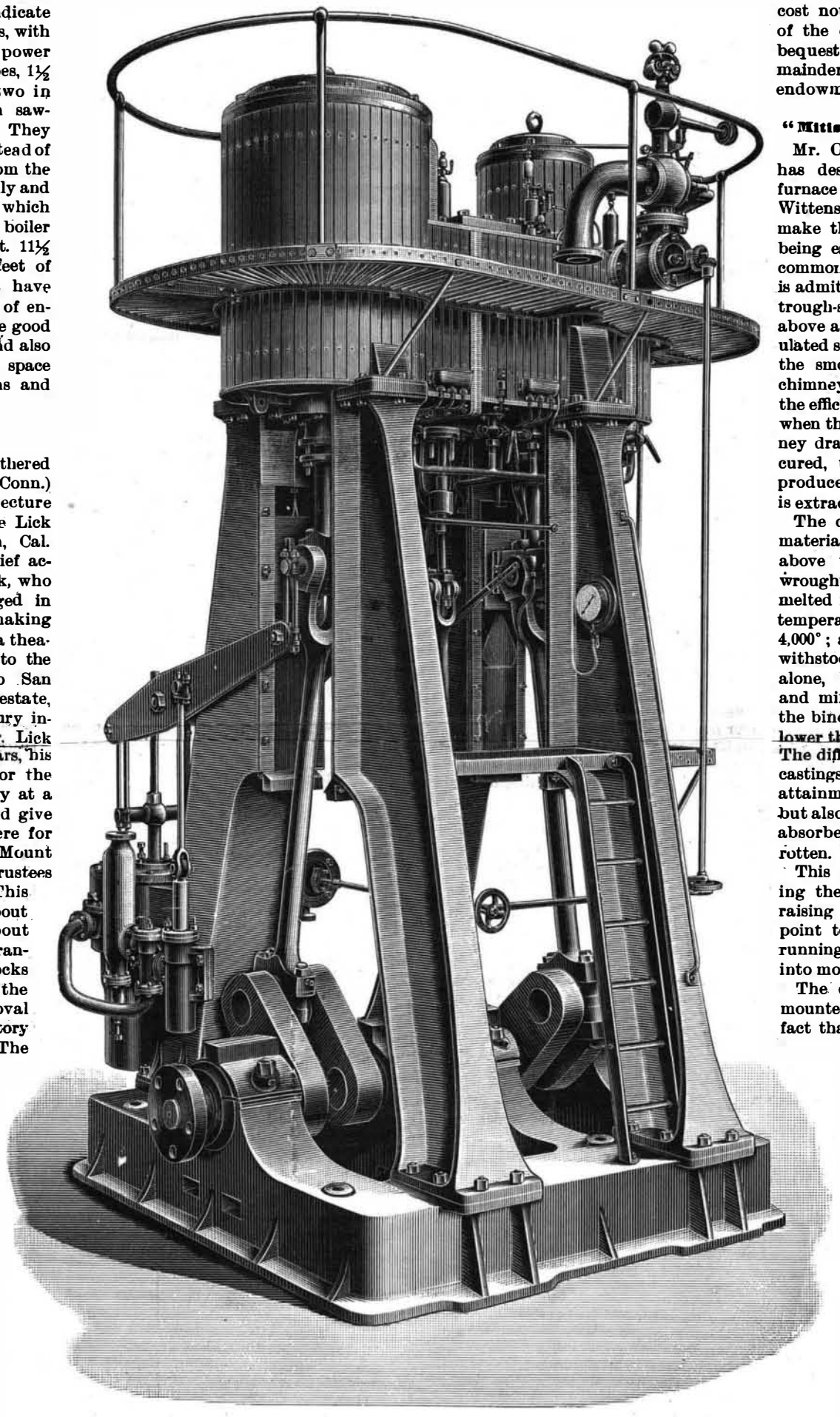
INVERTED CYLINDER MILL ENGINES.

We give a perspective view of a pair of inverted cylinder mill engines constructed by Messrs. Westgarth, English & Co., of Middlesbrough-on-Tees. The cylinders are 15 in. and 30 in. in diameter, with a stroke of 36 in. The high pressure cylinder is fitted with one of Schaeffer & Budenberg's automatic expansion regulating valves. The jet condenser is formed in one of the back columns, and the pump fittings are of gun metal. The crankshaft is 6½ in. in diameter, and is built up.

The engines have been built for the sawmills of Messrs. English Brothers, at Peterborough. They are designed to indicate 250 horse power at 70 revolutions, with a boiler pressure of 90 lb. The power is transmitted by six Manila ropes, 1½ in. in diameter. The boilers (two in number) are designed to burn sawdust and the refuse of the mill. They are of the marine type, but, instead of the flue being carried upward from the smokebox, it is taken downwardly and horizontally below the boiler, which is thus heated externally. Each boiler is 8 ft. 9 in. in diameter by 9 ft. 11½ in. long, and has 540 square feet of heating surface. The makers have been led to advocate this type of engine for land purposes from the good results gained by them at sea, and also from the saving they effect in space and in the cost of foundations and engine house.—*Engineering.*



IMPROVED COMPOUND MILL ENGINE.

The Lick Observatory.

A large audience recently gathered at the rooms of the Bridgeport (Conn.) Scientific Society, to hear the lecture by Prof. David P. Todd on the Lick Observatory at Mt. Hamilton, Cal. He commenced by giving a brief account of the life of James Lick, who in early manhood was engaged in divers occupations, from the making of a piano to the managing of a theater. After acquiring property to the amount of $45,000, he went to San Francisco and invested in real estate, which in a quarter of a century increased one-hundredfold. Mr. Lick died at the age of eighty years, his chief bequest being $700,000 for the erection of a great observatory at a mountain elevation that should give the most favorable atmosphere for astronomical observations. Mount Hamilton was selected by the trustees as being the proper location. This mountain has a summit about 4,500 feet high, and is located about fifty miles southeast of San Francisco. About 45,000 tons of rocks were blasted and removed from the apex, leaving an irregularly oval plateau, upon which an observatory building has been erected. The lands about the mountain, which are set aside for observatory purposes, comprise a government reservation of about 1,500 acres, to which the trustees have added 160 acres by purchase.

As Mr. Lick gave specific direction that the income from his endowment of the observatory should be made useful in promoting science, his trustees made provision for observing the transit of Venus of 1882. The results obtained were found very satisfactory, and Professor Todd showed upon the screen a beautiful picture illustrating clearly the work accomplished. Lantern slides in abundance were used to make plain the lecturer's remarks, although the lecture itself was very comprehensive and unusually clear. Illustrations from different standpoints of all the buildings on the main plateau, the interior of the great observatory, and ground plans of the site and its approach were all highly instructive in connection with the explanations.

The contract for the object glass of the great telescope, which will be the largest and most powerful in the world, was placed with the Messrs. Clark, of Cambridgeport, five years ago. They have just completed the work assigned to them, and the glass has been transferred by palace car to the observatory. The prospective capabilities of the large telescope are exciting astronomers to a state of high tension. They expect to employ a power of 3,500 diameters on the instrument, when the weather is most favorable, and the theoretical distance of the moon would then become about 60 miles. Making due allowance for the unavoidable effects of the earth's atmosphere and other unfavorable conditions, the observer might expect to see the moon much the same as he would without the telescope if it were only a hundred miles away. If at the same time the moon happened to be at its least distance from the observer, about 220,000 miles, and if the objects on the moon were suitably illumined by the sun's light, it is possible that details of its nature might be satisfactorily made out, even although they were no larger than the national Capitol building at Washington.

The location of the observatory in a region which is entirely cloudless during the greater part of the year constitutes an advantage which only those an fully appreciate whose work has suffered serious interruption from the lack of a continuously clear sky. The peak of the mountain stands above the clouds nearly all the time, and a series of pictures were shown, reproducing the startling effect of the sea of clouds.

The means of publication, a most important consideration in the management of a great observatory, has not escaped attention. The legislature of California has shown its entire appreciation of the observatory and its work by the passage of a resolution providing for the issue of such reports, researches, observations, and productions as may come from the institution and be submitted by the Lick trustees for publication. Finally, and most important of all, there is an assured endowment of generous proportions, the income from which is wholly available for the maintenance of the establishment and the prosecution of its work. The considerate management of the trustees will enable them to complete the observatory at a cost not much exceeding three-fifths of the entire allotment of Mr. Lick's bequest for this purpose, and the remainder will constitute the permanent endowment fund of the institution.

"Mitis," or Flexible Iron Castings.

Mr. Ostberg, a Swedish engineer, has described the arrangement of furnace whereby Mr. Noble and Mr. Wittenstro m melt wrought iron and make the so-called mitis castings as being essentially constructed like a common petroleum lamp. Mineral oil is admitted in a stream upon a series of trough-shaped fire bars placed one above another, and the air blast is regulated so as to burn the oil just under the smoking point. The area of the chimney has a great influence upon the efficiency of the arrangement; but when the proper proportions of chimney draught and oil supply are secured, the temperature that can be produced in these petroleum furnaces is extraordinarily high.

The crucibles containing the raw material are placed about one foot above the bars; and 65 lb. of scrap wrought iron—horseshoes, etc.—are melted in from 40 to 50 minutes. The temperature of the molten mass is 4,000°; and this great heat is perfectly withstood by crucibles of good fireclay alone, hard burned, finely ground, and mixed with sugar or molasses as the binding material, which does not lower the fusible point of the whole. The difficulty in making wrought iron castings has hitherto been not only the attainment of the high heats necessary, but also that when fluid the metal has absorbed the furnace gases and become rotten.

This absorption has gone on during the period of superheating or raising the metal from the melting point to that which will permit of running it into ladles and pouring it into moulds.

The difficulty has now been surmounted by taking advantage of the fact that the melting point of alloys is lower than that of the pure metal. Thus, although the melting point of pure wrought iron is 4,000°, if there were only so much carbon in it as would convert it into tool steel, the melting point would be about 1,000° lower, although the carbon is itself infusible. To make mitis castings, therefore, when the pure metal begins to melt, a minute addition of aluminum is made—the actual quantity being only 0·05 or 0·1 of 1 per cent. This addition has the effect of reducing the melting point by 300° or 400°, which is, of course, the same as though the metal were superheated to this amount; the contents of the crucible being reduced from the state of sirup to the fluidity of water. Thus there is no time for the absorption of furnace gases; and the castings as made are, on account of their homogeneity, stronger by from 20 to 25 per cent than the raw material.

THE *Gardener's Monthly* suggests that agricultural colleges assign small plats of ground to such of the students as may desire to cultivate them, and in such way as their tastes or inclinations may lead them. These plats to be supervised or overlooked by some competent person, and reports made at the annual commencement of such as were found to be worthy of special mention.