No. 724,307. PATENTED MAR. 31, 1903.

A. P. S. MACQUISTEN.

CONTROLLING MECHANISM.

APPLICATION FILED JULY 28, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 2.

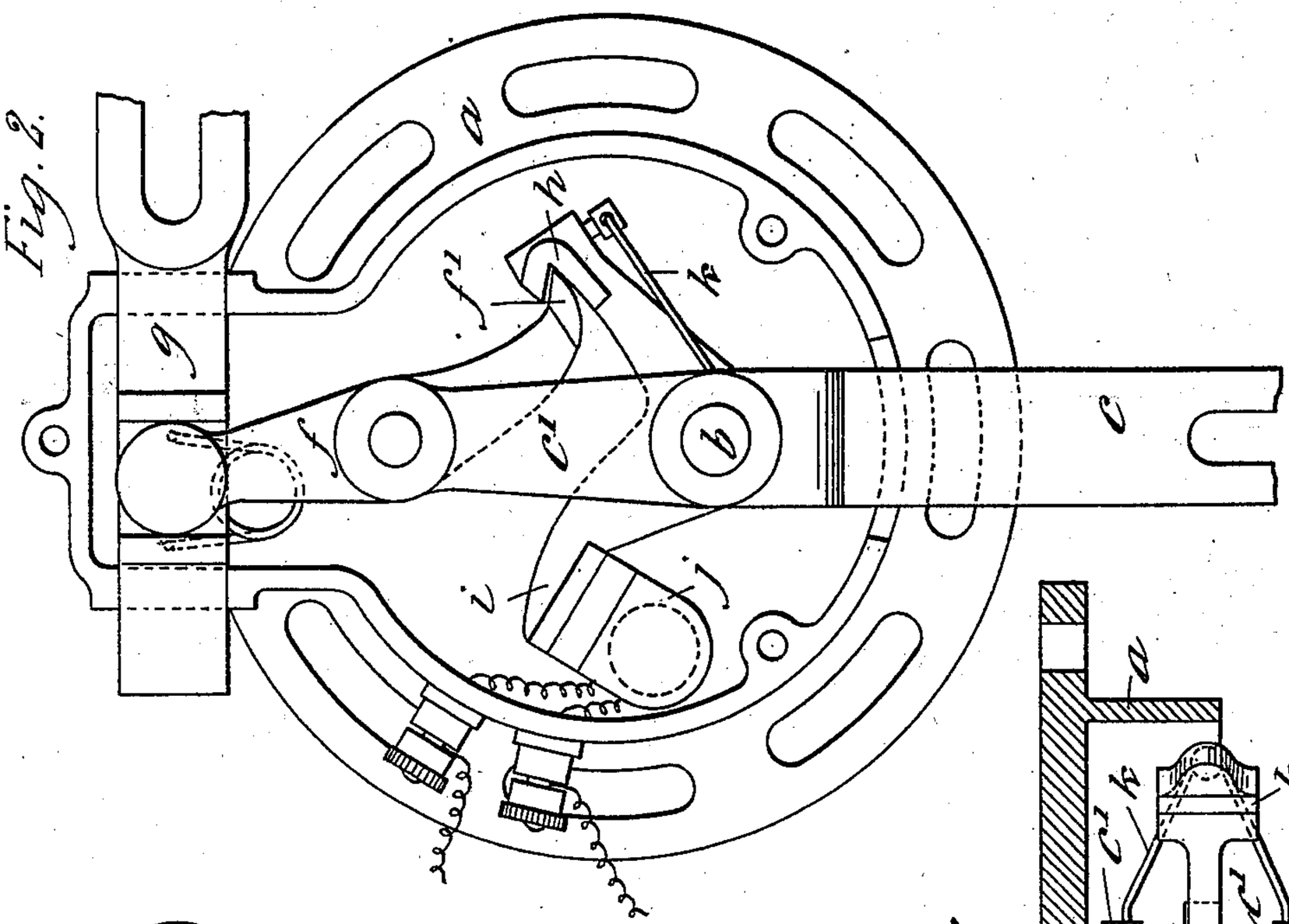

Fig. 3.

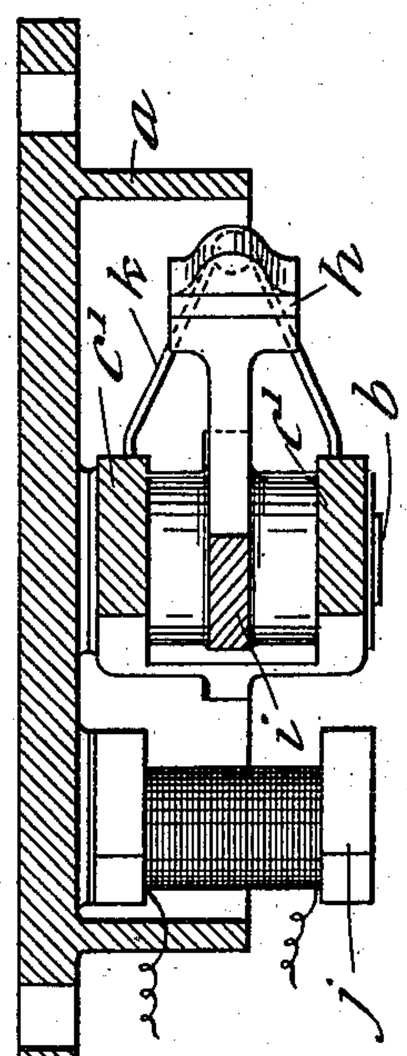

Fig. 1.

Witnesses:

C. D. Kesler.

Inventar

Arthur P. S. Macquisten

By James L. Norris.

Atty.

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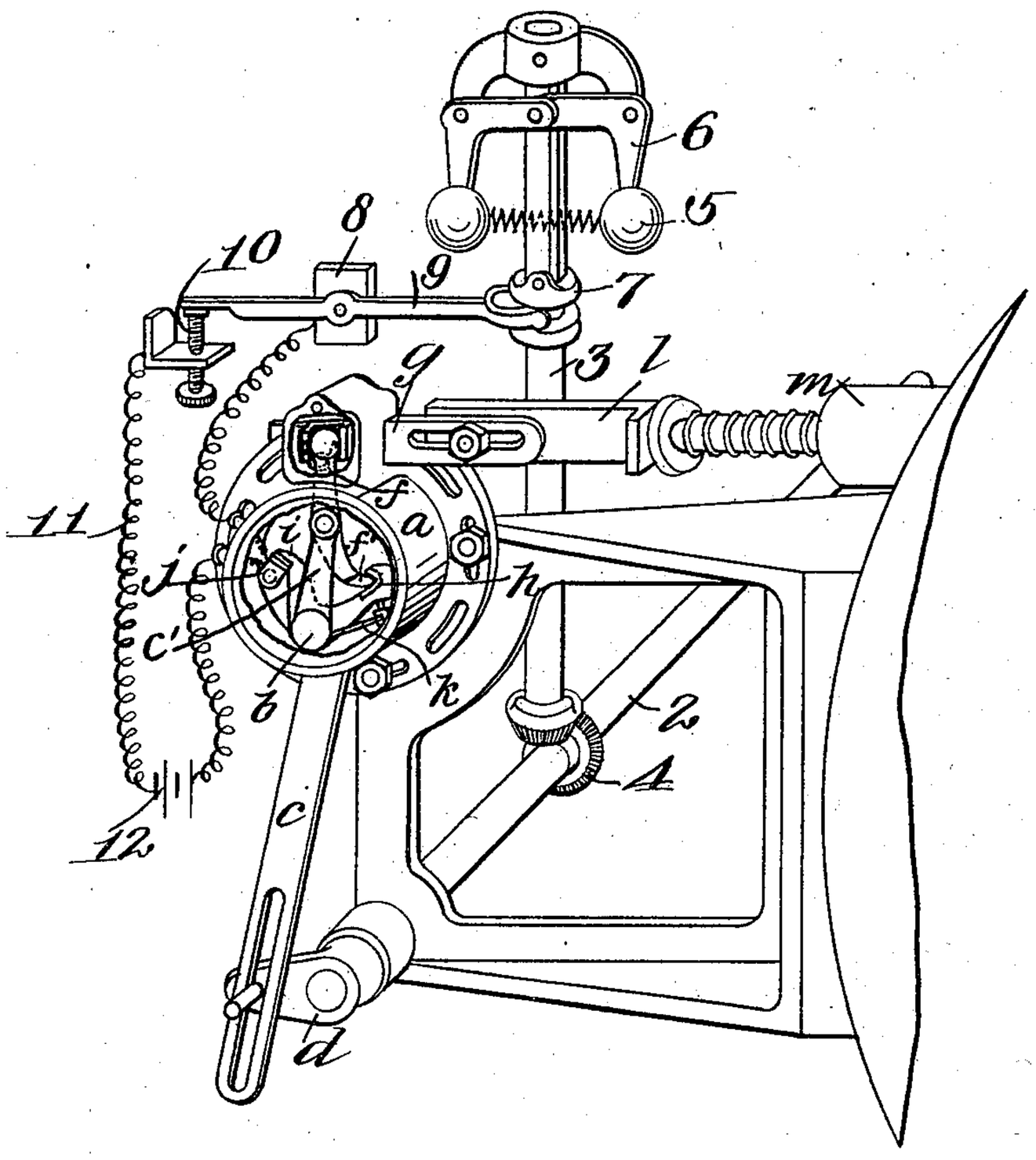
APPLICATION FILED JULY 28, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 4.



Witnesses:
F. O. Parker
H. B. Kenyon

Inventor
Arthur P. S. Macquisten
By Francis L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

ARTHUR P. STANLEY MACQUISTEN, OF GLASGOW, SCOTLAND.

CONTROLLING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 724,307, dated March 31, 1903.

Application filed July 28, 1902. Serial No. 117,361. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR P. STANLEY MACQUISTEN, chartered accountant, a subject of the King of Great Britain, residing at 33 Renfield street, Glasgow, Scotland, have invented a certain new and useful Controlling Mechanism, (for which I have applied for a patent in Great Britain, dated July 8, 1902, No. 15,226,) of which the following is a specification.

My invention relates to mechanism for electrically determining whether the motion of a lever or equivalent moving device shall or shall not be transmitted for performing a certain operation, such as actuating the controlling-valves of motor-engines and the like, the closing or breaking of the electric circuit being made in all cases to determine whether the mechanical force supplied by the moving lever or other device shall or shall not be made to effect the operation which it is intended to perform.

In the accompanying drawings I have illustrated my invention in connection with a motor-engine, though I desire it understood that it is particularly adapted for application to many uses not herein described or illustrated.

I shall describe my invention by reference to Figures 1, 2, and 3, Fig. 1 showing a front view of the mechanism with the cover removed, the parts being in the position for ordinary working, Fig. 2 being the same view with the parts in the position which they assume at the middle of the range when the circuit of the electromagnet is closed, and Fig. 3 showing a cross-section on line X X, Fig. 1. Fig. 4 illustrates the application of my improved stop mechanism to a motor-engine.

Upon a bearing *b* in a casing *a*, attached to any convenient part of the apparatus in connection with which it is to be used, I pivot a lever or movable member *c c'*, to the long arm *c* of which a to-and-fro rocking motion is given through a definite range. To the short arm *c'* of the lever *c c'* is a pivoted trigger-lever *f*, whose one end is engaged in a slot in a slide *g*, capable of sliding between guides in the casing *a*. The other end or tail of the trigger-lever is bent to one side, and it has its end *f'* formed as a beak adapted to engage with a projection or hook *h*, formed on the armature-lever *i*. The latter carries at its other end an armature which at one end of the range fits closely upon the two poles of an electromagnet *j*, fixed to the casing *a*. The armature-lever *i* is arranged to swing on the pivot *b* of the lever *c c'*, and its hooked end *h* is connected by a light spring *k* to the lever *c*.

The action of the mechanism is as follows: The lever *c c'* being moved continuously to and fro, it causes the pivot of the trigger *f* to move to and fro in a corresponding manner, and the trigger simply rocks on its connection with the slide *g*, which remains stationary, and when the tail *f'* of the lever moves to the right hand the hook *h* of the armature-lever *i* is caused by its spring connection to the lever *c c'* (which at the time is moving to the left hand) to be drawn out of the path of the trigger-tail *f'*, as shown in full lines at Fig. 1, so as to allow the trigger-lever to rock freely to and fro on its upper end engaged with the slide *g*, which remains stationary. At each motion to the left of the short arm *c'* it brings the armature on *i* close up to the electromagnet *j*, as indicated by the dot-and-dash position, so that when the electric circuit through the magnet is closed the electromagnet *j* being energized holds the armature when brought against it, and as in that position of *f* the hook *h* is situated in the path of the trigger-tail *f'* it follows that as the short arm *c'* begins to move to the right *f'* engages with *h*, so that *f* is locked to *c c'*, as shown at Fig. 2, and consequently as *c'* continues to move to the right it causes *f* to move the slide *g* to the right. The said motion of *c'* and *f f'* to the right will cause a corresponding motion to be imparted to the hook *h*, whereby the armature on *i* will be made to break away from the electromagnet, and the spring *k*, which has previously been strained by the above-described action, will then draw the hook out of engagement with *f'*, so that when the electric circuit is interrupted the parts will resume the first-described condition. As the armature is always brought close up to the electromagnet, a slight current will suffice to energize the latter sufficiently to hold it for effecting the engagement of the hook,

and consequently only a slight amount of force will be subsequently required to pull the armature away from the magnet.

The electromechanical relay action secured by the mechanism described presents many advantages, for while a very small current indeed is only required to energize the magnet sufficiently to hold the armature and its lever against the force of the spring *k*, which need only be made sufficiently strong to overcome the friction upon the bearing *b*, the mechanical force which may be transmitted through the apparatus is unlimited, dependent only upon the strength of the several parts. The method of mounting the armature-lever connected by a spring to the rocking lever *c c'* secures that no springs are in action during the ordinary working of the apparatus. It is only when the circuit is closed that the spring *k* is strained. It will be seen that the applications of such a mechanism—namely, to all purposes in which an action involving a large mechanical force is to depend upon some small and delicate movement at a distance—are numerous. I have in Fig. 4 illustrated its application to control of valves in a motor-engine, though, as above explained, it is adapted for other uses. In Fig. 4 the apparatus is seen controlling the admission-valve of a gas-engine, deriving its to-and-fro motion through a definite range from a revolving shaft of the engine and acting through a prolongation *l* of the slide *g* upon the plunger of the valve *m*. While the circuit through the magnet remains open, the slide *g* will remain at rest at the left-hand end of its stroke and the plunger of the valve will remain undisturbed in its closed position; but as soon as a current is directed through the circuit of the magnet by a contact closed in the governor when the speed of the engine fails the slide *g* is plunged forward by the motion of the shaft and the plunger of the valve is driven in to admit a charge to the cylinder. According to the construction illustrated in Fig. 4 the circuit through the electromagnet which operates the armature-lever *h* is closed by the mechanism which I will now describe in detail. The revolving shaft 2, which is operated by the engine in any suitable manner and which imparts a to-and-fro motion to the lever *c* of the stop mechanism through the crank *d*, rotates the vertical shaft 3 through the bevel-gearing 4. Mounted upon the upper end of the vertical shaft 3 is a centrifugal governing device, consisting of the weights 5, mounted upon the lower or outer ends of bell-crank levers 6. The inner ends of the bell-crank levers 6 are connected by any suitable means—such, for instance, as a rod—to a contracted sleeve 7, which is movable longitudinally on the vertical shaft 3. Pivoted upon a suitable support 8 is a contact-lever 9, which is provided with a forked end that fits into the contracted portion of said sleeve 7. The opposite end of the contact-lever 9 is adapted to contact with the adjustable terminal or contact point 10 of an electric circuit 11, which passes through a battery 12 and into the electromagnet *j*, Figs. 1 and 2, said circuit being completed through a wire leading from the electromagnet *j* to the contact-lever 9, as shown.

The operation of the foregoing construction is obvious. When the engine is running at a high rate of speed, the weights of the centrifugal governing device will assume a horizontal position and the inner arms or ends of the bell-crank levers 6 will force the contracted sleeve 7 in a downward direction upon the vertical shaft 3. This downward movement of the contracted sleeve will cause the outer end of the contact-lever 9 to move away from the terminal or contact point 10, thus insuring an open circuit through the electromagnet *j*; but when the speed of the engine decreases and the weights of the centrifugal governing device assume their lowermost position the contracted sleeve 7 will be caused to rise, the contact-lever 9 will be thrown into contact with the electric terminal 10, the electromagnet *j* will be energized, the armature-lever *i* will engage the trigger *f*, and the slide *g* and extension *l* will be actuated to open the valve *m* and permit a fresh charge to enter and increase the speed of the engine.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a movable member; a trigger loosely mounted on said movable member, a lever adjacent to said trigger and means for throwing said lever into engagement with said trigger, for the purpose specified.

2. The combination of a movable member; a trigger loosely mounted on said movable member; an armature-lever adjacent to said trigger; an electromagnet, and means for energizing said electromagnet to throw said armature-lever into engagement with said trigger.

3. The combination of a movable member; operating mechanism for imparting a uniform movement to said movable member; a trigger loosely mounted on said movable member; an armature-lever adjacent to said trigger; an electromagnet; and means, thrown into operation by said operating mechanism, for energizing said electromagnet to throw said armature-lever into engagement with said trigger.

4. The combination of a movable member; operating mechanism for imparting a uniform movement to said movable member; a trigger loosely mounted on said movable member, an armature-lever adjacent to said trigger; an electromagnet; means thrown into operation by said operating mechanism for energizing said electromagnet to throw said

armature-lever into engagement with said trigger; and means operated by said trigger for controlling said operating mechanism.

5. The combination of a lever; operating means for imparting a uniform swing to said lever; a trigger loosely pivoted upon said lever, a slide engaged by said trigger; a hooked armature-lever mounted upon the pivot of said lever, and movable therewith; an electromagnet adjacent to said armature-lever; means thrown into operation by said operating means for energizing said electromagnet to engage said hooked armature-lever with said trigger to operate said slide, and means operated by said slide for controlling said operating means.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

A. P. STANLEY MACQUISTEN.

Witnesses:
ANDREW M. MACINTOSH,
DAVID GRANT.