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APPARATUS FOR CONTROLLING AND FOR INTERMITTENTLY DRIVING OF RESPIRATORS AND OTHER MEDICAL APPARATUS	
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FOR CONTROLLING AND FOR INTERMITTENTLY
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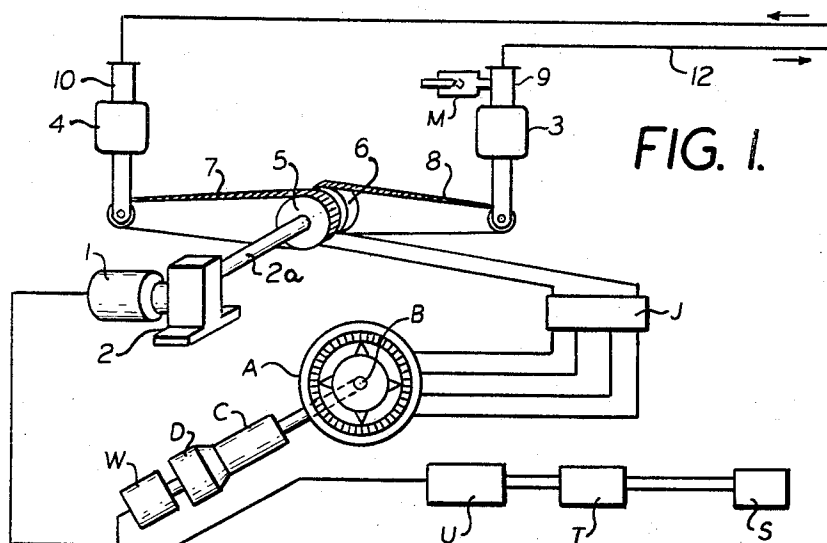


FIG. 1.

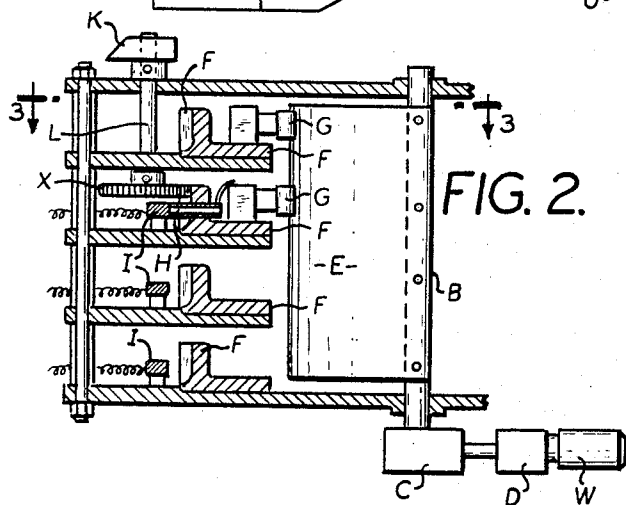


FIG. 2.

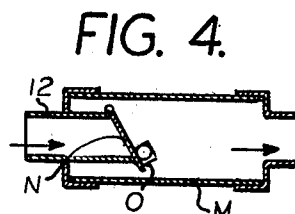


FIG. 4.

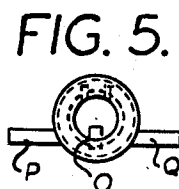


FIG. 5.

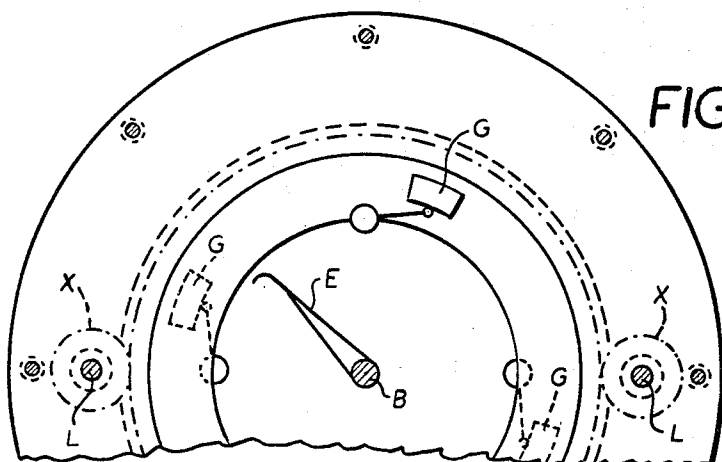


FIG. 3.

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APPARATUS FOR CONTROLLING AND FOR INTERMITTENTLY DRIVING OF RESPIRATORS AND OTHER MEDICAL APPARATUS

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4 Claims. (Cl. 128—145.6)

The present invention relates to an apparatus for controlling and for intermittently driving respirators and other medical apparatus.

It is one object of the present invention, to provide an apparatus for controlling and for intermittently driving respirators and other medical apparatus, which permits dividing a minute in a certain number of respiratory cycles in a respirator, giving artificial respiration, by permitting each cycle to be split into variable periods, corresponding to the different stages constituting the cycle, viz., insufflation, pause, exsufflation, pause.

A couple of pumps adapted to control the inhaling and exhaling, respectively, are intermittently driven from a continuously rotating shaft via respective magnetic or hydraulic clutches which are switched "on" and then "off" from the time splitting device provided in accordance with the invention.

Each one of the above periods may be given substantially the full value of the cycle, or two or more of said periods may be associated to form the cycle.

In case, the apparatus is set for "triggering" there is provided automatic triggering of the apparatus according to a controllable time-table if the patient does not trigger himself by inhaling or by starting to inhale.

It is another object of the present invention to provide an apparatus for controlling and for intermittently driving respirators and other medical apparatus, which also permits the remote control of the apparatus by means of automatic lighting of pictorial representations of the lungs at different predetermined time periods and the indication of the volume of inhaling on a graduated scale, thereby, permitting the precise control of the apparatus.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which:

FIGURE 1 is a schematic view of the control mechanism of the apparatus;

FIG. 2 is an elevation of the apparatus, partly in section, indicating the possibility of variation of the time periods in each cycle;

FIG. 3 is a fragmentary view along the lines 3—3 of FIG. 2;

FIG. 4 is a sectional view of a calculating means operated by a photo-electric cell; and

FIG. 5 is an elevation, partly in section, of the lamp.

Referring now to the drawings, the mechanical-electrical operative elements of the respirator are disclosed.

A sector disc S has an input which feeds an auto-transformer T, which in turn is fed by current of 6, 12 or 24 volts, selectively, which feeds a battery U having any chosen voltage such, that it is continuously charged at its maximum by feeding current continuously. All members of the apparatus take their current from this battery.

A motor 1 is in continuous operation. It drives a reduction gear 2 turning an axle 2a at variable speed by manual control on an operating board, in order to provide according to the chosen speed larger or smaller volumes by pumps 3 and 4, which are operated by engag-

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ing, with the turning axle 2a, clutches 5 and 6 and the connecting rods 7 and 8.

Electro valves 9 and 10 are disposed on the mentioned pumps 3 and 4.

The arrangement A permits the cutting of a minute in a certain number of cycles and within each cycle, the variation of the duration assigned for each time period, inhaling, pause, exhaling and pause.

The arrangement comprises four divisions, each for a time period constituting a cycle.

The center axle B is connected with a speed variator C receiving its movement from a reduction gear D, which permits the rotation of the axle B at 8 to 60 revolutions per minute, which is a rotary speed, which varies the number of cycles within a minute. A motor W completely independent of the main motor 1 enables the rotation of the central shaft axle B of the time splitting device.

Referring now again to the drawings, and in particular to FIGS. 2 and 3, the axle B carries a unique cam E, disposed on the same axle and which cooperates with the four previously mentioned divisions.

Each division carries a toothed gear F centered relative the axle B, on which is secured a micro-circuit breaker G, connected to a carbon H frictionally engaging a collector ring I, which in turn is connected with a time relay J (FIG. 1).

Three buttons K are secured on their respective axles L supporting pinions which mesh with the gears F.

The first division gear F is fixed, (and has no corresponding pinion). Also fixed is the micro-circuit breaker G, associated with the first division. In this division gear F can be eliminated, since the micro-contact G is fixed.

As seen in FIG. 3 the circuit breakers G of the respective divisions are angularly spaced apart from one another. As the axle B rotates the cam E and engages the micro-circuit breakers G in sequence during each revolution, a pulse is generated to each corresponding relay feeding the clutches 5 and 6 and the electro valves 9 and 10, which in turn could feed the control of other mechanical, hydraulic or other power drives. The relays cause the clutch for each pump to couple and disengage each pump with the turning axle 2a of the reduction gear, respectively.

The micro-circuit breakers G are placed apart from each other at 90°, dividing the cycle in four equal time periods. By modification of the relative position of the micro-circuit breakers G, by means of the buttons K, and the time periods of the same cycle are varied according to the desired conditions of the operator. This can provide in addition an inhaling period during a complete cycle or practically during a complete cycle, an exhaling and a pause, as well as the association of two, three or four time periods under infinitely variable conditions.

The relays operate such, that the contact of the cam E on the circuit breaker cuts the previous one, until a new contact of the cam E with another circuit breaker cuts the latter and so on, until a new cycle is reached.

The number of circuit breakings in variable time periods could be increased or decreased, if desired, and depends upon the variation of the number of divisions.

The relays are connected with pictorial representations of the lungs at the various periods in the cycle, in order that each representation is lighted in its turn to visualize the condition of the lungs at the corresponding stage, while the connection rod 8 has a pointer which moves in front of a scale to show the volume of air which is caused to be inhaled.

Referring now again to the drawings, and in particular to FIGS. 1, 4 and 5, in case the apparatus is set for "triggering," a valve M is branched off in the feeding

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channel 12 leading from the inspiration pump 3 (via electrovalve 9). It carries a light directional valve N, which supports a diaphragm O darkening the light rays of a projector P, which in the inoperative state does not impinge on a photo-electric cell Q, properly disposed and rendered inoperative by the diaphragm O.

From the moment the patient inhales, the diaphragm O by lifting permits the penetration of the light rays which impinge upon the photoelectric cell Q, and the current which is produced switches on the start of a respiratory cycle and which is then stopped. The latter has been precontrolled as to its characteristics.

A new cycle is created in two ways:

If the patient inhales, the diaphragm O lifts up again and the photoelectric cell operates to produce a new cycle.

If the patient has not inhaled, a new cycle is created by a retarding device controllable between 1 and 10 seconds (electronic counter).

Furthermore, in order to obtain an exact control without requiring of calculation of a linear or circular arrangement, electric indicators for each chosen volume (volume of inhaling) may be provided giving the value of the minute ventilation as a function of the intended frequency.

The arrangement can comprise different embodiments by providing, by example a graduated disc, displaced by rotation, the rays indicating the frequency, by means of a fixed graduation, and, thereby, the value of the minute ventilation.

In the enclosed drawing all modifications of shape, dimensions, locations of the different members are given by example and in a non-limiting sense, the scope of the present invention being determined by the objects and the claims.

We claim:

1. An apparatus for controlling and intermittently driving respirators comprising
 - an electric motor,
 - a reduction gear operatively connected with said motor,
 - two pumps driven by said reduction gear, one of said pumps being adapted for inhalation and the other of said pumps being adapted for exhalation,
 - a rotating axle having a cam secured thereto for joint rotation therewith,
 - a second motor for driving said rotating axle,
 - a disc mounted on said axle and bearing graduations, toothed gears supported for rotation coaxially with said rotating axle,
 - a plurality of circuit breakers disposed respectively one on each of said toothed gears and peripherally and axially spaced apart from each other, operatively connected with said pumps for intermittent drive, and successively engaged by said cam, the separation

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of said circuit breakers determining the division of the cycles of operation,

a carbon coordinated to operatively connect with the corresponding of said circuit breakers,

a collector ring provided for and engaged by the corresponding of said carbons,

a pinion meshing with each of said corresponding toothed gears,

time relays,

said collector rings being connected with said time relays and generating pulses, during rotation of said cam, and

hand-controlled pinion means for turning said pinions and thereby varying the relative position of said toothed gears and said circuit breakers thereon, in order to change the time period for a cycle.

2. The apparatus, as set forth in claim 1, which includes

means for controlling said apparatus by lighting pictorial representations of lung schemes at different time periods of said cycle.

3. The apparatus, as set forth in claim 1, which includes

a valve including a diaphragm covering and uncovering, respectively, light rays, and

a photoelectric cell impinged by said light rays in the uncovering position of said diaphragm, in order to start operation of said apparatus.

4. The apparatus, as set forth in claim 1, further comprising

a clutch for each pump operative to couple each pump with said reduction gear, and

said time relays electrically connected in pairs with each of said clutches, so as, respectively, to engage and disengage each clutch from said reduction gear.

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