

United States, and the *Herald* finds this to be \$841,631,929. It therefore appears that the manufacturing establishments of New York and vicinity, numbering 18,105, and employing 303,163 persons, come within twelve per cent. of producing as much value as the city's whole immense foreign importation. The *Herald* is rather surprised at this, and would like to see such a change towards Free Trade as would make New York the storehouse of the world. The *Protectionist* thinks things are better as they are, and that what the country wants is more manufactures rather than more commerce.

The tendency shown for manufactures to become massed together at the great centres is something to be remarked upon. Not a few may be surprised to learn that the western city, Chicago, ranks next to Philadelphia, and actually before Boston, in manufactures. The distribution of manufactures throughout Canada is a subject of considerable practical interest, and is worth looking into, in connection with the same thing over the border.

BACK PRESSURE IN THE STEAM ENGINE.

There is always more or less of loss connected with the working of the steam engine in getting rid of the exhaust steam in the cylinder. The "live steam," as it is often called, on the one side of the piston, has not only to push the piston before it with all the load of the mill resisting, but on the other side of the piston there is an opposing steam pressure resisting the motion. This is the "exhaust steam," which at previous half stroke of the engine entered the cylinder as "live steam." Its share of work has been performed, and by the time the piston has reached the end of its motion, there is still some capacity for work left in the steam, but it cannot be made use of in the cylinder, and now becomes a positive obstruction or opposing force. In some engines where expansion is not made use of, this opposing force of the exhaust steam becomes a very serious matter. How to get rid of it, and what to do with it, so as to get most advantage from the heat or power contained in it, have long been problems, upon which a great variety of opinions have been held by engineers and engine builders.

The ordinary slide valve engine, with valve set to get the greatest amount of steam *into* the cylinder, with the view of getting the greatest amount of power out of the engine, is very often found, on testing the Indicator, to have a very heavy amount of back pressure, especially at the beginning of the stroke, where it does most harm.

It would pay in most cases to alter the slide valve, that the exhaust port may be open even before the forward stroke has been completed, so that on the piston moving back the opening may be clear, and the greatest pressure of the exhaust steam already gone. This of course is of most advantage to non-condensing engines, and to engines running at high speeds, and is in keeping with the best locomotive practice.

Thus removing the forward pressure by opening the exhaust so early, certainly looks like letting the steam go away before its work is done, and it does take a little off the amount of power given by the engine at that part of the stroke, but it is more than made up by the gain at the beginning of the next half stroke.

The most efficient as well as most economical engines are those where the greatest forward pressure of steam is applied to the piston, while the crank is moving from its dead centre through the first ninety degrees, and less pressure applied during the remaining ninety degrees of crank motion necessary to complete the piston's movement from one end of the cylinder to the other. One reason of this is that during the first quarter revolution of the crank the piston is gradually increasing in velocity, and the weight of the reciprocating parts, the piston, cross-head, &c., absorb a considerable amount of the power, as their velocity has to be brought up from nothing to that of the crank pin. During the next quarter revolution of the crank the reverse is taking place; the velocity of the reciprocating parts diminishes from that of the crank pin down to nothing, and the power previously absorbed is now given off. Hence anything by which the pressure can be increased during the first quarter revolution, even though it should cause a loss during the second quarter, will be a gain.

The intelligent application of the Indicator to engines at saw mills where fuel is no object, but power is the main thing wanted, will often reveal just such a defect as has now been described. In the attempt to get "live steam" pressure as long as possible on the piston, the difficulty of getting rid of the exhaust has been overlooked, or not properly understood. This difficulty increases very rapidly as the piston velocity is increased, and the faster an engine runs the greater care should be taken to have a free exhaust.

Some experiments made by Mr. D. K. Clark on locomotives seemed to show that the back pressure from exhaust steam varied as the square of the piston speed.

It is often the case that the size of steam ports and setting of valve are determined without any reference to the speed at which the engine is to run.

(to be continued.)

POLITICAL ECONOMY.

(Communicated.)

Waggon-loads of books and papers have been written, printed, and distributed, world wide—on what has been popularly termed the "Science of Political Economy." And yet there are many thoughtful and wise men who question the propriety of designating any system or doctrine a science which, in theory and practice, has such various and contrary interpretations.

This brief paper is not designed to settle or even to discuss this aspect of the question, but rather to put the inexperienced reader on the track to make up an independent judgment on that Economy which shall secure to the greatest number, in every community, the highest degree of financial prosperity.

There is to every system a germ, origin, or tap-root, which gives character to the product. It is, generally, quite necessary to become acquainted with these "seeds of things" to know how to plant and cultivate them. We get the word "economy" from the Greek *oikonomia*; *oikos*,—house, and *nomos*—law, usage, rule; and this latter word from *nomos*—to distribute, manage, etc. Of course every reader knows that