EXTENSION LADDERS.

(See page 237.)

Rapid increase of population and growth of cities has rendered ground so precious that it has been considered necessary to erect buildings from three to ten stories high, to serve as homes, warehouses, factories, etc. The situation of any unfortunate being who chances to be caught in the upper stories of a burning building, in which the stairways are invaded or destroyed by the flames, is truly dangerous and pitiful. To devise means by which the rescue may be accomplished, while facility is afforded for fighting the fire at a vantage, has been a problem with many attempts and many partial solutions. The production of a ladder to reach the windows in any of the uppermost stories at will, demands portability, lightness, strength, rapid and easy extensibility, and simplicity. The successful combination of all these elements is difficult of attainment. Extension ladders either rest upon the sill or wall which they are to reach, or are self-supporting. The former are the more simple, but dangerous in the case of walls falling ; and the latter are the heaviest, but most useful.

The differences among those requiring support, are chiefly in The differences among those requiring support, are chiefly in the modes of fastening together the sections of which they are composed; nearly all of them requiring to be "up-ended" and faised, after joining, in the same manner as simple ladders. The hook and ladder trucks on which these ladders are carried differ somewhat in their construction; in some, the sections being carried on edge, and in others, on their faces or flat sides. The former mode is greatly to be preferred, as permitting the withdrawal of the longer ladders, which are generally the first needed, or of any one, without disturbing the others or removing the axle of the tiller-wheel. In some, however, of those carrying the ladders on their faces, each ladder rests upon a separate set of rollers and may be withdrawn separately; and a rigid frame is thus secured; but in most of these, the tiller shaft passes through the rungs of all the ladders, thus preventing the removal of any one until this axle is first withdrawn.

The sections, decreasing in length, weight, and strength, are generally fastened together by passing the butt of one into strong iron sockets either on the face of, or between, the ends of the other. The latter mode diminishes the width and capacity of the upper section, without materially decreasing its weight. For strength and security, the butts of each section should be banded, and shod with iron points.

When these ladders can be used as hose-elevators, and can be lengthened or shortened without taking down, their usefulness is increased.

The Scott & Branson telescopic ladder has a double set of rungs front and back in the lower section; between these the upper section slides, being moved up and down by a rope passing over a pulley on the top rung of the lower section, as in the Bangor ladder. A suitable stop-catch holds the sliding ladder at any desired point.

The remainder, or "self-supporting" extension ladders are not removed from the truck on which they are transported. In order to preserve the balance of the machine while the weighted ladder leans forward and outward, weights, guys, and braces are employed. The principal designs are those of Skinner, Porta, Pine, Watson, and Pritchard.

The Watson & Perry Ladder is shown in the accompanying one representing it as running, and the other as elevated at a fire. The truck, which runs on four wheels, consists of a frame in two parts. The front part is the hose cart and engine tender, and to the hind part is attixed the main ladder, thirty feet in length; and upon this works a slide ladder of equal length, raised and lowered by a winch at the foot ; and from the slide ladder rises a socket ladder 16 feet long. To each side of slide ladder rises a socket ladder 16 feet long. To each side of the slide ladder, and projected therewith, is affixed a pipe for the hose, with a screw top and bottom, to which the hose and branchpipe may be readily attached. From the top of each ladder exwindlass on a frame. By this the ladder is given any elevation required, and held firmly. When the machine is housed or running the triple ladder is in a horizontal position, affording room beneath for transporting a number of extra ladders, seven lengths of hose, 500 lbs. of coal, and the usual complement of hose, axes, picks, lanterns, etc., and having an extreme length, horses in-cluded, of only 32 feet, allowing it to be turned without a tiller, in a short radius. When the fire ladder is to be used, the with-drawel action of the truck brings the two parts of the truck brings drawal of the pin connecting the two parts of the truck, brings the ladder, turning on the axle of the hind-wheels, to the ground at an angle of 45 degrees.

It may thus be wheeled, by two men, upon a smooth or rough surface, into any position, and raised to any height from 30 to 70 feet, resting upon the earth for a base, and being self-supporting. "At a trial in Brooklyn it was run up, unlimbered, fixed, and a man placed by its help on the top of a high building within 90 seconds."

The Pritchard Ladder employs in its construction the principle of the jib-crane, the lower or main ladder constituting the boom, and the extensions, which slide on independent rollers below the main ladder, may be attached by any desirable method.

The min ladder or "boom," has between the butts a strong worm-wheel keyed to an immovable axle. A worm gearing on a bed plate raises and lowers the ladder in the vertical plane; while a second worm gearing revolves the bed-plate and ladder in the horizontal plane. It will be readily seen that the ladder will reach any point, at any angle in height, or in any direction; merely requiring stays or braces to afford a firm base. These last are telescopic, the sliding sections being set to any length from the top of the ladder, by means of a chain and wheel. Each motion is simple and positive. It may be operated in any alley into which the wheels will enter; extending over yards or streets, to the building. By a suitable attachment it may be used as a fire-escape, although not very rapid in the case of a rescued person to climb down the ladder. — The Polytechnic.

GOVERNORS.

From Knight's American Mechanical Dictionary we take the tollowing illustration and description : (See page 236.)

The governor is a device which regulates the admission of steam to the engine according to the rate of motion. The intention is to maintain uniform velocity, and any acceleration of speed above a given rate causes a valve to be partially closed, diminishing the area of steam passage; contrariwise in case of flagging in the speed of motion of the engine. The favorite form of governor has a pair of balls suspended from a vertical shaft, so as to swing outward when the shaft is rotated. The greater the speed the greater the centrifugal force, and consequently the farther the balls depart from the axis of rotation. The inclination of the ball arms is made effective in working the valve.

This use of the device of the two suspended revolving balls, whose circle of revolution widens as the speed of the engine increases, is due to James Watt, who adapted it from an ancient device in windmills.

The full-page engraving shows fifteen variations in form and structure of the ball-governor, two forms in which a propellor wheel acts in a liquid, and one form in which the pressure of steam is directly upon the valve.

In a the balls receive their rotation from the bevel gearing above, increment of speed causing the balls to fly outward and raise the sliding sleeve on the spindle. To this sleeve is connected the end of a lever arm whose vertical oscillations are communicated to the butterfly or throttle valve, as in Figs. k or l.

In b the balls receive rotation by the bevel wheels, next below the sliding collar. To the collar is attached a sleeve on which the lower bevel gears remain at rest as long as the pin on the said sleeve is not in contact with either of the studs projecting from the upper and lower surfaces of the respective bevel wheels. This is the position shown in the cut, and is that assumed when the engine is running at the required speed. Should the speed be accelerated, the raising of the balls would raise the sleeve and its pin, and thereby rotate the upper bevel wheel, turning in one direction the miter wheel with which it engages. If the speed tall below the medium, the pin on the sleeve falls and turns the other bevel wheel, moving the miter wheel in the other direction. The horizontal shaft of the miter wheel operates the throttle valve or gate of the pen stock.

cacts by substantially the same means through a system of levers upon a belt shifter. In the medium position the belt runs on a loose pulley; but when the balls rise by acceleration of speed, or fails by retardation, the belt is shifted on to the upper or the lower pulley, which pulley acts upon the valve or gate requiring adjustment. In d, instead of the arms being connected with a slide working

In d_i instead of the arms being connected with a slide working on a spindle, they cross each other and are elongated upwardly, where they connect with the valve-rod by two short links.

Pickering's governor, e, has balls on springs, the upper ends of which are attached to a collar fixed on the spindle, and the lower end to a collar on the sliding sleeve. The springs bend outwardly proportionally to the centrifugal force of the balls, and thereby raise the sleeve, acting upon a rod which diminishes the