IMPROVED COMPOUND CONDENSING PUMPING ENGINES.

We present herewith perspective and outline elevations of the improved compound condensing duplex pumping engines, manufactured by the Knowles Steam Pump Works, of Boston, and New York. As will be seen, the perspective view shows an engine with independent air pumps and condenser, while the outline elevation shows one with the air pumps, condenser, feed pump and heater, and steam traps, etc., attached.

THE INTEROCEANIC PROBLEM AND ITS SCIENTIFIC SOLUTION.

[Abstract of an address before the American Association for the Advancement of Science, at its 35th annual meeting, Ann Arbor, Mich., August, 1885, by Elmer L. Corthell, C.E.]

By the advancement of Science, and particularly through the means furnished by the Science of this age it is possible to solve this problem in such a way as to meet the demands of Commerce. The wants of man increase, but his power to supply them increases also.

The ocean steamship, the locomotive, the telegraph and the ocean cable have accomplished wonders in bringing together the scattered countries of the earth, but this very accomplishment has brought greater demands upon Science.

It should be a source of pride to the representatives of Science, that it can furnish the means for overcoming an obstacle that turned back both Columbus and Cortez from their earnest search for the Pacific countries.

The most serious obstacles to commerce have yielded to the science of man—all except this one that lies here in the centre of the world—a narrow neck of land uniting two continents and thus presenting an unbroken barrier, extending from the north nearly to the south pole.

In order to fully appreciate the necessity for Interoceanic communication, information is needed on all subjects that affect humanity—Industry, Commerce, Politics and Religion. We must know what each country has for the demands of the others and by what routes the products of the world move. The more we investigate the more will it appear that free interchange is seriously hampered by the Interoceanic obstacle before us.

The Transcontinental Railroads have crossed the continent, but they cannot afford to carry many bulky products.

Still less can the Panama Railroad do it on account of the great expense of transshipment. The cereals of the Pacific still go around Cape Horn on a voyage of 16,000 miles, and other agricultural, and also manufactured products, traverse routes equally long and expensive. Our manufacturers, who turn out over five billion dollars worth every year, exporting only two per cent.—cannot participate in the two billion dollars worth of trade of the far Pacific countries.

The goods cannot go Eastward, for there they must compete with cheaper goods, going on shorter routes.

For four hundred years the attention of the world has been turned towards the American Isthmus. Governments, companies and individuals have examined, surveyed, planned and projected, but nothing has resulted. Our own statesmen, from Jackson to Arthur, have urged the importance of and necessity for this work.

The many routes examined have resolved themselves into three only, viz.: Panama, Nicaragua and Tehuantepec.

Asstming it practicable to make the crossing at Tehuantepec, no one will question the assertion that it is much the most advantageous route. Its great commercial advantages are evident from two facts, first,—it lies nearer the axial line of productions, which may be assumed as passing through Hong Kong, San Franscisco, New York and Liverpool. Second,—the nautical conditions are much more favourable than at the other locations, calm and baffling winds prevailing on either side of the Isthmus near its southern end, making it almost impossible for sailing vessels to navigate in those waters.

The true scientific method is that one which performs the work of transferring ships from one ocean to the other most promptly and most economically. This method is the Ship Railway.

This method is, in general, to lift the vessel from the water by well known means and transport it 134 miles over the country and place it in the opposite ocean by the same means. The details embrace a lifting dock, with a spstem of hydraulic rams, so aaranged as to hold up and perfectly distribute the weight of the vessel, and a system of carriage supports conforming to the position of the rams and actuated by them, so as to be placed under the hull of the vessel.

The roadbed wtll be built of the best materials at hand, which the surveys show can be found on the whole length of the railway. The superstructure will be long steel ties on which will be laid heavy steel rails, weighing about 100 pounds per lineal yard. Powerful locomotives will haul the ships across the Isthmus. The locomotives built recently by the Baldwin Works are sufficiently powerful to do this work. These engines weigh when ready for service 102 net tons and their capacity is 3,600 gross tons on a level. Three of these will haul the maximum load of 5,650 tons at fifteen miles an hour on grades up to twenty feet to the mile.

The railway follows a succession of broad valleys, so that it is often necessary to make changes of direction to avoid the heavy excavations that would be required by employing the ship railway curves of twenty miles radius. These abrupt changes of direction are made by great floating turn-tables which float in segmental basins around a central pivot, though they do not rest on anything but the water, which is pumped into the surrounding basin from the turn-table to give it flotation.

The harbours, both on the Gulf and on the Pacific, are excellent and commodious and the entrance to them can be deepened with small expense.

The large number of practical experts who have carefully examined the plans have given unequivocal testimony to the entire practicability of the method and also to its economy.

This is not the only Ship Railway that has been projected. They have been designed for Honduras, Egypt and Nova Scotia. The time is passed when it is necessary to prove to practical men the feasibility of the Ship Railway method, therefore the next important subject is taken up more in detail, viz.: the superior economy of the ship railway over the ship canal, both in construction and operation.

The history of canal and rail transportation, going back to the earliest days of railways shows how quickly the latter took the lead in every respect, economy as well as despatch.

Experience and experiments, both in this country and England, are found in abundance to prove this.

If we compare ship canals and ship railways we find a greater difference in favour of the latter. The restricted channel in which the ship moves in a canal is the cause of the greater expense required to push the vessel through the water. The boat or ship practically creates a hill up which she is continually climbing; the faster she is urged through the water the steeper is the hill and the greater is the power required, which increases as the cube of the velocities.

An historical examination of the actual cost of moving freight by canal and by railroad shows that the latter is far in advance of the former in economy, and if the time lost on the canal is taken into account there is a still greater difference.

Some of the more importont details of the comparison are here given. The constant improvements in railroad transportation have reduced the cost of hauling to 6-10 mill per ton per mile.

The load has increased from 20,000 pounds to 60,000 pounds in the last ten years, while the weight of cars has only increased 2,000 pounds. The increase of eapacity in cars and power in locomotives, the introduction of steel rails and better system in operation, are the principal causes of the cheap and effective transportation of the present day.

Now, carry out these tendencies to their legitimate extent, as they will be in the Ship Railway; instead of 15 tons the average, or 30 tons the maximum, moving on two rails, put on 1,800 tons, moving on six rails, and then with great concentratev motive power, the freight willl be hauled for 2-10 of a mill per ton.

Then, compare speeds; two miles on barge canals is the economical and average speed, one mile per hour on ship canals is the customary speed, and not over two miles on the Suez canal.

On railroads it is 15 to 20 miles and on the Ship Railway 10 miles. The relative cost of transporting a ton of freight on a cnnal by steamer and in the free waterway of the ocean is as six to one. The total cost of docking and hauling from ocean to ocean on the Ship Railway will be 12 cents, but the cost of steaming the Nicaragua Canal will be 60 cents.

The immense cost of construction and maintenance of the canals, excavated, as the Panama is below sea level, through a