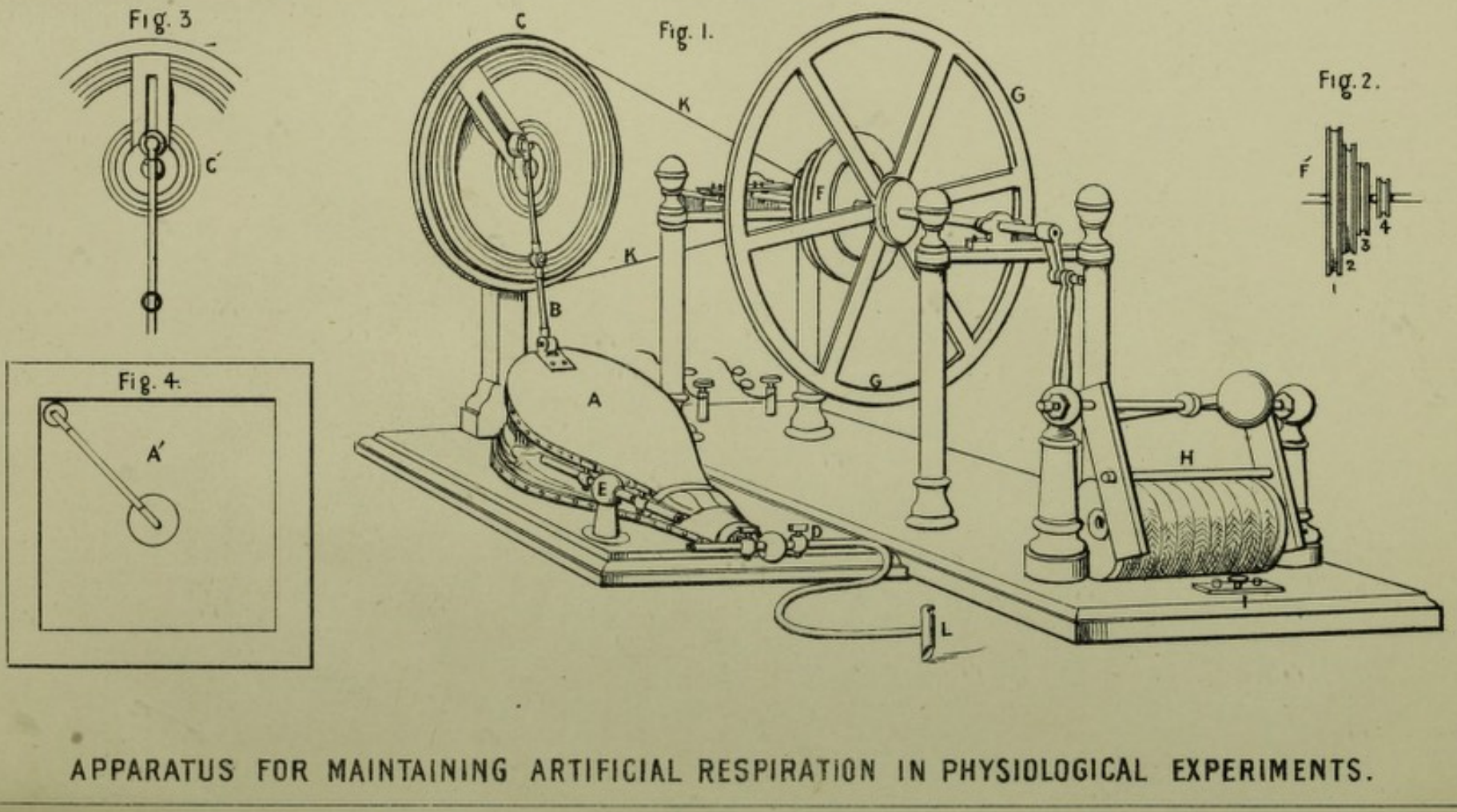
Apparatus for maintaining artificial respiration in physiological experiments / by John G. M'Kendrick, M.D., F.R.C.P.E.



APPARATUS FOR MAINTAINING ARTIFICIAL RESPIRATION IN PHYSIOLOGICAL EXPERIMENTS.

APPARATUS

FOR

MAINTAINING ARTIFICIAL RESPIRATION IN PHYSIOLOGICAL EXPERIMENTS.

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It is frequently necessary, in certain physiological experiments, more especially those in which the vagi have been cut, or in which the animal is under the influence of woorara, or any other poison influencing the mechanical action of the lungs and chest, to maintain artificial respiration for a time varying in length from a few minutes to several hours. It is desirable, in these circumstances, to keep up respiration at a uniform rate, both as to the number of respirations and as to the amount of air introduced in each action corresponding to an inspiration. In most physiological laboratories in Germany the method of artificial respiration is often employed, and many ingenious but complicated instruments are in use. The apparatus now used in the Physiological Laboratory of Edinburgh University, a figure of which is given in the accompanying plate, is simple in construction, and by means of it the three following conditions can be fulfilled:—(1.) The number of respirations can be graduated from 20 to about 80 per minute; (2.) The quantity of air introduced can be graduated from about 5 to about 18 cubic inches; and, (3.) Oxygen, or any other gas, can be introduced at pleasure, and to any required amount.

The motive power of the apparatus is an electro-magnetic machine;

seen on the right of Fig. I. This machine, made by Mr W. H. Hart, mechanician in this city, is worked by four or six Bunsen's elements, the surface of zinc in each element being about 40 square inches. The helix is seen at H, and the strength of the apparatus is materially increased by the centrifugal action of the large wheel G G, which is sufficiently powerful to carry the keepers of the magnet into the position represented in Fig. I. By taking out a small stop-connector at I, the current passing round the helix H can be arrested at once. On the axle of the wheel G, there is a disc of wood F, seen also in profile in Fig. II., F′, on which we have a graduated series of grooves Fig. II., 1, 2, 3, 4, for receiving the belt, by means of which any machinery may be set in motion—the speed communicated decreasing from the groove 1 to the groove 4, as the diameter of the various circles diminishes.

The essential part of the apparatus is a small bellows A, worked by a rod B, having a joint in the centre, and which is attached to a disc of wood C, moved by a band of catgut K K, in communication with the motive power. I have arranged the rod B so, that by elevating or depressing it in a slit in the disc C, the upper part of the bellows A will be pressed through a greater or less vertical distance, and, consequently, more or less air expelled. A view of this arrangement is seen in Fig. III. When the apparatus is in action the air is drawn into the bellows underneath in the usual way. In Fig. IV., a view is given of the under surface of the bellows. Into the opening guarded by the valve of the bellows, I have inserted a tube which passes to the base of the upright tube E, seen in Fig. I. This upright tube is provided with two smaller tubes, each having a stopcock. Atmospheric air enters by one or other of these tubes; and if a mixture of air and oxygen, or oxygen alone, be required, one of these is connected with a gasometer containing the gas. When the bellows is compressed the air passes through the tube D to L, a canula inserted into the trachea. When air is thus driven into the lungs by artificial means, they are dilated, and the chest expands. The elasticity of the lungs is usually sufficient to expel the air, which escapes through a small hole in the upper part of the canula L. If the influence of an induced

current be required to stimulate the muscles of the chest or the diaphragm, a small induction apparatus is easily connected with the part of the electro-magnetic machine where the continuous current is closed and opened, so that a series of shocks, at regular intervals, may be sent to the muscles. By having a double pipe at the nozzle of the bellows D, artificial respiration may be maintained in two small animals at one time. The speed of the apparatus may be graduated either by increasing or diminishing the number of elements employed for working the electro-magnetic machine, or by placing the belt K K on different grooves on the disc of wood seen at Fig. II., 1, 2, 3, 4. The electro-magnetic machine may of course be used for many other purposes. The whole apparatus is reduced in the plate to one-eleventh of real size.