

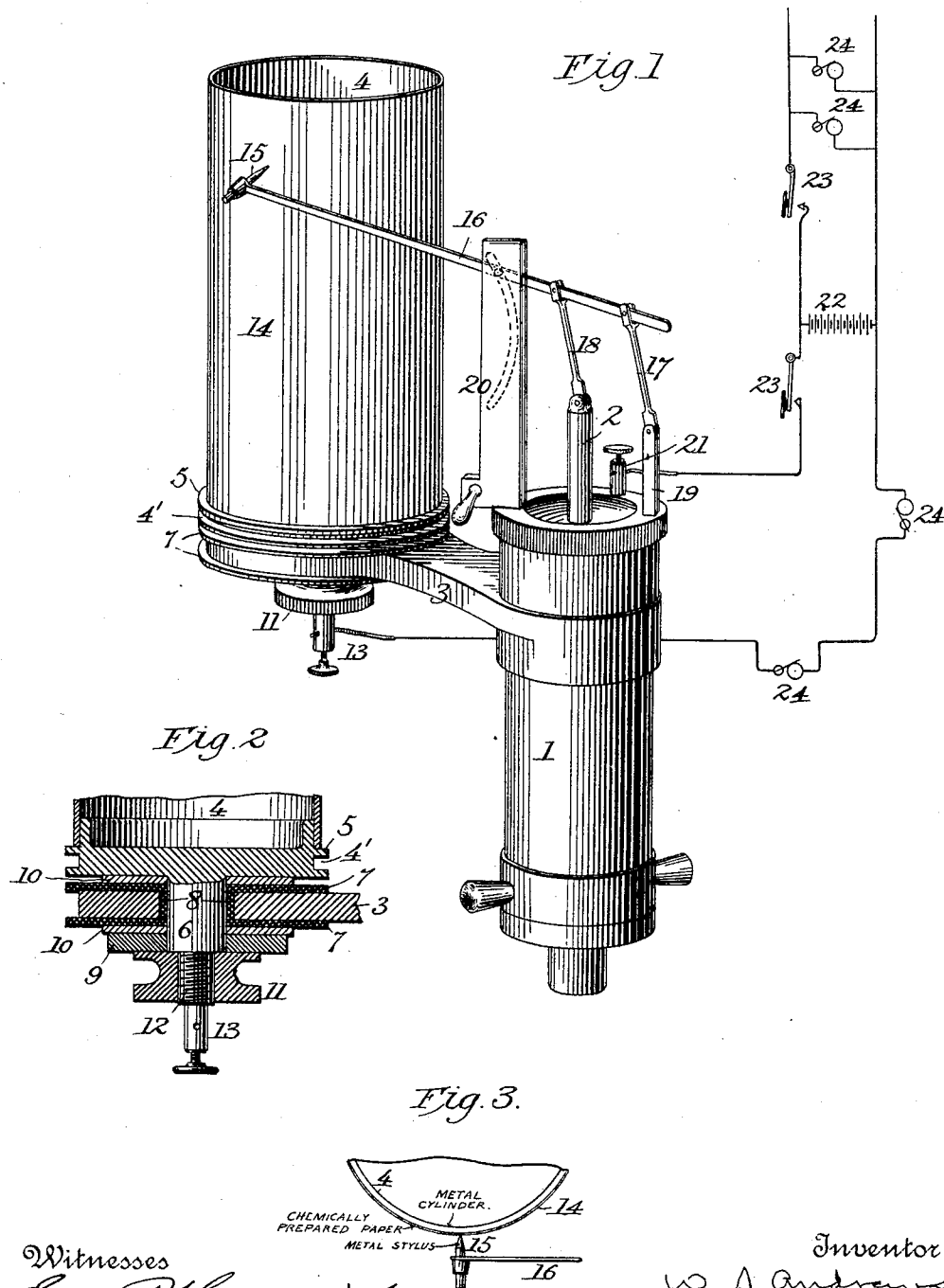
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W. S. ANDREWS.
STEAM ENGINE INDICATOR.

(Application filed May 25, 1898.)

(No Model.)



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STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 613,003, dated October 25, 1898.

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To all whom it may concern:

Be it known that I, WILLIAM S. ANDREWS, residing at Schenectady, county of Schenectady, and State of New York, have invented an Improvement in Steam-Engine Indicators, of which the following is a specification.

This invention relates to an improvement in the construction of steam-engine indicators, and in order to clearly set forth the improvement the ordinary and well-known form of steam-engine indicator may be briefly described as follows: A cylindrical shell is made to preferably turn backward and forward on its axis by a motion derived from the cross-head of a steam-engine. This movable cylindrical shell will hereinafter be called the "cylindrical shell." A small cylinder is furnished with a piston, which is designed to be propelled in an outward direction against a definite spring-pressure by the direct pressure of steam in the cylinder of the steam-engine. The piston has a rod the free end of which is connected with a swinging arm through some form of parallel motion. The swinging arm carries a pencil the point of which by the above-mentioned combination of movements is made to travel in a straight line up and down the cylindrical shell above mentioned and parallel to its axis.

The apparatus as above described is usually called a "steam-engine indicator," and its purpose is to make a permanent record of the steam-pressure in the cylinder of the engine at all parts of its piston-stroke.

This apparatus will hereinafter for simplicity and brevity be termed an "indicator."

It is often necessary to operate two or more indicators simultaneously and at some exact instant, and in order to do this with an existing form of construction the indicators are so arranged that the movable arms carrying the pencils can be simultaneously moved so as to bring the pencils into contact with their recording-surfaces by electromagnets in an electric circuit, said magnets acting, upon completion of the circuit, to move the arms and their pencils toward the recording-surfaces, where the pencils remain as long as the circuit is held closed, thus making a record on the recording-surfaces in accordance with the steam-pressure in the cylinders of engines to which the indicators are attached.

In this way the recording device of an indicator can be operated at a distance, and the recording devices of several indicators can be operated at a distance at the same instant and the time of contact made of exactly the same duration, and one person can control by a single operation the contact of the recording devices of all the indicators.

The object of this invention is to improve upon and simplify the construction and arrangement above referred to and to provide such a construction and arrangement which will be adapted for and capable of use with existing indicators, so that the latter may be operated by hand or by electricity.

In carrying out this invention chemically-prepared paper is employed for the recording-surface, and in lieu of the ordinary pencil a metallic marker is mounted on the end of the swinging arm of the indicator, and it is so adjusted that the marker may be made to press lightly all the time on the chemically-prepared paper mounted on the cylindrical shell. A number of such indicators with the chemically-prepared paper mounted on their cylindrical shells and a number of metallic markers, as aforesaid, are located in an electric circuit and so arranged that upon closing the circuit a current of low tension will pass through the markers, the recording-surfaces, and their supporting cylindrical shells and by the action of the current on the chemically-prepared paper cause lines to be traced thereon and records made.

To illustrate the manner of carrying out this invention, reference is had to the accompanying drawings, in which—

Figure 1 is a perspective view of a well-known form of indicator arranged in an electric circuit in accordance with my invention. Fig. 2 is a detail view, in vertical section and broken away, of the lower end of the cylindrical shell and its support. Fig. 3 is a detail plan view of a portion of the cylindrical shell and recorder.

1 is the cylinder of an indicator, and 2 its piston-rod. The cylinder 1 is provided with a laterally-projecting bracket 3, on the outer end of which is mounted the cylindrical shell 4, preferably as follows: The cylindrical shell 4 is provided with a metallic bottom or base 5, having a centrally-depending cylindrical

projection 6, which extends through and is adapted to turn in a hole in the bracket-arm 3. The cylindrical shell 4 is insulated from the bracket-arm 3 in any suitable manner, preferably by means of a bushing consisting of the washers 7 and a short sleeve 8, which may be made of mica or any other suitable insulating material. The depending projection 6 is stepped in a plate 9, and between plate 9 and the lower washer 7 and between the base 5 and upper washer 7 are located metallic washers 10, which protect the insulating bushing and washers and take up the friction. The several parts are held in position by a milled thumb-nut 11, mounted on a screw-threaded projection 12 on the lower end of the projection 6. Upon the lower end of the projection 12 is a binding-post 13, for a use hereinafter set forth. The cylindrical shell 4 may be made to turn backward and forward in the usual manner. The continued reciprocating motion of the engine cross-head thus produces an oscillatory movement in the cylindrical shell similar to the motion of the balance-wheel of a watch. 14 indicates the recording-surface, consisting of paper chemically prepared in any suitable and well-known manner and mounted on the cylindrical shell 4.

The apparatus for marking and recording on the recording-surface is preferably constructed and arranged as follows: 15 is the marker, which is a piece of metal with a preferably blunt point and presses lightly against the paper 14. The marker 15 is mounted in the end of an arm 16 and may be detachable therefrom. The arm 16 is connected to the piston-rod 2 of the indicator by some well-known form of parallel motion—as, for example, by means of the hinged rod 17, mounted on the bracket 19, the hinged arm 18, connected to piston-rod 2, and the guide-post 20 for the arm 16. By means of this construction and arrangement the arm 16 is moved in accordance with pressure of steam in the engine-cylinder, and the marker 15 is correspondingly moved over the recording-surface. Normally in the operation of the engine the marker 15 is moving over the recording-surface and makes no mark on the chemically-prepared paper.

In order to cause the marker to record on the recording-surface and at a distance and also so that several indicators constructed and arranged as the one just described and at some distance apart may be simultaneously operated from a distance, a number of indicators constructed and arranged as the one just described are located in an electric circuit, as shown in the diagram in Fig. 1. This electric circuit extends from the binding-post 13 to binding-post 21 through cylinder 1, bracket 19, hinged rod 17, arm 16, marker 15, chemically-prepared paper 14, and cylindrical shell 4, and included in said circuit is a battery 22, a switch 23, and a number of simi-

lar indicators 24, connected either in multiple or in series with the battery 22, as shown.

It will be seen from the foregoing that each cylindrical shell is insulated from its marker, so that an electric current of low tension cannot pass from one to the other except through the prepared paper 14. Now on closing the switch 23 a current of low tension will pass through all the arms 16, markers 15, and chemically-prepared papers 14, and the markers 15 will simultaneously trace visible lines on the prepared paper in accordance with the movements of the arms 16.

While a particular way of insulating the recording-cylinder from the marker is herein set forth, I do not limit myself thereto, as other means may be employed without departing from the essential features of this invention, which broadly contemplates the cylindrical shell being insulated from the marker excepting through the prepared paper.

The marker could be insulated from its supporting-arm and the circuit extend directly from the marker instead of through its supporting-arm.

In lieu of the chemically-prepared paper any chemically-prepared surface may be used with the cylindrical shell whereby an electric current will pass through the recording-surface and make a record thereon.

Should it be desired to operate the indicator by hand in the ordinary way, it is evident that a common marking-pencil may be substituted for the metallic marker, and ordinary paper may be used on the cylindrical shell instead of the chemically-prepared paper. The pencil can then be pressed against the operating-surface and the record or diagram made in the usual manner. In this way an indicator constructed as herein described may be operated with equal facility either by electricity or by hand.

Although this invention is herein described as applied to steam-engine indicators, its use is not necessarily limited to engines moved by steam, but it may also be applied to indicate the power developed by gas, pneumatic, hydraulic, and other engines.

Having thus described my invention, I claim—

1. In combination, an indicator with a cylindrical shell having a chemically-prepared recording-surface, a metallic marker operated by the indicator, and an electric circuit, the cylindrical shell and marker being in said electric circuit, whereby on closing the circuit, an electric current will pass through the marker, the chemically-prepared recording-surface and the cylindrical shell, causing a record to be made on said surface, as set forth.

2. In combination, a number of indicators having chemically-prepared recording-surfaces on their respective cylindrical shells, a number of metallic markers, one for each indicator and operated thereby, and an electric

circuit, said cylindrical shells and markers being in said circuit, whereby upon closing said circuit an electric current will pass through said markers, the recording-surfaces and the cylindrical shells, causing records to be made on the recording-surfaces, as set forth.

3. In combination, a movable recording chemically-prepared surface and a movable metallic marker, the recording-surface and marker being located in an electric circuit, whereby upon the closing of said circuit an electric current will pass through said marker and cause a record to be traced on said recording-surface.

4. In combination, a number of steam-engine indicators, each having an oscillating cylindrical shell covered with chemically-prepared paper, the several indicators being located in an electric circuit, whereby upon closing said circuit an electric current will pass through the markers and recording-surfaces and cause records to be made thereon.

5. In combination, a number of steam-engine indicators each having a chemically-prepared recording-surface, the several indicators being in an electric circuit, whereby upon said circuit being closed, an electric current will pass through the several markers and recording-surfaces and records be simultaneously made thereon.

6. In an electric circuit, a number of cylindrical shells, each having a chemically-prepared recording-surface, and metallic markers, each bearing against its prepared recording-surface, whereby upon closing said circuit an electric current will pass through said markers, prepared recording-surfaces and cylindrical shells and cause records to be made on said prepared recording-surfaces.

7. In an electric circuit, a number of steam-engine indicators, each indicator having a

movable chemically-prepared recording-surface, and each having a metallic marker, whereby upon closing the circuit, an electric current will pass through the marker, and the recording-surface and cause a record to be made on the latter, as set forth.

8. In combination a metallic oscillating cylinder mounted on and insulated from its support, and having a chemically-prepared recording-surface, an arm having a metallic marker on its outer end in contact with the recording-surface, and an electric circuit, the several parts being in said circuit, whereby upon closing the latter an electric current will pass through the marker, the prepared recording-surface, and the metallic cylinder and a record traced on said recording-surface, as set forth.

9. In a steam-engine indicator, a movable metallic cylinder, covered with chemically-prepared paper, a metallic marker, and an electric circuit in which said indicator is located, whereby upon closing said circuit, an electric current passing through the marker, prepared paper and cylinder, will cause a record to be made on said paper, as set forth.

10. An electric circuit, and a number of steam-engine indicators located in said circuit, each indicator comprising a movable metallic cylinder, chemically-prepared paper mounted on said cylinder, and a movable metallic marker, the several parts being so constructed and arranged that upon closing the circuit, an electric current will pass through the markers, the recording-surfaces and the movable cylinders, and cause records to be made on said recording-surfaces, as set forth.

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