(No Model.) 3 Sheets—Sheet 1.

RUDOLF RITTER V WALCHER-UYSDAL.

BAROMETER FOR INDICATING FIRE DAMP.

No. 341,822. Patented May 11, 1886.

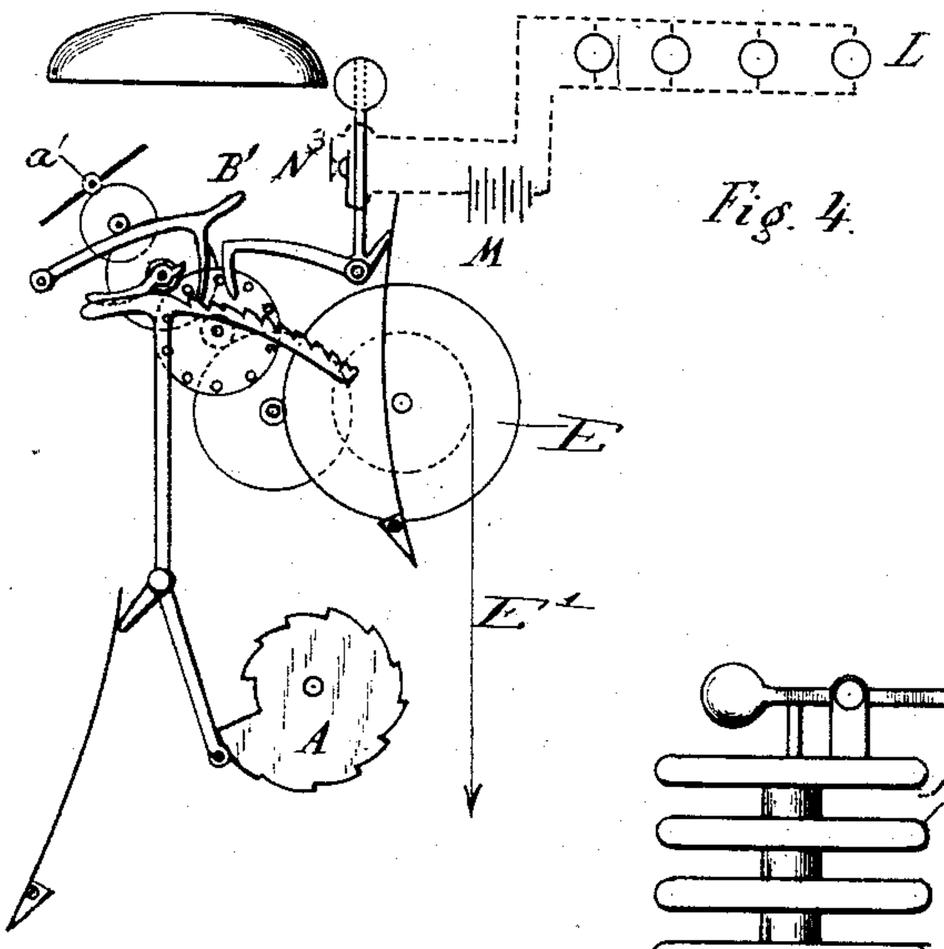

Fig. 4.

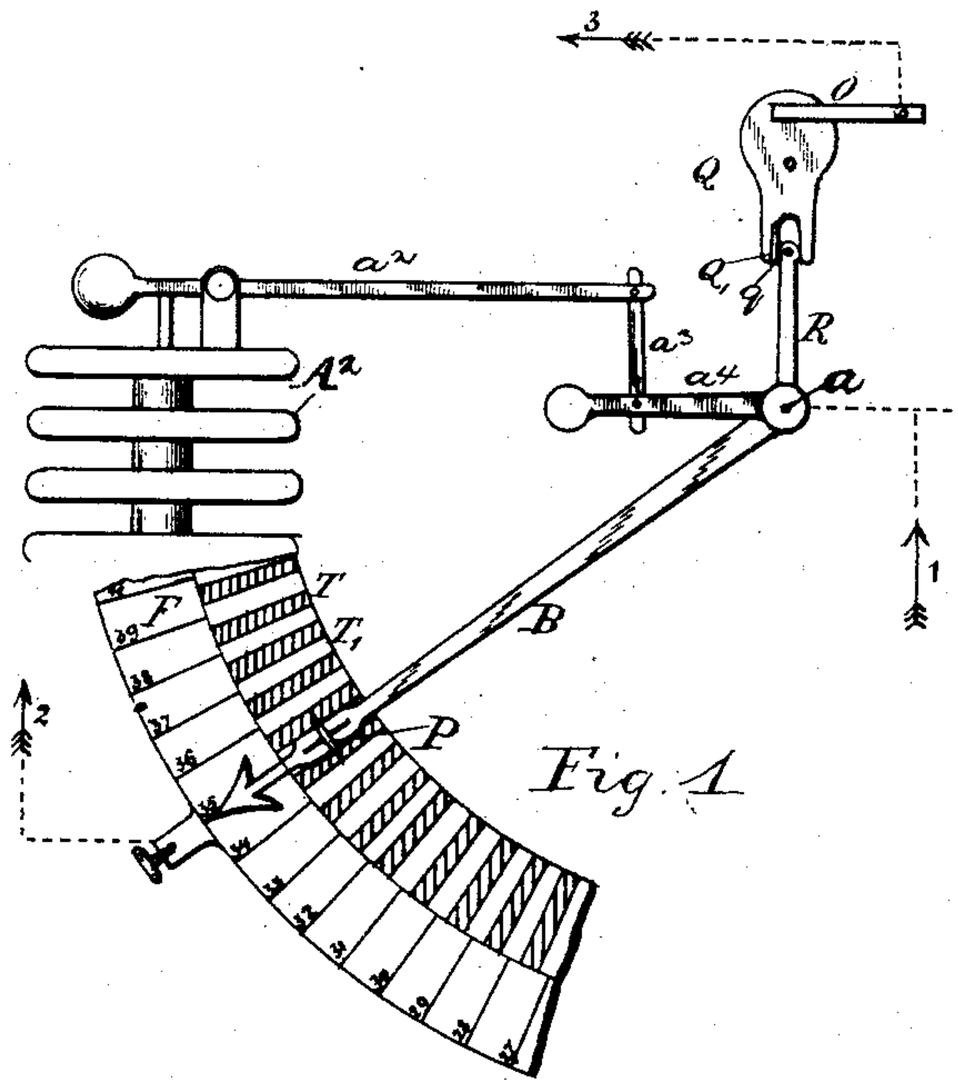

Fig. 1.

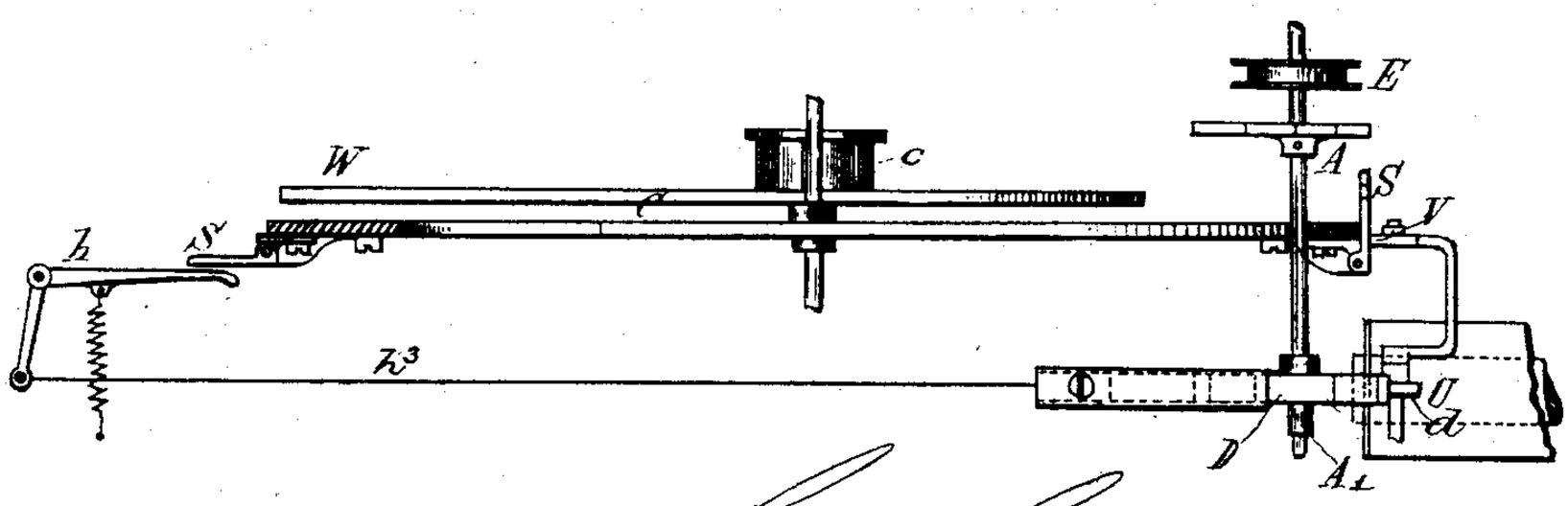

Fig. 3.

Witnesses.
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by J. Connolly & Bro.
Attys.

(No Model.) 3 Sheets—Sheet 2.

RUDOLF RITTER V WALCHER-UYSDAL.

BAROMETER FOR INDICATING FIRE DAMP.

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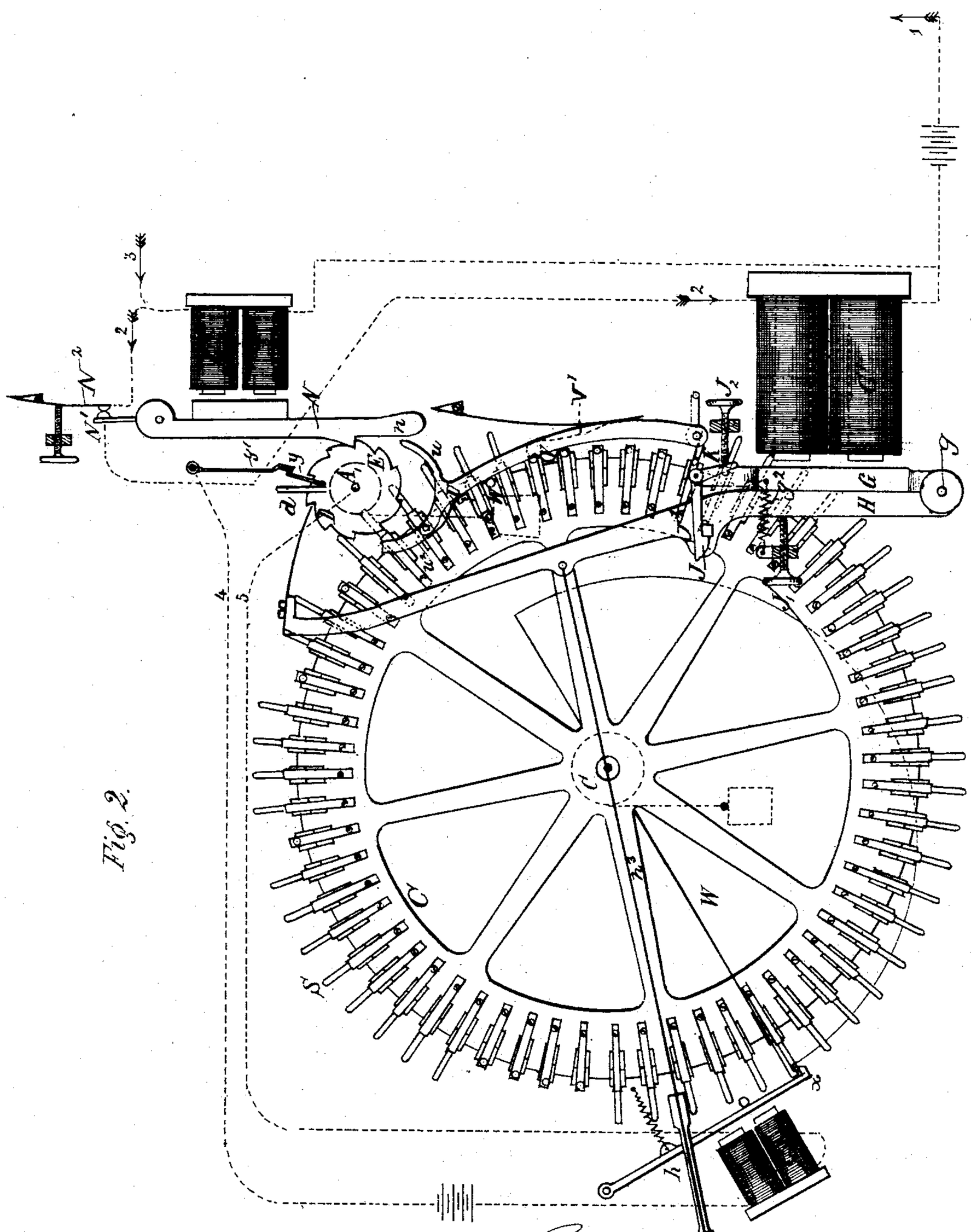

Fig. 2.

Witnesses
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(No Model.) 3 Sheets—Sheet 3.

RUDOLF RITTER V WALCHER-UYSDAL.

BAROMETER FOR INDICATING FIRE DAMP.

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Fig. 5.

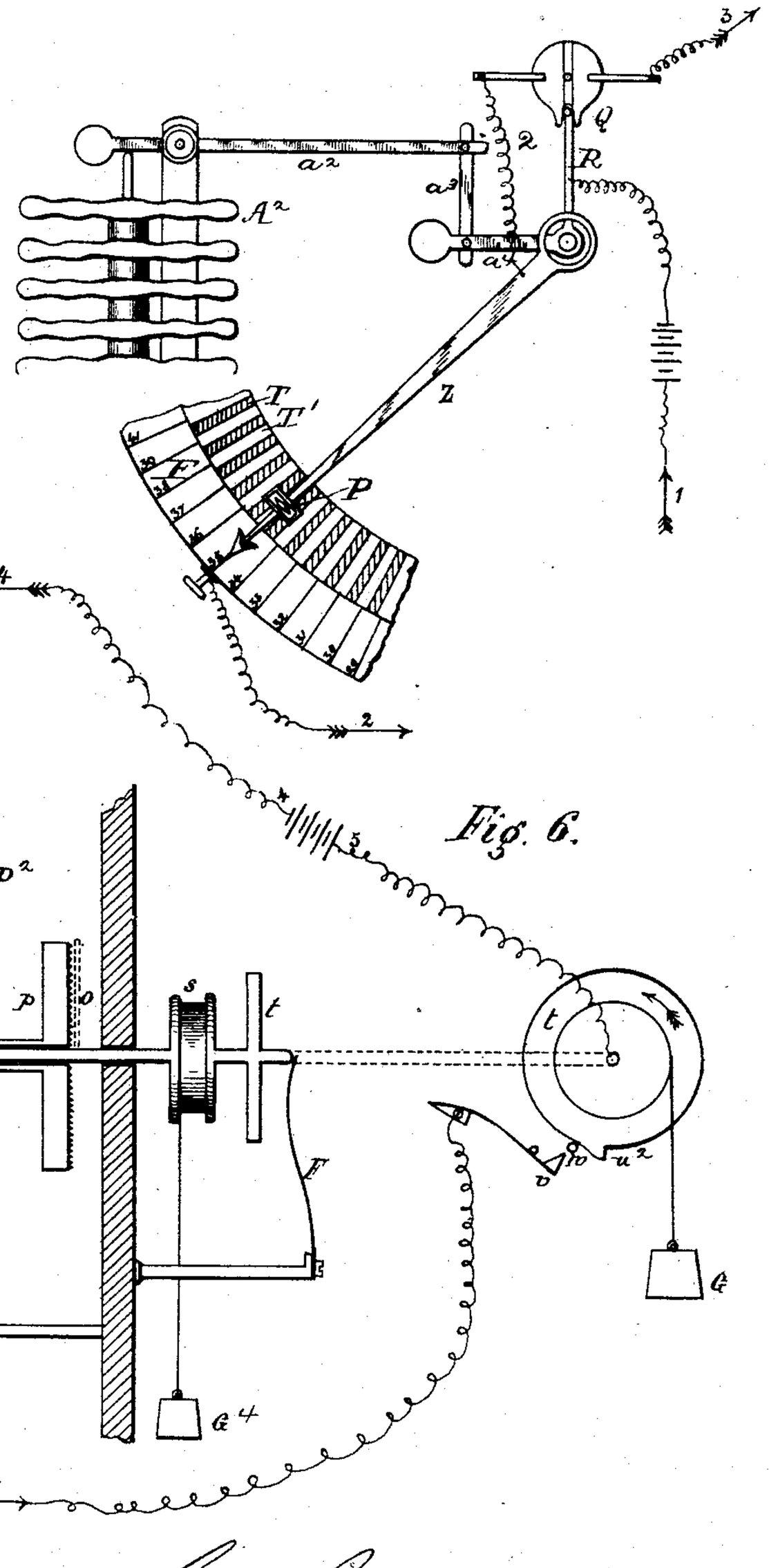

Fig. 6.

Witnesses.

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UNITED STATES PATENT OFFICE.

RUDOLF RITTER V. WALCHER-UYSDAL, OF TESCHEN, AUSTRIA-HUNGARY.

BAROMETER FOR INDICATING FIRE-DAMP.

SPECIFICATION forming part of Letters Patent No. 341,822, dated May 11, 1886.

Application filed October 15, 1885. Serial No. 179,995. (No model.) Patented in France August 21, 1885, No. 170,760; in Belgium August 21, 1885, No. 69,962, and in Austria-Hungary October 13, 1885, No. 29,926 and No. 54,463.

To all whom it may concern:

Be it known that I, RUDOLF RITTER V. WALCHER-UYSDAL, a subject of the Emperor of Austria-Hungary, and a resident of Teschen, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Indicating-Barometers, of which the following is a specificaion.

This invention relates to apparatus for signaling or indicating the variations of a barometer, chiefly designed for ascertaining when emanations of gas or fire-damp in collieries are likely to occur.

I have discovered that the emanation of gas from coal in coal-mines is inversely proportionate to the pressure of the atmosphere—that is to say, that the emanation increases with a diminishing air-pressure and diminishes with an increasing air-pressure. Besides the extent of the fall of the barometer, the rapidity of the fall is of special importance, as in the case of a rapid decrease of the atmospheric pressure the ventilating machines or fans are incapable of supplying air fast enough to overcome the great volumes of gas emanating from the coal. The increase of the atmospheric pressure, however, removes the danger at once. Accordingly, by carefully observing the barometer, the approach of danger can be ascertained and precautionary measures taken. The uninterrupted observation of a barometer is, however, a duty which can scarcely be expected from any one for a length of time.

The present invention therefore consists in an instrument whereby the decrease of the atmospheric pressure and the danger are indicated. This instrument comprises a clock and a bell. The barometer is so connected with the bell that the latter indicates the number of millimeters which the barometer has fallen by the number of strokes which it gives. This signal, however, is only given for a definite period of time—say, for instance, eight hours—so that the number of strokes on the bell corresponds to the number of millimeters which the barometer has fallen during the eight (8) hours which have passed. For this purpose the clock must disengage the mechanism for signaling the fall of the barometer at the expiration of every eight hours. When the barometer rises, the mechanism may be so arranged that no signals are given, the mechanism remaining in its normal position.

It is evident that the instrument can be made to operate in different manners. The barometer can be an aneroid barometer or a mercurial barometer. Ordinary repeater striking mechanism or an electric bell can serve for signaling, and the connection of the clock with the bell can be broken by either electrical or mechanical means.

Among the various constructions which can be employed, I will describe two as being especially suitable.

In the accompanying drawings, Figure 1 is a plan view, partly in section, of an aneroid barometer adapted for the purposes of my invention. Fig. 2 is a plan view of the signaling mechanism. Fig. 3 is a side view of a portion of the same. Fig. 4 is a plan view of a detached portion of the striking mechanism. Fig. 5 is a plan view of a modified form of barometer; and Fig. 6 is a side view, partly in section, of a modified form of signaling apparatus.

According to the first construction, (shown in Figs. 1 to 4,) the barometer contains six or seven boxes, A^2, on the aneroid system, as shown in Fig. 1, which boxes transmit their movements through a system of levers, a^2 a^3 a^4, to a shaft, a, with which are connected a hand, B, and a short lever, R. The said hand carries a small wheel, P, of platinum and silver or other suitable alloy, which wheel makes electrical contact with a metallic ring, F, marked with the scale of the barometer. The said ring, hand, and short lever are in an electrical circuit, 1 2. Small plates T, of ivory, are arranged in the metallic ring, and small platinum plates T′, whose surfaces are in the same plane as the surfaces of the small ivory plates, alternate with the latter. The end of the lever R moves between the limbs of a fork, Q, and can only make contact with the latter when the barometer is rising, as one limb, Q′, of the fork is covered with an ivory plate, g.

O is a sliding contact-spring, which bears upon the fork Q, and serves at the same time as a brake for the latter. Now, if the barometer is falling, the electric circuit 1 2 is closed at every millimeter by the roller P on the hand B, making contact with a platinum strip, T′.

An electro-magnet, G′, in this circuit is thereby energized and attracts its armature G, which turns upon a pivot. A lever, H, Fig. 2, is mounted upon the same pivot, g', as the armature G, and is connected thereto by a latch, J, on one arm of a bell-crank lever, J′, so that as the armature moves toward the magnet the latch is detached by the other arm of the bell-crank lever coming into contact with an adjusting-screw, J^2, whereby the lever H falls back. The effect of this arrangement is, that even with a comparatively long contact at any particular platinum strip the lever H acts rapidly and only once. When this platinum strip is passed, the contact ceases, the armature G is drawn back by a spring, g^2, and the latch J again engages with the lever H. Whenever the barometer falls one millimeter and the lever H is moved, an escapement or ratchet wheel, D, is pushed one tooth forward. Upon the shaft of the said ratchet-wheel D is fixed the stepped snail-wheel A, Fig. 4, of the striking mechanism and a cord-pulley, E, Fig. 3. The ratchet-wheel D is provided with a stop, d, in order that the snail-wheel A cannot be moved beyond the first and tenth steps. The striking mechanism is arranged to be disconnected every minute by the clock lifting the latch B′, the number of strokes on the bell indicating the number of millimeters which the barometer has fallen.

As shown in the drawings, the stepped snail-wheel is so arranged that the striking mechanism will operate every minute, even when the barometer is rising, so that in falling an additional stroke is added for each millimeter. This arrangement has the advantage that the striking taking place every minute indicates that the apparatus is in proper operation.

If the arrangement of the striking mechanism is to be such that the latter strikes only when the barometer is falling, and then only when the fall amounts to one or more millimeters, a stop can be caused to engage with the fly-pinion a of the striking mechanism by means of an electro-magnet, which is energized when the barometer is rising.

As already observed, it has been found that not only at long but especially at rapid falls of the barometer the emanation of gas considerably increases. If, for instance, the barometer falls ten millimeters in from eight to ten days, the efflux of gas will not be very considerably increased, as the ventilation can overcome the gases passing out slowly, whereas if the barometer falls ten millimeters in one day the emanations of gas will be very dangerous. The apparatus may therefore be so arranged that the signaling of each millimeter of the fall of the barometer does not continue for an indefinite time, but only for eight hours. In other words, the number of the strokes of the striking mechanism only corresponds with the number of millimeters which the barometer has fallen during the past eight hours. This result is effected by the following arrangement: C is a disk provided with sixty-four pins or bars, S, capable of being turned upon pivots so as to project laterally from the disk. The said disk is moved by the clock-work a distance corresponding to one sixty-fourth of its periphery every quarter of an hour. It therefore makes half a revolution in eight hours. As often as the lever H moves the escapement or ratchet wheel D one tooth forward, it throws aside a pin on the disk C by means of a lever, h, as shown in Fig. 3, connected to the lever H by a cord, h^3. After eight hours this pin comes into contact with a projection on a lever, V′, fixed on the same axis as the lever U, as shown in Fig. 3, thereby pressing the arm u of the lever U against the arm n of the pawl N, and effecting the disconnection of the ratchet-wheel and snail-wheel from the said pawl, whereby the snail-wheel is caused to move back one tooth by means of the weighted cord on the pulley E. The pins thrown aside are raised again by an inclined plane, K, fixed to the casing of the instrument. A pawl, u^2, on the left-hand arm of the lever V prevents the escapement-wheel D moving back more than one tooth. This pawl can move upon a pivot.

In case the disconnection of the ratchet lever or pawl N should coincide with a forward motion of the lever H, the disconnection of the lever N cannot take place completely, as, during the advance of the ratchet-wheel, the pawl u^2 would bear against the teeth of the said ratchet-wheel, and would not allow the lever U to move far enough. When the barometer rises, the electric circuit 1 3 is closed by the contact of the short arm R with the uncovered limb of the fork Q. The electro-magnet g^2 in this circuit is then excited, the lever N is drawn back, and the ratchet-wheel, together with the stepped snail-wheel, are completely disconnected, so that they turn back to step 1. By the movement of the lever N the spring-contact N′ is moved away from its opposite contact, N^2, whereby the circuit 1 2 is interrupted, and thus renders the energizing of the electro-magnet inserted in the circuit impossible. The spring-contact N′ is so arranged that in the ordinary movements of the lever N the circuit is not interrupted, but only when the lever N is completely drawn back by the electro-magnet in the circuit 1 3. When within eight hours the barometer falls, rises, and falls again, the pins thrown aside during the first fall would make the position of the stepped snail-wheel wrong for the second fall. With every rise of the barometer, therefore, a general disconnecting device must engage with and raise all the pins turned down. This result is effected by the eccentric disk W, which, being connected with a cord-pulley, c, turns in the opposite direction to that of the clock-hand when the latch x is disconnected, and raises in this motion all the pins which may have been thrown down. This disconnection of the latch x takes place directly the ratchet-wheel D is moved back,

when the barometer rises, by means of an arm, *y*, arranged on the stop-pin on the ratchet-wheel D, which arm makes contact with a spring, *y'*, (covered on the left-hand side with ebonite,) thereby instantaneously closing the electric circuit 4 5 and energizing an electro-magnet, G^3, therein, of which the latch *x* forms the armature.

Auxiliary bells L, Fig. 4, may be erected in any desired places and caused to operate by the spring-contact N^3 and the local battery M as soon the striking mechanism is set in operation.

According to the second construction, (shown in Figs. 5 and 6,) the making of the electrical contacts by the barometer takes place in a similar manner to that just described, only in a more simple manner. The fork Q is divided into two parts by insulating material, and the hand Z is insulated from the arbor upon which it is mounted, whereby the closing of the circuit 1 2 is only possible when the barometer is falling, and the closing of the circuit 1 3 only when the barometer is rising. The spring-contact N', before described, is then rendered unnecessary. When the barometer is falling, the lever H is operated once at every millimeter of movement of the barometer by the closing of the circuit 1 2 and the energizing of the electro-magnet G', thereby causing the ratchet-wheel D and the stepped snail-wheel A to advance one tooth and one step, respectively. With the stepped snail-wheel is connected ordinary repeating striking mechanism. The ratchet-wheel D and the stepped wheel A have, however, eleven teeth or steps, respectively, and the first step of the stepped wheel is so high that with this step a disconnection of the striking mechanism does not take place at all; accordingly the striking mechanism does not operate when the barometer is rising. The next step, which corresponds with a fall of one millimeter, gives one stroke per minute. When the barometer is rising, the electro-magnet G^2 is energized, in consequence of the closing of the circuit 1 3, whereby the stopping lever or pawl N is attracted, and the ratchet-wheel D, together with the stepped snail-wheel A, are disconnected and brought back to their original positions. The disconnection of the striking mechanism after a definite period of time (say eight hours) takes place in quite a different manner from that described in the first construction.

The device P^2 is similar to that in Hipp's chronoscope. The movable spindle *n* carries Hipp's needle *o*, a cord-pulley, *s*, and a disk, *t*. The disk *t* has a tappet, u^2, which, at each complete revolution, makes a momentary contact with a contact-piece, *v*, thereby closing the circuit 4 5. The current of this circuit flows also around the electro-magnet G^2. The disk *p*, which is provided with radial teeth, is caused to revolve once in eight hours by a wheel, *r*, of the clock mechanism. Whenever the ratchet-wheel D is moved forward one tooth, it forces the lever N back, so that the latter presses the movable spindle *n* to the right. The needle *o* is thereby shifted from between the teeth of the disk *p*, and the disk *t* is turned by the weight G^1 into its original position, as shown. As soon as the tooth of the ratchet-wheel has passed, the spring F forces the movable spindle *n* back, the needle *o* enters between two teeth of the wheel *p*, and the spindle *n* is now rotated by the clock-work until, after a lapse of eight hours, the contact u^2 *v* takes place, whereby, through the closing of the circuit 4 5, the needle *o* is again shifted, and the disk *t* again moves into its original position. When the barometer is rising, the closing of the circuit 1 3 performs the same operation. Now, if within eight hours after a fall of a millimeter of the barometer a second fall of one millimeter occurs, the disk *t* passes to its original position, and the striking mechanism now gives a double signal for eight hours, if during this time no fall or rise of the barometer has taken place. This somewhat modified manner of signaling has the advantage that after a fall of several millimeters the bell-signals cease simultaneously eight hours after the last millimeter fall, which for the purpose of giving warning is in no way a disadvantage in the working of mines.

What I claim is—

In an apparatus for indicating by audible signals variations of air-pressure, the combination, with an aneroid barometer having a movable index adapted to make and break electric circuits, of electro-magnets, electric circuits, and devices through which said circuits are closed and said electro-magnets energized, and signaling mechanism adapted to be operated by said electro-magnets, and constructed and arranged substantially as described, whereby at definite intervals the signaling mechanism is returned to its normal position, as set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

RUDOLF RITTER V. WALCHER-UYSDAL.

Witnesses:

C. O. PAGET,

E. G. F. MOELLER.