THE LONDON BLACKWALL TUNNEL.

On the 22d of May last this latest example of shield driven tunnels was dedicated for public travel in London, in the presence of their Royal Highnesses the Prince and Princess of Wales, and the London County Council and other dignitaries. We are indebted to Mr. Maurice Fitzmaurice, one of the resident engineers, for a pamphlet giving a brief description of the tunnel.

It appears in London there are very few free bridges across the Thames. This tunnel built under the Thames is the only free crossing between the Tower Bridge and the Woolwich Free Ferry, a distance of nearly nine miles, and will be largely used because of the large population of London east of the London Bridge. The tunnel is constructed of iron plates bolted together, lined on the inner surface with white glazed brick, and has an external diameter of 27 feet—one of the largest shield driven tunnels ever built. The roadway inside is 16 feet wide, with head room above the center of 17 feet 6 inches. On each side are footpaths for pedestrians. Under the roadway is a space reserved for sewers, gas and water pipes.

The tunnel proper is 6,200 feet long and is lighted throughout by electricity brilliantly enough so that a newspaper can easily be read in any portion.

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1025, is illustrated the great hydraulic steel shield used in the building of the tunnel under the banks and the bed of the river. Several unusual difficulties were encountered, one being the giving way of the river bed above the shield and letting in the water. This was prevented or overcome in a measure by dumping clay soil into the river over the path of the shield, which kept the bed compact. After the tunnel was finished the extra layer of clay on the bed was dredged out. Compressed air was also used in the front section of the shield to drive back the water and protect the workmen during the excavation, especially in tunneling through a gravel soil. A transverse steel partition provided with several doors in the front portion formed a watertight bulkhead in an emergency, the earth being shoveled through the different doors as occasion required.

On driving the shield (weighing 250 tons) forward by hydraulic rams, the enormous water pressure of two and three-quarter tons to the square inch was used, and at times it was over 5,000 tons. The portion of the tunnel under the river was built in one year, or at an average rate of 100 feet per month. The total cost was a trifle over $4,000,000. Another important fact is that the entire work was completed within the original estimate or contract tender. A summary of the materials used is as follows: Cast iron, 17,000 tons; bricks, 7,000,000; white glazed tiles, 1,000,000; cement, 20,000 tons; concrete, 110,000 tons; asphalt, 5 acres; electric light cables, 12 miles; earth excavated, 500,000 tons.

There is no question but what the tunnel will be of great utility to the population of London, and the council, promoters and engineers deserve great credit for their perseverance in pushing the work to completion.

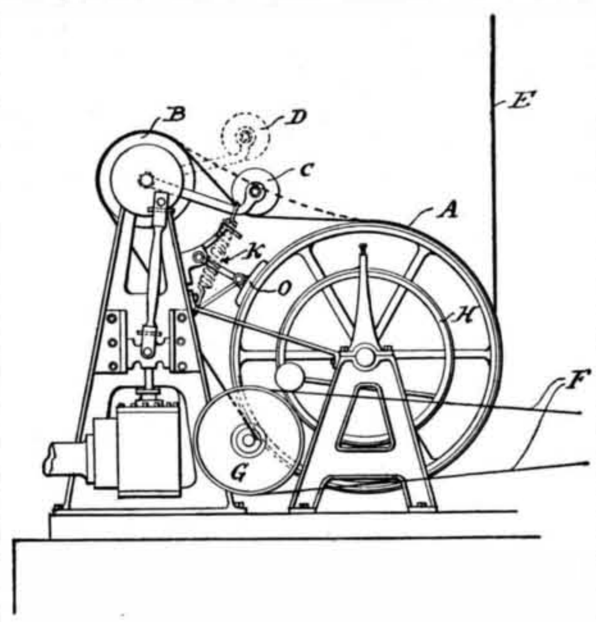
FALL OF AN ELEVATOR IN THE POST OFFICE BUILDING, NEW YORK.

The fall of a freight elevator last week in the general post office, New York, is one of those cases of failure which possess a special interest for the mechanical engineer. By the courtesy of Lieut. A. B. Fry, Chief Engineer and Superintendent of Repairs, United States Buildings, New York, we have examined the elevator and are enabled to present our readers with an outline sketch of the hoisting machinery and a detailed account of the causes which led up to the accident.

The elevator, which is located on the Park Row side of the building and near the northeast corner, is one of two duplicate elevators which are used for carrying freight, mails, and post office employes. It runs from the basement to the top floor. On the morning in question it started from the basement with 1,500 pounds of plaster in bags, two laborers, a post office employe, and the elevator man—a total estimated load of about 2,150 pounds. A stop was made at what is known as "the gallery," the first landing above the ground floor, and here two more railway mail clerks entered the car. The elevator man pulled the shipper rope for a further ascent, when the car almost instantly fell to the bottom of the shaft. On striking it rebounded, according to some of the occupants as high as five feet, and according to others only a foot or two. The two hoisting ropes, which broke at the drum, then ran up over the top sheave and fell upon the car. All the occupants were more or less seriously injured by the drop of forty feet and by the falling of the steel ropes upon them.

At the time of the accident there was a live load of about 2,400 pounds on the car, and it was naturally supposed that the strain had proved too much either for the ropes or some part of the overhead gear or hoisting engine. An examination of the wreck showed that the overhead gear and the hoisting machinery were intact, but that the two ¾ inch steel ropes had parted at a point about 14 inches from the clamps which fastened them to the drum. At first sight it looked as though this rupture of the ropes was the direct cause of the disaster; but on closer examination two circumstances were noted which rendered this very improbable. For in the first place the breaking strength of the ropes was fully seven times greater than the combined weight of the car and its load—about 3,700 pounds—and moreover the ropes were both found to be in excellent condition at the point of rupture. One of these had been in service eight or nine months and the other about eighteen months, the life of a rope subject to such service as these being from three to five years. Another consideration which makes it impossible that the ropes failed from the direct pull of the car is the fact that when the latter commenced to fall there were six or seven turns of the rope wound upon the drum between the point of subsequent rupture and the point at which the rope left the drum and ascended the elevator shaft. Even when the car was on the sub-basement floor there were one and a half turns on the drum, and hence a considerable amount of the strain would be transferred by friction to the drum and would never reach the rope at the point of rupture.

If it was not the failure of the ropes, what caused the fall of the car? The theory accepted by the engineer is that it was due to slipping of the belt which connects the engine shaft and the drum, and that this was caused by a heavy load combined with awkward handling. By reference to the accompanying sketch of the hoisting engine, a McAdams & Cartwright machine, it will be seen that the drum, A, is driven by a belt from the pulley, B, on the crank shaft of a two cylinder vertical engine. The tension of the belt is regulated by the deadweight of an idler or belt tightener, C, which is carried by a couple of arms hinged to the crank shaft. The hand ropes, F, leading through the car pass over a "shipper" pulley, G, on whose shaft is a gear wheel which operates a horizontal rack on



SKETCH OF POST OFFICE ELEVATOR HOISTING ENGINE.

the valve stem of the engine. Attached to the same shaft is a cam which lifts a weighted arm when steam is admitted to the engine and releases the strap brake, H. A separate check rope is also provided by which the brake can be thrown full on in cases of emergency—which latter device, unfortunately, the operator failed to apply when the car started to fall. Another powerful brake, K, is provided, which is brought automatically into action if the belt should carry away, in which case it would be set hard against the pulley by the fall of the idler.

Regarding the slipping of the belt and the consequent fall of the car, it must be remembered that the latter is not counterbalanced, and, consequently, when the brake, H, is raised there is nothing to prevent the car from falling but the belt friction. It has been found by careful test that by suddenly jerking the hand ropes and giving the engine a full feed of steam, the sudden start of the pulley, B, especially with a heavy load, will throw the idler clear of the belt into the position, D, shown by dotted lines. This slacks the belt and leaves the drum momentarily free to unwind. Under average moderate loads the jump of the idler is small, and scarcely sufficient to affect the action of the belt; but on this occasion, when the load was exceptionally heavy, it is supposed that the operator instinctively gave a heavy pull at the hand rope and threw the idler high enough to allow the car time to commence its descent. By the time it fell upon the belt again the car would have acquired great momentum and the idler would simply rebound from the belt. Practically the only check upon the descent of the car would be that due to the friction and the inertia of the drum, which weighs about 600 pounds, and the velocity of the car, which, as we have said, was not counterbalanced, would be very nearly that due to its falling freely through a space of 40 feet. By the time it reached the bottom of the shaft the ropes were unwound from the drum, and the bruised appearance of the strands at the break indicate that they were entangled and cut through either at the first descent or on the rebound of the car.

It is evident that, whether this is the true explanation of the disaster or not (and it is quite compatible with the facts and subsequent tests), the weak point in this system of elevator lies in the uncertain nature of the tension on the belt. The defect can be remedied by inserting a stiff coil spring between the idler and the engine frame, as shown in dotted lines in the sketch. This is to be done in the case of the two engines at the post office, and it is a precaution that should be adopted as a measure of safety in the case of all hoisting engines that are operated on this plan.

DEATH OF ALVAN G. CLARK.

Alvan G. Clark, the famous telescope lens maker and astronomer, died suddenly of apoplexy at his home at Cambridge, Mass., on June 9. Mr. Clark had returned from Chicago two weeks before, after placing the famous objective in position in the great telescope tube at the Yerkes Observatory, at Williams Bay, Wis. A short time before the trip he had a slight stroke of paralysis, but recovered in a few days.

Mr. Clark will be the last of the famous lens makers. He was born at Fall River, Mass., in 1832. After a grammar school education he became associated with his father and brother in the manufacture of telescopes, the factory being at Cambridgeport, Mass. When Alvan Clark, the founder of the firm of Alvan Clark & Sons, died in 1887, just after the firm had completed the great telescope lenses for the Lick Observatory, Alvan Graham Clark became the head of the firm. Among the lenses completed under his supervision was the 26 inch lens in the Naval Observatory at Washington and the 30 inch refractor for the Imperial Russian Observatory. For the latter work Mr. Clark was decorated by the Czar. The most important objective which Mr. Clark ever undertook was the lens for the great telescope of the Yerkes Observatory. This is the greatest refracting telescope ever made, the lens being 40 inches in diameter and the focal length 64 feet. The cost of the lens and fittings was about $65,000.

Mr. Clark was also an astronomer of high standing. In 1870 he accompanied the total eclipse expedition to Jerez, Spain, and he was a member of a similar expedition to Wyoming, in 1878. He discovered fourteen double stars, including the companion to Sirius, for which a gold medal was given to him by the French Academy of Sciences.

KITES AS AN AID TO DISCOVERY.

Prof. William Libby, Jr., of Princeton University, is about to undertake a unique exploring expedition, with a party of six. They expect to leave New York the first week in July, for Albuquerque, New Mexico. In the vicinity of this place rises from the alkali plains to a height of more than 700 feet a "mesa" or tableland of sandstone. The top of this has never been explored by white men, because the almost perpendicular walls make its summit inaccessible even to the most experienced mountain climbers. To students of archæology and anthropology, this tableland possesses great interest, because of the belief that it was once the home of a race of cliff dwellers. Articles of pottery have fallen from the top of the "mesa," so this belief seems reasonable. Prof. Libby and his party intend to explore the tableland, if it is a possible thing.

They will remain in camp at its base until they are either successful or are convinced that their endeavors are useless. They intend to avail themselves of several devices to reach the top. The first idea of Prof. Libby was to take a mortar with the expedition, and shoot a line over the "mesa" at its narrowest point, where it is only a few yards wide, the method being very similar to that adopted by the life-saving service. Recently, Prof. Libby became impressed with the utility of Mr. Eddy's kites, and the professor has visited Mr. Eddy relative to the matter. Prof. Libby will have material for a dozen of Mr. Eddy's kites prepared. They will be constructed for use in the extremely light winds prevalent in the vicinity of the lone tableland. He will ship the mortar, cables and other equipments for the expedition. If the cable can be successfully hauled over the "mesa's" summit the party will rig a boatswain's chair on the cable, and thus be able to ascend to the top of the tableland.

STATURE AND WEIGHT.

These anthropological elements are discussed in a highly satisfactory manner by Dr. Buschan, of Stettin, editor of the Centralblatt für Anthropologie, in the "Real Encyclopadie der Gesammten Heilkunde," now publishing in Berlin.

In America no tribe is mentioned with an average under 1·60. The tallest are undoubtedly American, some (doubtful) Caribs of the Orinoco at 1·84 and the Tehuelche of Patagonia at 1·78.

The article on the weight gives abundant information about the relative weight of the brain and other organs.

Both articles contain a very complete bibliography of the recent scientific literature of the subjects.