volts each; they do at times reach 400 amperes, but 300 is about the average. Taking the horse power electrically as my standard, I find that these engines are developing an electric horse power that is equivalent to a mechanical horse power on from 2 to $2\frac{1}{8}$ pounds of coal per hour under all conditions.

I have computed the horse power of the ordinary compound and condensing engine of the latest improved type, and from the same data, namely, electric horse power, I have found that $2\frac{1}{4}$ lbs. of coal per horse power, under all conditions, was the best they could do.

Now there is something more to be said about the jacketed engine before I conclude, and that is that the joints stand better than on the ordinary compound engine; and, contrary to my expectations, the packing stands equally well if not better than in the ordinary compound engine. These engines are easy to start, because there is no water to contend with; the separator keeps the main steam pipe free of all water that would otherwise have to be drawn off by drips, and there is no more trouble with the engine after she is started from this source than there was before she started up; this in itself is a great relief to the mind of the engineer when he knows there is no danger from that most dreaded of all things—water.

I have given a few of the facts on which I base my judgment of the jacketed engine, and I will now conclude by saying that you have to run a jacketed engine with separator attachments to the main steam pipe, to know its worth.

An interesting debate followed the reading of Mr. Murphy's paper at the convention of Stationary Engineers.

In reply to a question from Robert King, of Kingston, Mr. Murphy said they had used screened coal and had also used cinder screens and hard pea coal mixed. His figures were only approximate, but while he had no detailed statistics, his conclusions were such as to satisfy himself that the jacketed engine was the most economical. Replying to Mr. Mitchell, of London, he said the Lancashire boiler was used, but they had also used the Babcock boiler.

Mr. King said that at their plant in Kingston they took refuse and hard coal screens, first trying equal parts, and then two to one. They had also mixed three parts of hard coal and one of soft, and had got one horse power (indicated) out of $1\frac{3}{4}$ lbs. coal, running an Inglis & Hunter condensing engine 16 x 30, 42 in. stroke. They were at this moment running a twelve-hour test on pea coal, which cost $3.34 a ton laid down in the yard. The other coal from which a horse power was got on $1\frac{3}{4}$ lbs. cost $2.95 a ton.

Mr. Murphy said the engine used in Montreal was 24 x 48, 48-in. stroke, and they had on the road 110 motor cars and 76 trailers. He wished it understood that the engines there were not working economically. If they were it could be got down to $1\frac{3}{4}$ lbs.

Mr. Edkins bore out the last statement, and said there was a wide difference between the work required of the two engines. Enormous loads had at times to be carried on these engines, and one could not get economical work, for the reason that part of the stroke was cut off when there was a sudden lightening of the load.

Mr. Wickens thought it was plain that there was a good deal to be said on both sides. Some of the best engineers tell us that the steam jacket is of no use, and they go into figures and explain it; while others equally eminent answer us that the jacket is of great benefit, and back their opinions up with statistics.

For THE CANADIAN ENGINEER.

THE INJECTOR.

BY ALBERT E. EDKINS, TORONTO.

When we take into consideration the vast number of injectors that are in use for feeding steam boilers, it seems somewhat strange that the principles which govern their action are not more generally understood. Probably there has been no other appliance placed in the hands of the engineer for operation of the principles of which he has known less, and yet has been able to work so successfully.

In speaking of the principles which govern the action of the injector, I wish it to be distinctly understood that I do not allude to the pages of complex formulæ and matter to be found in every scientific work on the subject, and which are too far advanced for men of limited education to understand; but what I allude to as the principles of the injector is the common, every day principle involved, and which can be readily understood by any engineer who can read, and is endowed with ordinary intelligence.

We can well afford to leave the formulas for the proportioning of the jets of the injector to the scientist and the makers of them; but what we want is to know sufficient of the principle of the instrument to enable us to keep it operating successfully, and in case of a failure to be able to detect the cause thereof. It is with these things that this paper is calculated to deal.

The injector, we are told, was invented by Gifford over thirty years ago. I have heard it said, or I have read it somewhere, that the original inventor was experimenting with some apparatus on a steam boiler, when he found to his surprise that it was possible to inject water into a boiler by utilizing the steam pressure of the same boiler. This seemingly paradoxical result was very much wondered at, and we can easily imagine that it would be looked upon by many as an utter impossibility.

Referring to Diagram No. 1, to a person having no knowledge of the subject, it does certainly look unlikely that water could be forced into a boiler by the very steam generated within it, and this too (as is often the case) in the bottom of the boiler, where the pressure is greatest, in consequence of the height of water in the boiler.

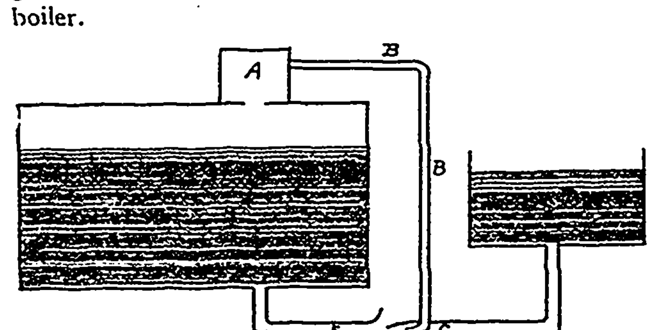

DIAGRAM 1.

Diagram 1 represents a section of the injector, and boiler also, from which the injector takes its steam to operate it in feeding water into the bottom of said boiler. A represents the dome or steam space from which is carried a steam pipe B, which is connected to a cone C, which is connected to a tank full of water D. The cone C is connected to another pipe or cone E, through which the water is driven into the boiler.

All valves and cocks are left out in the sketch, as they are not necessary for illustration.

To a person unacquainted with steam engineering,