VENTILATION OF RAILWAY TUNNELS.

To ventilate a building containing various apartments, with opening doors and windows that interrupt or modify the air current, is somewhat difficult; but to thoroughly purify the atmosphere of a railway tunnel, which is a single closed apartment, is one of the most easy matters with which the engineer has to deal. The air in the long railway tunnel under the city of Liverpool is changed every ten minutes by means of a large steam fan, placed near the center.

A novel method has lately been adopted on a portion of the Underground Railway in London, which is described in a recent number of *Engineering* as follows:

"A very careful investigation of the condition of the air in the Metropolitan Railway covered way was undertaken conjointly by Messrs. George H. Bachhoffner, Henry Letheby, and J. Whitmore, and the result of their investigation showed that, while the air of the tunnel was sufficiently impregnated to impart disagreeable and, in some cases, inconvenient sensations, no source of danger could possibly exist. With regard to carbonic acid, a number of careful experiments showed that, in the railway tunnels, during the busiest period of the day, when its quantity attained a maximum, there were only 6·1 parts to 10,000 parts of air in volume. In many crowded places of public resort, such as churches, theaters, law courts, etc., the quantity of carbonic acid reaches the proportion of 32 parts per 10,000; and in Manchester, during foggy weather, it is often 8 parts per 10,000 in the streets. The presence of carbonic oxide can be scarcely detected. This result of this investigation proved conclusively that no danger from inhaling the air in the tunnel could possibly exist.

The section of the Metropolitan Railway lying between the Gower street and Portland road stations, a length of half a mile, has no communication with the outer air between the two points just named.

A means presents itself, however, for improving the ventilation of this length of the line through the fortuitous circumstance of the Pneumatic Dispatch Company's tube crossing the crown of the Metropolitan Railway arch between Gower street and Portland road. This tube connects the Euston square terminus with the company's pumping station at Holborn, whence a second section of the tube is carried on to the General Post Office. The Euston-Holborn tube, which is 3,080 yards in length, is of ⌐ section, 4 feet 6 inches high, and 4 feet in width. On the floor of the tube, rails are laid, upon which run carrier wagons, 10 feet 4 inches in length, and weighing each 22 cwt. The ends of these carriers conform to the shape of the tube, and a close contact with the sides of the latter is always maintained by means of rubber packing. These carriers—either empty or loaded with letters and parcels—travel between Euston, Holborn, and the General Post Office. The motive power, which is located at Holborn, consists of an engine with a pair of 24 inch cylinders, of 20 inch stroke. This engine drives a fan 22 feet in diameter, at an average speed of 160 revolutions per minute. By this means a pressure of about 6 ounces per square inch is obtained, available either for forcing the carriers from Holborn to Euston, or on the return journey for exhausting the tube, and thus creating a sufficient difference of pressure against the ends of the carriers. The traffic between Holborn and the Post Office is conducted in precisely the same manner.

The relative positions of the pneumatic tube and the Metropolitan Railway tunnel are, as we have mentioned, such that openings could easily made between the roof of the latter and the floor of the former, for the ventilation of the railway tunnel.

This idea has been carried out very successfully by Mr. S. De Wilde, resident engineer of the Pneumatic Dispatch, with the approval of the Metropolitan Railway Company, and, as at present worked, a very sensible improvement in the ventilation of the tunnel is effected. Two rectangular openings, each 6 feet by 2 feet, are cut through the roof of the tunnel into the tube, and these openings are closed by valves hung upon trunnions, and so balanced as to open freely inwards. When the carrier is on its way from Euston to Holborn, and after it has passed the tunnel, the valves are opened by the passing carrier, the air is drawn in from the tunnel at the rate of about 1,000 cubic yards a minute, until the carrier reaches Holborn, when the action of the fan is reversed, and a pulsation of air is sent through the tube, until it strikes the valves, and closes them.

It will be worth while for the Metropolitan Railway Company to consider whether they cannot ventilate this section of their line more efficiently and a great deal cheaper than by the help of the Pneumatic Dispatch fan. The length of the line between Gower street and Portland road is about 900 yards, and the cross section of the tunnel is 450 square feet; its capacity is thus 1,215,000 cubic feet. Supposing this amount of air to be changed every hour, 20,250 cubic feet would have to be dealt with per minute. If openings no larger than those now leading into the pneumatic tube were adopted, a velocity of 22 feet per second through these openings would change the whole of the air every hour as above stated; and the pressure required to give this velocity, is only 0.122 ounces per square inch, the excess of pressure being absorbed principally by the friction of the tube. Even supposing that a Siemens steam blast be used for the purpose, it would be found more economical than the system now proposed. With this jet, the volume of air that can be exhausted by a volume of steam reduced to atmospheric pressure is 1·37 to 1, that is to say that, to exhaust 20,000 cubic feet of air per minute, 14,600 cubic feet of steam at atmospheric pressure would be required, corresponding to 9 pounds of steam per minute, or 540 pounds per hour, and representing a consumption of about 60 pounds of coal per hour. As we have said, this would not prove the most economical means of ventilating the tunnel, but the first cost of its establishment would be confined to the necessary connections and a small steam boiler. On the other hand, if a fan were placed close to the tunnel, an engine of three horse power, consuming from 10 to 15 pounds of coal per hour, would be ample for the purpose."

In view of facts like these, we hope that railway passengers, who find the atmosphere of our long railway tunnels sometimes disagreeable, will remember that the nuisance exists, not because it is difficult to overcome, but solely because railway companies are so careless and parsimonious as to refuse to burn a few pounds of coal, to promote the comfort of passengers.

Take, for example, the Erie Railway tunnel, at Jersey city, not quite one mile in length; was there ever a more smoky, foul, or disagreeable place for passengers to go through? The reason is obvious. Both tracks of the railway tunnel are constantly occupied by locomotives belching forth clouds of smoke, and the company employs no special means for ventilation. The area of the Erie tunnel is about the same as that of the London Metropolitan Railway, namely, 450 feet cross section, but it is twice the length of the Gower street station tunnel.

On the basis of the estimate given by *Engineering*, it would require the consumption of from 20 to 30 lbs., of coal per hour to ventilate the Erie tunnel, by an hourly change of its entire contents, while from 40 to 60 lbs. of coal would ventilate its entire length every half hour.

It will also be seen, from the foregoing, how utterly absurd is the bugbear which property owners and others have tried to raise against the construction of the Broadway Underground Railway in this city, namely, that its atmosphere would be bad. The truth is that the sectional area of the Broadway tunnel will not exceed that of the London Underground Railway. Calling the area 450 square feet, and the tunnels between the stations half a mile in length, the Broadway company will, according to the estimate of our cotemporary, be able to renew the entire contents of its tunnels every fifteen minutes on a fuel consumption of 40 to 60 lbs. of coal per hour, costing, say, 10 or 12 cents. This would probably give a better ventilation than is ordinarily found in our dwellings, offices, and stores.

Railroad Train Timer.

An ingenious invention has lately been successfully tested on the Vandalia Railroad, Ind., which records the motion of railway cars. There is a locked iron box, attached to one side of the car and containing a clock. The mechanism of the latter causes a small drum, on which is wound a sheet of paper, to travel at a constant rate. With the axle, by means of rods and gearing, a pencil touching this paper is connected. As the pencil is moved slowly across the paper, by its mechanism governed by the axle, and as the paper is slowly moved forward, the pencil point inscribes a diagonal line back and forth. The paper is ruled in very small sections, every fourth line being dotted and representing one mile; so that, supposing the car goes a mile in four minutes, the line will cross just four sections diagonally from one dotted line to the next one. If the car stops, the line crosses the paper directly and shows the number of minutes that the train is at rest.

The names of the stations are written at the proper places on the paper, and thus the exact rate of speed made at any point on the line can be subsequently noted. The apparatus thus affords an excellent check on the train officials, as, if the train be run ahead or behind time, the fact is sure to be detected.

The St. Joseph, Mo., Exposition.

An industrial and agricultural fair is to be held in St. Joseph, Mo., from September 7 to 12, inclusive. The grounds extend over an area of 100 acres, and form the site of large and commodious buildings, the main hall of which covers 30,000 square feet, and the machinery hall, 16,000 square feet, of surface. There is also a fine race course and ample accommodations for live stock. No entry fee is charged, and liberal arrangements have been made with connecting railroads.

The money premiums aggregate the large sum of $25,000, and are offered for almost every conceivable object and process. There are also special prizes, mainly awarded by the citizens of St. Joseph, two of which, at least, are evidently intended to benefit the community through the advantages of brisk competition. One is offered for the best calico dress made by any young lady under the age of twenty years, and the other to the mother of the best looking baby between the ages of one and two years. The individual who is about to undertake the arbitration of the last mentioned question has our cordial sympathy.

The Ruins of Farkin.

The Rev. Dr. H. D. Barnum, missionary in Turkey, in a recent letter to the New York *Observer*, gives an account of a visit he lately made to the ruins of Farkin, in Eastern Turkey, near the border of Persia. He says: *En route* to Van we spent several hours with great interest among the ruins of Farkin. The present town is little better than any of the other towns of Koordistan; but it is surrounded by a very fine ancient wall, and contains very imposing ruins, which for picturesqueness of effect fairly rival the Coliseum and the Forum at Rome. The most noticeable are a large cathedral and the elegant standing arches and pillars of a church, built 1,400 or more years ago, in memory of the Christian martyrs who were put to death by the King of Persia. There is likewise a very fine mosque or late date, also in ruins, and a palace, all of which combine to form a picture, the like of which is seldom seen in any land.

Spiral Bevel-Edged Arrow Heads.

We published not long ago an engraving of an Indian arrow head, with spiral bevels to give rotary motion to the arrow during its flight. The specimen was from the collection of Dr. Olmstead, who believed it to be unique. As a result of that publication, we have received several similar specimens; also letters from other individuals who are in possession of specimens. In the collection of 250 arrow heads belonging to Mr. A. J. Schultz, of Dayton, Ohio, there are six which have the bevels. From these evidences it appears that the rotating arrow was a not uncommon projectile with the North American tribes.

NEW BOOKS AND PUBLICATIONS.

MECHANICAL HUMOR: a Collection of Original Anecdotes connected with Engineering and Mechanics. By J. Richards, Mechanical Engineer, Author of "The Principles of Shop Manipulation," etc. Price $1. Philadelphia, Pa.: George Richards, Franklin Institute Building.

Mr. Richards has collected in this volume several readable sketches and anecdotes of workshop life and its peculiarities, accidents, and remarkable occurrences. The last tale in the book, called "Struck by a Sea," is a good piece of descriptive writing.

AN INTRODUCTION TO THE STUDY OF GENERAL BIOLOGY, Designed for the Use of Schools and Science Classes. By Thomas C. McGinley, Principal of Croagh National School, Ireland. With 124 Illustrations. Price 75 cents. New York: G. P. Putnam's Sons, Fourth avenue and 23d street.

The rapid increase of our knowledge of the initial forms and phenomena of life, due so largely to the labors of Balfour, Carpenter, and Huxley, has awakened great interest in this most important branch of natural science; and there is a widespread demand for elementary and accurate text books of the subject, which Mr. McGinley has responded to in a terse, well written treatise, carried down to the latest date. We commend it to the notice of instructors in natural history.

THE LEADER, a Collection of Sacred and Secular Music for Choirs, Conventions, and the Home Circle. By H. R. Palmer and L. O. Emerson. Price $1.38. Boston, Mass.: Oliver Ditson & Co., 277 Washington street.

This volume adds one more to the number of books of dilute music which encumber the shelves of our school and other libraries. Most of the songs contained in this book would not pass muster as a school girl's first attempts at harmony; and the few meritorious selections in it (Mendelssohn's "May Bells" and one or two more) are garbled and disfigured to suit the "taste" of the compilers.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 31 to August 18, 1874, inclusive.

BOLT AND NUT LOCK.—I. D. Guyer, New York city.
CAR COUPLER AND BUFFER.—O. Pooley, Buffalo, N. Y.
CAR REPLACER.—E. Newcomb, Westbrook, Me.
CLOTHES WRINGER.—C. M. Howlett, Auburn, N. Y.
DENTAL ENGINE.—N. Stow, Binghamton, N. Y.
ELLIPTIC SPRING.—E. Cliff *et al.*, New York city.
EMBROIDERY ATTACHMENT.—G. M. Ramsay, New York city.
FORGING, DRILLING, & RIVETING MACHINE.—R. H. Thurston, Hoboken, N. J.
FUEL FOR METALLURGY.—C. E. Lester, New York city.
GENERATING POWER.—C. C. Walcott *et al.*, Washington, D. C.
HARVESTER.—D. M. Osborne (of Auburn, N. Y.), London, England.
ILLUMINATING CLOCK DIALS, ETC.—H. O. Cook, Brooklyn, N. Y.
MAKING CHAIN, ETC.—J. Selden, Erie, Pa.
MAKING FISH HOOKS.—William Court *et al.*, Brooklyn, N. Y.
PAVEMENT.—P. Zadig, San Francisco, Cal.
PORTABLE FOUNTAIN.—G. J. Wenck, New York city, *et al.*
SELF-SUSTAINING MOTIVE POWER.—G. Rischmuller, San Francisco, Cal.
SEWING MACHINE FEED.—G. Merrill, New York city.
SHAFT COUPLING AND PULLEY HUB.—A. Brehmer (of Philadelphia, Pa.) London, England.
SWIMMING APPARATUS.—F. Tryon, Brooklyn, N. Y.
UMBRELLA.—C. A. Thompson, East New York, N. Y.
VEHICLE WHEEL.—J. H. Small (of Buffalo, N. Y.), London, England.