STEAM ADMISSION.

I.

IN every line of business some men are content to go on year after year doing the same kind of work in the same way. If asked why it is done in such a way and not in some other way, they can give no better reason than "It has always been done this way." There is no royal road to a knowledge of engineering, and the man who is too indolent to think for himself, or to discover any better reason for doing a thing in any particular way than that "it was done that way before," had better find an easier occupation. The man who has charge of a steam engine should be master of the engine, so far as knowing how to keep it in order and make it do the work it was intended for.

The action of steam in the engine is a subject well worth studying, and every man who runs an engine should know at least something about it, and of the reasons why one engine works better than another. One point to which too little attention is given is the admission of steam to the cylinder. The aim of correct admission is to get, as nearly as possible, the full boiler pressure on the piston at the right time. What constitutes the right time need not be considered at present, as it is a different question from that now under consideration.

With any given engine, how may the engineer know whether or not it is possible to get anything near the boiler pressure into the cylinder? The quantity of steam to be transmitted from the boiler into the cylinder in a given time is what really determines the matter.

As a matter of fact, a loss of ten pounds, or fifteen pounds, between the boiler and piston is not uncommon. Engines can be made that the difference will be so little as hardly to be discernable. It has been proved that if in following the piston, or rather in driving it, the steam has to flow through the pipes and ports at a velocity higher than one hundred feet per second, there will be a loss of pressure; but if the steam pipe and ports are made so large that the steam velocity through them is one hundred feet per second or less, then there will be scarcely any loss of pressure, unless from the condensation that takes place when the pipes are not properly protected.

This, however, does not give an immediate answer to the problem, because the question arises, what is the velocity of the piston? At the beginning and end of each half revolution, it has no velocity, and at about half stroke it is going as fast as the crank pin, while the number of feet travelled per minute is much less than that travelled by the crank pin.

Take for an example the case of an engine with a cylinder eighteen inches in diameter, and a stroke of three feet, and intended to be run at eighty revolutions per minute, what size should the steam pipe be in order to admit full pressure up to half stroke? In this engine the piston will travel four hundred and eighty feet in a minute, but at about half stroke it will be moving at a rate of nearly seven hundred and fifty-four feet per minute.

It was stated that the steam should not move faster through the pipe than about one hundred feet per second, that is, six thousand feet per minute; now if the piston is moving only seven hundred and fifty feet per minute, the area of the steam pipe may be as much less than the area of the piston as seven hundred and forty is less than six thousand.

The rule may therefore be stated thus: Multiply the area of the cylinder by the speed of the piston at the point in the stroke to which boiler pressure is required to be maintained, and divide by six thousand, and the result is the area of the steam pipe.

In the example considered, this rule would call for a steam pipe six inches diameter, but if the full pressure is to be maintained for only quarter stroke instead of half stroke, then the mean piston speed of four hundred and eighty feet may be taken instead of the highest piston speed, and a pipe five inches will answer.

A SIMPLE STEAM PRESSURE CALCULATOR.

By Wm. Cox.

THE accompanying diagram, an original design by the writer, is a species of circular slide rule by which the theoretical average pressure per square inch resulting from any possible cut-off and initial pressure can be instantly determined, or conversely, given any average pressure, the several combinations of cut-off and initial pressure which will produce it can be at once determined.

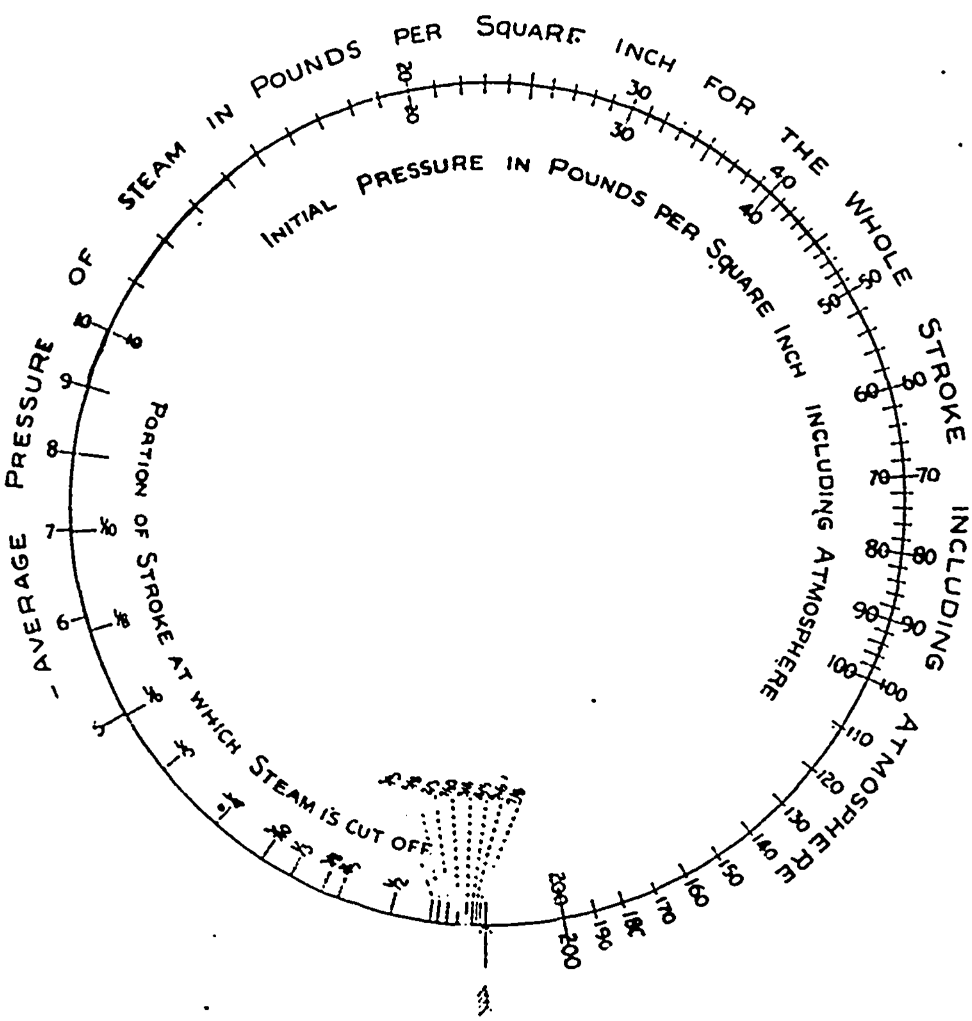

DIAGRAM FOR CALCULATING STEAM PRESSURE.

The diagram is not ready for use in its present form, as printed, however. To prepare it for use: Cut out the square space of blank paper on which the diagram appears, and mount it on a square piece of card-board. Then cut the central disk free very carefully, so that it may be an exact circle. Glue the outer part of the sheet to a second piece of card-board, and fasten the central disk to it by a pin passing exactly through its center so that it may be free to revolve within the outer part, and flush therewith.

When this is done, if any given ratio of expansion be set at the arrow, the diagram will show all possible combinations of initial and average pressure which can result from that ratio.

The diagram N indicator is based on the formula.

$$p = P\frac{(1+H)\times l}{L} \text{ or } = P\frac{1+H}{R}$$

where L = Length of stroke in inches.

l = Distance travelled by the piston before the steam is cut off.

R = Ratio of expansion $= \frac{L}{l}$.

H = Hyperbolic logarithm of R.

P = Initial pressure of steam in pounds per square inch, including atmosphere.

p = mean pressure during stroke in pounds per square inch, including atmosphere.

This formula is solved by the diagram at a single setting for all possible values of any of the variables.

To find the mean pressure: Set the "portion of stroke at which steam is cut off" ($l \div L$) on the disk, to the arrow on the indicator; then, coinciding with the "initial pressure of the steam" on the disk will be found the "mean pressure" on the indicator.

No allowance is made for imperfect vacuum.—*Engineering News.*