The Concentration of Power.

As the power of steam is the most universally applicable of all the forces used for driving machinery, its concentration becomes a matter invested with considerable importance. A great deal has been done in the production of small high-speed engines of late years, but a great deal more remains to be done before the principle can be regarded as approaching those limits, beyond which it may be neither safe nor prudent to carry it. The *Great Britain* locomotive has frequently given out 1,000 horse-power for many minutes together, with a pair of 18-inch cylinders, 24-inch stroke, the weight of the engine in working order being little over 35 tuns, or, with the tender, 50 tuns. This may, perhaps, be considered as a maximum effort which it would not be advisable to attempt to maintain. Taking the work done, then, at but half this, or 500 horse-power, we have still over 14 horse-power per tun; or, if we neglect the weight of the wheels as in no way necessary to the development of this power, we have at least 15 horse-power per tun of machinery. One of the steam fire-engines, tried last year at Sydenham, developed nearly 30 horse-power, the weight being under 50 cwt. This estimate of power does not pretend to strict accuracy, as the indicator was not used, and the power was calculated merely at an assumed pressure, some 20 or 30 lbs. less than that in the boiler. Still if we disregard the weight of the wheels, driving seats, etc., we find that the amount of power developed nearly equals that of a first-class locomotive, weight for weight. Modern express engines give out 350 horse-power as a matter of daily occurrence, and even goods' engines sometimes a great deal more. It is needless to say that in all these cases the power is obtained by an extremely high velocity of piston. In stationary engines, seldom confined in space, the march of improvement goes slowly, but, nevertheless, steadily on; and we trust ere long to see the clumsy beam and its appendages banished forever in favor of high speed engines, working expansively. The *Allen* engine, exhibited in 1862, inaugurated a change of practice, which is slowly making its way. This engine had a piston speed of 600 feet per minute, and ran 140 revolutions with an ease, steadiness, and absence of heating, not greater, perhaps, than was to be expected from the care taken in designing the machine to the minutest details, but very satisfactory, nevertheless, in that it furnished a complete refutation to arguments now and then brought forward, and dug up, as it were, from old-fashioned practice, to prove that a high speed engine must in the nature of things be a failure.

[There is a beam engine, 16-inch cylinder and 4 feet stroke of piston, of the Corliss pattern in Providence, R. I., which makes, day and night, 650 feet piston-speed per minute.—Eds.]

In order then, to concentrate power, it is only necessary to impart a high velocity to some member of a system of mechanism which first receives the direct effect of the original moving force, as the piston of a steam engine, or the bucket vanes of a turbine. No theoretical objections exist to the adoption of this course. The practical objections are found to reside chiefly in friction, and the difficulties met with in carrying out a complete and thorough system of lubrication. In the case of vertical spindles heavily loaded, and running at high velocities, it is necessary that the footstep should be worked to some curve, which will extend the bearing surface and prevent the extrusion of the lubricant. In the case of steam engines, the main-shaft bearing seldom gives trouble if properly made, especially if the weight of the fly-wheel is sufficient to keep the shaft down steadily in the lower brasses. The connecting rod head, with its brasses and crank-pin, are not so easily dealt with, and it cannot be denied that the annoyance which those occasion, has done much to retard the introduction of high-speed engines. The fact is, that the brasses will not permit of that amount of looseness or play which may exist in any other bearings almost, because of the destructive hammering action which ensues. It is not easy to say why tightening a brass should make it heat; we find in every-day practice that a bearing which supports perhaps 1 cwt. per square inch, without undue friction so long as it is left moderately slack, will become almost red hot in a few minutes, if an additional pressure of not more than a few pounds per square inch is brought on it by screwing down the cap. Until we can give a satisfactory explanation of this phenomenon, it is not easy to see how its occurrence can be guarded against. Meanwhile, it is the source of all the trouble ever met with from a connecting rod end. The best remedy appears to consist in increasing the surface very considerably, and providing an effectual method of lubrication, either by a telescope pipe from an overhead vessel of oil, or, in cases where the engine stands for a few hours out of the twenty-four, by boring a large cavity in the crank-pin, and filling it with tallow, a transverse aperture conveying the lubricant when melted to the surfaces where its presence is required. Attention to little matters of detail and good workmanship are really all that are required to insure the success of any motor running at a high speed.—*London Mechanics' Magazine.*

PETROLEUM FOR GENERATING STEAM.

We have received from R. A. Fisher, M.D., an analytical and consulting chemist of New Haven, Conn., a pamphlet giving an account of some experiments undertaken by him to ascertain the value of petroleum burned by Mr. Hill's method as compared with anthracite coal for generating steam. By Hill's process the petroleum is evaporated in a close box, steam is mixed with the vapor, and the vapor is burned as it issues from bat-wing burners.

Dr. Fisher burned petroleum by this plan "several hours" under a small boiler and measured the water evaporated. He then burned anthracite coal under the same boiler for four hours and thirty-five minutes, and measured in this case also the water evaporated. The steam was generated under a pressure of forty lbs. to the square inch, and hence from a temperature of 268°. After making proper allowances for the heating of the water the results were 7·81 lbs. of water, at 268°, converted into steam by 1 lb. of petroleum; 4·89 lbs. of water at 268°, converted into steam by 1 lb. of coal; or, 2,000 lbs. of coal gave the same heating power as 1,252·2 lbs. of petroleum.

"With coal at ten dollars ($10) per 2,000 lbs., it would appear from these figures, that petroleum of the quality used in the experiments just described, in order to compete with coal, must be furnished at ten dollars for 1,252·2 lbs. (198·69 gallons), or at 5·02 cents per gallon. But if burned in the apparatus of Mr. G. Hill, it must be furnished at a still lower figure; for while with coal the whole amount of steam generated can be used to drive machinery, in Mr. Hill's apparatus, a large proportion of the steam produced is required to assist the combustion of the petroleum.

"No experiments were made to determine exactly the quantity of steam thus employed, but from the fact that the coal evaporated but about four gallons of water per hour, while the petroleum evaporated about six gallons, without causing more steam to pass through the 'safety valve,' we must infer that the steam produced from two gallons of the water per hour (or about one-third of the whole amount generated), passed through the 'steam feeding pipe' into the retort, and thence to the burners.

"In view of all the facts elicited by these experiments, we cannot avoid the conclusion that at the present prices of petroleum and coal, say coal at $10 per 2,000 lbs., and petroleum at 40 cents per gallon, the cost of fuel in Mr. G. Hill's process, of burning the vapor of petroleum in contact with 'superheated steam,' is about ten times as great as when generating steam with coal."

Dr. Fisher concludes his pamphlet in these words:—"According to Mr. Tate, 'the oils (petroleum) as found in nature, contain as nearly as possible an equal number of equivalents of carbon and hydrogen.' This would make the composition of crude petroleum nearly identical with oil of turpentine. MM. Favre and Silbermann, in their refined researches already quoted, found the heat evolved by the perfect combustion of 1 lb. of turpentine to be sufficient to raise only 108·52 lbs. of water from 31°—212°. This, then, is about the maximum calorific power of crude petroleum—11·64 per cent greater than that of anthracite coal. Therefore, whether the perfect combustion of crude petroleum be effected by burning it directly, or after having converted it into gas; whether it be burned in the state of vapor alone, or mixed with air, or 'superheated steam' (as in Mr. Hill's apparatus), or though the mechanical arrangement consists of 'a series of corrugated recesses upon a vertical cone of cast-iron placed in the furnace' (as contrived by Messrs. Shaw & Linton), it is impossible to develope a greater calorific power than that with which it has been endowed by nature—that of heating about 108 times its weight of water from 32°—212°: a calorific power not quite 12 per cent greater than that of anthracite coal.

"It is therefore fallacious to suppose that at the present relative prices of coal and petroleum, this substance, by any 'improved method of burning,' can be made to generate steam as cheaply as coal. Of the truth of this, science has already convinced those who have faith in her teachings; accurate experiment will, in due time, convince those who are satisfied only with tangible evidence."

NEW BOOKS AND PUBLICATIONS.

The Indicator and Dynamometer. Main & Brown. Henry Carey Baird, Publisher, 406 Walnut street, Philadelphia.

The intelligent engineer who aspires to become something more than a mere "stopper and starter" takes every opportunity to increase his stock of theoretical knowledge. For without a union of both practice and theory but little substantial progress can be made. In looking at a steam engine in operation we see nothing but the outward movement. It may turn its centers smoothly and without jar, and be apparently in excellent order; but when we ascertain what is transpiring within the cylinder, by means of the indicator, it may be found that twice the amount of fuel is consumed to do the work that is necessary.

It is for the purpose of ascertaining whether an engine is doing what it should that the indicator is provided, and no establishment that burns fifty tuns of coal in a year should be without one. Engineers should make themselves familiar with the instrument, and extend its use as much as possible; much greater economy in the use of steam would be the result.

The treatise which we have made the caption of this notice is a standard work, and is clear and lucid to those who study for information and not curiosity. It is illustrated with diagrams showing defects in engines, pointing out the cause and cure, and explaining the principle on which the indicator works, so that the student not only knows that the diagram is made in such and such a manner, but also *why* it is so made.

Every engineer in the country, not acquainted with the indicator, should send for this work and master it, and manufacturers should encourage their engineers to do so, for a thorough knowledge of the instrument will result in economy to them if it is practically applied. An advertisement can be found in No. I., Vol. XI., Scientific American.

Phrenological Journal. Fowler & Wells, 389 Broadway, New York. $2 per annum, in advance.

The July number of this periodical commences the fortieth volume. A very marked improvement is visible in this number, both in appearance and character of the contents. The magazine, for such it now is, contains a great many handsome illustrations of military men and others in civil life, with dissertations on their characters, as shown by their crania. The general reader will find much to interest and instruct him.

Patent Breech-loading Tobacco Pipe.

In the list of English patents published in the London *Mechanics' Magazine* of May 20th, is this:—

2,424.—An improved mode or method of filling tobacco pipes of an improved construction.—G. R. Tilling and J. Park. Dated October 3, 1863.

In carrying out this invention the inventors fill or charge the bowl, head, or other tobacco-containing part of a pipe with tobacco from the bottom, the side, or the rear of such bowl, head, or other tobacco-containing part, in manner which will be wel understood as breech-loading. And to permit of such filling or charging, they construct pipes with apertures at the bottom, the side, or rear of the bowls heads, or other tobacco-containing parts, sufficiently large to allow a charge or "fill" to be passed in either under tobacco already lit in the pipe, or for filling before lighting, and such apertures they close by any suitable means.