dations, &c. The wharf at which this pier is to be attached will be roofed in so that all the ambulance may be accommodated on the wharf, and shut in from the street, and that the public may be kept clear.

The fourth pier is to be erected close to Wandsworth bridge; it is to be for the accommodation of patients in that district. This pier will be similar to Blackwall Pier. These piers have been designed by Mr. Adam Miller, and are being erected under his superintendence. The *Endymion* and the *Castalia* are connected by a covered gallery (Figs. 6 and 7), which will allow a certain relative motion of the two vessels.

There are, in connection with the *Castalia*, three steamers for the ambulance service, viz., Red Cross, Albert Victor, and Maltese Cross. The illustrations, Figs. 8, 9, and 10, page 357, represent the latest, the Maltese Cross, built by Messrs. Edwards and Symes, Cubitt Town, E.' This steamer is designed with two hospitals, viz., one aft and one forward, and is made to carry twice as many patients as the first steamer, Red Cross, constructed by the same builders. The dimensions of this steamer are as follows: Length, 132 ft.; breadth, 16 ft. 6 in.; depth, 7 ft. 6 in. The engines are of the oscillating type, with cylinpers of 23 in. diameter, with 30 in. stroke, steam pressure of 40 lb.

The hospital arrangements for the patients in the matter of beds and conveniences, ventilation, &c., have been carried out to the instructions of Surgeon-General Bostock, who has taken a great interest in all the ambulance arrangements. The accommodation for the crew is put forward. The captain and medical officer are placed on deck abaft the boiler casing. The nurses have a berth in each hospital; a store-room is made under deck, right aft the transom for medical comfort. Filtered water cisterns are placed on deck at each entrance to the hospitals; a galley, with a cooking range, is fitted at one of the wings of the paddle-boxes, so that in the event of the ambulance steamer being delayed by fog in the river the patients would have the same comfort as in the hospital proper.

The ambulance steamers have also been designed by Mr. Adam Miller, and the Albert Victor has also been converted by him into an ambulance steamer.

The ratepayers, or the outside world, have not any idea of the great amount of attention and labour given to the asylums of London by the chairman, Mr. Galsworths, and the managers of the Metropolitan Asylums Board. During an epidemic many of the managers simply work night and day. The chairman, Sir Edmund Hay Currie, of the General Purposes Committee, and the members of that Committee, may be seen at work often at midnight, on Sundays, as well as other days, getting patients sent on to the hospital ships.—*Engineering.*

THE COST OF MAKING STEEL RAILS.

The actual cost of producing a ton of steel rails in Pittsburgh is placed by a local paper at $26.83, shown by the following itemized statement:

COST OF PIG METAL.

1 1-10 tons of coke, at $2	$ 2 20
Limestone	50
Ore, scale, etc	10 00
Labor, including repairs	1 75
General expenses	38
Interest	35
Cost of a ton of metal	$15 18

COST OF INGOTS.

1 1-5 tons of metal direct, at $15.18	$18 12
Refractories	20
Lubricants	2
Repairs	24
General repairs	17
Labor	1 13
General expenses	9
Spiegel	2 31
Interest	10
Cost of a tons of ingots	$23 48

COST OF RAILS.

1.05 tons direct with initial heat, at $22.48 per ton	$23 62
Labor and office expenses	1 90
Repairs entire	49
Steam (natural gas)	10
General expenses	35
Interest	22
Tools, files, etc	15
Cost of a gross ton of steel rails	$26 83

The paper also states that the cost of making a ton of steel rails in England at present is $20.17.

AN ELECTRO-DYNAMOMETER WITH EXTREMELY LIGHT SUSPENDED COIL..—(*Nature.*)

In my former communications to *Nature* it has, I believe, appeared (1) that the induction currents used by Du Bois Reymond, Duchênne, and other observers for physiological and therapeutical purposes were only arbitrarily and very insufficiently measured; (2) that the simplest and most practical instrument for their measurement is a delicate electro-dynamometer; (3) that in consequence of their extreme smallness, every available method must be employed to reduce the sluggishness of such an instrument without impairing its accuracy; (4) that an instrument of this character, shown by me before the Physical Society at Oxford in June, 1882, had answered very well, indeed better than a more expensive apparatus designed by Prof. Kohlrausch for larger currents.

It was, however, objected that there is an insurmountable difficulty in keeping a good contact between the aluminium and silver-gilt wires used in it for suspended coil and suspending wire respectively.

At the British Association meeting in Montreal I was able to show an improved form of the contrivance, in which this difficulty was surmounted; and, in addition, a method of damping the oscillations, which, while improving the insulation, enabled the weight of the suspended coil, on which the force of the torsion couple depends, to be varied between limits practically infinite.

The contact difficulty is met by taking a small plate of ebonite 3 mm. by 5 mm. in size, and tapping into it two small gold screws, long enough to project through, and carry two little nuts on the opposite sides. To the two screw heads the ends of the aluminium coil, bent into rings and filed flat, are firmly screwed; under the two nuts are twisted the ends of the gilt-silver suspension wires; the nuts are then similarly screwed home. Ebonite is elastic enough to render the junction air and fluid-proof

The second requirement was attained by coiling the aluminium wire in a thin tube of cork, and immersing it in a vessel half filled with petroleum oil. Aluminium is about two and a half times heavier than water, nearly three times the specific gravity of this oil; whereas cork floats on it. Consequently, by properly proportioning the amount of cork relatively to the wire coiled on it, any desired specific gravity from absolute flotation to that of aluminium itself can be obtained. It is even practicable to load the coil, like a Sykes's hydrometer, by dropping glass beads on a vertical aluminium wire in the axis of rotation. Here they have scarcely any influence on the swing of the coil. The damping effect of the oil, which is contained in a small globular receptacle, like a fish-bowl, between the fixed coils, is very complete and satisfactory. I had the pleasure of presenting the first rough instrument thus made to Prof. Johnson for the physical laboratory of McGill College.

W. H. STONE.

INCANDESCENCE ELECTRIC LAMPS.

Recent improvements in the manufacture of incandescence lamps have very much reduced the consumption of electrical energy, which was, say two years since, necessary for the production of a given candle power.

For a lamp giving an illuminating power equal to 20 standard candles, it is claimed that for this type of lamp, which appears to be the one most generally employed, only 2½ watts per candle power are required.

It need not be said how important this is in the more economical production of the electric light, but it might be asked whether the carbon filaments of such lamps are as long lived as those older loops which demanded a greater expenditure of electrical energy to obtain a given result.

It has recently been brought to our notice that in several installations in which a well-known incandescence lamp has been used, the number of filaments which have given way after a few weeks use is quite appalling, although the lamps were worked at an electromotive force some 5 or 6 per cent. lower than they were intended for.

The question, then, is whether the economy in the current strength is not more than counterbalanced by the increased expenditure for new lamps.

It is a very noticeable fact that in the Edison system the lamps appear to be in much the same condition, as regards consumption of electrical energy, as they were several years