

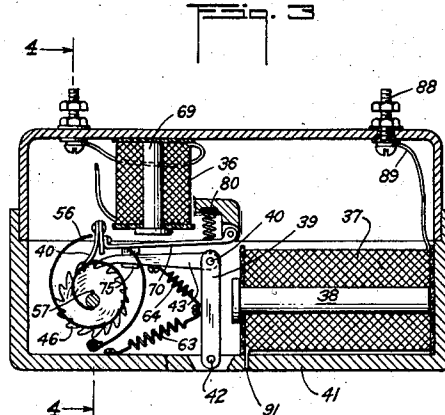
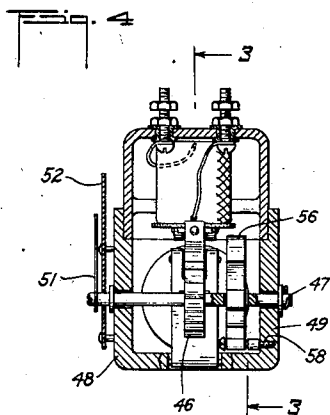
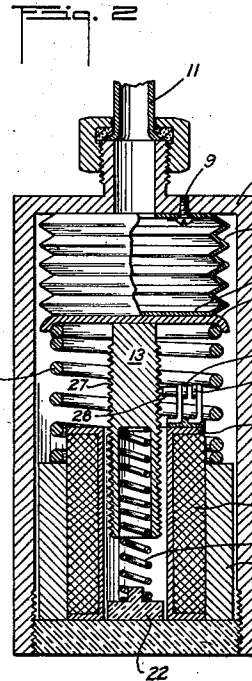
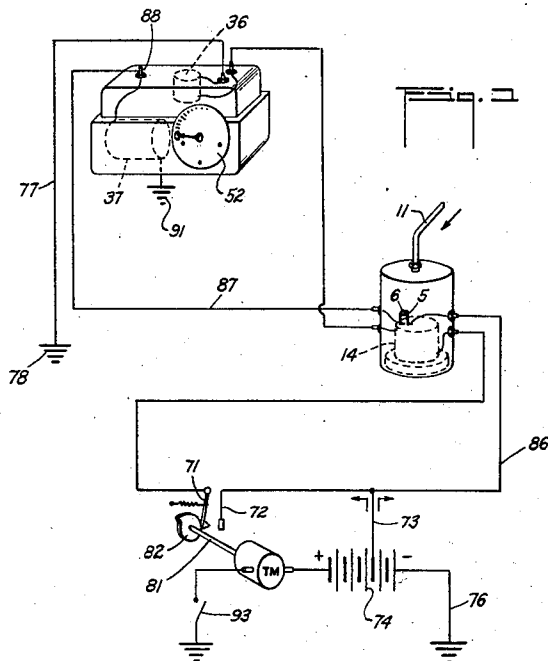
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INDICATING MECHANISM

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INDICATING MECHANISM

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5 Claims. (Cl. 177—351)

This invention relates to indicators, and an object thereof is to provide improved electro-magnetic means for operating an indicator, and in particular for the transmission of operating impulses thereto.

In the accompanying drawings the invention is shown in a form suitable for indicating the pressure of a liquid in a closed container, or flowing through a closed conduit; but it is to be understood that the drawings are merely for the purpose of illustration and description and do not constitute a definition of the limits of the invention, reference being had to the appended claims for such a definition of limits.

In the drawings,

Fig. 1 is a schematic representation of the parts employed in the preferred embodiment of the invention, and the electrical energizing means for said parts;

Fig. 2 is a longitudinal sectional view of the impulse sending, or measuring unit;

Fig. 3 is a longitudinal sectional view of the impulse receiving, or indicating unit; and

Fig. 4 is a transverse sectional view along the line 4—4 of Fig. 3.

The primary impulse sending mechanism is shown in Fig. 2 as including a pair of normally separated current conducting switch elements 5 and 6, the former being stationary and the latter being resilient and movable to alternately make and break a circuit by alternate contact with and separation from the contact 5. The means for effecting the alternate engagement and disengagement of the contacts 5 and 6 in response to changes in pressure in the container or conduit, whose pressure is to be indicated, preferably includes a reciprocable element subjected to the pressure of the fluid in the container or conduit, and also subjected to oppositely directed mechanical and electro-magnetic forces.

As shown in Fig. 2 the fluid receiving portion of the switch actuating element is in the form of a flexible bellows 7 constructed of suitably corrugated metal fastened to the case 8 at one end by suitable means 9, and adapted to expand in a direction away from said stationary end as the fluid entering the bellows through the connection 11 exerts pressure upon said bellows, causing the lower end 12 thereof to exert a downward pressure upon the magnetizable core or plunger 13 of an electro-magnetic device 14 having a winding 16 adapted to be energized at regular intervals by means to be described. This tendency to produce a downward movement of the core 13 is opposed by suitable means such as compression springs 18 and 19 mounted on abutments 21 and 22 respectively, the upper end of the spring 19 being engageable with the core 13 as shown, and the upper end

of the spring 18 being engageable with a disc 24 interposed between the upper end of the core 13 and the lower end wall of the bellows.

In order to translate the reciprocatory movement of the plunger 13 into vibrating motion on the part of the contact 6, the former is provided with a series of circumferential grooves or corrugations shown at 27, with respect to which corrugations the correspondingly tapered shank 28 of the switch element 6 acts as a cam follower. The size and setting of the spring 19, in relation to the electro-magnetic strength of the coil 16, is preferably such that the said spring effectually prevents movement of the plunger 13 to a position lower than that indicated in Fig. 2 prior to the energization of the said winding 16, but is yieldable to permit such downward movement in response to the passage of current through the winding 16. Following de-energization of winding 16 the extent of the return movement (and therefore the number of vibrations of the contact 6) is directly proportionate to the pressure being exerted upon the bellows 7 by the fluid in the container or conduit whose pressure is to be indicated, and with which container or conduit the tube 11 is in communication.

The secondary or impulse receiving unit is shown in Figs. 3 and 4 as involving a pair of electro-magnetic devices 36 and 37, the latter having a core 38 adapted, when current is passed through the winding of the solenoid, to attract an armature 39 pivoted to the casing 41, as indicated at 42, and having a latch or pawl 43 pivotally connected to its opposite end, as indicated at 44, said latch or pawl being adapted to co-operate with the teeth of a ratchet disc 46 secured to a shaft 47 rotatably mounted in the side walls 48 and 49 respectively, of the casing 41, and having secured thereto at its outer end a pointer 51 movable across the face of a dial 52 bearing suitable figures to indicate the pressure existing in the conduit 11. A spring 56 is wound spirally, with one end passing through the shaft 47 as indicated at 57 in Fig. 3, and the opposite end held fixed by suitable means 58 secured to the casing as indicated in Fig. 4, the direction of the winding of the spring 56 being such as to cause rotation of the shaft 47 to a position which brings the pointer 51 to the zero, or non-indicating position on the scale 52 (Fig. 1) upon release of the pawl 43 by the means now to be described. In the arrangement shown, the dial scale is such that clockwise movement of the pointer produces progressively smaller readings, a rise in pressure being indicated by a counter-clockwise movement.

A pair of tension springs 63 and 64 (Fig. 3) cooperate to hold the armature 39 and the pawl 60

43 in the respective positions indicated in Fig. 3, with pawl 43 in engagement with one of the teeth of the ratchet disc 46. These springs also act to insure contact of the pawl 43 with successive teeth of the ratchet disc, and thereby impart a step by step rotation to said disc (and hence to the pointer 51) in response to repeated energizations of the electro-magnetic device 37 in the manner to be described, such step by step action continuing until such energizations are interrupted. Meanwhile a resilient detent 40 maintains the disc in the position to which it has been rotated until a disengaging force is exerted thereupon. In the embodiment shown, such disengaging force is exerted by the magnetic attraction of core 69 upon an armature 70 having a depending lug 75 extending under and engaging the pawl 43 to raise the latter in response to energization of the winding 36.

As indicated in Fig. 1, the winding 36 is electrically connected in series relation with the winding 16 of the solenoid 14 and is therefore energized concurrently with said winding 16, such concurrent energization being effected upon closure of the normally open switch contacts 71 and 72, the circuit being by way of a lead 73 connected with a positive tap from the current accumulator or battery 74, the negative terminal of which is grounded as indicated at 76, and the return lead 77 from the coil 36 being similarly grounded as indicated at 78. The means for closing the contacts 71 and 72 at regular intervals may be of any suitable construction, and is indicated in Fig. 1 as including a constant speed timing motor T. M. adapted to be energized from any suitable source, such as the battery 74, and adapted to drive a low speed shaft 81 through a suitable gear train (not shown) causing the said shaft to rotate at a speed, for example, of 20 revolutions per minute, so that the cam carrying disc 82 of said shaft will act to close a circuit through the contacts 71 and 72 at intervals of 3 seconds or thereabouts. The electro-magnet 37 is also preferably energizable from the same source 74 which energizes the electro-magnets 14 and 36, and the circuit thereto includes the above described conductor 73, also a lead 86 connecting with the above described switch contact 5, and a second lead 87 connecting the movable contact 6 with the terminal post 88 to which the winding of the electro-magnet 37 is connected as indicated at 89 in Fig. 3, the other end of said winding being grounded as indicated at 91 in Figs. 1 and 3.

In the beginning of the cycle of operation, the rotor T. M. is assumed to be energized (the switch 93 having been previously closed) and the first closure of the contacts 71 and 72 by operation of the cam 82 will cause current to flow to the windings of the solenoids 14 and 36 in series. This energization of the electro-magnet 36 raises detent 40 and armature 70 against the opposition of the compression spring 80 thereby releasing the detent 40 and the pawl 43 from the teeth of the ratchet disc 46, and allowing the spring 56 to return the pointer 51 to the non-indicating position on the dial. At the same time the energization of the winding 16 of the solenoid 14 attracts the plunger 13 toward the abutment 22. This energization is but momentary, however, since the cam on the disc 82 occupies but a small portion of the periphery thereof; and the resulting de-energization of the winding 16 allows spring 19 to return the plunger 13 toward the position indicated in Fig. 2, the degree of return depending upon the pressure existing in the bellows 7 as

against the offsetting force of the spring 18. During this return movement of the plunger the contacts 5 and 6 are opened and closed a corresponding number of times as the shank 28 of the contact 6 rides along the corrugated surface of the plunger. Each closure of the contacts produces an energization of the winding 37 and a corresponding impulsive movement of the pawl 43, thus causing the disc 46 to be rotated step by step and a corresponding indication to be registered by the pointer 51 upon the dial 52, the pointer moving in a clockwise direction, as viewed in Fig. 1. The pressure in the conduit 11 for the instant is thus indicated, subject to alteration upon the next closure of the contacts 71 and 72 if the pressure in the conduit 11 undergoes even a very slight change in the intervening interval, it being understood that the pointer returns to the non-indicating position by the action of the coil spring 56 prior to assuming its new position.

It is to be seen from the foregoing that the invention provides means for producing continual, although not continuous, indications of the slightest changes in the pressure or other physical property of the fluid to be measured, and makes it possible to produce such an indication on a dial disposed in a location remote from the fluid containing conduit, the only connection therebetween being of an electrical nature and thus eliminating the necessity of extending tubes or mechanical transmitting means from one unit to the other.

If it is desired to have the pressure at any given time recorded for a longer interval, rather than "cancelled" by the return of the pointer to the non-indicating position, this may be done by opening switch 93, whereupon all three magnets become de-energized, and pawl 43 acts to hold the pointer at the last indicated reading, thus preserving a record of the pressure then existing.

If it is desired to indicate temperature, for example, rather than pressure, this may be done by filling the expansible chamber 7 with a volatile fluid, and substituting a bulb at the point of connection indicated at 11 in Fig. 2. It is also understood that changes may be made in the construction, arrangement and number of the parts employed, as well as in their interrelation and method of operation, within the scope of the appended claims.

What is claimed is:

1. The combination of a transmitting means having a solenoid mounted at one end thereof, an armature extending from said solenoid, a movable element at the opposite end of said casing for limiting the movement of said armature, said element movable in response to some external condition to be measured, resilient means for constantly urging said armature toward said movable element, a pair of electrical contacts, means associated with the armature for opening and closing said contacts a number of times proportional to the extent of movement of said armature, whereby an index element of an electrically controlled receiving means is moved proportionally to the movement of said armature, said index element having an initial position, means constantly tending to return said index element to its initial position, electromagnetically controlled ratchet and pawl means for moving said index element step by step from said initial position to spaced apart new positions in response to the opening and closing of an electrical circuit including said electromagnet by said con-

tacts, pawl means for holding said element against return movement as it proceeds step by step from one position to another, a second electromagnetic means for rendering said holding means ineffective, contact means operable at intervals for simultaneously energizing a circuit including said solenoid and a circuit including said second electromagnetic means whereby said holding means is rendered ineffective to allow an uninterrupted, single step return movement of said index element to said initial position.

2. The combination of a transmitting means having a solenoid, an armature extending from said solenoid, a movable element for limiting the movement of said armature, said element being movable in response to some external condition to be measured, resilient means for constantly urging said armature toward said movable element, a pair of electrical contacts, means associated with the armature for opening and closing said contacts a number of times proportional to the extent of movement of said armature, whereby an index element of an electrically controlled receiving means is moved proportionally to the movement of said armature, said index element having an initial position, means constantly tending to return said index element to its initial position, electromagnetically controlled ratchet and pawl means for moving said index element step by step from said initial position to spaced apart new positions in response to the opening and closing of an electrical circuit including said electromagnet by said contacts, pawl means for holding said element against return movement as it proceeds step by step from one position to another, a second electromagnetic means for rendering said holding means ineffective, contact means operable at intervals for simultaneously energizing a circuit including said solenoid and a circuit including said second electromagnetic means whereby said holding means is rendered ineffective to allow an uninterrupted, single step return movement of said index element to said initial position.

3. The combination of a transmitting means having a solenoid, an armature extending from said solenoid, a movable element for limiting the movement of said armature, said element being movable in response to some external condition to be measured, resilient means for constantly urging said armature toward said movable element, a pair of electrical contacts, means associated with the armature for opening and closing said contacts a number of times proportional to the extent of movement of said armature, whereby an index element of an electrically controlled receiving means is moved proportionally to the movement of said armature, said index element having an initial position, means constantly tending to return said index element to its initial position, electromagnetically controlled means for moving said index element step by step from said initial position to spaced apart new positions in response to the opening and closing of an electrical circuit including said electromagnet by said contacts, pawl means for holding said element against return movement as it proceeds step by step from one position to another, a second electromagnetic means for rendering said holding means ineffective, contact means operable at intervals for simultaneously energizing a

circuit including said solenoid and a circuit including said second electromagnetic means whereby said holding means is rendered ineffective to allow an uninterrupted, single step return movement of said index element to said initial position.

4. The combination of a transmitting means having a solenoid, an armature extending from said solenoid, a movable element for limiting the movement of said armature, said element being movable in response to some external condition to be measured, resilient means for constantly urging said armature toward said movable element, a pair of electrical contacts, means associated with the armature for opening and closing said contacts a number of times proportional to the extent of movement of said armature, whereby an index element of an electrically controlled receiving means is moved proportionally to the movement of said armature, said index element having an initial position, means constantly tending to return said index element to its initial position, electromagnetically controlled means for moving said index element step by step from said initial position to spaced apart new positions in response to the opening and closing of an electrical circuit including said electromagnet by said contacts, means for holding said element against return movement as it proceeds step by step from one position to another, a second electromagnetic means for rendering said holding means ineffective, contact means operable at intervals for simultaneously energizing a circuit including said solenoid and a circuit including said second electromagnetic means whereby said holding means is rendered ineffective to allow an uninterrupted, single step return movement of said index element to said initial position.

5. The combination of a transmitting means having a solenoid, an armature extending from said solenoid, a movable element for limiting the movement of said armature, said element being movable in response to some external condition to be measured, resilient means for urging said armature toward said movable element, an electric circuit breaker, means associated with the armature for opening and closing said circuit breaker a number of times proportional to the extent of movement of said armature, whereby an index element of an electrically controlled receiving means is moved proportionally to the movement of said armature, said index element having an initial position, means tending to return said index element to its initial position, electromagnetically controlled means for moving said index element step by step from said initial position to spaced apart new positions in response to the opening and closing of an electrical circuit including said electromagnet by said contacts, means for holding said element against return movement as it proceeds step by step from one position to another, a second electromagnetic means for rendering said holding means ineffective, contact means operable at intervals for simultaneously energizing a circuit including said solenoid and a circuit including said second electromagnetic means whereby said holding means is rendered ineffective to allow an uninterrupted, single step return movement of said index element to said initial position.

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