A USEFUL PENDULUM AND A SIMPLE WIRELESS METHOD FOR THE VELOCITY OF SOUND.

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The following arrangement of a mercury contact pendulum will find a variety of uses in any physics laboratory and its description may offer several suggestions to amateur wireless operators. While all of the ideas presented are not new, the simplicity of the apparatus will appeal to busy teachers. All the parts necessary for each experiment will be found at hand in the ordinary laboratory.

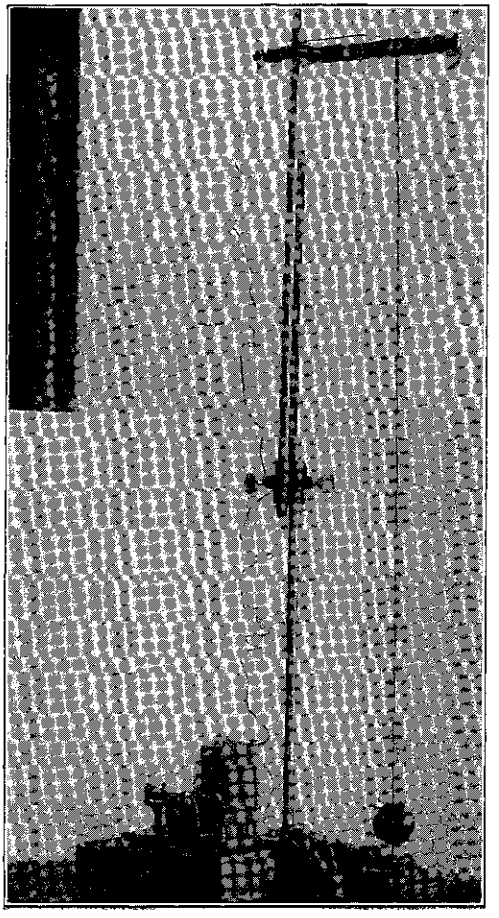

Fig. 1.

For illustrating the laws of the pendulum and finding the value of gravity, the apparatus is arranged as in figure 1. The upper part of the fine iron wire which holds the pendulum bob is fastened to a small clock spring. For all ordinary purposes, the thin flexible spring gives results equal to those obtained with a knife edge support. It can be readily clamped in any position, allowing the length of the pendulum to be quickly adjusted, and there is no danger of its being broken by constant swinging. The bob is 1.5 inch iron ball through which the wire passes to be soldered in place. Nearly an inch of the wire projects below the ball and is twisted into a spiral in order to facilitate adjusting its length in making contacts. A watch glass, filled with paraffine with a shallow trough about 3 mm. wide across the surface, holds the mercury for the contact.

As the telegraph sounder can be heard throughout the room, it gives an accurate method for counting the swings in determining the laws of the pendulum for physics classes. For short lengths, the contact can be set at the end of the arc, thus allowing double vibrations to be counted. Quicker results and a higher degree of accuracy in determining the acceleration of gravity can be secured with this simple arrangement than will be found possible with anything but expensive apparatus.

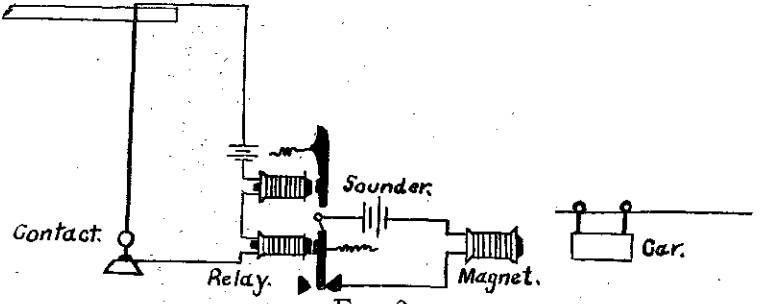

FIG. 2.

By including a telegraph relay in the circuit, the same pendulum can be used to release the car or iron ball where an inclined wire or wooden plane is used to illustrate the acceleration of falling bodies. The connections will be made clear from an examination of figure 2. The electromagnet remains in circuit except when the pendulum contact touches the mercury. The click of the sounder will coincide with the time of release of the car. Figure 3 shows a convenient method for finding how far the car has traveled at the end of any required time. The brush held

by the clamp is moved along under the trolley wire until the stroke of the bell as the car completes the circuit coincides with the click of the sounder.

For determining the velocity of sound in air, the apparatus is arranged as in figure 4. Instead of the telegraph sounder, an electric bell or gong is placed in the circuit. The pendulum is adjusted to beat seconds and a screen is placed in front of it so that the ball will be visible only at the end of the swing. A black iron ball of this size can be seen at the necessary distance against a white background. The students are instructed to move away until the stroke of the bell is heard at the same time that the pendulum reaches the end of its swing.

The elementary principles of wireless telegraphy can be illus-

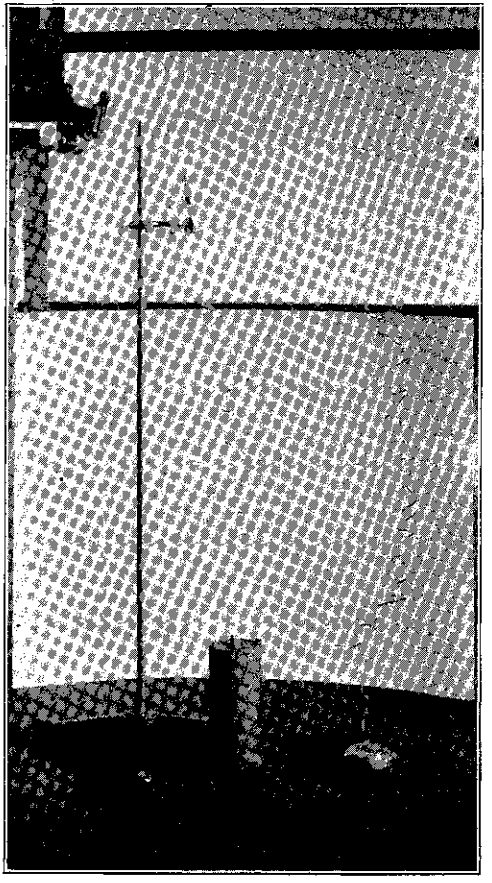

FIG. 3.

trated by the apparatus shown in figure 5. Such a pendulum is often used in physics laboratories where students in different rooms wish to take time from the same clock. The method illustrated has proved more efficient than any arrangement where the spark occurs at the point of contact with the pendulum bob. This apparatus is quickly adjusted and saves having the current constantly wasted on the primary of the induction coil. Ground can be secured by connecting to a gas or water pipe. The detector is a modified Massie's oscillaphone. It consists of two small pieces of carbon ground to a knife edge and fastened with hot sealing wax about 5 mm. apart.

A crystal of silicon or a light cambric needle is laid across the edges. If a 75 ohm telephone receiver is not at hand, two ordi-

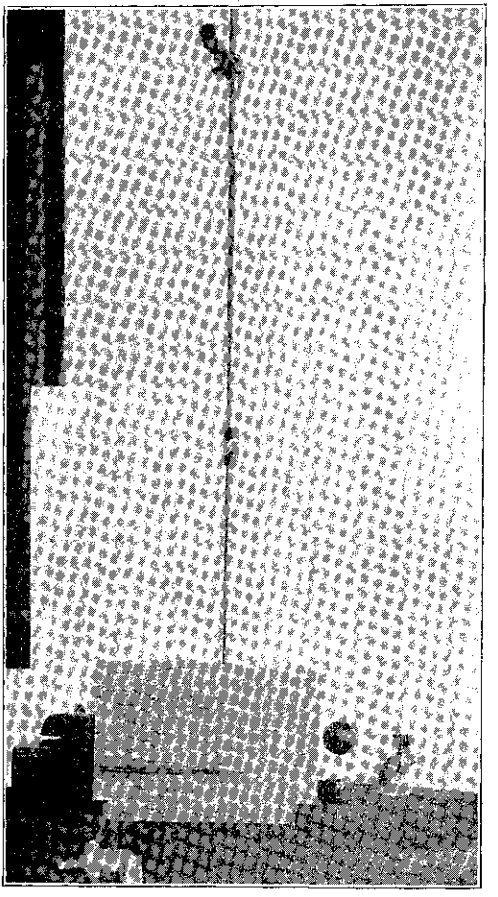

FIG. 4.

nary receivers placed in series, one for each ear, will answer nearly as well. This detector will work within a radius of several hundred feet if good "grounds" are made.

Figure 6 illustrates another modification of the pendulum for determining the velocity of sound. The pendulum is adjusted to beat half seconds. The electric gong is arranged to ring as the

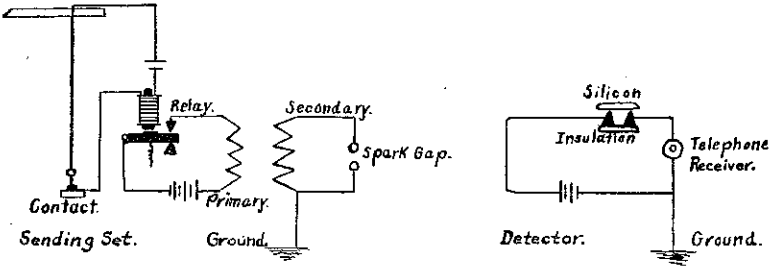

FIG. 5.

pendulum reaches one end of its swing. The other contact is so adjusted that a good spark is secured at the spark gap when the pendulum reaches the opposite end of the arc. The detector of figure 5 can be used. Ten or twelve feet of flexible wire should be attached to the receiver to permit of its being quickly moved about. The ground wire is attached to a sharp metal or carbon rod which can be thrust into the earth. The detector is placed

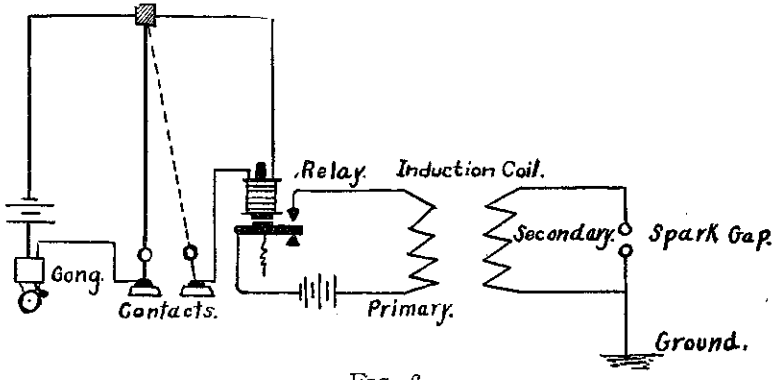

FIG. 6.

at such a distance that the sound in the receiver coincides with the stroke of the electric bell. The distance to be measured in finding the velocity of the sound wave is obviously that from the gong to the telephone receiver. For both this and the method described above, the pendulum can be conveniently placed on a table before an open window. If a complete wireless set is in

use, several interesting variations of the above experiment will suggest themselves. A portable aerial for the detector can be easily constructed if it is desirable to measure the velocity of sound over distances greater than those within reach of this simple arrangement. A couple of strands of copper wire strung across the room near the ceiling will answer for the sending aerial.

This apparatus has been in use with the writer's classes for the last two years and has given excellent results in all the experiments suggested. Very much better results have been secured by taking the experiments on the laws of the pendulum out of the individual laboratory work and presenting them to the class as a whole by using one or two pendulums of the type described. Both experiments on the velocity of sound have proved intensely interesting to students.

DEATH-RATE OF THE GERMAN EMPIRE IN 1912.

The Imperial Health Office has published the following statistics bearing on the frequency of certain important causes of death from about 400 urban communities. The number born living increased by 0.1 per cent. The increase, however, is found only among illegitimate births, which amounted to 3,209, while the number of legitimate children born was 2,577 less. The number of stillbirths also increased by 100, which was wholly attributable to the illegitimate children. On the other hand, the birth-rate has fallen from 256.6 per 10,000 in the previous year to 251.2. As a further unsatisfactory circumstance the number of stillbirths per 10,000 children born living amounted in the previous year to 322, but in 1912 to 324. The death-rate has fallen about 8.4 per cent, or 33,178, in contrast to 1911, which was very unfavorable in this respect. The death-rate sank from 16.32 to 14.60 per 1,000 of population. Especially the number of deaths in the first year of life was markedly reduced, compared with the previous year, by about 25.2 per cent. As a result the death-rate compared with 100 born living fell from 18.9 to 14.1.

As to the causes of death, an increase was observed in deaths from whooping-cough of 736, or 22.6 per cent; from measles and rötheln of 160, or 4.8 per cent; from diseases of the respiratory tract of 562, or 1.1 per cent; from murder and manslaughter of 116, or 24.5 per cent; from suicide of 443, or 6.9 per cent; and as a result of accident of 390, or 4.2 per cent. On the other hand, there was a reduction in the number of deaths from gastro-intestinal catarrh and diarrhea of 30,346, or 51.8 per cent; from typhoid of 585, or 39.3 per cent; from diphtheria and croup of 1,123, or 16.6 per cent; from scarlet fever of 259, or 9.4 per cent; from puerperal fever of 83, or 5.8 per cent, and from tuberculosis of 725, or 1.7 per cent. The number of deaths from gastro-intestinal catarrh and diarrhea in children under a year old diminished more than a half, from 49,409 in the previous year to 24,129. The excess of births over deaths rose from 9.35 in 1911, to 10.51 in the year of this report.