Correspondence.

The Bottle That Cannot be Refilled.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to make some remarks in answer to your article "The Bottle that Cannot be Refilled," in the SCIENTIFIC AMERICAN of November 30, 1895.

First: If people can "imitate both bottles and trademarks of standard makers without detection," then there is no necessity of trying to prevent the refilling of the bottles.

Second: The object (in my opinion) of the fraudulent refillers is not so much for the bottle as for obtaining the label intact.

Millions of bottles are purchased annually from restaurants, etc., the principal object being to get the labels in good order, so that the bottles can be refilled.

Third: As a protection for bottles—to prevent the refilling of them by fraudulent refillers—the labels should be made on the Bank of England's bank note system, including a label destroyer.

ALEX. S. LA FONTAINE.

Cerro Colorado (Amba) Curacoa.

The Integral Parts of a Locomotive.

A writer in the Chicago Record describes the parts of a locomotive and their functions and the feeling an engineer has for the one he drives.

Down grade, a clear track, an easy siding seven miles ahead, No. 2 out of the way, seventy pounds of air, twenty empties and a caboose behind, the fireman on the footboard polishing the hand rail and throwing rapid transit kisses to the pretty girl on the fence; a fresh pipeful of tobacco, a bright, crisp morning, steam shut off, the locomotive sliding down the slant with only the noise of rumbling machinery and the rush of sixty-five tons of metal and breakfast but half an hour off, are conditions which fill the heart of the engineer in the cab with a rapturous love of life and movement. Like an enormous toboggan the freight train glides down the incline, swaying and creaking, jolting and jumping on the curves, but not a puff or hiss from the engine. Then comes the drone of the whistle, the grinding of the brake shoes on the wheels as the air is put on, three or four impatient yaps from the locomotive, a switch is thrown, and the magnificent machine draws ahead slowly and with dignity onto the siding.

It was an old engineer who said, patting the great driving wheel: "Electric motors may take the place of steam locomotives some day, but they never will be as handsome."

He spoke from his heart, for to the engineer and fireman a locomotive is the greatest, the most magnificent, the finest, the most intelligent, and nearest approach to a human being in the mechanical world. The engineer speaks of his engine as "her." He encourages her, and chides her, and sometimes swears at her when she is "cranky."

He protects her from stiff joints with the finest of lubricating oil; she is fed with the best of coal, and bedecked with the brilliantly polished brass and copper fittings. He watches over her with a jealous guardianship, and humors and caresses her constantly. He is sad when she does not reciprocate his affection, and lauds her unstintedly when she is good.

This enthusiasm of the engineer is shared to some extent by every man who stands beside a locomotive. It is fascinating to the average admirer, because it is mysterious. The beautiful proportions and massive construction excite admiration because they appeal to the eye, but the rods, pipes, valves, link motion, bell cranks, levers, and other parts of its anatomy are beyond the common understanding.

Yet a locomotive is but two stationary engines mounted on wheels, which also carry the boiler, fire box, pump, and attendants. If anything, it is more simple in construction than some of the triple expansion or compound Corliss valve engines which are bolted to foundations in a machine shop or a great factory. There are thousands of stationary engines equipped with reversing gears almost identical with those used on a locomotive, and the steam valve of a locomotive is a simple sliding valve.

The locomotive consists, first, of its boiler, which is solidly attached to the two steam cylinders in front. The cylinders are bolted firmly to the frame of the running gear. The back part of the boiler stands between and over the driving wheels, and over it is the cab, which protects the engineer and fireman from the weather.

The furnace, or fire box, is part of the boiler, in that it is not a separate and outside furnace, and the sides of the furnace are formed by the water legs of the boiler, which come down to below the grate bars. This gives the rear end of the boiler a shape like a keyhole.

The hump or dome on top of the boiler nearest the engine cab is the steam dome, and from this dome the dry steam is taken to the steam cylinders through a pipe which passes through the boiler and divides into two pipes under the smokestack. That part of the boiler which begins under the smokestack and extends to the pilot or "cowcatcher" is called the "smoke box," and in it is a wire netting which catches the sparks and cinders.

The "exhaust" steam from the cylinders passes up through an exhaust pipe which does not quite reach the bottom of the stack inside of the smokebox, so that the steam, forced out of the exhaust in puffs, makes a draught which sucks the air through the grate bars in the bottom of the firebox to perfect combustion.

In the dome end of the steam pipe which conveys the steam from the dome to the cylinders is a valve, which is opened and closed by a rod that passes back to the engine cab. This is the "throttle valve," and when the engineer says he has "thrown her wide open," he means that he has pulled back the "starting bar" so far that the valve in the dome is opened as far as it will go, and the cylinders are getting all of the steam that it is possible to give them. The engineer keeps his hand on the lever of the starting bar, or, as it is commonly called, the "throttle." The lever which comes up, almost touching his knee, is the reversing lever. It is similar in design, but much more finished in workmanship and of handsomer proportions, to the grip lever in a cable car.

At its lower end it is held by a steel pin to the frame and moves back and forth. An arched piece of flat steel with notches cut in the upper edge, called the "sector," is used to hold the reversing lever in any position desired, for a steel tongue, raised and lowered by a lever which extends down the handle of the reversing lever, fits into the notches and thus holds the reversing lever. The reversing lever moves the "reach" far back and forth, and the reach bar is connected with the link motion.

The link motion is a device by which the engineer can let steam in at either end of the cylinder, and thus start his engine ahead or reverse it. This is done by two eccentric rods, the "forward" and "backward," which by suitable mechanism that must be seen to be understood actuate the sliding valve in the steam chest.

By throwing the reversing lever forward the valve gear is so adjusted that the steam enters the cylinder so as to move the engine forward; by throwing the reversing lever back the opposite effect is secured.

A locomotive moves over the steel rails because of its "tractive" force. This traction is increased by increasing the weight over the driving wheels. The friction between the tires of the drivers and the steel rails causes the wheels to grip the metal, and as the rails are immovable, the wheels must go forward.

The steam, by pressure and expansion, forces the piston in the cylinder to move. The "piston rod" is connected with the "crosshead," which moves back and forth between the "guide bars." The connecting rod transmits the motion to the drivers, and the drivers, revolving, move the engine.

It is sometimes necessary to increase the friction between the drivers and rails, and this is done by throwing dry sand on the rails immediately in front of the driving wheels. On some locomotives the sand box is perched on top of the boiler, and a rod from the engine cab opens the sand valves, one for each side of the engine, and the sand falls down through pipes to the rails.

Steam cylinders require oil for lubricating purposes, and this oil is fed to the steam valve through a pipe which passes from the cab through the boiler, so that the oil is not affected by the cold air. As soon as steam is shut off from the cylinders they grow cold and the steam condenses to water. This must be drawn off, and the engineer in his cab, by pulling a rod, opens the "cylinder cocks" and keeps them open until the sound of the escaping steam tells him that nothing but dry steam is passing through. It is when the cylinder cocks are open that the flying locomotive sends out jets of steam to the right and left.

In the tender of the locomotive, which is entirely separate from, although a part of, the locomotive, the coal and water are stored. The water is kept in the tank which forms the sides and back of the tender, and the water, brought from the tank through a feed pipe, is forced into the boiler through an injector.

The fireman, with a large scoop shovel, feeds the ravenous maw of the locomotive with coal. A chain is hooked to the furnace door, and when the fireman slides a scoopful of coal over the iron floor plates to the door he pulls the chain, the door opens, the coal is dumped into the firebox, and the door is slammed shut at once, for no fireman likes to let cold air enter his firebox over the fire.

The careful fireman does his work on the principle that slow combustion is the nearest to perfection, because it makes less clinkers and saves fuel and labor in cleaning. He keeps his fire bright and has no "cold" corners, and keeps his fire even so far as thickness of burning coal is concerned.

It is his duty to keep steam up and the boiler supplied with water, help the engineer to look out for signals, oil up, keep the cab clean, ring the bell, and throw coal at tramps who may be stealing a ride on the front platform of the mail car.

The invention of the automatic air brake relieved the engineer of a great deal of worry and nerve tension, for by a slight movement of the handle of the "engineer's" valve he can apply the brakes on every car of a train equipped with automatic air brakes.

In a short time the old familiar whistle "down brakes," which sends a train crew galloping over the tops of freight cars to wind up the hand brakes, will be heard no more, for every railroad in the country is equipping its freight cars with automatic air brakes, thus giving the engineer as much control over a hog train as he has over the "fast mails" and "limited throughs."

Standing in a vertical position on one side of a locomotive is the air pump. It compresses air into a main reservoir tank, which generally is placed under the front end of the boiler. From this line a pipe leads to the engineer's valve in the cab, and from this valve the air is admitted to the main air pipe, which extends under the train. The air in this pipe is kept at a pressure of about seventy pounds to the square inch.

Before the train leaves the station the auxiliary air reservoirs under each car are filled with compressed air, and this air is passed into the brake cylinders whenever, from any cause whatsoever, the pressure in the main air or train pipe is decreased. The engineer sets the brake by letting some air out of the train pipe.

If he is approaching a station he lowers the pressure gradually, thus applying the brakes by degrees, but if he sees the headlight of another locomotive coming toward him on the same track, he applies the emergency stop by opening the valve slide, and this sets the brake so "quick and hard" that the passengers are "brought up standing."

In the engine cab are steam gages and air gages, gage cocks for ascertaining the level of the water in the boiler, a water glass for the same purpose, levers for opening the safety valve, a cord for ringing the bell, a clock, and generally a number of photographs of pretty women, while under the cushions in a box are tools of all kinds and descriptions, the always present lunch box, and the soap and towels which the fireman and engineer use when they wash up after a run.

An Antarctic Continent.

The Hydrographic Office has received corroborative reports from mariners which go far to demonstrate the existence of an antarctic continent of considerable extent and elevation. The Naval Hydrographer, in connection with a recent ice chart issue, gives a few of the most important reports from a navigator's point of view, and says:

"On no other frequented trade route are vessels so liable to be obstructed by drift ice as in that portion of the South Atlantic lying to the east of Cape Horn and the Falkland Islands. As given by the most reliable authorities, the mean ice limit for this region runs northeastward from Cape Horn through latitude 50 degrees south, longitude 52 degrees west, as far as latitude 42 degrees south, longitude 35 degrees west, the occurrence of ice north of the fortieth parallel being rare.

"The chart shows the limits, according to the numerous reports received by the United States Hydrographic Office, of the enormous ice fields encountered by mariners in those waters during the exceptionally severe years of 1892 and 1893. All of these reports agree in describing the icebergs seen during these years as colossal in height and extent, and herded so closely together that any attempt to force a passage through the main body of the drift was attended by grave danger, many vessels being more or less damaged by collision, and two lost.

"A remarkable feature of the ice seen during these years was the different age of neighboring bergs, many of them presenting the sharp outline, jagged edge, and perpendicular face of recently detached ice, while others showed evidence of having been long afloat. Earth stains and discolorations upon several showed that at some period they had been in contact with the land."

Tree Ages.

Gericke, the great German forester, writes that the greatest ages to which trees in Germany are positively known to have lived are from 500 to 570 years. For instance, the pine in Bohemia and the pine in Norway and Sweden have lived to the latter age. Next comes the silver fir, which in the Bohemian forests has stood and thrived for upward of 400 years. In Bavaria the larch has reached the age of 275 years. Of foliage trees, the oak appears to have survived the longest. The best example is the evergreen oak at Aschoffenburg, which reached the age of 410 years. Other oaks in Germany have lived to be from 315 to 320 years old. At Aschoffenburg the red beech has lived to the age of 245 years, and at other points to the age of 225 years. Of other trees, the highest known are ash 170 years, birch 160 to 200 years, aspen 220 years, mountain maple 225 years, elm 130 years, and red alder 145 years.—Public Opinion.

A Carbonic Acid Spring.

While boring operations were going on at Sondra, near Gotha, the diamond drill was suddenly thrown up on July 27, when a depth of 627 ft. had been reached, and water and gas rushed up under a tremendous pressure. For 24 hours nothing could be done. The eruption of carbonic acid gas then quieted down sufficiently to allow operations to be restarted, but 20 ft. lower down gas was again struck, and this time the men had to flee for their lives. The roar was so terrible that the people around become seriously alarmed. It is estimated that hundreds of thousands of cubic yards of carbonic dioxide were discharged every hour, and that the original pressures of the gas amounted to 400 lb. or 500 lb. Heavy iron tools were tossed about like playing balls. Mr. Max Landgraf, the superintending engineer, was telegraphed for. For some time, however, nothing could be done but to rail in the place and wait for calmer days. At intervals of an hour and a half or two hours mineral water was thrown up 100 ft. This water resembled in its composition the water of the famous steel spring of Liebenstein, a favorite health resort of the Thuringian Forest, only a few miles from Sondra. This is the third time that powerful sources of carbonic acid have been met with in Germany in recent days. The acid spring near Münden, in Hanover, has been active for some time; the one at Salzungen was struck last March. During October the Sondra spring was successfully tapped, not without difficulty. The apparatus consists of a system of pipes screwed into one another, cocks for the water and the gas, and a manometer. It was supplied by Messrs. Biegleb, Hansen & Company, of Gotha, and took two days to fix; several times the whole apparatus was blown out again. The gas consists of very pure carbonic acid, 98 per cent, with 2 per cent of nitrogen. It rushes out at a temperature of about 40° Fah., and is now being secured—at least a small portion of it. The water, which contains sulphur besides the free carbonic acid, is as much appreciated as the Liebenstein spring. The first primitive attempts to secure the mineral water in ordinary bottles failed, the bottles being burst. The boring was undertaken by a Cologne company with the hope of finding potassium salts. This idea has not been given up, but for the present the carbonic acid claims attention, and the search for potassium salts will be continued in another place. The simultaneous outbreak of both would be undesirable.—Engineering.

Spots on Prints.

Referring to spots appearing on photographic prints, the British Journal of Photography says: "They are produced from a cause but little suspected by many, namely, from dust of a pernicious nature settling on the prints while they are in a moist state. The dust from coke stoves seems, from some experiments we made some years ago, to be of a highly injurious nature; and there is generally plenty of that about, where coke is burnt, when the stoves are disturbed and the atmosphere is dry. Sometimes these spots make their appearance before the prints are mounted, but, more generally, not till some time afterward. As a rule, there is no visible nucleus, as that, of course, comes away when the paper is dry, but not before the mischief has been done, although it may be at once manifest. Particles of coke dust are not the only ones that will cause these spots, for several of the things used in the dark room will do the same—bichloride of mercury, for example. A little of its solution spilt on the floor, and allowed to dry, becomes dust when the room is next swept out. If moist prints were always carefully protected from dust and floating particles, we should hear far less of mysterious spots on prints."

SPAIN produces annually 80,000,000 gallons of olive oil, Italy 35,000,000 gallons, and France about 30,000,000 gallons.

THE LEAMY REVOLVING TRAPEZE.

The application of mechanics to scenic and gymnastic displays has an interesting exponent in the revolving trapeze, an exhibition which, after attracting much attention in England, has come back to the United States, and is now being shown in the native country of its inventor. It forms one of the principal attractions of the Olympia Music Hall in this city. In the smaller cut we illustrate the mechanism

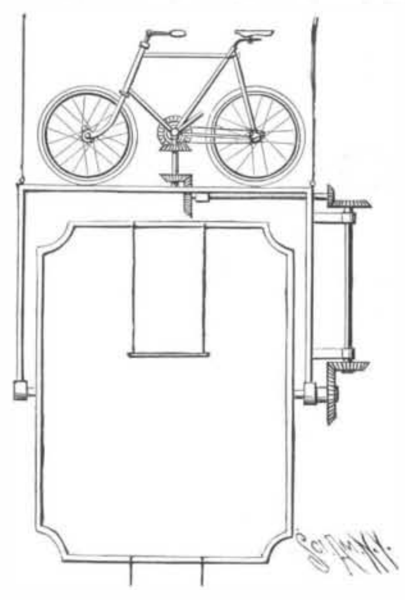
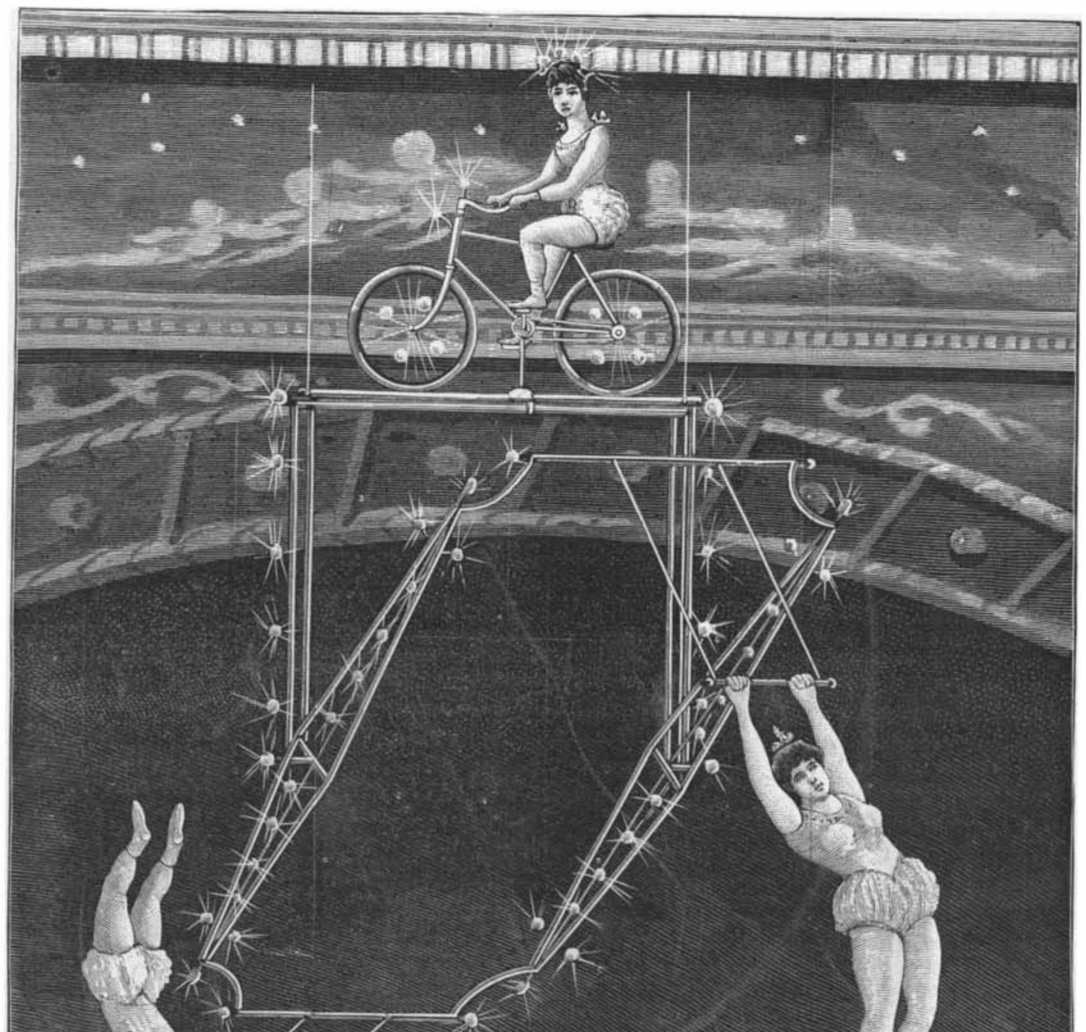


DIAGRAM OF THE REVOLVING TRAPEZE.

of the apparatus, while the performance executed upon the apparatus is shown in the larger cut. From the ceiling of the great auditorium is suspended a vertical three sided rectangular frame open at the bottom. In its lower extremity is journaled at the center a four sided rectangular frame, from whose extremities two trapezes hang. To the upper side of the vertical frame is secured a bicycle, which by gearing shown in the



THE LEAMY REVOLVING TRAPEZE AT THE OLYMPIA MUSIC HALL.

small cut connects with the axle of the lower frame, so that when the cranks of the bicycle are worked the lower frame is turned round and round. It can be brought into accurate balance by means of shot. The whole apparatus, including the bicycle, is studded with incandescent electric lamps, and the performer who rides the bicycle wears a helmet carrying electric lights. The very striking performance is explained in great measure by the cut.

One of the performers sits on the bicycle and, turning the cranks, as if riding, keeps the lower frame in rotation, while two performers perform different evolutions on the trapezes thus carried around through the air. A switch board is placed at the head of the bicycle, and by manipulating switches the vari-colored electric lights are turned on and off so as to produce any desired effect. Independent of the high merit of the performance simply as gymnastics, the mechanical points are of value; for ease and safety of manipulation and security from any failure is an absolute essential. No one has anything to do with its operation except the three performers, so that it is constantly under their control. Where any attempt is made to operate such mechanism from behind the scenes, there is always a great liability of trouble or partial failure, but here the performer on the bicycle does all the work of actuating the mechanical portion and has every part under constant supervision and control, while the illuminated bicycle, located as it is at great height from the floor, is an added attraction. It is not too much to say that this exhibit is one of the star pieces of the entire performance. The length of the trapeze ropes, it will be observed, is so adjusted as to allow the performer to pass through the frame without touching it, and the absence of a center bar in the frame is necessary to the same end.

An Earthquake in Persia.

On November 17, 1893, a most destructive earthquake occurred at Kuchan, Persia. The city was practically destroyed, and the loss of life was enormous, it being reported that twelve thousand persons perished.

A cable dispatch from Teheran, Persia, dated January 9, states that two severe earthquakes, causing the loss of 1,100 lives, have occurred in the Khalkhal district.

The first shock, which was experienced on January 2, was very severe. It completely destroyed the village of Zanzabad and partly destroyed other villages. Three hundred persons perished in the several villages.

On the following Sunday there was another and severe shock which destroyed the small town of Goi and did great damage in many of the villages in the district affected. Eight hundred persons were killed in Goi alone. Large numbers of cattle and sheep perished.

The London Times of January 10 published a dispatch from Teheran saying it is reported in that city that severe earthquakes were felt on January 8 at Meshed and Kelat.

No damage was done at the former place. What, if any, damage was done at Kelat is not known at present.

The Swiss National Exhibition.

The Swiss National Exposition will be held at Geneva, beginning May 1 and ending October 15, 1896. The Swiss Confederation has made liberal appropriations and the different cities and cantons have contributed largely to a popular subscription. The exhibition grounds are on both banks of the river Arve, and the directors of the enterprise have erected some fine buildings, which are now rapidly approaching completion, and great attention has been paid to landscape gardening. There are many unique features in the mechanical and the electrical departments. The electric exhibit will be one of the most important collections of electrical appliances ever seen in Europe. Twelve thousand horse power will be derived from the River Rhone and will be transmitted to the exhibition grounds from a long distance. An interesting feature of the exposition will be the electric carriages which will convey the visitors to the part of the grounds which they wish to visit. The exposition promises to represent all that is best in industry and science in Switzerland.