

without any injury to the operator. Flights from higher elevations are to be carried out, but for these the aeroplane is to be provided with a tail piece, which it is anticipated will enable the machine to be more easily controlled.

During the next few months, also, the first trials with the dirigible airship invented by Col. Templer, the head of the war ballooning department, are to be carried out. The inventor has been engaged upon this aerostat for several years past, and has been assisted in his efforts by the War Department. The design of this aerostat follows the usual lines, comprising a cigar-shaped gas vessel 140 feet in length by 25 feet in diameter at the center. Its capacity is about 70,000 cubic feet of hydrogen, and the lifting power is over 6,750 pounds, though the structure itself weighs 1,200 pounds. It is most strongly constructed, the material of the gas envelope being of great thickness, so as to resist tearing and cracking. It is ribbed diagonally and inclosed in a network of fine cord. So stoutly is the envelope constructed, that when inflated the balloon is as solid as a football, and one can walk over it without making the slightest indentation.

Forty feet below the gas bag is suspended a light wicker frame-work shaped like a whaleboat. This carries the 40-horse-power gasoline motor sets, which are of special type, and the disposition of which is carried out upon novel lines. At either end of the frame-work are placed the propellers, the experiments with which show that in calm weather a speed of twenty miles an hour should be attained. The steering of the airship is effected upon novel lines. The construction of this vessel has been carried on with great secrecy in a house specially provided for the purpose. The vessel is, however, now completed, and the trials will take place at the first favorable opportunity. The vessel has been three years under construction, and the inventor has been able to eliminate those features which experiments by other inventors during this period have proved to be either unsatisfactory or useless.

The German military department has also decided to exploit the subject. The work, however, will not be carried out by the government, but by private enterprise, a company having been especially incorporated in Berlin under the influence of the Kaiser for this purpose. The object of this company will be to examine and test the various airships constructed in the anticipation that one suitable to military requirements may be discovered.

#### CANALS AND RAILWAYS IN INDIA.

BY L. H. YATES.

Some important facts and figures relating to the respective values of canals and railways in India were laid before the Society of Arts, London, quite recently. Mr. R. B. Buckley, C.S.I., wished to point out that there ought not to be any rivalry between the two modes of transit, when rightly and fairly considered, and others who spoke after his paper had been read indorsed this opinion. Both methods are necessary for the full development of a country, and both tend to increase the total volume of trade. The point where friction arises in India is that the government readily grants free land to the railway companies, and guarantees the payment of interest on their capital outlay, while the navigation companies can obtain no help at all, and, save in a few instances, the government is unwilling to spend anything on maintaining even the original great waterways.

Making a few comparisons between railways and canals, with reference to their profit to the state, the reader of the paper pointed out that the Bengal Central Railway, since its opening in 1881, has been worked at a gross loss of £400,000, after the guaranteed interest of 3½ per cent has been paid. During the same period, the Calcutta and Eastern canals, taking interest at the same rate, had worked at a profit to the state of £25,000. "This," said he, "is a fair case in which a canal working side by side with a railway has held its own against competition, and the example gives force to the contention that it is to the interest of a country that money should be spent on navigable waterways." He did not grudge the expenditure of 235 millions on the railways of India in the last half century, but the five millions spent on her waterways had been totally inadequate and disproportionate. The Assam-Bengal Railway provides another instance of unequal treatment. The trade which passes between Bengal and Assam is, next to the domestic trade of Bengal itself, the most important of the whole country, and roughly speaking, one-third goes by rail and two-thirds by water. The railway runs through from Chittagong to Jhat and Dibrughur, and will in a short time be connected with Calcutta. While it is of great benefit and convenience, it is worked at a heavy loss to the state, though constructed and worked by a company, with a guarantee of 3 per cent interest payment. The capital expended by the end of 1904 amounted to £8,400,000, and after meeting interest charges the loss on the working of the line was in 1905, £93,000; in 1900 it was £200,000; and in 1904,

£270,000. "This," said Mr. Buckley, "is an example of the price which the state pays from the general revenues, for benefits which the railway is supposed to confer."

The Honorable East India Company was the first to organize steam traffic on the Bengal waterways, and so far back as 1834 the business had become a very profitable one, and by then a regular line of steamers was running from Calcutta to Allahabad. Now the traffic is worked by different companies, with large fleets of steamers and flats. These companies have no guarantee on their capital and receive no contribution from the state toward the payment of their interest, but during the years in which eight millions sterling have been spent on the construction of the Assam-Bengal line, the only large improvement here made, that on the Bhil route, has cost £50,000, and this brought in last year a direct net revenue of about £2,500, or 5 per cent on its cost. No doubt the returns from the railway will improve in time, and the reasons which determined its construction were, perhaps wisely, largely independent of its financial success, but the marked difference between it and the treatment of the navigation companies has led to much sore feeling, in consideration of their respective returns.

The greater number of the canals in India have, of course, been primarily constructed for irrigation—for the preservation and improvement of agricultural crops. But in a number of cases the main canals have been so constructed that they might be used for navigation as well as for irrigation, and there are three important canals in India which have been constructed for navigation only, with several minor ones of the same class. About one-fourth of the aggregate length of irrigation canals in India has been made navigable. The cost of the purely navigation canals has been about a million and a half sterling. These canals are in immediate contact with the tidal creeks and rivers connected with the Bay of Bengal; indeed, the greater portion of the Circular and Eastern Canal, which connects Calcutta and Barisal in Eastern Bengal, consists of natural tidal channels artificially improved. The Calcutta and Eastern Canal is in many respects a remarkable work, not only in construction, but because it is one of the few instances where the government has itself undertaken to improve it by outlay of money. The canal itself runs generally east and west, while the various channels, or "gongs," as they are called, which are connected with the Bay of Bengal, run generally north and south. These gongs are mostly tidal, so that the general ebb and flow of the tide is more or less at right angles with the line of the canal. The main channels are linked together by an intricate system of cross streams, which intersect the forest of the Sunderbunds in all directions, so that it is always possible to find a way from one gong to another. The canal has, in fact, utilized a system of cross channels between the main gongs to some extent; in other instances artificial cross channels have been made.

It has been maintained that it is at least desirable, if not necessary, to make the trunk lines of an irrigation system navigable, in order that an easy and cheap means of transit may be provided for grain and other crops. It is said that the expense of the additional work is not large, while the convenience to the people is very great. But after going into the question at considerable length, and giving the various causes which make for and against the feasibility of altering the construction from one system to another, Mr. Buckley had reached the conclusion that, taking all things into consideration, the difference of cost between a canal designed purely for irrigation, and one adapted from that for navigation also, is from £1,500 to £2,000 per mile. The profits on navigable waterways are almost solely found on the purely navigation canals. The Orissa Coast, the Calcutta and Eastern, and the Buckingham Canal, bring in more revenue than all the others combined. The obvious reason for this is that the navigation canals follow trade routes, while canals designed primarily for irrigation do not. The latter, when navigable, are useful to the people whose villages are near them, but seeing that, taken collectively, the irrigation systems of India pay 7 per cent on their cost, it should hardly be a matter for objection if in one function they are not altogether satisfactory. On all Indian canals tolls are charged on the boats which use them. It may not be strictly accurate to say that in all countries save England and India the canals are free, but it is true in the main. In France, in Italy, and in Austria-Hungary (with the exception of the Iron Gates Canal) no tolls are levied on navigation; in Belgium and Germany, though tolls are charged, they are very low; in the United States and Canada all are free save those which are not the property of the state. In Egypt tolls were abolished in 1901. It would seem as if the time had come when the government of India should consider the desirability of leaving the navigation of the canals as free as is the traffic of the roads.

It was pointed out by a speaker, after the reading of Mr. Buckley's paper, that the greatest service ren-

dered by the smaller canals was that of providing roads in districts where roads on land were difficult to maintain. Small canals between rivers would serve really important agricultural districts much better, indeed, than roads, and in thus catering for local interests there was a much better prospect for their becoming financially successful than in any attempt to make them compete with rival routes and leading lines.

A writer on the subject of "British Canals" said that where canals do not pay *per se*, they pay by increasing the volume of trade. This was the reason why France and Germany found it profitable to spend so largely on the development of their canal systems, and the trade increase they could show was the proof. In the case of the Manchester Ship Canal, this was strikingly brought out; in itself it was a failure, financially considered, but since its opening and working an enormous number of industries had sprung up which could never have arisen had not the canal been there first, and so it was with many other canals. If a community benefited as a whole by the expenditure made upon these objects, there ought to be no thought of antagonism as to the respective merits of each means; all deserved their share of support, and from the state at least, all deserved equal consideration.

#### MOSQUITO EXTERMINATION.

This is another name for the prevention of mosquito breeding by obliterating the primary conditions requisite for their wholesale production. On the 11th instant the Third Annual Convention of the American Mosquito Extermination Society was held in this city, at the New York Aquarium, and supplemented in the evening by a dinner given at the Union League Club by the President, Mr. Wm. J. Matheson, in honor of several guests and Health Board officials.

At the convention it was shown that much progress had been made toward the abatement of the mosquito nuisance by a greater enlightenment of public sentiment in its favor, as evidenced through recent legislative enactments.

In the State of New Jersey, for example, where only a few years ago the suggestion of eliminating the mosquito met with ridicule, now, as a result of a more universal education and extension of information on the subject, it is reported that the State Legislature has passed almost unanimously an appropriation of \$350,000, to be expended at the rate of \$50,000 per year for the diking and ditching of the great salt marshes lying adjacent to the city of Newark and about the Hackensack River. Legislation is also in process in the New York Legislature to the same end for the benefit of New York city.

The convention adopted what is termed a "Mosquito Brief," stating in simple language the number of species of mosquitoes that inhabit marsh lands and cesspools of the United States—that they can only breed in water; that one mosquito can lay on the average three hundred eggs a day; that the life of one mosquito is about a month. The most dangerous of Southern mosquitoes is the *Stegomyia fasciata*, the natural carrier of yellow fever germs.

At the evening dinner, Gen. Fred D. Grant, of Governor's Island, U. S. army post, gave some interesting reminiscences on mosquitoes and their effect on the health of the army. He related how he had protected a division of the army located on one side of the Rio Grande River, in a southern section of the country, from the spread of yellow fever, which had broken out in a town situated on the opposite bank. He secured funds from Washington to carry out an effective system of screening, and said as a result that not one of his men was taken with the fever. On Governor's Island, numerous relics in the shape of 15-inch-gun shells were inverted, so as to shed water instead of holding it, which had the effect of relieving locally the generation of the insects. Even upright rifle barrels were filled with sand to avoid the collection of water.

Mr. Paul D. Cravath related an interesting record concerning the relation of the mosquito to malaria. On the north side of Long Island, about thirty miles from New York, there were certain valleys and bays where the mosquito was notoriously evident. The areas were located upon a map. Another record was made as to the extent of malaria over this section, from physicians and others, and these areas were placed upon a second duplicate map. This medical map was then superimposed over the first map, and it was found the areas in both cases pretty evenly matched each other.

This record is of special interest to all boards of health, and proves most graphically how it is possible to improve the public health by the prevention of mosquito breeding.

Other interesting remarks were made, showing how marshy places by being reclaimed and converted into public parks could easily improve land valuations and at the same time become a public benefit.

The United States gasoline torpedo is now an official weapon. Its speed is 36 knots.