slowly making its way. This engine had a piston speed of 600 ft. per minute, and ran 150 revolutions with an ease, steadiness, and absence of heating, not greater, perhaps, than was to be expected from the care taking 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, dug up, as it were, from old-fashoned practice, to prove that a high speed engine must in the nature of things be a failure.

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 bearings seldom give 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 the crank-pin, are not so easily dealt with, and it cannot be denied that the annoyance which these 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 bearing 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 apperture 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 ensure the success of any motor running at a high speed.

Notwithstanding a great reduction in the dimensions of any engine, power can scarcely be said to be concentrated while the boilers remain very large. In many cases, a small boiler is imperatively dictated, and it yet remains to be seen if peculiar arrangements cannot be adopted, by which a very small furnace and a fierce combustion will do the work of one much larger with equal economy. Hitherto fire boxes have been rapidly burnt out under such conditions; perhaps this has been occasioned by the over thickness of the plates. Locomotive fire boxes frequently burn down to a thickness of little more than one-fourth of an inch very quickly, although they will last for years without much subsequent deterioration. A generator might possibly be constructed with excessively thin cold drawn steel tubes, through the substance of which the heat would pass so quickly to the water that their destruction would be almost indefinitely retarded.

THE HISTORY OF THE HYDRAULIC PRESS.

As the celebration of centenaries seems to be one of the fashions of the time, perhaps we may be allowed to celebrate, in a mild way, the second centenary of the hydraulic press. We may say that we may even feel in manner bound to this our celebration of the anniversary of the invention of this mighty mechanical agent, because, just as with regard to the origin and histories of immortal bards, there are some very mistaken and dubious accounts current as to the origin and history of the hydraulic press. The first birth of this machine, only second in value and importance to the steam engine, may be said to date from 1664; for in that year was published the *" Traité de l'équilibre des liqueurs, et de la pésanteur,"* by that extraordinary man, Blaise, Pascal. He wrote:—*" Si un vaisseau plein d'eau, clos de toutes parts, a deux ouvertures, l'une centuple de l'autre, en mettant à chacune un piston qui lui soit juste, un homme, poussant le petit piston, égalera la force de* 100 *hommes qui pousseront celui qui est plus large, et en surmontera* 99." He goes on to say that, " in whatever proportion are sizes of the openings, if the forces on the pistons be as the openings, these forces will be in equilibrio." Pascal then, with remarkable clearness and method, points out that the principle of virtual velocities found in the lever, the inclined plane, &c., is also to be seen in this machine, " as the space gone over by the little piston is to that passed by the large piston, as the force of the second is to that of the first." The first hydraulic press was of an essentially rough-and-ready kind, as it consisted simply of a barrel filled with water, in communication with a long vertical tube. The hydraulic pressure, however, burst Pascal's wooden barrel with the same efficiency as the cylinders of some ill-constructed and badly cast presses are now broken this day. We next here of the hydraulic press in Leopold's " *Theatrum Machinarum,*" published in 1720. A practical application of its principles was made about 100 years ago by a distinguished anatomist of that day, named Wolf. In order to examine animal tissues, he stretched his specimen over the broad and short leg of an inverted syphon, the lodger leg being filled with water. The hydraulic pressure thus distended the substance stretched over the short leg of this, probably now obsolete, " anatomical syphon " At last came that remarkable man Joseph Bramah, born nearly in the middle of the last century, and the Richard Roberts of his time. Although it has been ignorantly stated in Mr. Smiles's last work that he was not