A NOVEL ENGINE FOR DIE-SINKER'S USE.

In the making of dies, perhaps the greatest difficulty is experienced in finishing. Riffling-files fail to touch the spot properly; specially bent files are equally inadequate; and even the ingenious expedients to which the experienced die-sinker resorts fail. Like most manufacturers who are makers of dies, the S. S. White Dental Manufacturing Co., Chestnut Street corner Twelfth, Philadelphia, Penn., have found it more than usually expensive and arduous to finish dies properly. The company determined, after many special tools had been tried, to use a modified form of its dental engine, the exceedingly flexible working arm of which seemed well adapted to the work of die-sinking. The trial proved a complete success; no trouble whatever was experienced in quickly reaching and finishing any part of the most intricate dies. Further experiment finally culminated in the manufacture of an engine by means of which the die-sinker is enabled efficiently to perform the most difficult work in this art.

In its general construction the machine is an S. S. White dental engine modified and strengthened to meet the requirements of the die-sinker. The main feature of the whole apparatus is the ingenious arm employed, which is a power shaft perfectly flexible, revolving as freely as a straight shaft, so that the full power is transmitted to the working end. This highly flexible arm consists of a tempered steel wire cable, so wound that it maintains its tension without straining or uncoiling, rigid ends being provided for the attachment of a pulley, hand-piece, and tool-holder. A woven sleeve protects it throughout its length.

Two such arms are employed, the one (used for light work) for carrying tools whose shafts are 0.092 inch in diameter; the other (for heavier work) driving a coarse grinding wheel 1 3/4 inch in diameter and 1/4 inch face, or a cutter or drill in steel to about 1/8 inch diameter. Since the threaded connection for the bench stand are interchangeable, either arm can be quickly substituted for the other.

A convenient holder for the hand-piece is formed by a forked rest secured to the engine stand. At the opposite end of the rest is a lug which engages the pulley and acts as a clutch when the hand-piece is in the rest, thus preventing the arm from being thrown out of its place by the accidental starting of the engine.

In the making of many dies, after the milling-cutter and chisel have been used, much finishing remains before hardening, which, heretofore, could be accomplished only by means of riffling-files and emery sticks. It is at this stage of the work that the engine saves time and labor. In correcting the distortions caused by hardening and tempering, and in quickly removing the wrinkles formed in many drop-forging dies, without drawing the temper or even taking the die from the drop, the flexible arm is also exceedingly serviceable.

ELECTRICAL TOP AND MOTOR.

BY HOWARD B. DAILEY.

Although slow in finding place among the world's important commercial utilities, static electricity has long occupied in experimental physics a realm of peculiar and fascinating interest.

Very beautiful are many of its phenomena, and especially striking are some of the effects of electrical attraction and repulsion, those mysteries of nature, whose early manifestations were the basis of the first historic electrical experiments. The apparatus here described furnish most pleasing illustrations of dynamic action within a static electric field, and in a novel manner exhibit these subtle forces at work.

The static electric top is an experiment of singular beauty, and well repays the amateur for the slight labor its simple construction entails. The top proper is in a disk of stiff mica, 4 5/8 inches in diameter, mounted between two small buttons of wood or vulcanite upon a short piece of stout knitting needle. The lower end of this steel spindle, which is sharp pointed at both ends, projects nine-sixteenths of an inch below the disk; and rests, when the instrument is in operation, in a little indentation worked with the point of a file in the upper end of a vertical glass support rising from the center of a mahogany base. For the sake of ornament several concentric cir-

lar stripes may be painted upon the top with a solution of red sealing wax in alcohol.

The disk, whose edge should be made to run true, must be carefully balanced, if necessary, with a bit of wax, attached to its surface. A second insulated standard, seen at the right in the figure, carries a gilded wooden ball, 1 1/2 inches in diameter, fixed at a distance from the central support just sufficient to avoid contact with the top's edge in its rockings to and fro. A brass wire, shown at the left, rises from the base and presents a sharpened end to the edge of the top at a point distant from the ball about one-third the circumference of the disk; the wire being curved well out away from the top's lower side and made to approach its edge in a horizontal direction. Finally, at the top

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of the central glass pillar on the side nearest the ball, is fastened horizontally a piece of quarter-inch polished brass rod, with rounded ends and of a length about equal to the diameter of the mica plate. The angular adjustment of this induction rod, whose place is normally about half an inch below the mica disk, has much to do with the speed and stability of the top. Its best position must be determined by experiment; however, that indicated in the diagram will be found nearly correct. *D* is the mica disk; *b*, the electricized ball; *p*, place at which the wire point approaches the disk; *r*, the brass induction rod; the wire point and rod making respectively angles of sixty and seventy-five degrees with a line, *l'*, through the centers of disk and ball. The rotation will be in the direction of *a*.

To start the top, a wire from the negative pole of a Wimshurst machine—from that side which gives the brush effect on the collecting combs—is inserted in a small hole in the ball; the brass wire discharge point is connected, through a binding post on the base, with the opposite side of the generator.* The disk, then held lightly in position for a few seconds with a finger placed upon the pointed upper end of its handle, im-

* This wire, with its binding post, might, with some advantage, be insulated upon a short vulcanite support.

ELECTRICAL TOP.

mediately begins a swift rotation; when the finger may be removed and the top kept in motion by the forces at work within the electrostatic field—will spin continuously as long as electrical excitement is maintained. In working the Wimshurst some care must be taken not to supply too much current, as sparks or brush discharges across the instrument are not desirable; also, to guard against deleterious effects from outside inductive influences, the top should be removed some distance from the plates, conductors, etc., of the machine.

As an interesting variation of this experiment, the neat static motor is shown. A 4 1/2-inch mica disk has the pivot-pointed ends of its spindle fitted loosely into indentations near the tops of two upright posts of polished brass. An insulated brass ball placed opposite the horizontal diameter of the disk as closely as possible to its edge, and the pointed conductor rising from the ornamental brass post attached to the vulcanite base at the right, complete the arrangement. The ball and discharge point being connected respectively with the opposite poles of a static machine in operation, the mica plate revolves at a speed of nearly 2,500 revolutions per minute; and, since the force with which it turns is considerable, light machinery may be driven from the small grooved hard rubber pulley upon the shaft. As either of these experiments is obviously but a modification of the other, the theory of operation is essentially the same for both, and will be readily understood by any one familiar with the principles of electrostatics.

In the case of the top, that portion of the disk opposite the curved wire receives along its edge and adjacent surface strong positive electrization, causing repulsion from the point with simultaneous attraction by the negatively excited ball. Rotation ensues, charged sections of the mica arriving at *b* and yielding up to it their positive electricity, receiving negative instead in a hissing stream of small sparks. Passing by, these parts are now strongly impelled forward by repulsion from the similarly charged ball, until, coming within the attractive influence of the positive wire, the cycle is repeated. The rotation is probably aided in some manner by a current of air—"electric wind"—which blows from point to ball across a portion of the disk in the direction of its motion. The precise nature of the influence exerted by the metallic rod below the disk is somewhat obscure. Its presence seems to effect through some inductive process a certain necessary balancing of the acting forces; without it the top indulges in violent gyrations and soon tumbles off. These instruments demonstrate to excellent advantage the mechanical action of static electricity, and will be found valuable adjuncts to the static machine.

Experiment Stations in Hawaii and Porto Rico.

Congress has appropriated funds for the inauguration of agricultural experiment stations in the islands of Hawaii and Porto Rico. Prof. S. A. Knapp, of Louisiana, has been selected to investigate the agricultural conditions and possibilities of Porto Rico. He went to the island in June, and will study the lines of experimental investigation which should be undertaken there, locations suitable for stations, and the approximate expense of inaugurating and maintaining the work. He will also look into the feasibility of undertaking co-operative experiments with the residents of Porto Rico.

Dr. W. C. Stubbs, director of the Louisiana experiment stations, will make a preliminary survey of the conditions in the Hawaiian Islands. He sailed for Hawaii about the middle of July, and will spend the month of August in the Islands. The conditions there are somewhat different from those in Porto Rico, as a station for experiments in sugar production has been maintained by private beneficence for a number of years. This will probably be a profitable field for investigation in the use and economy of water in irrigation, as probably in no other place has so much money been expended for pumping water for irrigation. In some cases the expense is as high as \$125 per acre annually.

DIAGRAM OF ELECTRICAL TOP.

STATIC MOTOR.