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GREAT TELESCOPES.

Only eighty miles to the moon, or, rather, the human eye, to all intents and purposes, is brought within the above distance to our attendant satellite, through the annihilation of 160,000 miles of space by the immense refracting telescope represented in our illustration. Its magnifying power, in other words, is 3,000 times, and as the eye naturally receives a beam of light one fifth of an inch in diameter, this instrument, gathering from the surface of its twenty-five inch object glass, will have an illuminating power 15,625 times greater. That is, it will convey that number of times more light into the eye.

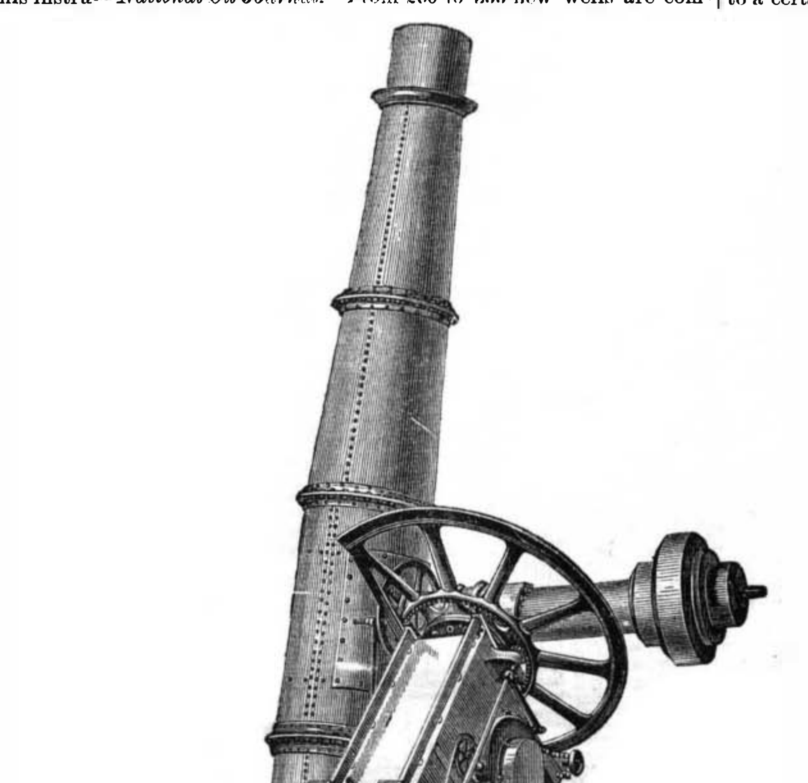
The object glass, now the largest in the world, was recently made in England. It is by far the most difficult part of the apparatus to construct, for it must be without blemish, *striæ* or wavy lines, of absolutely uniform density, and perfectly pellucid. To produce so large a lens, the labor is immense, for, with the increase of power, every defect is proportionately magnified. Even after the glass is cast, its grinding to exact curves and the application of the polish is a scarcely less formidable work.

The tube of this telescope is of steel, of strength sufficient to prevent the possibility of flexure under the great weight which it has to carry. A zinc tube within serves to cut off any currents of warm air which would disturb the cone of light. The instrument is mounted on a pillar, twenty-nine feet high, on which it is adjusted with the nicest precision. Suitable clockwork serves to carry it around in following any heavenly body which is under observation. The entire instrument weighs nine tuns.

The next largest telescope is located in the observatory in Chicago. It was made by Mr. Alvan Clark, and its object glass is eighteen and a half inches in diameter. The two next in size, having objectives three inches smaller, are of German manufacture and are located at Cambridge, Mass., and Pulkowa, Russia.

Though the instrument we illustrate is now the largest in existence, it will not long remain so. The Messrs. Clark, of Cambridgeport, Mass., have, for some time past, been engaged in grinding a twenty-seven inch lens for our Government, which, when complete, is to cost $50,000. The telescope in which it will be placed will, in all probability, be located on some elevated position, or in the astronomical station to be established by the United States Coast Survey Bureau, on the Sierra Nevada mountains. It will be situated at a hight of from seven to ten thousand feet above the sea level, in an atmosphere of great purity and comparatively free from clouds. This great instrument will doubtless allow of observations which will add greatly to our knowledge of physical astronomy.

Perhaps it may be the fortune of our readers at some future period to learn of the construction of the million dollar telescope, to be built under government auspices, the erection of which we recently advocated in these columns. In such a case, instead of being eighty miles from the moon, as we now virtually are, we should reduce that distance to four or five miles. The magnitude of the results which could thus be obtained can hardly be conceived; but the question of the existence of human or other beings in the moon, which, from the times of that veracious scientist, Baron Munchausen, to the present day, has disturbed the mental equilibrium of sensational would-be astronomers, might at least be definitely settled through the convincing agency of direct optical proof.



THE LARGEST REFRACTING TELESCOPE.

Novel Fire Alarm.

Mr. N. M. Booth, Secretary and Superintendent of the Ohio River Telegraph Company, at Evansville, Ind., has lately put a novel fire telegraph and steam signal apparatus into operation in that city.

The telegraph is so arranged that, when the circuit is closed, it pulls the support from under a lever. The lever, being an extension of the handle to a cock, falls and swings back and forth, letting on the steam and cutting it off as it continues to swing. When oscillation ceases, the whistle gives a prolonged scream until the lever is replaced ready for another alarm. This line is only a part of Major Booth's invention, being intended as a signal to the engineers to put on extra water pressure in the water pipes when a fire occurs. On a recent trial a police officer turned the alarm key, when instantly the steam whistle tooted out five or six puffs and then settled down to a long shriek.

Names of Oil Wells.

We have frequently been amused as well as interested at the odd names given to oil wells in the oil regions, says the *National Oil Journal*. From 200 to 300 new wells are completed each month, and to each must be given a name by which it may known by the producers and pipe companies, and we do not wonder that owners should find a dearth of names or resort to those that seem odd. Should the same name be used more than once, much confusion and annoyance would be the result, and many times mistakes would be made that it would be next to impossible ever to correct. We find one man, who evidently thinks much of the game of cards, who has named his wells "High," "Low," "Jack," "Game," "Seven Up," etc. Another man thinks more of such things as "Race Course," while "Reliable" and "Prosperity" and "Calamity" figure very conspicuously with "Faith," "Hope," and "Charity." Not far away, and beneath the "Maple Shade," another, with "Wild Cat," "Black Sheep," and "Devil's Ridge," closely fills up the background, and we might go on indefinitely, but we forbear. "What's in a name," if the well pays?

Air and Steam Engines.

It is well known that the injection of a certain small quantity of air amongst the steam that is to supply a steam engine has been found to produce improved economy of heat to a certain extent. There are obvious causes for this fact connected with the more efficient communication of heat from the fuel to the water and steam. For example the air may be previously passed through tubes which expose a large surface to the fire in addition to that which the steam boiler alone presents, or the air may be itself part of the products of combustion, being freed from dust by suitable processes.

The following remarks are intended to show that according to the principles of thermodynamics the air has a tendency, independently of the communication of heat from the fuel, to increase the efficiency of the steam in transforming heat into motive energy, and to show that it is worth while to test how far this beneficial action can be carried in practice, by the aid of experiments in which a larger proportion of air shall be employed than has hitherto been tried. It is well known that the efficiency of any heat engine is limited by the temperatures between which it works; the greatest possible efficiency, that is, ratio of work done to heat expended between given limits of temperature, being expressed by dividing the range of temperature by the absolute temperature at the higher limit.

In order that this theoretical duty may be realized, it is essential that all heat whatsoever received by the working substance should be received at the highest limit of temperature, and all heat rejected by the same substance given out at the lowest limit; for example, if the air is heated at five atmospheres and cooled at one atmosphere, of absolute pressure, the upper and lower limits of absolute temperature bear to each other the proportion of 1·58 to 1, and the theoretical efficiency is about 0·37. In a steam engine working between the same limits of pressure, the theoretical limits of temperature on Fahrenheit's ordinary scale would be about 296° and 212°, corresponding on the absolute scale to 757° and 673° Fahrenheit, and the theoretical efficiency would be equal to 84÷757=·124. It is easy to see in a general way that in an engine in which the fluid employed consists of air and steam mixed, the efficiency will be something intermediate between the quantities above set down, being less than that in which air alone is employed. The most efficient engine of all, theoretically, would be one in which nothing but dry air was employed. Here we are met by the fact that great practical difficulty has been found to attend the employment of dry air, in particular that it has been found almost impossible to prevent the heating vessel from becoming overheated, and consequently burned. On the other hand, an engine worked with steam alone is liable to fall considerably below the calculated theoretical efficiency. There is a certain proportion of air to steam which enables all the heat required for raising the temperature to be produced by the compression of the air, being the surplus over and above that which is required in order to raise the temperature of the air itself, and thus the efficiency of the engine is prevented from falling materially below the calculated theoretical efficiency for steam. In the examples already given, the compression of dry air to five atmospheres would produce a rise of 390° Fahr., while the actual rise required is only 84° Fahr., and without going into a minute calculation of the surplus heat produced by the compression of the air, it may be mentioned as the result of such a calculation that the surplus heat so produced amounts to about three fourths of the whole heat due to the compression, and that by introducing a mass of air at each stroke, equal to about one and one third the mass of feed water employed, the whole heat, necessary for raising by 84° Fahr. the temperature of the air and water, may be obtained by compression of the air alone, to the great benefit of the efficiency of the steam.

The above example appears to be sufficient to show that it is worth while, in what have lately been called aëro-steam engines, to carry experiment further than has hitherto been done in the direction of the introduction of large quantities of compressed air.