

March 16, 1937.

L. W. BLAU ET AL

2,074,043

SEISMOGRAPH

Filed July 29, 1932

2 Sheets-Sheet 1

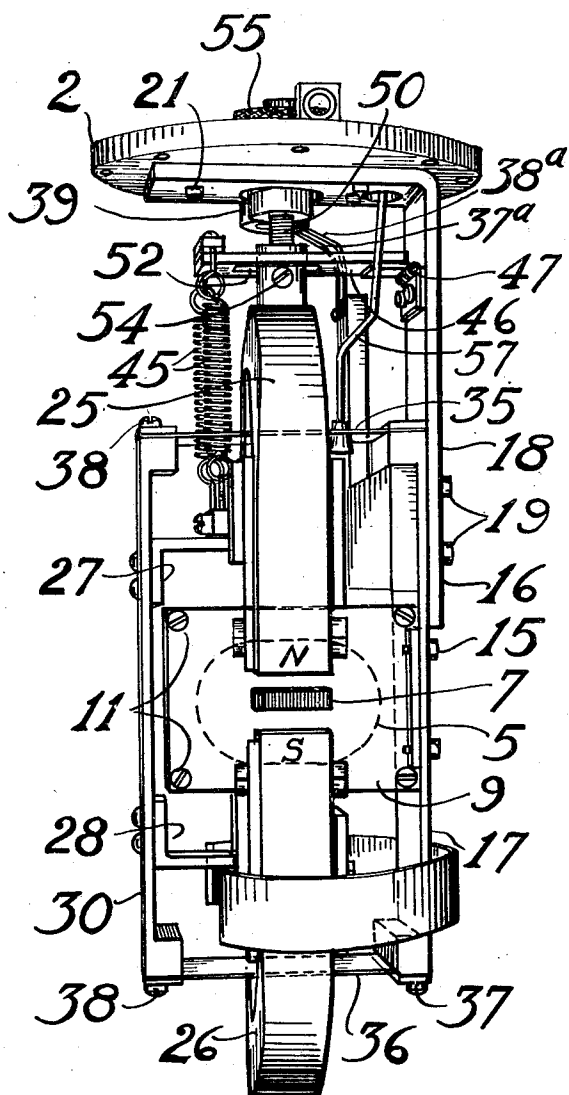


Fig. -1

Ludwig W. Blau, INVENTORS

Louis Statham

BY

W. E. Currie, ATTORNEY.

March 16, 1937.

L. W. BLAU ET AL

2,074,043

SEISMOGRAPH

Filed July 29, 1932

2 Sheets-Sheet 2

Fig. - 2

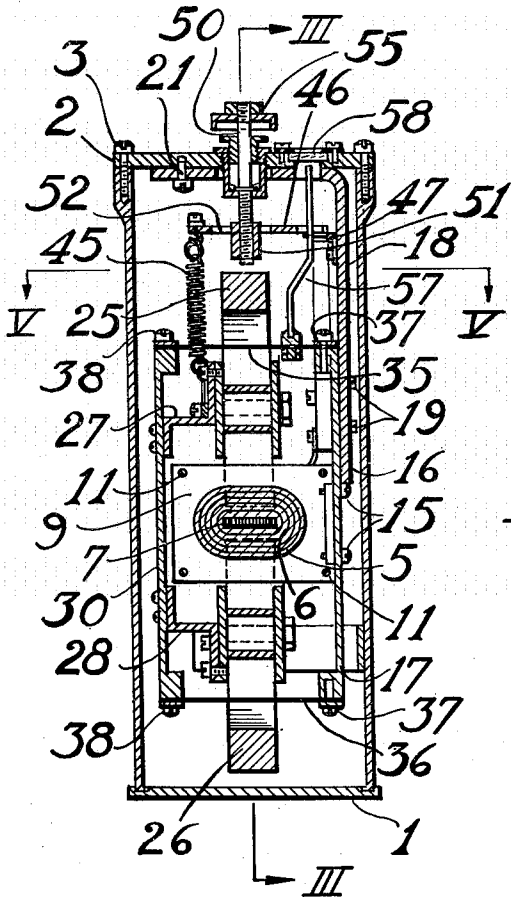


Fig. - 3

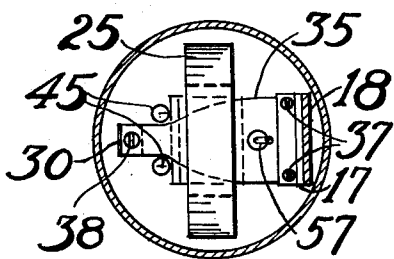
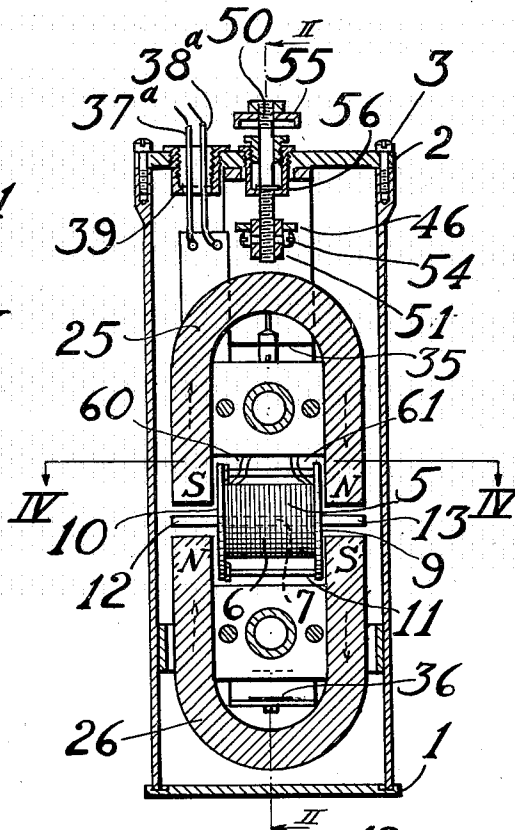


Fig. - 5

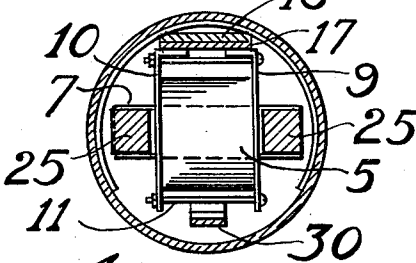


Fig. - 4

Ludwig W. Blau INVENTORS
Louis Statham
BY

W. E. Currie ATTORNEY.

UNITED STATES PATENT OFFICE

2,074,043

SEISMOGRAPH

Ludwig W. Blau and Louis Statham, Houston, Tex., assignors to Standard Oil Development Company, a corporation of Delaware

Application July 29, 1932, Serial No. 626,132

4 Claims. (Cl. 177—352)

This invention relates to improvements in seismographs. The invention will be fully understood from the following description taken in connection with the accompanying drawings in which latter—

Fig. 1 is a perspective view of the device with the casing removed;

Fig. 2 is a longitudinal sectional view taken along the line II—II of Fig. 3;

Fig. 3 is a longitudinal sectional view taken along the line III—III of Fig. 2;

Fig. 4 is a transverse sectional view taken along the line IV—IV of Fig. 3; and

Fig. 5 is a transverse sectional view taken along the line V—V of Fig. 2.

Referring particularly to the drawings, reference numeral 1 designates a case having a closure 2 secured by means of screws 3 to seal the case. The case constitutes a supporting frame for the instrument.

A coil 5 is supported rigidly within the case. The coil comprises a winding 6 of copper or other metal wire and an iron core 7 which is preferably laminated as shown. The coil is secured rigidly to a coil frame comprising plates 9 and 10 held together by bolts 11. Opposite ends 12 and 13 of the iron core protrude beyond the coil frame. The coil frame is secured rigidly by bolts 15 to a supporting frame 16. The frame 16 is formed of bars 17 and 18 rigidly connected by bolts 19. The bar 18 depends from and is rigidly supported by the closure 2 by means of a bolt 21.

A system is movably supported from the frame 16. The movable system includes spaced magnets 25 and 26 which are secured as a unit by means of brackets 27 and 28 respectively to a plate 30. The movable system is yieldably suspended from the frame 16 by means of flat spring members 35 and 36. The spring members 35 and 36 are secured at one end by screws 37 to opposite ends of the bar 17. The spring members 35 and 36 are secured at their movable ends by means of screws 38 to opposite ends of the plate 30. The springs 35 and 36 function as centering springs which partially support the movable system. The coil is connected to electrical conductors 37a and 38a which extend through a gland 39 in the closure 2.

The movable system is further yieldably supported by means of helical springs 45, the lower ends of which are secured to the bracket arm 27 and the upper ends of which are secured to a substantially horizontally disposed center-piece 46. The center-piece 46 is supported in a sub-

stantially horizontal position from the frame 16 by means of a hinge 47.

The center-piece 46 is adjustable from the exterior of the case by means of a screw 50. The screw 50 carries at its lower end a collar 51 which protrudes through an elongated slot 52 in the center-piece 46. The collar 51 has set screws 54 adapted to engage the under side of the center-piece 46. The upper end of the screw 50 protrudes through an opening in the closure 2 and terminates in a hand wheel 55 upon the exterior of the casing. The screw extends rotatably through a suitable gland 56 which seals the opening through the closure 2. An indicating bar 57 projects upwardly rigidly from the spring 35 and terminates in position to be viewed from the exterior of the case 1 through a glass window 58. Preferably the movable magnet system is adjusted by means of the screw 50 so that the parts of the instrument are in correct position and ready for operation when the indicating bar 57 is seen in the center of the window 58.

The magnets 25 and 26 are suspended with the poles of the magnets disposed on opposite sides of and spaced from the ends 12 and 13 of the core.

It will be evident from the arrangement shown that magnetic lines of force starting from the north pole of magnet 25 proceed across the iron core 7, to the south pole of the magnet 26 and through the magnet 26 to the north pole of the magnet 26 whence they again traverse the iron core 7 to the south pole of the magnet 25. Other magnetic lines of force travel from the north pole of the magnet 25, penetrate the end 13 of the iron core 7 and follow this core to the end 12 of the iron core to return to the south pole of the magnet 25. Other magnetic lines of force travel from the north pole of the magnet 26, penetrate the end 12 of the iron core and follow the core to the other end 13 to return to the south pole of the magnet 26. It will be understood that if the magnets 25 and 26 are equal in intensity of magnetization and if the iron core 7 is exactly at the same distance from the magnets then the lines of force traveling along the iron core from one end to the other cancel each other. If, however, one magnet is nearer the iron core than the other its lines of force are not cancelled by the lines of force of the other magnet. There is thus a change in the flux through the iron core while the magnet is moving relative to the core. This change in flux induces an

electro-motive force in the coil. The induced current is conducted from the coil through conductors 30 and 31.

The seismograph depends for its electro-motive force upon the change in flux in the iron core of the coil which is caused by relative motion of the magnets and iron core thereby effecting a high degree of sensitivity of the instrument.

It will also be understood that the coil may constitute the moving system and the magnets may be connected rigidly to the frame of the instrument if desired so long as relative motion is attained between the coil and the magnet system.

Various changes may be made within the scope of the appended claims in which it is desired to claim all novelty inherent in the invention as broadly as the prior art permits.

We claim:

1. In a seismograph, a frame, a coil wound on a rigid iron core, the ends of the core protruding from the coil in a horizontal direction, means immovably securing the coil to the frame, and a movable system including magnets of large inertia, means yieldably suspending the magnets from the frame for movement in a vertical direction with the poles of the magnets disposed on opposite sides of and spaced from the ends of the core whereby the magnets are maintained substantially stationary when the frame is subjected to seismic vibrations and motion of the core relative to the magnets induces electromotive force across the coil.

2. In a seismograph, a frame, complementary permanent magnets having a large inertia and defining arms having confronting pole faces, the confronting poles of opposite magnets being of opposite polarity, a unit of small inertia including a coil between the arms of the magnets and wound on a rigid core extending through the coil and between the pole faces of the magnets, and means separately supporting the unit and the magnets from the frame for equal relative movement toward and from each

other throughout the extent of the core when the frame is vibrated during seismic vibrations, the core being normally disposed in equally spaced relation between confronting pole faces of the opposite magnets whereby flux in the core is balanced and electromotive force is generated in the coil upon said relative movement.

3. In a seismograph, a frame, complementary permanent magnets rigidly secured together in alignment vertically and defining arms having confronting pole faces, confronting poles of opposite magnets being of opposite polarity, a unit including a coil between the arms of the magnets and wound on a rigid core extending through the coil and between the pole faces of the magnets, and means separately supporting the unit and the magnets from the frame for equal relative reciprocating movement in a vertical plane toward and from and with respect to each other throughout the extent of the core when the frame is vibrated vertically during seismic vibrations, the core being normally disposed in equally spaced relation between confronting pole faces of the opposite magnets whereby flux in the core is balanced and electromotive force is generated in the coil upon vertical vibration of the frame.

4. In a seismograph, a frame, vertically spaced complementary permanent magnets of large inertia defining arms having confronting pole faces, confronting poles of opposite magnets being of opposite polarity, means resiliently suspending the magnets from the frame to form a suspended mass of large inertia which arms remain substantially stationary when the frame is subjected to seismic vibrations, and a unit including a coil between the arms of the magnets and fixed to the frame and wound on a rigid core extending through the coil and between the pole faces of the magnets whereby the movement of the pole faces with relation to the core is in a direction at right-angles to the axis of the core.

LUDWIG W. BLAU.
LOUIS STATHAM.