in all respects, and many modifications will readily suggest themselves. Wherefore, for the true scope of the invention, reference should be had to the appended claims.

I claim:

1. In a speech privacy apparatus of the nature described, the combination of a disc, means for rotating said disc, a sector of magnetizable material mounted on said disc, a plurality of electrically connected recording members adjacent said disc for impressing signals on said sector said members being spaced about the surface of said disc at equal intervals the spacing of said members being dependent upon the angular length of said magnetizable sector and being arranged on radii of different lengths, and a plurality of electrically connected reproducing elements for picking up the impressed signals arranged at intervals equal to the intervals between said recording members and at similar distances from the center of the disc each said reproducing element being angularly spaced from a recording member with which it cooperates.

2. In a speech privacy apparatus of the nature described, a disc having a magnetizable sector of n degrees thereon, means for rotating said disc, a plurality of electrically connected recording members spaced at n degree intervals around the face of the disc and adjacent thereto at varying distances from the center thereof for impressing signals on said sector, and a plurality of electrically connected reproducing elements at n degree intervals for picking up the impressed signal each spaced from the center of the disc a distance equal to the distance of one recording member from the center of the disc.

3. In a speech privacy apparatus of the nature described, a circular disc containing a quadrant of magnetizable material, four recording members connected in series adapted to have an input signal applied thereto said members being positioned adjacent a face of said disc so as to be enabled to impress a signal upon said magnetizable segments said members being spaced at 90° intervals about the disc and at different distances from the center thereof, and four reproducing elements spaced at 90° intervals about said disc and adjacent thereto each at a distance from the center of the disc equal to the distance of a different one of said recording members from the center of

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said disc said reproducing elements being electrically connected in series.

4. The invention of claim 3, further characterized by means for varying the positions of the said recording members relative to the center of said disc.

5. The invention of claim 3, further characterized by means for varying the positions of said reproducing elements relative to the center of said disc.

6. In a speech privacy apparatus of the nature described, a disc having a magnetizable sector thereon, means for rotating said disc, a plurality of electrically connected recording members equally spaced about the surface of said disc and adjacent thereto said members being at different radial distances from the center of said disc, a similar plurality of electrically connected reproducing elements equally spaced about the surface of said disc and between said recording members each of said elements being at a radial distance from the center of said disc equal to the radial distance of one of said members from the

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center of said disc and mounted for individual adjustment relative thereto, and a similar plurality of erasing devices adapted to condition a path upon said sector before such path moves beneath a recording member.

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Patent No. 2,531,435

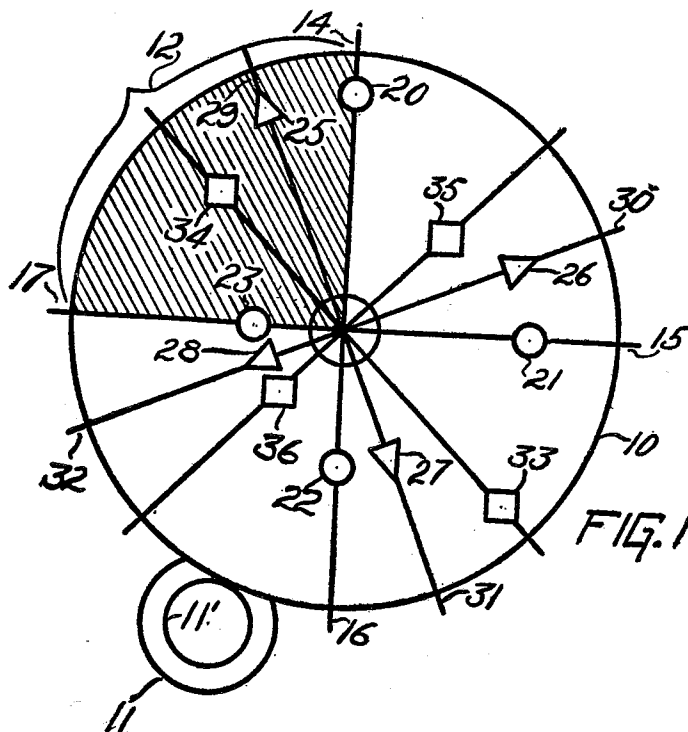
Certificate of Correction

November 28

DANIEL F. HOTH

It is hereby certified that error appears in the above numbered ;
requiring correction as follows:

In the drawing, Fig. 1, disc 10, should appear as shown below in
of as in the patent—



and that the said Letters Patent should be read as corrected above, so th
the same may conform to the record of the case in the Patent Office.
Signed and sealed this 20th day of February, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

Certificate of Correction

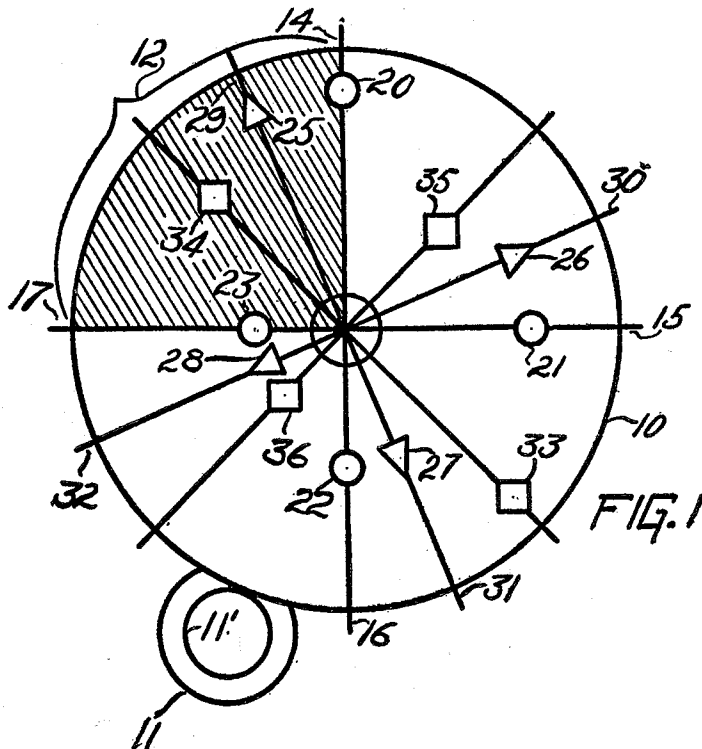
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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.