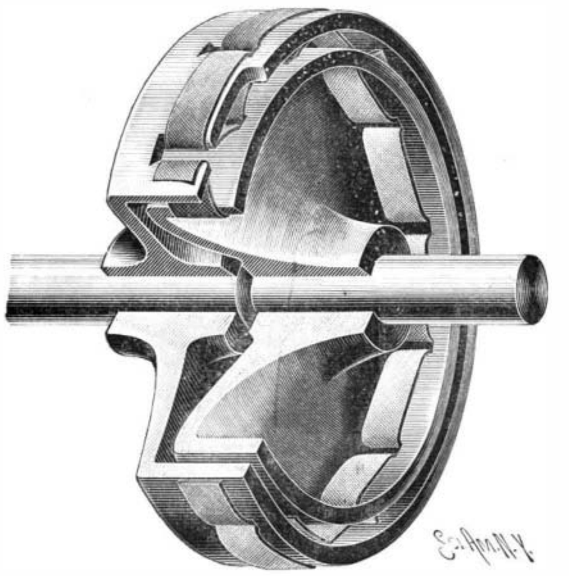
there are 19 flumes whose length aggregates 1,965 feet.

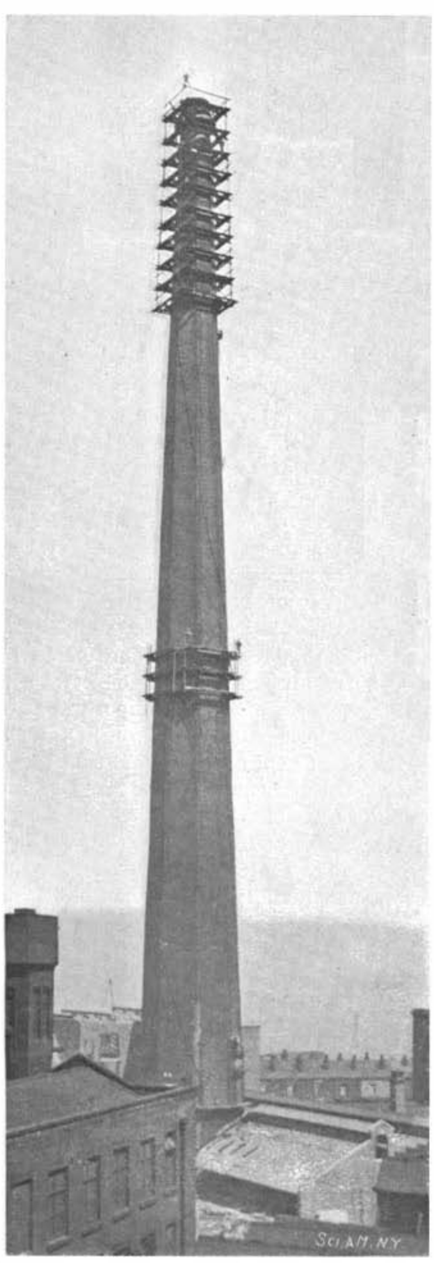
But the most striking feature of the ditch is the manner in which it is carried over the numerous gulches which scar the sides of the great extinct crater. Some of these gulches are very deep, and their sides are nearly perpendicular. To cross them pipe lines are used, not stretched across on trestles, but following the less expensive and more stable method of dropping into the gulches and allowing the water to



THE ZODEL FLEXIBLE COUPLING.

flow on the principle of the inverted siphon. Of these siphons there are twelve along the line of the ditch, all built of quarter-inch pipe, 44 inches in diameter. Their aggregate length is 4,760 feet, or nearly one mile. The largest of them crosses Maliko Gulch, a gash in the slope of the volcano which stretches nearly from the summit to the sea, and which is 350 feet deep and less than a quarter of a mile wide. Across this gorge it seemed next to impossible to carry a siphon, but Engineer E. L. Van Der Neillen, who planned the ditch and carried it successfully to completion, succeeded in doing the work. A photograph taken a week before the completion of the ditch is published with this article.

The completion of this great canal, which has been named the Lowrie Irrigating Canal, after the gentleman who conceived it and pushed it to a successful



SECOND TALLEST CHIMNEY IN ENGLAND—HEIGHT, 367½ FEET.

finish, marks a new era in Hawaii. By it have been demonstrated the possibilities in bringing water from distant spots in the rain belts, of which each of the islands boasts, to the comparatively dry regions which constitute a great portion of the area of many of them. The Lowrie Canal cost $250,000, but it will mean rich returns to the stockholders in the plantation which it supplies with water; and other plantations all over the group will doubtless emulate the example of the enterprising manager of Spreckelsville and put in similar irrigating canals. WADE WARREN THAYER.

THE ZODEL FLEXIBLE COUPLING.

The firm of Escher, Wyss & Company, of Zurich, Switzerland, made a fine exhibit at the Paris Exposition of engines, refrigerating machinery and paper-making machines. Among the novelties which were shown by them was the Zodel flexible coupling, which is extensively used on the Continent for the direct coupling of dynamos, turbines, etc. Two disks provided with flanges are secured to the ends of the two shafts which are to be coupled. The flanges, one of them lying inside the other, are perforated by a series of slots through which is threaded a leather or a cotton belt, so that the short stretches of belt lying between the flanges have a nearly tangential position, so that they effectively transmit the tangential driving effort without waste tension in the belt. The Engineer, from which we derive our information, states that the coupling appears to work smoothly, and the belt is said to have a long life in it.

A SIMPLE METHOD OF BROACHING BRASSES AND BEARINGS.

The brasses or bearings used on car-journals are ordinarily turned on an engine-lathe—a process which requires no little time and some skill. A machine has been patented by Mr. Jason A. Baker, of 1505 Liberty Avenue, Houston, Tex., which forms these brasses and bearings at a single stroke, and which is so far automatic that the operator has merely to control certain water and air-pressure valves.

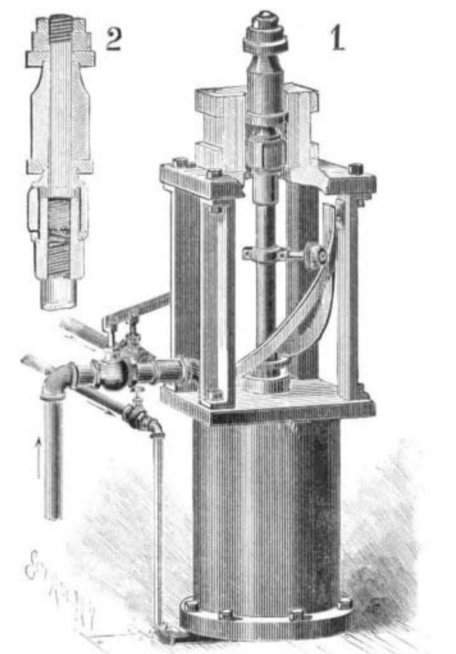
The machine comprises a cylinder containing a piston driven on the down-stroke by water-pressure, and on the up-stroke by air-pressure. The piston-rod at its upper end carries a broaching-head comprising two circular cutters separated by a collar, so that first the lower cutter and then the upper cutter passes through the brasses on the down-stroke of the piston. The brasses or bearings are therefore cut, contrary to the usual method, at a single stroke. A centering-ring is employed to hold and center the brasses while they are cut. In addition to its reciprocating movement, the broaching-head has a turning motion imparted by an arrangement consisting of an arm secured to the piston-rod, which arm carries a roller traveling on a spirally-arranged track. When the piston moves down, the roller in traveling on its track turns the broaching-head. If it be desired to reverse the movement of the piston-rod, the arm is adjusted so that the roller travels under a second track extending in a direction opposite to that of the first.

The upper end of the cylinder is connected with a water-supply pipe, and the lower end of the cylinder with a valved air-pressure pipe. An outlet pipe leads from the water-supply for the escape of the water from the cylinder, the valves of these two pipes (serving respectively to regulate the inflow and outflow of water) being controlled by a common lever. The motor employed is actuated solely by water-pressure.

THE BUILDING AND REPAIRING OF TALL CHIMNEYS.

The building and repairing of tall chimneys offer engineering problems of considerable magnitude. One of our engravings represents the repairs to the second tallest chimney in England, and our other engraving shows the novel staging used in the construction of a chimney built by the Plume & Atwood Manufacturing Company, at Thomaston, Conn. The latter chimney is 150 feet high, 15 feet in diameter at the base and 9 feet at the top. It is built of red brick with an inside flue of firebrick which reaches quite to the top. The staging was designed by Mr. J. M. Chatfield, of Thomaston, and is held in place by two bands which are made in eight sections. Each section, which is 38 inches long, is constructed of two parallel pieces of iron 38 inches long, 3 inches wide, and a quarter of an inch thick, fastened horizontally 9 inches apart, to five wooden uprights or staves 18 inches long and 1¼ inches thick which come into direct contact with the chimney. To each end of the flat iron pieces is riveted one leg of a piece of angle iron; the opposite legs, at right angles with this band, are fitted with long bolts connected with the adjoining section in like manner. The bolts are threaded throughout their entire length, 30 inches, and serve to hold the section together, and tighten or loosen the band around the chimney, allowing the space between the sections to decrease or increase as the band is moved up or down the chimney.

To each section in the upper band is bolted a wooden bracket. The upper end of the bracket is 10 feet long and extends below the lower band. Blocks prevent the uprights from moving sideways; these blocks are fastened to the band, forming a groove in which the upright slides as the band is moved up and down. The horizontal members of the brackets extend out 5 feet at right angles to the uprights and are raised a



A MACHINE FOR MAKING BRASSES AND BEARINGS.

few inches above the upper band. On these eight brackets rest the planks of the staging proper. The bands are raised and lowered by means of eight screws, one in each section; each screw is 9 feet long and is fastened at the upper band by a collar held between two pieces of angle iron which are bolted to the upright of the bracket. At the lower band the screw, which is threaded 6 feet of its length, passes through a nut held between two other pieces of angle iron which are bolted to the flat iron pieces in that band. The upper band is tightened around the chimney by means of the bolts; the lower band is then loosened by the same means and the screws turn the nuts at the lower band and press against the top pieces of angle iron and raise the lower band to the desired position. That band in turn is then tightened and the upper one is loosened and the screw is reversed, causing the nuts to press against the lower pieces of angle iron, thereby raising the upper band, to which the brackets and staging are fastened, to its proper position, which is about 6 feet above the lower band. This band is then tightened, and the staging is then ready for use.

Our engraving also shows the neat device by which material is hoisted. The crane arm is bolted to one of the sections in the upper band. The workmen obtain access to the staging by means of an iron ladder which is built into the chimney as the work proceeds.

Mr. James Smith, the well-known steeplejack of Rochdale, near Manchester, England, a description of whose *modus operandi* for the felling of tall chimneys by underpinning was published in the SCIENTIFIC

A NEW STAGING FOR BUILDING CHIMNEYS.