### PROPOSED ADDITION TO THE HARBOR WORKS AT DOVER, ENGLAND.

The Admiralty Pier at Dover, well known for its immensely solid construction, has been found to be so convenient a landing and embarking place for continental traffic that another work, leaving the shore from the other end of the town and, with the work already constructed, inclosing a harbor of refuge of 350 acres extent at low water line, has been proposed by Colonel Sir Andrew Clark. We publish herewith a bird's eye view of the town, with the suggested improvement.

The trains of the two railroads, whose depots are seen on the left in the engraving, at present run on the top of the solid masonry of the pier, allowing passengers to pass immediately from the cars to the steamboats; but the new plan suggests the construction of an inside landing place, with covered platform for loading and unloading trains, also shown in the view (for which we are indebted to *Engineering*). This would improve the accommodations considerably, as the place of arrival and departure would be protected from the very strong tide of the Straits and from the sea, which runs at times at great hight. But the more important proposition is the other arm of the work, quitting the eastern part of Dover and proceeding seawards in a southsouthwesterly direction for a distance of 3,800 feet. It then turns westward and continues further for 2,200 feet, stopping at a point 600 feet from the end of the Admiralty Pier. This 600 feet width is the entrance to the harbor.

The pier already in progress has been twenty five years in hand, the work being executed in stone facing, the inner filling being of concrete. The new work is to be entirely of the latter material, and it is proposed to use convict labor in the construction. By modifying the design of the structure now being erected, which is another feature of Colonel Clarke's design, it is believed that the whole can be completed in five years.

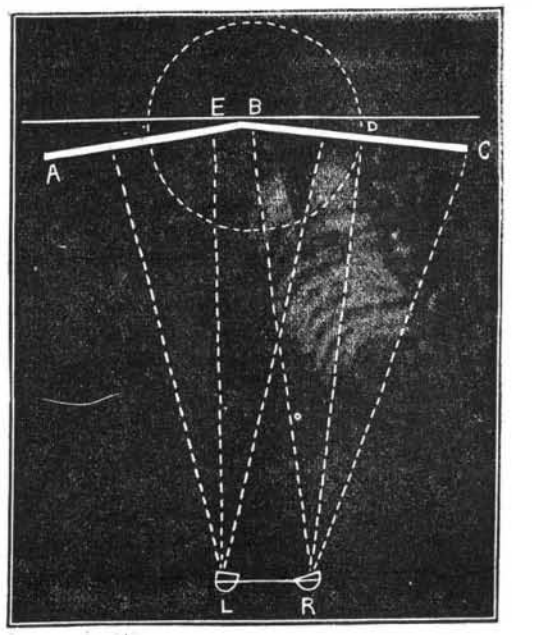
The value of a harbor of refuge at Dover will be understood when it is known that the South Foreland is but five miles east from the town. This promontory is frequently the scene of most tempestuous weather; and when the wind is northeasterly, whole fleets of vessels lay there unable to round it, suffering very considerable damage. The work would also add to the attractions of Dover as a marine resort, its beautiful surroundings and bracing air having long made it renowned in Europe. It has a very handsome façade of residences, and the commercial part of the town lies well protected by the South Downs, which almost surround it and through which the two railroads enter by long tunnels. Immediately to the left of our picture is the cliff whose appalling hight is so well described in "King Lear," from which it obtained the name of "Shakespeare's Cliff." A prominent point in the view is Dover Castle, which was built by Julius Cæsar after his landing in Great Britain, 1,930 years ago. Thirty-five acres of ground are covered by this work, which is still a redoubtable fortress, now armed with the best modern artillery. The hights on the west side of the town are surmounted by a very large fortification, with barracks, bombproof magazines, etc. But the harbor of refuge, open to all nations, will be a more beautiful and probably more useful example of the powers of modern science than either ancient or modern strongholds.

THE Chemical Society of Berlin have decided to erect a statue of Liebig, either at Darmstadt, Giessen, or Munich. Subscription lists have been opened throughout Germany in order to secure the necessary funds.

### New Stereoscope for Large Pictures.

In the accompanying diagram I have attempted to indicate the construction of an instrument, available for pictures of large size. The two halves of each stereogram are to be mounted on pieces of cardboard, joined together by leather, cloth, or other flexible material, so that the whole may be shut up like a book, with the pictures face to face.

Let L and R indicate respectively the positions of the left and right eyes of the observer, and the lines, A B and B C, the boards or frames upon which the folio pictures rest. The perpendicular pencils of light from the center of each picture now reach the eye pieces in converging lines, which, by




transmission through the prisms, may be rendered parallel or divergent to suit the particular theory of binocular vision approved of by the constructor of the instrument. I may observe that parallelism is the idea which accords best with my own apprehension of the subject. After transmission through the prisms, the rays are finally passed through suitable magnifying lenses, whose centers, I apprehend, may be employed for the purposes of vision. The eye pieces themselves may be constructed of single pieces of glass ground to a spherical curve on one side (the outside), and to the refracting angle on the other.

To determine the angular inclination of the pictures to each other, find, first of all, the point, B, at which their juncture shall be placed. Then, with a radius equal to one half the width of the pictures to be shown, describe the circle seen in the figure. From each eye piece draw a line touching the outside of the circle, and from the center of the circle draw other lines through the points of juncture. The result is the angle for the pictures. In the right hand portion of the figure I have drawn lines showing the actual direction taken by the rays in passing from the picture to the prism, and in the left the virtual or seeming direction of those rays.

The advantages I claim for this form of lenticular stereoscope are:

1. That it admits the use of pictures of any size.
2. That those pictures are not mounted on separate sheets of card.
3. That they are, as heretofore, right handed, and therefore capable of production by any perfected process.—*D. Winstanley, in British Journal of Photography.*

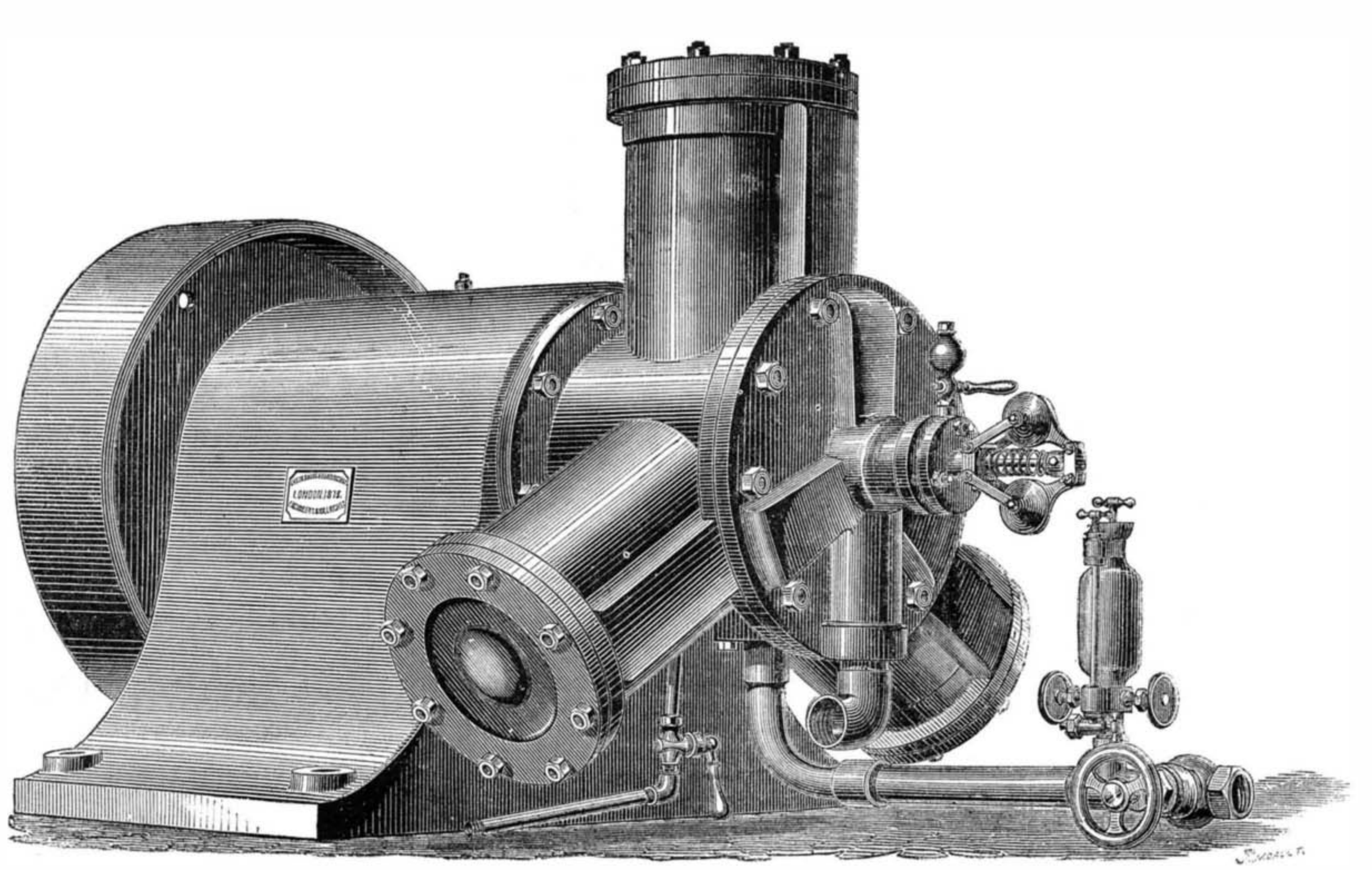
### THE THREE CYLINDER ENGINE.

We published sometime ago a sectional view of an engine constructed with three cylinders, placed at angles of 120°, and three pistons operating one crank. We give herewith a view of the complete machine, from which it will be seen that the dead centers are overcome and the fly wheel is dispensed with; and a very high piston speed, to the attainment of which engine builders are now specially directing their attention, is at once made possible. Two thousand revolutions per minute, without jar or disturbance, are said to have been reached by this engine, which is the invention of Messrs. Brotherhood and Hardingham, London, England. The cylinders are arranged, says *Engineering*, to which we are indebted for our illustration, around a central chamber with which they communicate, the whole being cast in one piece. The crank pin, after passing through the connecting rod eyes, is prolonged, and fits into a hole in a rotary slide valve, which it thus actuates. The valve has a steam and exhaust port, which are alternately placed in communication with the passage belonging to each cylinder. In working this engine, steam is admitted to the central chamber, and exerts an equal pressure on the inner sides of the three pistons. Thus far the machine would be *in equilibrio.* But steam now passes through the slide valve to the outer side of one piston, thus throwing that piston into equilibrium but the three pistons collectively out of equilibrium. In other words, it renders the pressure on the inner sides of the other two pistons effective. A rotary motion of the crank and slide valve ensues, and the other pistons are alternately operated upon in a similar manner, the constant effective area for pressure being that of a piston and a half. If steam be not admitted during the whole of the inward stroke of a piston, it follows that the piston is not entirely thrown into equilibrium, and the crank has to assist it in the return stroke. The effect is of course equivalent to working steam expansively in an ordinary engine.

It will now be seen, and this is the most important feature of the engine, that a piston, when moving in one direction, pulls the crank, and when moving in the other, is pulled by the crank. Hence, the strain on the connecting rod is always a tensile one. No knock can therefore take place in the connecting rod eyes on the alteration in the direction of the piston's movement; so the fit may everywhere be quite loose, and, instead of constantly adjusting brasses, it is only necessary to renew a few bushes when excessive wear has taken place. Similarly the slide valve is free to slide on the crank pin, and adjust itself to its face as wear takes place; and the back of the crank disk always maintains a steam-tight joint in the same manner. The lubrication at first proved a source of difficulty, but it is now amply secured by the simple addition of an impermeator to the steam pipe, the oil being carried by the steam as a medium to all the working parts.

In the course of experiments it was found that few metals would stand heavy work in high pressure steam under such conditions. Ultimately hard phosphor-bronze bushes for the connecting rod eyes, working on a hardened steel crank pin, were adopted, and these are found to last a long time without any oil whatever, the steam affording of itself sufficient lubrication for these two metals.

An average speed of only 300 feet per minute for the pistons is said to give a very high indicated horse power in pro



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