ELEVATORS.

(See page 296).

The increasing value of land in great cities—the necessity in some manufactures (as sugar refining, &c.), of such an arrangement and construction as will permit the continuous downward passage of the materials in process of manufacture—increased ceiling height, and the ambition of individuals and corporations to tower above their fellows—have led to the erection of buildings whose upper floors could only be reached, if stairways were the sole means employed, by an amount of muscular exertion which would be fatiguing te the most robust, and beyond the strength of the more feeble and aged. Few consider that stair-climbing necessitates an actual lifting of the whole weight through a vertical distance equal to the height of the stairs. A man weighing 160 lbs., in walking up a flight of sixteen steps, each with an eight-inch rise (corresponding to a twelve foot ceiling), in a time of twenty seconds, has lifted 1920 pounds a foot high in that time—nearly a ton weight. To climb to the top of a four-story building—say fifty-two feet vertically to the fourth floor—in ninety seconds, represents the lifting of 8300 lbs. a foot high in that time. Reduced to minute foot-pounds, this equals 5533 pounds lifted a foot high in a minute, or one-sixth horse-power.

Staircases were of course out of the question for merchandise, for which an external or an internal hoistway and tackle had long been provided; a cage being more recently substituted.

The exertion and time required to reach the upper floors of tall buildings had rendered those floors far less desirable than the lower, and had led to a discrimination in the ceiling height and in the cost and convenience of fitting which still further militated against the upper stories and materially affected the rental. Builders gradually appreciated this fact, and the shrewder ones so arranged the floors as to give a half basement and a first floor considerably above the street level—thus practically giving two first floors with an equal amount of climbing. The owners of older buildings met this in part by calling their first floor the "ground" floor, and promoting the second floor to the dignity and name of the first, and so on all the way up; a usage which prevails in New York city, but which, while it may give additional tone to the garret rooms, does not take an ounce off the foot-pounds referred to, or give the climber any more breath to say "fourth floor" than he formerly had to say "fifth." By giving the upper floors the same head-room and equally convenient and costly fittings, the discrimination against them was partly removed—after one got up there; but the work and shortness of breath remained.

Stairways as now built have the additional demerit of taking up a great deal of valuable surface-room in the most desirable portions of the building.

We find, then, that the tendency of men to avail themselves of the privilege announced in the famous expression of Hon. John M. Clayton, that right and title to land extended "heaven high and hell deep," has led to the almost inordinate extension skyward of public and even private buildings, and has more recently rendered it necessary to extend the hoist-way system to the accommodation of passengers; and in new buildings the staircases were relegated to the less valuable portions of the floor space. The earliest passenger elevators were simply a betterment of the goods cages; and the fact that their ropes sometimes parted and let the cage and contents down with a run, did not add to their popularity. Safety attachments were next in order—first in the shape of an extra rope, and later in ingenious clutches or catches, generally dependent for action upon butting, jamming, or twisting friction. These lessened the risk and fairly inaugurated the era of passenger elevators; until now-a-days a large building is considered as incomplete without one as without steam or furnace heat, and no hotel can get good rates for its upper floors unless there is an elevator to keep them up.

There was but one serious drawback to the introduction of the elevator—the necessity of employing a steam engine to do the hoisting. The minor evil of the roughness of action attendant upon the hoisting action of most of the quick-stroke winding engines prejudiced people with loose teeth and sensitive stomachs against the voyage; and the action of a quieter motion and smoother ascent became one of the longed-for innovations.

Fortunately, the power had long existed, and nothing but the newness of the application was a bar to its adaption to the purpose. This was a matter soon overcome; and we have now, in the hydraulic elevator, something more nearly approaching the public demand for a smooth and safe riding apparatus not necessitating the use of steam.

We illustrate herewith one form of hydraulic elevator, (*) having a hollow cast-iron base from which projects a cast-iron cylinder fitted with a piston, and through which base is a shaft carrying three drums, one within the base, and carrying chains attached to the piston, and the others, shown in the cut, carrying the two wire hoisting ropes of the cage, which pass down to the bottom of the cage and pass under an iron shaft there. A three way cock, operated by a wire rope from the cage, admits, cuts off or discharges the water. The rise of the piston unwinds the piston and revolves the drum shaft, causing the car to ascend. The safety attachment is a wedge brake which the breaking of either rope puts in operation by the strain on the other rope turning the shaft. There are but two stuffing-boxes—those in the sides of the base, and through which the drum-shaft passes. The piston is packed by hydraulic cup-packing of leather.

As applied to a private house, such an elevator requires a floor cutting of 3 by 2½ feet, and should carry four persons weighing in all 600 lbs. The car is balanced by weights. The two-inch wire ropes used should carry 16,000 lbs. A piston two feet in diameter and two-foot stroke would, with sixty lbs. water pressure, raise (neglecting fractions) $3.1416 \times 144 \times 60 = 27,143.424$ lbs. two feet high, or 1357.6712 lbs, forty feet high, consuming

$$\frac{3.1416 \times 144 \times 24 = 47}{231}$$

gallons of water. Allowing 20 per cent. for friction, the lift would be equal to 1086 lbs. forty feet high. No power is, of course, required to lower the car, as where steam is used.—*Polytechnic Review.*

(*) Made at the Burdon Iron Works, Front and Pearl Sts., Brooklyn, N. Y.

A COMMOM-SENSE PLUMB BOB.

(See page 296.)

The difficulty with the plumb bobs of theodolites, etc., is not that they vibrate or swing, like a pendulum, but that they *wabble*, and do not "center" quickly. The reason of this is that the cord suspending the bob twists and untwists, and causes the latter to twirl; but this rotation causes *wabbling* solely on account of the faulty shape of the bob.

Referring to the figures: A is the ordinary pear-shaped masons' bob, where the line gives the guage; B and C are the common top-shaped forms of instrument bobs, where the point marks a centre below. All three of these bobs become "drunken" when rotated by their strings twisting and untwisting. The turnip-shaped bob shewn at E will twirl at a rapid rate without wabbling; its point remaining centered. A disk, E, would twirl as steadily.

The reason is that a rotating body tends to rotate about its shortest axis. A ring, F, hung by a cord, and twirled very rapidly, will obstinately refuse to hang vertically and to rotate about its long diameter, but will, under rapid vibration, take the position shown at G, and when slowing down, or when speeding up, will "wabble." A chain ring suspended, as shown at H, will, when very rapidly twirled, spread out and keep the position shown at K. Hence the top-shaped bob, B, the pear, A, and the cone, C, will, when whirled by the untwisting cord, wabble, and their points will not remain centered; while the turnip, D, or the disk, E, will, even if the cord does twist, remain centred, and the line will be plumb.

A NEW FIRE EXTINGUISHER.—A new fire-extinguishing chemical compound has been lately devised, which, in its application for extinguishing fires, is quite different from the fire-annihilators in general use. The new composition is a mixture of chemicals which, on being ignited, evolve sulphurous acid and carbonic-acid gases, which fill the apartment or building, producing an atmosphere which smothers combustion. A successful trial of this invention was recently had in front of the City Hall, Philadelphia. A board shanty, 13 feet square and 10 feet high, was erected to represent an apartment, and furnished with a door, window, and a stove-pipe coming through the roof. The interior was coated with tar. On a bench were placed seven basins containing benzine, coal oil, and naphtha. In one corner was a 10 lb. box of the extinguishing compound, with a fuse attached to it running round the walls, on the self-igniting plan. The combustibles were set on fire, and in an instant the interior was one sheet of flame, bursting out through the door, window, stove-pipe and every aperture. A few moments after the compound was ignited, the gases that were generated therefrom instantly subdued the flames, and in less than half a minute the fire was entirely extinguished. The new substantance is called "Reec's Compound Fire Extinguisher."