a fine hole for its iron wire, are pushed down the side-tubes to within a millimetre or less of the mercury surfaces, and after the iron wires have been introduced sealing-wax is run in above the corks to ensure that no mercury will be spilt, or air-bubbles introduced into the capillary when the arc is moved about. This sealing of the tube also allows the arc to be run on its side, i.e. with the capillary tube vertical. If the arc does not at once run easily on A.C. (before the corks are introduced), it can be started on D.C. This D.C. arc will oscillate and the oscillations have the effect of driving tiny air-bubbles out of the capillary into the side-tubes.

An ordinary 75 W. lamp, inside the sheet-iron shield seen in the photograph, is in series with the arc tube. In practice, after plugging in to the mains (250 V. A.C. at 50 cycles per sec.), the arc was struck by splitting the thread with a pointed flame and it then buzzed on continuously without further attention. It was found that if the capillary had an internal diameter of 0·04 cm. and length 9 cm., the frequency of the arc flashes is exactly 50 per sec. When the 75 W. lamp is replaced by a 100 W. lamp, the arc length increases and the frequency of the flashes drops to $33\frac{1}{3}$ per sec. Another arc with a shorter horizontal capillary and with a 25 W. lamp in series ran at 100 flashes per sec.

A protecting screen of thin sheet-iron should be put round an arc in a quartz tube. It is convenient to have an aperture in the screen fitted with a slide which can be pushed aside. A Wood's filter may be fitted to slide along grooves in front of the aperture so that only ultra-violet light shall be emitted.

Fig. 2 is a photograph of a cathode-ray oscillogram showing the wave-form of the A.C. when the arc was running at 50 flashes per sec. Fig. 3 shows how the arc, running at 100 flashes per sec., picks up both halves of the A.C. cycle.

A SIMPLE SUPER-CENTRIFUGE FOR THE CONTINUOUS TREATMENT OF LIQUIDS.

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THE problem of removing unfilterable impurities from colloidal solutions, which was receiving attention in this laboratory, called for the construction of a powerful centrifuge which could be operated continuously, removing a small proportion of heavy material from a large bulk of liquid. It was decided to attempt to apply the principles of MM. Henriot and Huguenard's conical air-driven tops (1) to the construction of such a machine. Others have used these tops in various forms and articles by Beams (2), Beams *et al.* (3), Garman (4) and Beams and Pickels (5) give details of construction, and their papers have been consulted.

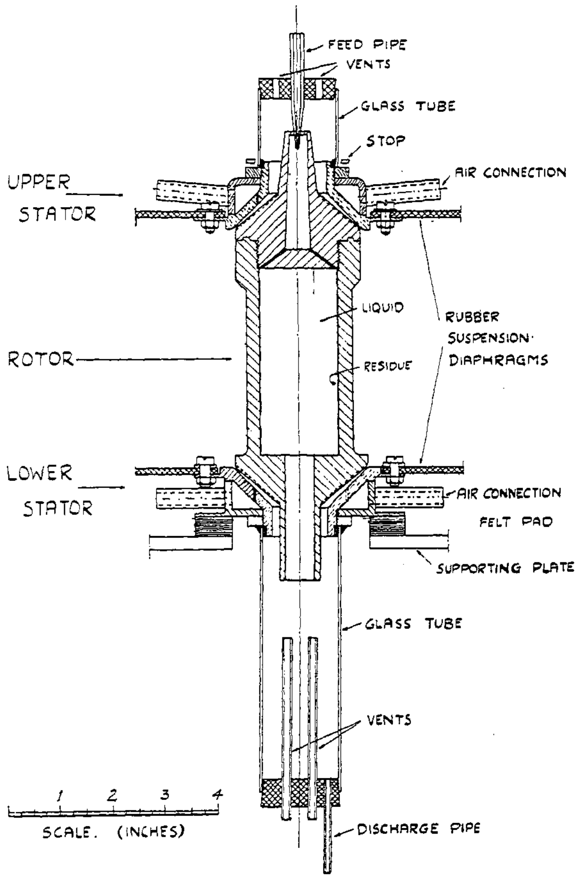
A sectional view of the machine is shown in the figure. The rotor is a hollow duralumin cylinder with conical ends and a screwed joint, the internal dimensions being $1\frac{1}{2}$ in. diameter $\times 3\frac{9}{16}$ in. long, giving a working capacity of about 90 c.c. The tail pieces which extend right through the stators enable liquid to be fed into and discharged from the rotor while it is revolving. Each brass stator forms a 90° hollow cone in the inside of an annulus containing compressed air. Eight small jets are drilled at a suitable angle* through the conical surface. The conical ends of the rotor, of angle 100°, each carry sixteen radial grooves about $\frac{1}{16}$ in. deep on which the jets of air impinge, providing the necessary driving force. The exhaust air escapes radially between the two cones, forming a vortex which is the actual bearing surface for the rotor. A slight vacuum is created at the centre of this vortex which holds the rotor in the stator at a distance of about $\frac{1}{2}$ mm. from it. The flexible mounting of the upper

* Cf. Beams and others, *loc. cit.*

stator facilitates correct adjustment. The duralumin rotor was made by turning in a lathe. No abnormal care was taken in this operation and no attempt has ever been made to check or adjust the balance of the machine. The joint is made tight against the internal pressure of the liquid by painting the tongue and groove with shellac. With the present machine the pressure reaches about 300 lb. per sq. in. when an aqueous solution is being treated.

The method of operating the machine is extremely simple. Air is admitted to the stators at a pressure of 30–100 lb. per sq. in., and the rotor attains its full speed of 500–850 revolutions per second in less than a minute. Liquid is then admitted through the $\frac{1}{2}$ in. diameter hole in the upper tail piece at the desired rate. It spreads through six small oblique holes on to the inner surface of the rotor, and builds up a wall of liquid until it reaches the $\frac{9}{16}$ in. diameter hole in the lower tail piece. The lighter fraction is then discharged continuously at the same rate that liquid is supplied to the machine. The heavy residue forms a layer on the inside of the rotor and can be removed after stopping the machine.

The speed of the machine is measured stroboscopically. A beam of light is focused on the slits of an interrupter disc rotated by a variable speed motor. The intermittent illumination thus obtained is directed upon the rotor, on which is painted a black band extending over three-quarters of the circumference. When the frequency of the illumination equals the speed of the rotor, the latter appears stationary; the motor speed is then observed and the rotor speed calculated.



Super-centrifuge for continuous treatment of liquids

The loading of liquid into the rotor has no effect on either the speed or stability of the rotor. Once the machine has been set in motion it will continue to run for a day or more and no attention is needed until it is stopped: the speed remains constant within close limits, providing a supply of clean dry air at constant pressure is maintained. The power lost in friction on the surface of the rotor increases very rapidly with surface velocity at speeds of the order of 500 ft. per sec. and consequently a small increase in air feed pressure produces a much smaller increase in speed. As at present operated, the machine uses about 50 cubic ft. of free air per min. when the air pressure is 100 lb. per sq. in.

The machine has been run continuously for upwards of 24 hours and the maximum rate of flow of the solutions treated has been 5 litres per hour.

REFERENCES

(1) Henriot & Huguenard. *J. Phys. Radium*, 8 1927 (433).
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(3) Beams, Weed & Pickels. *Science*, 78 1933 (338).
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(5) Beams & Pickels. *Rev. sci. Instrum.* 6 1935 (299).

NEW INSTRUMENTS AND TOOLS

NOTICE TO SCIENTIFIC INSTRUMENT AND TOOL MAKERS

In order to keep readers of the Journal in touch with the latest developments in scientific instruments and light machine tools, the Editor would be glad if all manufacturers of such instruments or tools would keep him informed of all new devices or important improvements in their productions as soon as they appear, either by sending him catalogues, pamphlets or circulars concerning them, or in the case of important developments, by letting him have concise special descriptions of their construction and performance.

WEAR AND LUBRICANT TESTER

C. Baker, 244 High Holborn, London, W.C. 1

In this wear and lubricant tester, designed by Mr R. L. Smith, there are three important features: these are (*a*) a 1 cm. hardened steel ball is used as a wearing member, giving a spherical impression; (*b*) in addition to the usual period test, the load may be automatically applied intermittently to the metal specimen under test; (*c*) alternatively, provision is made to give automatically actual stopping and starting under load, a condition often met with in actual practice.

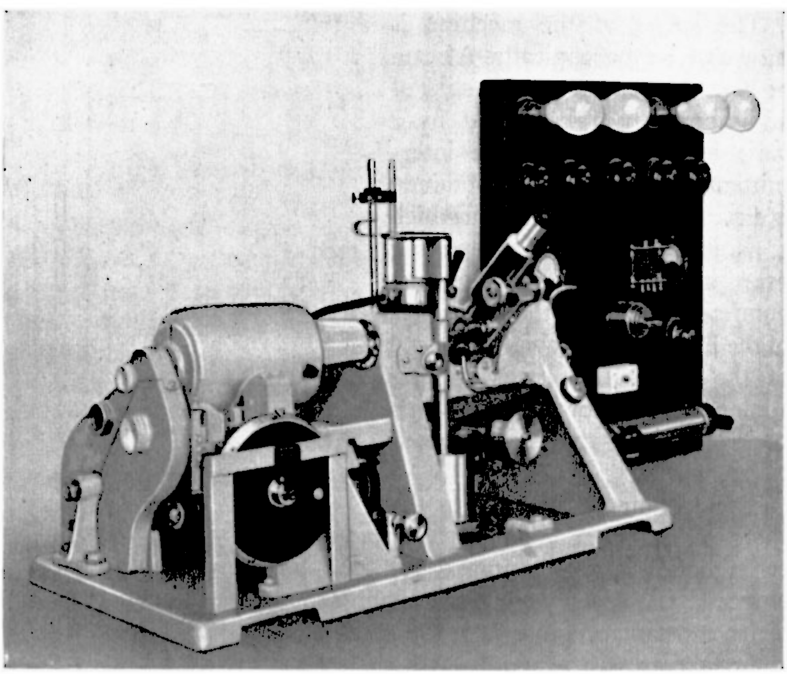

Fig 1. The Smith wear and lubricant tester

The machine has therefore been developed with the object of producing a sound, reliable means of inspecting and investigating the abrasive or lubricating qualities of metals and lubricants. It is stated that the conditions of the test can be controlled in such a manner that they represent the conditions called for in practice. The machine is supplied with numerous simple automatic devices which enable variations in the type of test to be performed in order to suit any particular requirements. The test may be conducted for any pre-selected period of traverse, after which it is automatically terminated; close personal attention during the test is thus unnecessary.