

Nov. 28, 1933.

J. C. THORESEN

1,937,394

SIGNALING APPARATUS

Filed Aug. 2, 1930

2 Sheets-Sheet 1

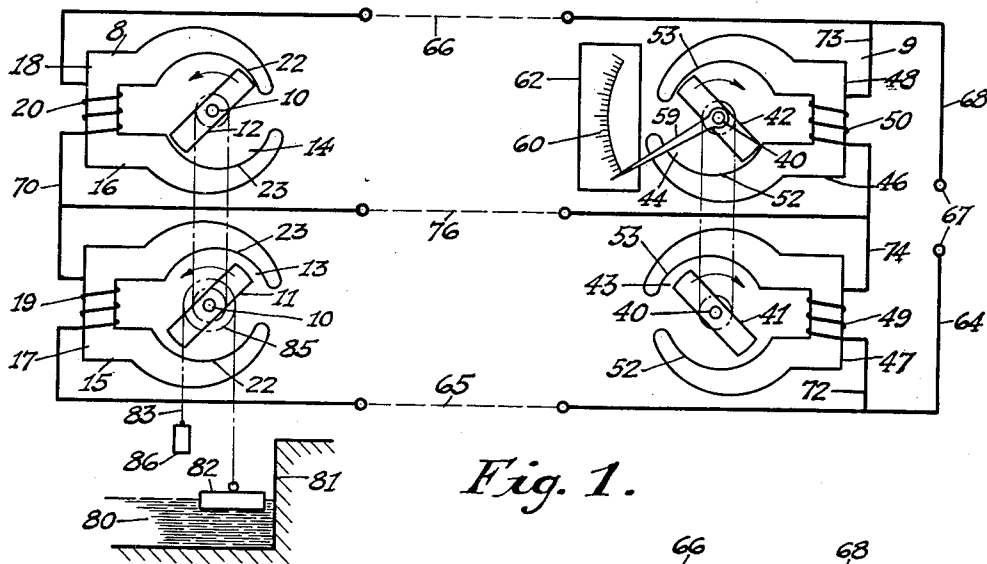


Fig. 1.

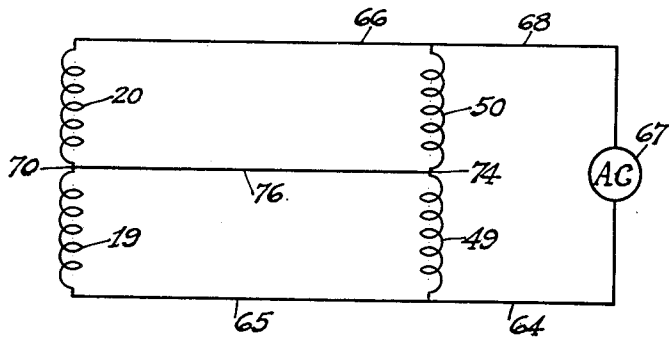


Fig. 2.

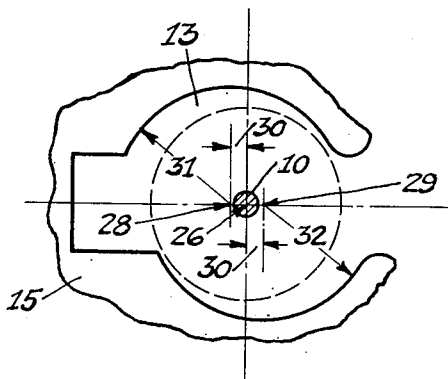


Fig. 3.

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2 Sheets-Sheet 2

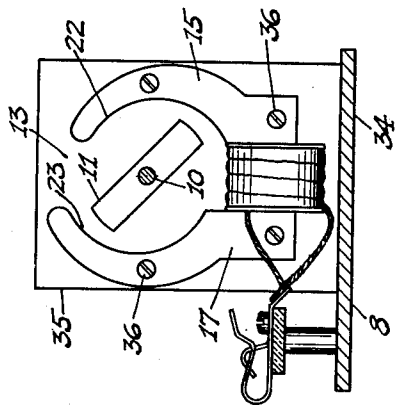


Fig. 5.

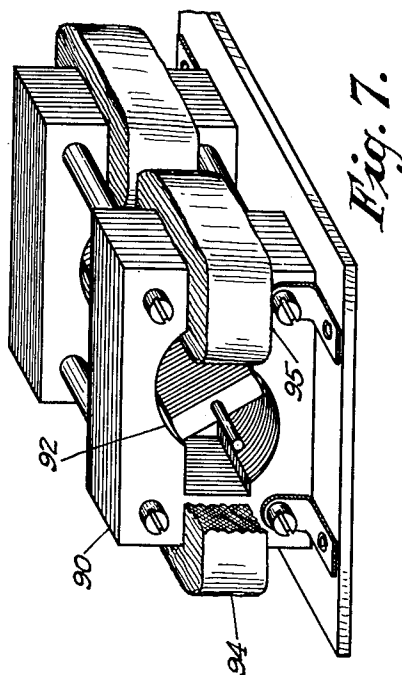


Fig. 7.

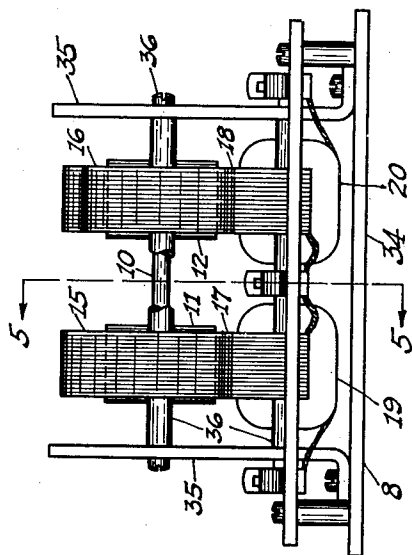


Fig. 4.

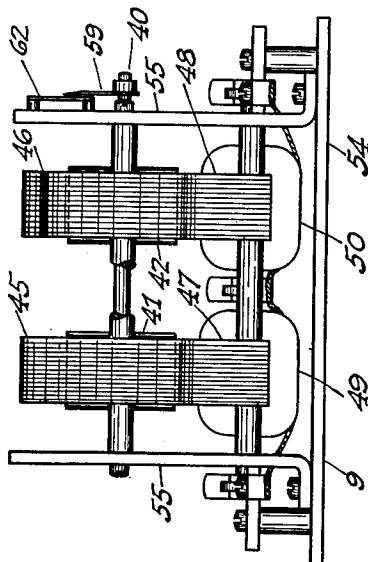


Fig. 6.

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UNITED STATES PATENT OFFICE

1,937,394

SIGNALING APPARATUS

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Application August 2, 1930. Serial No. 472,732

2 Claims. (Cl. 177—351)

My invention relates to electrical indication producing devices or systems of a telemetric character, commonly purposed to indicate, at a distant point, the level or rate of flow of liquids, the pressure of steam or other fluids, the degree of temperature, and the state of other variable physical forces.

The essential objects of my invention are compactness of structure, accuracy of record, certainty of operation, the reduction of the number of parts to a minimum; the avoidance of the friction involved in the use of solenoids, commutators, and other mechanical elements heretofore employed; and the attainment of these results in a simple and inexpensive construction. Other and ancillary objects of the invention will appear hereinafter.

To the above ends my invention consists in such parts and in such combinations of parts as fall within the scope of the appended claims.

In the accompanying drawings forming a part of this specification, and illustrating the principle of this invention, and the best mode now known to me for applying that principle,

Figure 1 is a partially diagrammatic view of my telemetric device, illustrating its use, in this instance, for the indication of the height of a liquid in a reservoir to a distant point,

Figure 2, a diagrammatic view of the electrical connections of the device,

Figure 3, a schematic showing of one of the stator openings,

Figure 4, a side elevation of the primary motor unit,

Figure 5, a section on line 5—5 of Figure 4,

Figure 6, a side elevation of the secondary motor unit, and

Figure 7, a perspective view of a modified form of my invention.

Like reference characters indicate like parts throughout the views.

In the present embodiment of my invention the assemblage of parts includes a primary or transmitter motor unit and a secondary or receiver motor unit represented in a general manner by 8 and 9 respectively. The former has journaled for oscillation about its axis a shaft 10 to which are fixed two oblong laminated rotor cores 11 and 12 composed of high magnetizable or permeable material such as soft iron. These cores rotate respectively within the operating openings 13 and 14 of cores 15 and 16 of the stators 17 and 18 of unit 8 carrying respectively the stator coils 19 and 20. The rotor cores are disposed at the same radial angle upon the shaft 10. Two opposite portions

of each of the stator core openings 13 and 14 constitute equally arcuate surface portions 22 and 23 nonconcentric to the enclosed rotor core and offset longitudinally of the stator core relatively to each other. The more advance arcuate portion 23 of one stator core is located, longitudinally of the unit 8, in alignment with the lower arcuate portion 22 of the companion stator core. In other words the poles of the stator cores 15 and 16 are eccentric and offset.

In calculating the degree of offset of each stator relatively to its operating opening and to the rotor shaft cooperating therewith, reference is made to Figure 3 wherein 26 represents the axial center of the shaft 10. Offset from the center 26 are centers 28 and 29. These centers are taken an equal arbitrary distance 30 from the center 26. This distance is determined by the amount of eccentricity desired. With 28 and 29 as centers, and with radii 31 and 32 respectively of equal length, the two arcs of the stator opening are described. The radii must be of a length in excess of the path of the rotor extremity which is shown in broken lines.

As herein shown the transmitter unit 8 includes a base 34, interspaced uprights 35 thereon in which the shaft 10 is journaled, and mounting pins 36 inwardly disposed upon the uprights for supporting the stators 17 and 18 in parallelism.

The secondary or receiver unit 9 includes a shaft carrying cores 41 and 42 similar in structure and material to those above described, which respectively rotate in openings 43 and 44 of the cores 45 and 46 of the stators 47 and 48 which respectively include stator coils 49 and 50. Opposite arcuate portions of each of these core openings constitute surface portions 52 and 53 mutually nonconcentric, and nonconcentric to the enclosed rotor core. One of the portions 53 is offset and advanced relatively to its cooperating portion 52. The portion 53 of one core is arranged opposite the portion 52 of the other core.

The framework of the unit 9 for carrying the stators 47 and 48 in parallelism is identical with that of unit 8, including the base 54, the uprights 55 in which the shaft 40 is journaled, and the mounting pins 56. A pointer 59 fixed to the shaft 40 cooperates with graduations or calibrations 60 upon a scale 62.

As clearly illustrated in Figure 1 the windings of the stators of units 8 and 9 have their adjacent terminals respectively connected by conductors 65 and 66 thereby connecting all of the windings in series. The conductor 76 is connected to conductor 70 and 74 thereby completing a bridge cir-

cuit. A source of alternating current 67 is connected to the bridge circuit through terminals 64 and 68.

The shaft 10 is caused to rotate under the impulse imparted by the force sought to be measured. In this instance the impulse is generated, as shown in Figure 1, by the rise and fall of a liquid 80 contained in a reservoir 81 and supporting a float 82 attached to one end of a cable 83 passing over a pulley 85 fast to the shaft 10 and carrying a counterweight 86 upon its free end. A rise of the float gradually moves the shaft 10 in the direction of the arrows, as shown in Figure 1. It will be understood that the use of the pulley and float is purely illustrative and may be omitted, the means for imparting initial movement to the shaft constituting no part of this invention.

In operation, as the angular position of the rotor 11, under the impulse from the shaft 10, occasioned by a rise of the float 82, changes to gradually diminish the width of the air gap in the magnetic circuit composed of the cores 11 and 15, simultaneously the air gap in the magnetic circuit composed of the cores 12 and 16 is gradually increased. This action causes an increased impedance of the coil 19 and coils 11 and 15, and a decreased impedance of the coil 20 and cores 12 and 16, which in turn causes the E. M. F. across the terminals of coil 19 to increase, and, across the coil 20, to decrease. This will cause the bridge circuit to become unbalanced. That is to say, the E. M. F. across the terminal of the coil 20, which equals that traversing the terminals of coil 50 when the bridge is balanced, has become less than sufficient, while the E. M. F. across the terminals of the coil 19 which should be equal to that across coil 49 has become greater. This causes a current to flow from one terminal of the supply line through the coil 20, line wire 76, and coil 49, thereby causing the torque on the rotor core 41 and its shaft 40 to increase in the direction of the arrows, as shown in Figure 1, and thus advancing the pointer 59 over its dial 62. The torque continues while the rotor shaft 40 and its cores 41 and 42 are in their movement decreasing the air gap in one magnetic circuit and increasing it in the other, and until the E. M. F. across coil 20 equals that across 50, and the E. M. F. across the coil 19 equals that across coil 49, and the balance of the bridge circuit is now restored with no current flowing through the line wire 76.

In Figure 7 is shown a stator core 90 wherein the opening 92, while of the same shape as the stator hereinabove described, is closed throughout its periphery and a current coil 94 and a potential coil 95 are substituted for a single coil.

It will be observed that a simultaneous increase and decrease of the breadth of the air gaps occurs between the pairs of rotor cores and stator cores of each of the two cooperating motive units, wherein the increase of one gap of a unit is contemporaneous with the decrease of the other gap of the same unit.

While I have herein shown and described merely for illustrative purposes two specific embodiments of my invention, and have disclosed and discussed in detail the construction and arrangement incidental to such disclosure, it is to be distinctly understood that the invention is limited neither to the mere details or relative arrangement of parts nor to the specific application shown, but that extensive variations from the illustrations may be made without departing from the principles thereof.

I claim:—

1. In an inductance bridge, an electrical instrument comprising a pair of substantially U-shaped stator elements, the arms of which include arcuately formed pole pieces, a winding on each stator, a symmetrical rotor associated with each stator to form an air gap at each end, means for mounting each rotor to rotate between the pole pieces of its stator, the pole pieces of each stator having their centers of curvature oppositely offset from the center of rotation of its rotor, whereby the air gap between each rotor and its stator will be progressively varied upon rotation of the rotor, and means mechanically connecting the rotors to rotate in unison so that the impedance of each stator winding is varied oppositely with relation to the other.

2. In an inductance bridge, an electrical instrument comprising a pair of stator elements, the arms of which include pole pieces, a winding on each stator, a rotor associated with each stator to form an air gap at each end, means for mounting each rotor to rotate between the pole pieces of its stator, means for progressively varying the air gap between each rotor and its stator upon rotation of the rotor, and means mechanically connecting the rotors to rotate in unison so that the impedance of each stator winding is varied oppositely with relation to the other.

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