are also in very common use for metallic pistons with divided rings, double sets of rings being used, and the springs pressing directly on the segments of the metallic rings, as in figs. 189, 190.

A stuffingbox is an apparatus used in immediate connexion with the piston. A simple aperture in the cylinder cover to permit the passage of the piston-rod, as in fig. 191, could not be made steam-tight: so that to prevent the escape of steam, a stuffingbox has to be made use of. This consists of a box cast round the hole of the cylinder-cover, fig 192, in which is laid, around the piston-rod and in contact with it, a large quantity of hempen packing. This packing is lubricated with oleaginous matter, and the ring, fig. 103, is then placed on the top of this matter, and pressed hard down upon it by screws, so as to squeeze the stuffing into every crevice. Stuffing-boxes of this description are employed wherever it is necessary to pass a rod out of a vessel, or into it, with out permitting the escape of the steam. Thus there is one at the entrance of each valve-rod into the steam chest of the cylinder valves, and also, wherever a rod passes into the interior of a boiler.

The governor is an appendage to a steam-engine, of much value in all its applications to the production of uniform revolving motion. It is merely a modification of an apparatus similar to the pendulum, and by which Huyghens once attempted to make a timekeeper in stead of the common pendulum. If we suppose the axis A *x*, fig. 194, to revolve on its centre, and the ball B hung by a thread from .r, two pieces of iron, *x* C and *x* C, being bent so as to form cheeks of a form called the cycloidal curve ; then when the string B *x* comes in contact with the cheeks, it will perform each semi-revolution in the same time in which it performs two oscillations as a common pendulum ; that is, if it be 39.1 inches from the centre of B to *x*, the pendulum will revolve once in two seconds. If, however, the ball B be suspended from *x* by a straight bar,

such as B *x* in the next figure, the line B *x* in deviating from A *x* will describe the circular arch A B, instead of a cycloid as formerly, and the time of oscillation will vary as the ball recedes from A, the revolutions being more rapid at *b* than at B. If in the position B, the line *x* C be 39.14 inches, then will the revolution be performed in two seconds, or at the rate of 30 revolutions per minute ; while at *b* they will he performed in less time, and between B and A more slowly; and in general to find the height *C x* for any required number of revolutions, it is only necessary to find by the rules for calculating the rates of the pendulums of timekeepers, what length of pendulum will give double that number of beats per minute, and that is the desired height for C *x.* The rule for this pur pose is easy. Divide the number 35226 by the square of the number of revolutious per minute, and the result is the height *Cx.* Thus to find the length of *Ax* for 30 revolutions per minute:—

30 squared = 30 × 30 = 900)35226(

required height = 39.14 inches.

The required regulation is effected in the following manner ;—

The balls B B, fig. 196, are suspended by rigid bars from the centre *x,* and are prolonged to *k* *k.* These bars are joined by links, *k y* and *k y,* to a moveable socket *y,* which can slide up and down the axis. The straight lever *y p* is acted on at one end by *y,* and at the other it draws or pushes down or up the handle of a circular disc *v,* so as either to close it or open it to different degrees ; this disc is in the steam-engine placed in connexion with the steam pipe that supplies the cylinder, so that if the engine should nt any instant move round too slowly, from having too much work to do, the balls will collapse, raise up *y,* and open ***υ*** to the fullest extent, as at 4, in the small sectional figure to the right ; 3 being the mean position ; while, on the other hand, should the engine, from its work being taken off, go round too quickly, the balls would fly off from the axis, bring down *y,* close the valve to 2 ; or if it had happened, as by an accident, that the load was suddenly withdrawn, close the valve altogether, as at 1 in the side figure.

But the action of this governor is not always sufficiently delicate, its power of adjustment being some what slow. An improvement has been made upon it by Messrs Cheetham and Bailey, of Staley Bridge, in Lancashire, which renders its action much more rapid. On the centre of the throttle-valve, as the disc *v* in the steam pipe is called, there is placed an iron tube, like a gun barrel, partially filled with mercury. When this tube