PRACTICAL MECHANISM.

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BY JOSHUA ROSE.

MOVEMENTS OF PISTON AND CRANK.

Let us now see how the steam in the front end, whose admission in the cylinder is shown in table No. 1, is exhausted. We find in that table that, at 11¼ inches of the stroke, the expansion ends, and the valve, ceasing to be a steam port, becomes an exhaust port.

TABLE No. 4..

Piston moved inches	Exhaust port open inch
11 7-8	1-16
12	3-8
Piston returned	
1-4	11-16
1-2	full
8 1-4	full
9	11-16
9 3-4	9-16
11	1-4
11 5-8	exhaust port closed
12	port again taking steam

The exhaust for the other end of the cylinder, that is, for the back end (the admission of steam to which is shown in table No. 2), is as follows:

TABLE NO. 5.—BACK END.

Piston moved inches	Exhaust port open inch
11 7-8	1-8
12	3-8
Piston returned	
1-4	5-8
3-4	full
9 1-4	full
9 3-4	3-4
11	7-16
11 5-8	1-8
11 3-4	port closes
12	port again taking steam

Here we find that the average area of exhaust port opening (allowing the full opening of the port for the eight inches or so of movement, during which the port was fully open, and which are therefore omitted, for brevity's sake, from the tables) is about $\frac{1}{8}$ of an inch for the front and about $\frac{108}{160}$ for the back end of the cylinder. Referring again to the admission of steam to the cylinder, and comparing it to the exhaust, we find that the front end had the least opening of steam port, and the back stroke the most, so that the exhaust is the most at the end where it is required to be the least, and *vice versa*.

In order that the value of a small increase in the valve travel may be fully appreciated, we will now take the same engine and alter its eccentric sufficiently to increase the valve travel from 2½ inches to $2\frac{13}{16}$, first noting that the travel of a valve necessary to open both the steam ports full (and allowing that the valve movement were true) is twice the width of each steam port and its lap, or, in other words, the width of each steam port and the lap on each side of the valve added together.

TABLE NO. 6.—FRONT STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	8	3 4 full
2	13-16	9	5-8
3	7-8	10	7-16
4	7-8	11	1-8
5	7-8	11 1-4	closed and expansion begins
6	7-8	11 13-16	expansion ends
7	7-8	12	exhaust open ⅛ inch

TABLE NO. 7.—BACK STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	13-16	8	3-4
2	7-8	9	1-2
3	7-8	10	1-4
4	7-8	10 7-8	closed and expansion begins
5	7-8	11 3-4	expansion ends
6	7-8	12	exhaust open ⅛ inch
7	7-8 bare		

Adding up the area of port opening at each inch of piston movement, and dividing the sum total by the number of inches in the stroke, which will give us in each case the average port area for the whole stroke, we shall find the average for the front end of the lesser valve travel to be ⅛ of an inch, and for the same end of the greater travel to be ⅛ of an inch, the average for the back stroke of the lesser travel to be $\frac{94}{160}$, and for the greater to be ⅛.

A glance at the respective tables will also show the admission of steam to be much greater during the early part of the stroke, in the case of the increased valve travel, which is of great advantage The quarter movements under the increased valve travel will be

TABLE NO. 8.

Movement of crank	Piston movement	Average port opening
1st quarter	6 3-4 inches	$\frac{138}{160}$
2d "	5 1-4 "	$\frac{9}{16}$
3d "	5 1-4 "	$\frac{134}{160}$
4th "	6 3-4 "	$\frac{87}{160}$

From the above table we find that the increase of valve travel has been more serviceable to the fourth quarter movement than any other, leaving its opening still less than the other, it is true, but still largely increased: which is very important, because it is so much more proportionate to quarter movement No. 2, during which the piston is (as in movement No. 4) moving from full power to a dead center, and further because it is especially desirable that the average area of the port opening should be as large as possible for and during the quarters having the longest piston movement. We also find that the average port opening for quarter movement No. 3 has not been affected by the increase of valve travel; this again is decidedly beneficial, for it was, under the short valve travel, the greatest of all independent of its proportion to the piston movement, and the most disproportionate of all when considered in relation to the piston movement; but under the increased valve travel, it is not only not the greatest, but it is less (as is also its piston movement) than is the average port opening of quarter movement No. 1, the crank (during each quarter movement) having moved from a dead center into full power. These considerations convince us that not only has the increase of valve travel given us a better steam supply, but it has given us one more regular and proportionate to the piston and crank movements.

Now let us examine to what extent and in what way our increase of valve travel has influenced the ports as exhaust ports. Commencing, then, with the front stroke, that is, the port at the front end of the cylinder, which exhausts the steam admitted through the area treated of in table No. 1, we find as follows:

TABLE NO. 9.—FRONT STROKE EXHAUST.

Piston moved inches	Exhaust port opened inch
11 7-8	1-16
12	3-8
Piston returned	
1-4	11-16
1-2	full
9 1-4	full
9 3-4	3-4
10	5-8
11	5-16
11 13-16	exhaust port closed
12	port again taking steam

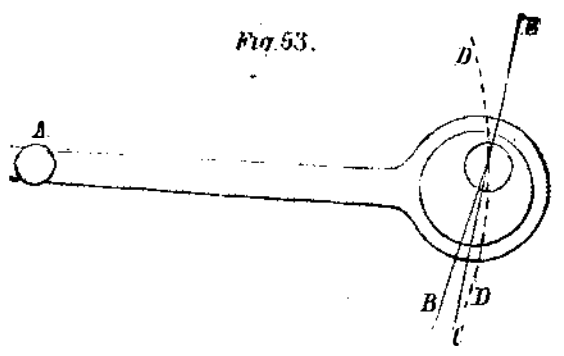
TABLE NO. 10.—BACK STROKE EXHAUST.

Piston moved inches	Exhaust port opened inch
11 7-8	1-8
12	3-8
Piston returned	
1-4	11-16
9-16	full
9 7-8	full
10 1-2	11-16
11	1-2
11 1-2	1-4
11 13-16	exhaust port closed
12	port again taking steam

Comparing the exhaust opening for the front stroke of both valve travels, we see that the increased travel has given us as free an exhaust in the early part of the exhaust, kept the exhaust port full open during 1 more inch of piston travel, given us a much more free exhaust during the latter part, and finally increased the average of exhaust opening from ⅛ to $\frac{114}{160}$. Comparing the exhaust opening for the back stroke of both valve travels, we find also that the greater travel has given us a greater exhaust opening in the early part of the exhaust, has kept the exhaust port full open during about 1½ inches more of piston movement, and increased the average of exhaust opening from $\frac{108}{160}$ (which it was under the lesser valve travel) to $\frac{118}{160}$ under the increased travel. Hence our increased travel has been highly advantageous to the opening and keeping open of the ports, both as steam ports and as exhaust ports.

It is here proper to explain how it occurs that the increase of valve travel gives a greater proportionate increase of steam port opening for the early part of the front stroke than it does for the early part of the back stroke, and also a greater proportionate exhaust area during the latter part of the back stroke than during the latter part of the front stroke, the reason for which is that the increase in the travel of the valve (and hence in the throw of the eccentric) increases the lead of the valve; and the altering of the position of the eccentric to take away this increase of lead brings the eccentric into such a position that a line drawn from the center of its bore to the most distant part of its circumference, representing the throw of the eccentric, would be nearly true (if it were circular instead of straight) with the circumference of a circle described from the center of the bolt at the opposite end of the eccentric rod, as shown in Fig. 53, A being

Fig. 53.



the joint of the slide valve spindle and eccentric rod end, B, the line representing the throw of the eccentric, and showing the position in which the eccentric requires to be set in the case of the lesser valve travel, C, a line representing the throw line of the eccentric as it is when the eccentric is made to suit the increased valve travel, and the dotted line, D, a circle struck from the center of A

It is apparent that the nearer the line representing the throw of the eccentric (that is, the line, B in Fig. 53) approaches in its main course to a line struck from the center of the eccentric rod end (D D, in Fig. 53), the less effect will an increase or decrease in the throw of the eccentric have in altering the position of the slide valve spindle (and hence of the valve) either backward or forward, at the time when the eccentric is in the position shown in Fig. 53. And, as the greater the increase in the throw of the eccentric the nearer will the throw line of the eccentric, when the latter is set, approach the line, D D, it follows that the less will the difference in the position of the spindle and rod joint (and hence of the valve) be when the eccentric is in the particular position shown. When, however, the crank has made one half of a revolution, and the throw line of the eccentric stands in the position denoted by the line, E, in Fig. 53, the least alteration in the length of the throw of the eccentric will have a great effect in altering the position of the joint, A, and hence of the slide valve, the effect being to bring the joint, A, nearer to the crank shaft in proportion to the increase, and to throw it farther back from the crank shaft in proportion to any decrease in the throw of the eccentric; which shows why an increase in the throw of the eccentric (or, in other words, of the travel of the valve) makes the difference in the port opening before referred to.

Preparation of Thallium from Soot of Sulphuric Acid Works.

BY FRANZ STOLBA.

In repeatedly working up the soot of two sulphuric acid works in Germany, where pyrites from Meggen were employed, a method was employed for separating the thallium, which depended upon a formation of a thallium alum. The soot is first passed through a coarse sieve to remove the pieces of brick, mortar, and clay mixed with it, and then boiled in water acidified with sulphuric acid. It is next placed on a suitable filter and stirred while carefully washed with hot water until all the acid is removed. The wash-water, after acidifying, can be used for boiling a second portion in, and so on. The first filtrate, which is tolerably concentrated, is evaporated in very shallow dishes to such a degree as to crystalize. Beautiful large reddish crystals of thallium-alumina-iron alum are formed as it cools. To the mother liquor was added some sulphate of alumina, and again evaporated, when a small quantity of mixed alums separated. The last mother liquor. as well as the rinsings from the crystals, when precipitated with crude hydro chlo. ric acid, yielded a surprisingly small quantity of chloride of thallium.

The crystals of thallium-alum were recrystalized twice from water containing sulphuric acid. The alum thus obtained was so pure that it yielded pure thallium when acted upon by pure zinc and pure sulphuric acid, and with pure hydrochloric acid, pure chloride of thallium was precipitated.

The crude chloride of thallium may be prepared in the usual manner, and next converted into sulphate by means of sulphuric acid, and finally, by means of sulphate of alumina, into thallium alum, which can be purified by recrystalization. The first method is, however, more convenient, because it does not involve the troublesome decomposition of the chloride by means of sulphuric acid. As the thallium alum is considerably more soluble in hot than in cold water, the conversion of the much less soluble sulphate into the more soluble alum offers the great advantage that the latter can be recrystalized from a much smaller quantity of water, which is more convenient and requires less time. Beside this, the alum is a compound easily converted into the chloride or iodide, from which the metal is easily obtained.

Horse Car Bell Punches.

The Hartford *Post* states that the patent bell punches manufactured at Colt's armory are now very extensively used on horse car lines, especially in the large cities. There are about 1,500 in use in New York, 1,600 in Philadelphia, 400 in Boston, 200 in Chicago. 150 in Buffalo, 100 in Providence, 150 in Albany, and 200 in Troy. In London there are 1,600 in use, 1,200 in Dublin, and 150 in Liverpool. These punches are not sold to the companies, but are loaned to them at a fixed rate, and there are two punches for each car. The punch which is used to-day is turned into the office to be reset for tomorrow, and in the meantime the conductor employs the spare instrument. A general rule is that every conductor is compelled to deposit $100 with the company for the safe keeping and fair usage of the punches.

Cruelties of the Seal Fisheries.

Attention has been called at different times to the barbarous practices identified with seal fishing. At the breeding season, the unfortunate animals are swooped down upon in their ice-bound retreats, and both young and old indiscriminately slaughtered. The young seals yield but little oil, and their skins are comparatively valueless; and it is, therefore, from a commercial point of view, inexpedient to kill them, leaving sentiment altogether out of the question. We are glad to observe that there is a probability of an arrangement being ratified which will ensure for the seals a close time, and save them from the extermination which now threatens. The British Board of Trade is moving in the matter, and the opinions of those connected with the trade are being ascertained with a view to ultimate action. It is probable, says the *British Trade Journal*, that an international law, binding on the British, Norwegian, and Swedish Governments, will eventually be agreed on, which will prevent the subjects of those governments from fishing for a specified period of the year