# *SUGGESTIONS FOR A NEW TYPE OF SEISMOGRAPH.*

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The great problem in the construction of all seismographic machines is to obtain a perfectly steady point from which the vibrations of the earth's surface can be measured. This problem has never been completely solved, but a great number of machines have been made which give an approximate solution of it. The principle of all these machines is the same; a heavy mass is suspended astatically, that is to say, it is suspended in such a manner, that, if it receives a small displacement no force is developed tending to restore it to its original position; and therefore conversly, if the point of suspension of the mass receives a small displacement there is no force developed tending to move the mass.

The motion of the point of suspension or of the framing of the machine, which is assumed to be the same as the vibratory motion of the earth's surface, is what has to be observed, and in general this is automatically recorded by the machine itself.

So far as regards this problem, it is impossible to suspend a heavy mass so as to be astatic in every direction, the nearest approximation to this being a weight suspended by a very long spiral spring or india rubber cord. In most of the machines that have been made it has been found advisable to so suspend the weight as to indicate motion in one direction only, and to use two separate machines to obtain the two horizontal components of the earthquake motion. To obtain either of these components accurately, the suspended mass should be capable of motion in a given horizontal line, and be incapable of motion in any other direction.

Fig. I.

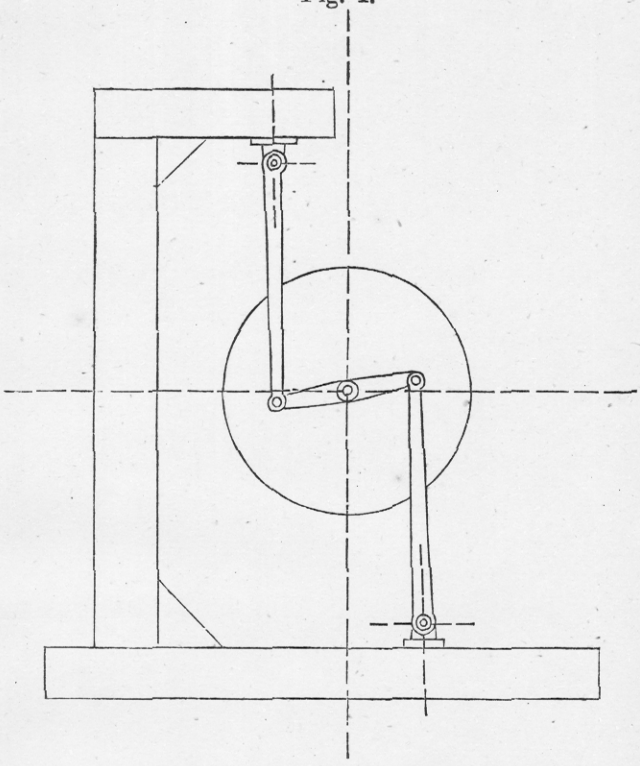


Fig. II.

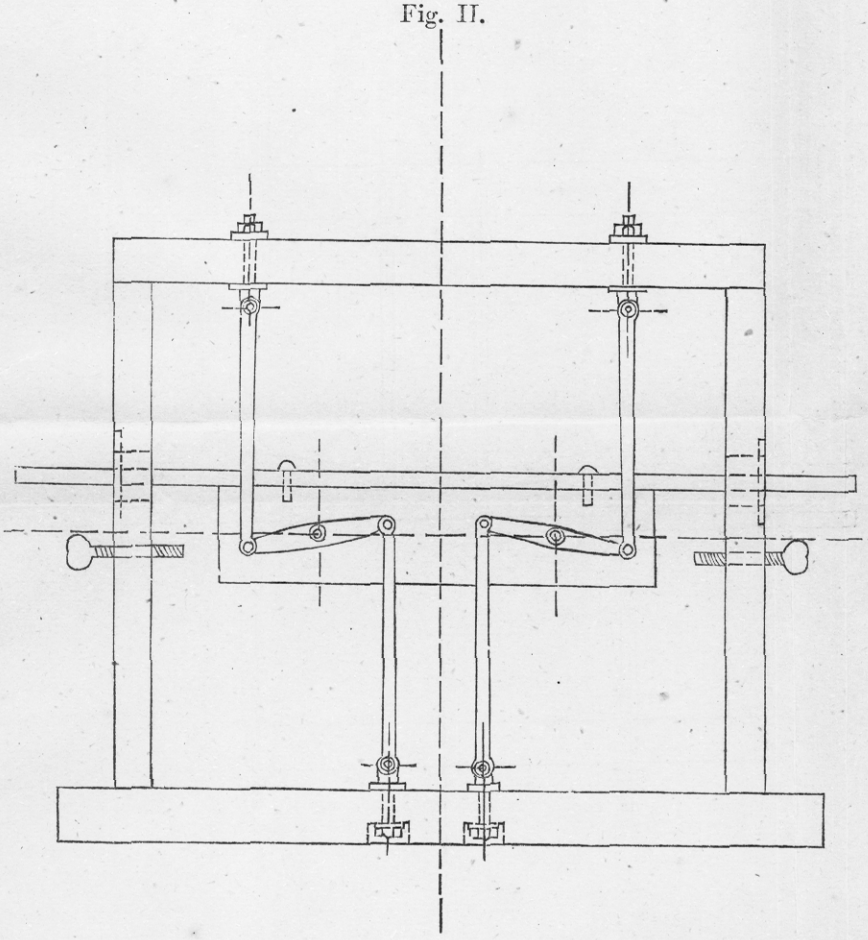
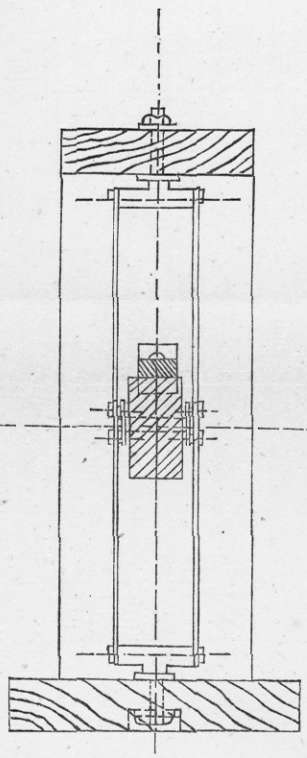


Fig. III.



Now for the various modes of suspension which have as yet been adopted, the range of motion is extremely small within which the suspended mass may be considered to be astatic and to move in a straight horizontal line.

There is on the table a model of an arrangement of astatic suspension which as far as I know has not been yet applied to a seismograph; but it may be readily recognized as the form of parallel motion that is used in Richard's Indicator. In this mode of suspension the range of motion within which the heavy mass may be considered to move in a straight line and to be astatic is greater, I believe, than that which has been obtained in any other way; omitting the consideration of methods in which the frictional resistances are obviously excessive.

The first idea of this machine was a single spherical or cheese-shaped weight pivoted on an axis passing through its centre to a set of links and radius rods on each side of it, as shown in elevation in Fig. I.

In the model as made, however, it was decided to try it with two sets of links and radius rods, and the weight then takes the form of a heavy bar; Figures II & III are a side elevation and section; an addition was afterwards made of a guide rod, fastened along the top of the bar and passing through the frame, so as to completely stop any horizontal motion other than the required one, the end of this guide rod also forms a convenient place for attaching a rod leading to any recording apparatus that may be adopted.

In the model on the table, being but roughly made, the friction is much greater than it need be with good workmanship; the pivots might be made a great deal smaller than they are in the model, or knife edges might be adopted instead of axles. The radius rods might also be made longer and the upper ones might be made of cord. In this way the friction might be reduced sufficiently to make the machine more effective.

Another point that is worth consideration in this machine (and also in all the others) is the size of the weight. Since the power required to move a given recording apparatus, or

arm carrying a pencil, is a constant, and is derived from the inertia of the weight, therefore the larger the weight is, the less it is affected by the friction of the recording gear. On this account the weight which in the model is only about 2 lbs might be made, I think, with advantage as heavy as 50 lbs.

In conclusion I may state that it was Mr. Milne who took all the trouble of having the model made.