Let H = Effective horse power of engine,
R = Mean radius of fly wheel,
N = Number of revolutions per minute,

Then in round numbers the weight in cwts. will $= \frac{90{,}000\ H n}{R^2\ N^3}$

In this formula n represents the degree of irregularity which is admissible, and this will of course depend on circumstances, and may be anything between 20 and 60. Where no great degree of uniformity is required, the former value will answer: for the finest cotton spinding machinery the latter is not too great. For ordinary practical workshop use, however, n may be eliminated, by substitution, and the formula then becomes—

For ordinary machinery, $W = \frac{2{,}000{,}000\ H}{R^2\ N^3}$

For purposes where a maximum regularity is requisite, $W = \frac{5{,}000{,}000\ H}{R^2\ N^3}$

In other cases some value between these will be found most suitable.* The determination of the diameter for any given power, and the velocity, cannot be settled exactly by any rule, as these things depend almost wholly on circumstances seldom quite within the control of the engineer. In corn mills the rim of the wheel should, as a general rule, run faster than the stones, in order to prevent back lash, and this holds good in the case of many other machines, as well as corn mills.

It is as well to remember that the pressure on the area of a piston does not accurately represent the pressure on a crank pin when the engine is in motion, because the velocity of a heavy piston, connecting rod, cross-head, and guide blocks, represents a very considerable amount of momentum; and thus at the beginning of a stroke the strain on the crank pin is less, and towards the end greater, than that due to the pressure on the piston. From this it follows that an engine might easily be constructed which, while working steam very expansively, would exert a strain nearly constant on the crank pin. It would only be requisite to proportion the gravity of the mass of metal reciprocating, the speed, the grade of expansion, and the initial pressure in order to attain this end. Thus fast running engines with heavy cross heads, &c.; will not require nearly so ponderous a fly wheel, if they are worked expansively, as at first sight may seem necessary in consequence of the varying pressure on the piston. For such engines the rules we have just given need not be departed from. Slow running expansive engines are usually so wasteful of fuel that they are not very popular; at least, steam is seldom cut off very early in their cylinders, and we need not, therefore, take them into consideration. Simple as the fly wheel is, there are many problems involved in its action worth the attention of the practical mechanic, and we purpose returning to the subject.—*Mechanics' Magazine.*

* The sectional area of a fly wheel rim in inches, $\frac{11{\cdot}42\ W}{D}$

CONCENTRATION OF POWER.

On the concentration of power depends the solution of important mechanical problems daily encountered by the engineer in the practice of his profession. In its practical form the concentration of power is embodied in the reduction of the dimensions of any motor to minimum limits, no matter what its individual construction, or the nature of the principles under whose administration it gives forth power. The problem, thus stated, involves in its solution many points of technical detail which can only meet with proper treatment at the hands of those practically, as well as theoretically, acquainted with the working of machinery, because all the difficulties met with in dealing with small machines intended to develop a high power are encountered in their working, seldom or never in their mere construction. The whole subject is one possessing no common interest, the struggle for concentrated power having produced some of the most elegant and important mechanical arrangements ever called into existence by the excogitations of mankind.

It is needless to complicate the subject just now by any disquisition on the origin of power. We know that no machine or system of machines, however complex or ingenious in construction, can do more than direct in o the required channels certain proportions of those forces which are developed by particular laws of nature over which we possess a very limited control. To originate power in themselves is beyond the capacity of wood, iron, stone, or, in short, any constructive materials at our disposal. The water wheel stands still until the stream is permitted to flow into its buckets; but the stream does not possess volition —it also would stand still but for the action of gravitation, a force in the abstract wholly independent of man's control or influence; obeying certain well-known laws, from which it never departs, and perpetually operating throughout the entire universe. Why a larger body should attract a smaller one, we do not know; we can only recognise and avail ourselves of the fact. In like manner, the steam engine is incapable of doing more than converting to useful purposes, a certain proportion of the force stored up in the fuel which heats the water from which the steam is raised. In either the fall of water or the combustion of fuel, a certain force is merely set free or called into action; it is never created by the aid of machinery of the existence of which, all the forces in nature are wholly and entirely independent. Thus, whenever a pound of coal undergoes the process of combustion, power previously stored up is set free; and precisely the same mechanical effort is requisite to evaporate a pound of water in an open vessel, as in a closed generator connected with a steam cylinder and piston. Were it not that pure force or power has existence independently of mechanism, there would be little room for improvement in the construction of machines. We should expect to find their dimensions bear an inv riable proportion to the amount of power which they were intended to produce, while the least possible variety would be permitted in matters of detail, on which their working would doubtless almost, if not altogether depend It is therefore perhaps fortunate that the existence of power is wholly separate and distinct