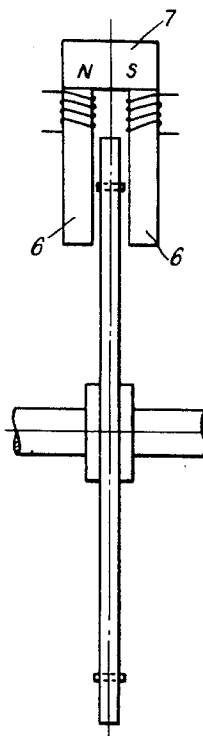
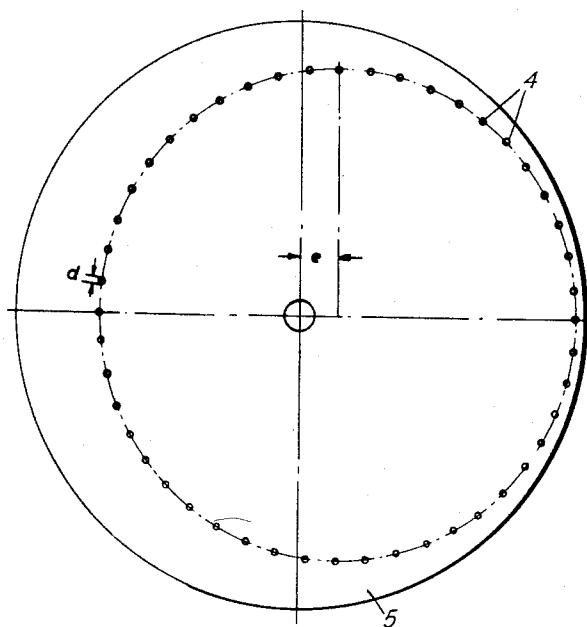
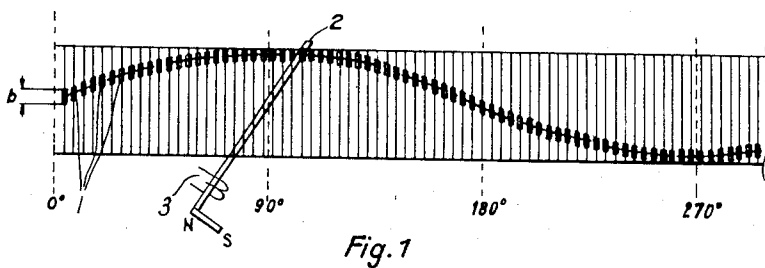


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TONE WHEEL TO PRODUCE FREQUENCY-MODULATED
LOW-FREQUENCY OSCILLATIONS
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TONE WHEEL TO PRODUCE FREQUENCY-MODULATED LOW-FREQUENCY OSCILLATIONS

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As is well known, a so-called phonic wheel or tone wheel may serve to produce voice frequencies. Such a device comprises a wheel which has a plurality of field-influencing members arranged in a row along its circumference to affect

either an electric or a magnetic field or a beam of light, doing so at a frequency that depends on the number and rotational speed of these members. A tone wheel of the design best known comprises a toothed wheel whose teeth are of ferromagnetic material and, when the wheel is rotating, pass through the field of a permanent magnet. This magnet has coils seated on its limbs or legs and in which voltages arise through the field intensity being influenced by the teeth. These voltages may, after amplification, be used to energize a sound generator or to control some switching operation or may be employed for measuring purposes.

In many cases, however, the problem has been to generate a low frequency voltage that varies as to its frequency, that is to say, a frequency-modulated low frequency voltage. Such voltages are, for instance used to actuate alarm apparatus or to test acoustic devices and, furthermore, to serve as intermediate carriers in plants of rotary radio beacons. In order to produce these voltages it has been necessary to arrange that the interspaces between said teeth are different from each other in accordance with the frequency variation or frequency swing, as it is called. The practice in this respect has been to provide, at some point of the row of teeth, for a minimum interspace of the teeth and to provide for a maximum interspace at the point diametrically opposite the former, and to arrange that the transition from such minimum to such maximum is sinusoidal.

However, the manufacture of tone wheels so constructed meets with serious difficulties because the tools necessary to produce the proper interspaces of the teeth are in their turn difficult to manufacture. Even complicate tools have proved not to operate with that degree of precision which is indispensable for producing the proper gradual increase of the interspaces. Moreover, the undesirable phenomenon of amplitude modulation is difficult to eliminate since it is hardly possible for the teeth to be given all the same width.

The invention relates to an arrangement for producing an oscillation, comprising a rotatable member, a plurality of field influencing means, spaced apart equal distances in a substantial

planar pattern about the circumference of said member, and a pick-up means operatively associated with said member for receiving effects from said field-influencing means upon their passage, whereby a wave of energy is produced, an arrangement for producing a frequency modulation of said wave of energy upon uniform rotational movement of said rotatable member, comprising mounting said rotatable member so that the plane of the pattern of said field influencing means is on an axis displaced from the axis of rotation of said member.

In compliance with what is stated herebefore, the said axes are angularly displaced. According to another feature of the invention the said axes are laterally displaced.

A better understanding of the invention may be had from the particular description of embodiments thereof made with reference to the accompanying drawing in which—Fig. 1 is a development of a wheel or drum illustrating the principles of my invention and Fig. 2 is an illustration of a disc used in a modified form of the invention, and Fig. 2a is an edge-view of the disc of Fig. 2 shown mounted in its relationship with the pick-up magnet used therewith.

Referring first to Fig. 1 the wheel or drum is in the form of a circular cylinder and the magnetic elements 1 are arranged about the periphery of this drum with equal circumferential spacing but defining substantially a plane at an angle to the axis of rotation of the wheel or drum. The teeth, as here shown, are parallel to each other and besides parallel to the wheel axis, but need not in any case be parallel to this axis. The distances by which the teeth are spaced apart are the same over the entire circumference. The original width of the teeth 1 is reduced to the width b by a milling process so conducted that the teeth so reduced shall constitute a sinusoidal row. The pole piece 2 of the tone coil 3 is positioned at an acute angle to the axis of rotation. If the tone wheel is rotated at a constant speed, a frequency-modulated voltage arises in the coil since the teeth arriving at the pole piece are each offset with respect to the preceding tooth.

The magnet system may be mounted pivotally to permit of changing the angle at which the pole piece and wheel axle are positioned with respect to each other. By this means the frequency swing will be adjustable.

The manufacture is still simpler in the case of Figs. 2, 2a. Here, the ferromagnetic members are mounted in the wheel disc so as to project

therefrom on either side, and they constitute a circular row which is displaced from the axis of rotatable member in relation to the wheel axis. Calculation shows that the evolute of this circular row in respect of the center point of the wheel is practically in the nature of a sine curve superimposed upon a constant value. For example, in the case of a displacement $e=6\%$ the difference from the exact sine curve is as small as 1.4%. The ferromagnetic members in the case of Fig. 2 are cylindrical studs 4 arranged to be moved, on either side of the wheel 5, past the poles 6 of a permanent magnet 7. The width of the pole pieces 6 should be equal to, or larger than, double the displacement e plus stud diameter d , whereby the number of lines of force intersected by the studs shall be substantially the same for each stud. In the case of Figs. 2 and 2a variation of the frequency swing will be possible if the studs are carried by a separate disc whose displacement e is variable.

In order that the amplitude be always the same, the air gap or construction of the pole piece must be such that the said members, which in the examples here described are studs or teeth, will cause the same voltage amplitudes to arise as long as the wheel is rotated at a constant speed. For instance, these members may to such end be made to influence the magnetic field for the same period each. In the example according to Fig. 2 the pole pieces or air gap require to be given dimensions smaller in accordance with the smaller velocity of those studs which are nearer to the center point of the wheel.

To avoid or decrease eddy losses it will be convenient for the wheel disc to be made of some insulating material or of a metal that behaves as a poor conductor of electricity.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. In an arrangement for producing an oscillation, comprising a rotatable member, a plurality of field influencing means, spaced apart equal distances in a substantial planar pattern about the circumference of said member, and a pick-up means operatively associated with said member for receiving effects from said field-influencing means upon their passage, whereby a wave of energy is produced, an arrangement for producing a frequency modulation of said wave of energy upon uniform rotational movement of said rotatable member, comprising means for mounting said rotatable member with the plane of the pattern of said field influencing means on an axis displaced from the axis of rotation of said member.

2. An arrangement according to claim 1, wherein said axes are angularly displaced.

3. An arrangement according to claim 1, wherein said axes are laterally displaced.

4. An arrangement according to claim 1, wherein said member is a disc, and said field influencing means are mounted in a circle eccentric to the axis of said member.

5. An arrangement according to claim 4, wherein said field influencing means are elements of magnetic material, and said pick-up means comprises magnetic pick-up members of a length to overlap said field influencing means during rotation of said member, and a coil mounted on said pick-up member.

6. An arrangement according to claim 1, wherein said member is a substantially right cylindrical drum, and said field influencing means are positioned on the face of said drums about a peripheral line defining a plane angularly related to the axis of rotation of said drum.

7. An arrangement according to claim 6, wherein said pick-up means is a magnetic element positioned parallel to the surface of said drum at right angles to said line, and a coil mounted on said magnetic pick-up means.

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No references cited.