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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STREET VENTILATION.

The solution of the problem of the purification of sub-surface and the lower stratum of surface atmosphere known as ground-air must sooner or later become vital to a city's inhabitants. That the state of the public health may be set forth as the chief asset of a community's prosperity is shown in the presence of an epidemic. Thanks to the high development which sanitary engineering has reached, sewage and ground water drainage is well nigh perfected. The question of surface and ground drainage, while backward in its development, becomes of none the less importance to the engineer, and though dealing with mixtures of gases they are as subject to governing laws of flow and diffusion as is the more stable liquid. In New York city, owing to the great concentration of inhabitants combined with the spirit of progress of our times, manifested by blocks of high buildings which change streets into narrow lanes, the many systems of pipe-galleries and tunnels for water, gas, steam, sewerage, telephone, telegraph, and light and heat electric wires, besides the rapid transit passenger tunnel soon to be installed, all tend for the most extreme conditions for an impressive exhibition of the evil. Street-tunnels, basements and buildings having an intimate connection, the free circulation of all that is harmful is unhindered.

The deleterious substances which are the chief sources of ground air contamination comprise, besides dry, dust-borne particles and matter held in suspension in water vapor, the effluvia arising from decomposition of organic matter and the more demonstrable poisons found in leaking illuminating gas mains. According to the statement of one sanitary expert, it is generally acknowledged by the gas companies of our city that fully one-third of the whole quantity of gas manufactured by them leaks away, before delivery through the house meters occurs. They recognize that it is far cheaper to manufacture this large excess of gas and allowing it thus unheeded to contaminate the lower atmosphere of streets and buildings than to attempt to make tight mains or house connections. Furthermore, as it has been demonstrated that the water gas, now so largely employed for lighting and heating, which is principally composed of carbon monoxide, is injurious and indeed becomes deadly when present in a quantity equal to one per cent of mixture. The custom of street dissemination of what might be called gas sewerage is proportionately as injurious to healthy living as though water sewerage was left to decompose in the city's gutters.

Carbon monoxide being odorless, it becomes doubly dangerous; for it not only suffocates mechanically, but acts directly as a true poison to the human system. Collections of mixed gases take place to such an extent that manhole explosions are not of infrequent occurrence, and the several companies occupying tunnel space in the streets are forced to secure conduit covers against gas pressure by bolting.

The plan to be submitted for the carrying off of contaminated ground air consists of a system of flues connected at sufficient intervals with sub-cellar and tunnel chamber compartments. When practical, chimneys constructed of metal piping or of brick may be built in connection with buildings. In districts where this is impossible they may take the form of ornamental columns. According to the observations of Dr. Draper, Director of the New York State Weather Bureau, the average yearly wind velocity over New York city is seven miles an hour. This speed being apparent at a mean height of seventy feet above ground level, it becomes thus entirely practical to employ the means which have been suggested for the removal of an insidious present and growing evil.

THE STEAM TURBINE FROM THE COMMERCIAL STANDPOINT.

In judging any new form of mechanical construction, it is the commercial considerations which, after all is said and done, decide whether it is to enjoy a temporary popularity, or be included among the useful and lasting improvements of its day. During the past four or five years the steam turbine has received more attention than perhaps any other device in the world of steam engineering; unless it be the water-tube boiler that can claim that distinction. It is not the fault of technical literature in general that the public is not pretty well familiar with the good points of the steam turbine; its compact form, great power in proportion to its weight, its general handiness, and its economy of operation. The many advantages of the turbine would lead one to expect that, commercially considered, it is a device upon which the capitalist would be sure to look with favor, as being from every point of view of installation, maintenance and operation, a decided "money-saver." This commercial aspect of the subject has been treated at considerable length in a paper read at the Detroit Convention of the American Street Railway Association, by Edward H. Sniffin, whose intimate connection with the development of the steam turbine in this country entitles him to speak with authority.

It has been found by actual tests on units as small as 400 kilowatts that only 14.47 pounds of steam was consumed per brake horse power per hour, which corresponds to something less than 13¾ pounds per indicated horse power per hour. In the larger units the turbine shows a uniform efficiency as compared with the best reciprocating engine practice; and only recently a rate of steam consumption corresponding to about 10.17 pounds per indicated horse power was guaranteed on a turbine of 750 kilowatts capacity. This is a performance of which only a very few engines of any size or type have been capable.

The question of the commercial value of the turbine, however, is a far wider and deeper one than that of mere steam consumption, for it must take note of the relative size of power-house required, the relative area and depth of foundations, and everything affecting the first cost of the plant itself. Into these elements of cost, the paper enters in full details. The paper, which is too lengthy for these columns, is published in the current issue of the SUPPLEMENT. It may be stated here, however, in brief, that the turbine requires about 80 per cent as much space as is necessary for a vertical engine of the same power and only 40 per cent of that needed for the horizontal engine. The most striking comparison in favor of the turbine is that which shows the cubic yards of foundation material required for the two types. In all three cases the foundations were estimated at a uniform depth of 15 feet, this depth being necessary to provide space beneath the engine room floor for condensers, etc., although for large reciprocating engines it is usually inadequate. The turbine has the great advantage that the only foundation which it requires is that necessary to carry its weight, as though it were simply a tank or some other stationary structure. It does not even call for foundation bolts, since there are no vertical or horizontal thrusts to be resisted. In a comparison of 1,000-kilowatt units, it was found that the volume of masonry foundation required for the turbine would be only one-ninth as great as for the vertical engine and one-fifteenth as great as that necessary for the horizontal engine. In a comparison of the building cost on a basis of fifteen cents per cubic foot of space inside the walls, the cost for the turbine is about one-half that for the horizontal or vertical engine. Among several actual cases given in the paper to show the saving in cost, we select that of a plant which was recently laid out to contain three 1,000-kilowatt units driven by vertical Corliss engines. Subsequent to the completion of the power house three more 1,000-kilowatt units were contracted for, steam turbines being ordered; and it was found that the use of the turbines saved 900 square feet of engine room floor space and about 38,000 cubic feet of space. Had the whole plant been originally designed for turbines, the cost of the land, building, foundations, etc., would have been reduced about $50,000. Perhaps the most striking proof of the economy of the installation of a turbine plant is that of a power house of 8,100 kilowatts capacity designed for the employment of vertical engines. In a consideration of the enlargement of the plant, it was found that there was no space for additional engine power, and that any increase would require encroachment upon valuable land. An estimate of what could be done by the employment of turbines proved that within the four present building walls, and without disturbing existing machinery, the total power of the plant might be doubled, by installing turbines in the space below the engine room level and by adding another floor of boilers—an arrangement which would reduce the interest charge over $3.00 per kilowatt per annum.

At the close of the paper the author stated that the 1,500-kilowatt turbine which has been for eighteen months in operation at Hartford, carries a load of from 1,800 to 2,000 kilowatts and has, indeed, carried a load, without any difficulty, of as high as 2,800 kilowatts. The Westinghouse Air Brake Company has four 400-kilowatt machines that have been running satisfactorily for about three years and doing all the work of the factory. The economy is high and there have been practically no repairs. The same company is now building three 4,000-kilowatt turbines for the rapid transit subway of New York, while four 5,000-kilowatt turbines are to be built for the Metropolitan District Road and three 3,500-kilowatt machines for the Metropolitan Road, both of London.

THE TWENTY-FIVE KNOT CUNARD STEAMSHIPS.

The contest for the high-speed transatlantic record has never seen a more interesting phase than that which it is now passing through. With the "Deutschland" carrying a record to her credit of 23.51 knots an hour; with the "Kronprinz Wilhelm" only a fraction behind the "Deutschland" in her average sea speed, and showing with each season a steady improvement; with the great "Kaiser Wilhelm II." launched and well on toward completion, and giving promise of 24 knots an hour and over, and with the plans for the two Cunard giants, designed to restore British prestige on the Atlantic, under consideration by various competing ship-building firms—it must be admitted that there never was a period in the history of high-speed transatlantic navigation more full of interest and promise than the present.

It is not likely that even the officials of the Cunard Company know what the exact dimensions, horse power and speed of the two new vessels will be; but we are reliably informed that, tentatively, the general features of the ships have been placed at 750 feet of length, 75 feet of beam, and a horse power of about 50,000.

Unless the directors change their minds, it is likely that the steam turbine will not be introduced on these vessels, for it is felt that notwithstanding the excellent performance of this type of motor on the "King Edward VII." and the "Queen Alexandra," it is too great a step from an installation of turbines of a few thousand horse power on a river steamer to the equipment of two costly vessels, on which so much is depending as on the new Cunarders, with what is as yet a comparatively new type of motor. Hence, it is probable that the great horse power of these ships will be developed in vertical, quadruple-expansion reciprocating engines; and the question which is now under consideration is whether this power shall be developed upon two or upon three shafts. If twin screws are used the proportions of propellers, shafting and engines would be enormous, since they would have to develop and carry probably not less than 25,000 to 27,000 horse power each. There is absolutely no precedent for such sizes and weights, the largest twin engines at present being those of the "Deutschland," which, when the boilers have been steaming freely, have developed as high as 38,000 horse power, or 19,000 on each shaft. The new "Kaiser Wilhelm II.," it is true, is to have engines of 40,000 horse power, or 20,000 upon each shaft, and in actual service they are likely to develop as much as 44,000, or say 22,000 on a single shaft.

It is natural that the Cunard Company in its endeavor to keep down the sizes of the separate engines should turn to the triple-screw system of propulsion. By so doing each shaft would have to carry only 17,000 or 18,000 horse power, or less than is now carried in the case of the "Deutschland." The objection to triple-screws is the very obvious one that the engine room staff would have to be greater for three engines than for two. But with this exception, it may be said that practically every other argument is favorable to the use of triple-screws. In the first place, judged from the all-important standpoint of safety of travel, there is less risk of total disablement in a triple than in a twin-screw ship. If one engine should be disabled only 33 per cent of the power is lost, and the ship still has 66 per cent with which to make port. The individual parts of the engine are much lighter, and hence it is easier to overhaul the engine in port, or, in the case of a breakdown, to make repairs at sea. Although it might seem at first that more of the ship's space will be taken up by three engine rooms than by two, the difference is not so great as might be supposed, inasmuch as the center engine would be located on the center line of the ship, astern of the wing propeller engines, and would occupy space in the least desirable portion of the ship from the standpoint of passenger accommodation. Admiral Melville, Chief of the Bureau of Steam Engineering of our Navy, is a strong advocate of the use of triple-screws, not merely for the Navy, but for the large transatlantic steamships. Speaking on the important question of economy he has shown that in the case of the fast commerce destroyers "Minneapolis" and "Columbia," which are fitted with triple-screws, there was a very decided economy realized by their use. Moreover, it is a significant fact that the French naval architects, who are among the best, if not the best in the world, and who are considered to have gone more deeply and thoroughly into the question of triple-screw propulsion than any other naval architects, appear to have adopted the triple-screw exclusively for all the large ships of the navy. They claim that, quite apart from their obvious military advantages, triple-screws show a very decided economy over twin screws. There is one other question which should be carefully considered in adopting twin-screw propulsion for transatlantic passenger ships, and that is the question of vibration, which has so much to do with the comfort of passengers. It is a well-known fact that in the largest high-speed passenger vessels, vibration is one of the most serious sources of discomfort. The effect of triple-screw propulsion in respect to vibration is a question which should receive a most thorough investigation. While speaking of vibration, one cannot but call to mind that the steam turbine, because of the absence of reciprocating parts, that is to say, of more or less unbalanced parts, is the ideal motor for passenger service. There is no question that the first transatlantic steamship that is fitted with a successful steam turbine will have a great advantage in this respect over high-powered boats driven by reciprocating engines. Broadly considered, it must be admitted that the success which has attended the installation of turbine units of great horse power in electrical plants foreshadows the day when the steam turbine will be exclusively used in transatlantic travel. We cannot but think that the Cunard Company should give a most exhaustive study of the existing high-powered turbine plants before they decide that there is any inherent quality of the turbine which renders it unsuitable for use in tandem on the shaft of a transatlantic liner. Already turbines of 7,000 horse power are under contract for electric railway plants. If they can be built in 7,000 horse power they can surely be built successfully in 9,000 horse power units, and two such turbines on each of the three shafts of the Cunard boats would give the desired maximum horse power and something over. In an accompanying editorial and in the current SUPPLEMENT will be found most powerful arguments on the score of economy of cost, weight and space, in favor of the steam turbine, and every one of these arguments applies with just as much force to the engine room of a transatlantic liner as it does to the power station of an electric railway company.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The constellations whose outlines are associated with winter begin to appear again in the eastern sky. At 9 o'clock in the evening, during the middle of the month, Cassiopeia is almost overhead, directly above the Pole star. It can be recognized as a zigzag line of fairly bright stars.

The next group to the eastward, along the Milky Way, is Perseus. The remarkable variable star Algol is the southernmost of its two conspicuous stars, and lies between Cassiopeia and the Pleiades, somewhat nearer the latter group. For most of the time this star is of nearly the second magnitude, but at intervals of about three days—2 days 20 hours 49 minutes, to be more exact—it runs down to the fourth magnitude, remaining at this brightness for about 20 minutes, while the rise and fall in brightness occupy about four hours each. Minima observable in the United States occur on November 2, 8 P. M.; November 20, 1 A. M.; 22, 9 P. M.; and 25, 6 P. M., Eastern standard time.

The variability of this star is believed to be due to the presence of a dark companion, which partially eclipses it at every revolution.

Below Perseus is Auriga, marked by an irregular pentagon of stars, one of which, Capella, is the brightest one at present visible anywhere in the sky. Below this again is Gemini, whose twin stars Castor and Pollux are just rising. To the right of Auriga is Taurus. The group of the Pleiades, with the ruddy Aldebaran lower down, make this an easy constellation to identify. The little V-shaped group of which Aldebaran is one, is called the Hyades. The next star to Aldebaran is an interesting wide double, just separable with the naked eye.

Below Taurus is the incomparable Orion, the most brilliant constellation in all the heavens. With the two bright stars in his shoulder and knee, and the line of his belt between, he is so familiar that he hardly needs description.

To the left of Perseus, and southeast of the zenith, is the little triangle that marks the head of Aries. The faintest of the three stars is a very pretty double, requiring a small telescope to bring it out, which has an added interest from the fact that it was the first double star noticed by astronomers. It was discovered by Hooke in 1664. The large but inconspicuous constellations Eridanus, Cetus and Pisces fill the southeastern sky.

The great square of Pegasus lies to the southwest of the zenith. A line of conspicuous stars extending from it toward Perseus marks the position of Andromeda. The nearest of these to Perseus—Gamma Andromedæ—is a very pretty double star, the larger component being reddish, while the smaller is green.

The conspicuous star low in the southwest is Fomalhaut, in the constellation Pisces Austrinus. Aquarius lies above it, and Capricornus to the right. The fine cross of Cygnus, almost in the center of the Milky Way, is one of the most prominent of the western constellations. The star at the foot of the cross is another fine double which can be divided by a powerful field glass, while its contrasted colors show finely in a small telescope.

Lyra lies below Cygnus on the right, and Aquila on the left, each marked by a bright star.

The Great Dipper is close to the northern horizon, and the Little Dipper swings to the left from the Pole star, encircled by the coils of the Dragon.

THE PLANETS.

Mercury is morning star in Virgo, and should be visible in the southeast before sunrise, in the early part of the month. On the 3d he is at his greatest elongation. He is nearer the sun than usual—19 deg.—but in compensation for this he is unusually bright.

Venus is morning star until the 28th, when she passes through superior conjunction, and becomes an evening star once more. It is interesting to note that on this occasion she actually passes behind the sun, being hidden by his disk for nearly 24 hours. The phenomenon is of course unobservable, as the planet is lost in atmospheric glare long before she gets near the sun's limb. All through the month she is too near the sun to be seen without a telescope.

Mars is morning star in Leo, rising about 1 A. M. on the 15th. He is nearly on the line joining Regulus and Spica, about one-third of the way from the former toward the latter, and is fairly bright.

Jupiter is evening star in Capricornus, remaining visible till about 10 o'clock. On the 1st he is in quadrature, and is due south at 6 o'clock.

Saturn is evening star in Sagittarius, and sets between 8 and 9. Uranus is in Ophiuchus, too near the sun to be visible, and Neptune is in Gemini, coming to the meridian at about 3 A. M.

THE MOON.

First quarter occurs at 7 A. M. on the 8th, full moon at noon on the 15th, last quarter at 3 A. M. on the 22d, and new moon at 9 P. M. on the 29th. The moon is nearest on the 16th, and farthest off on the 4th. She is in conjunction with Uranus on the 3d, Saturn on the 6th, Jupiter on the 7th, Neptune on the 18th, Mars on the 23d, Mercury and Venus on the 29th, and Uranus again on the 30th.

The Leonid meteors are due on or about the 13th of November, but there is no reason to anticipate any unusual display this year. The great body of meteors, deflected in its orbit by planetary attraction, has long since passed by the earth without meeting it, and whatever stragglers may appear this year will be so much obscured by the moonlight that only the brightest of them can be seen.

TEST OF A NORWEGIAN LIFE-SAVING BOAT.

On the afternoon of October 22, a hazardous demonstration of the efficiency of a Norwegian life-saving vessel took place in the English Channel. A tug boat, when four miles off Folkestone sighted a strange-looking object in the water. Steaming up, the captain found that the object was a large globe, from a manhole in the top of which a man's head projected. As the tugboat came alongside, two men crept out of the globe, who proved to be Captain Doenvig, the inventor of the device, and his assistant. They told a weird story of their adventures. It seems that their globe was dropped overboard from a steamer off Havre on the 21st, and that since then it had been knocking about in the Channel with its two occupants. In their confined quarters they had been penned for more than twenty-four hours before they had been picked up. Naturally the inventor considered his experience the most satisfactory proof of the efficiency of his device.

The apparatus, or buoy, is round as a globe, only a little flattened at the bottom. It is made from solid sheet iron of the following thicknesses: At the bottom five-sixteenths of an inch, on the sides three-sixteenths of an inch, and at the top one-eighth of an inch. The diameter of the buoy is 8 feet; the height 6½ feet. The buoy has a double bottom and draws 2½ feet of water when loaded. The inside of the buoy is entered through three water-tight trapdoors.

Under the deck, which is located about 1 foot below the water line, are placed 4 galvanized tanks, with capacity for holding about 140 gallons of fresh water. Alongside the wall runs a low bench to sit on, and the space underneath it is to be filled with canned goods. In the center of the inner room is a funnel that can be shoved up, thus letting fresh air into the buoy. In the top are three small windows, partly for the purpose of letting in light, but also for use in sending up rockets. The buoy is provided with a movable keel which can be let down from the inside; also with a rudder which can be applied in the same manner. Assisted by small oars, which are kept inside, the buoy can be propelled to land in fair weather. On the outside of the buoy is a cork belt, on which the men may stand and row. Further, the buoy is supplied with an anchor and 100 feet of steel rope and with sails, the air funnel serving as mast.

Some years ago the inventor, Captain Doenvig, was in a shipwreck on the coast of Virginia, which bereft him of his family, and ever since he has been deeply interested in the construction of a lifeboat which may be serviceable under all circumstances.

SCIENCE NOTES.

It will be remembered that some time ago Dr. Garnault attempted to disprove Dr. Koch's theory of the transmission of tuberculosis to human beings by animals by inoculating himself with bacilli from a consumptive cow. Dr. Garnault himself is perfectly well, but guinea pigs inoculated with skin taken from his arm have developed symptoms of tuberculosis.

Prof. Edmond S. Meany, of the Smithsonian Institution, is the first scientist to visit the mummy caves of the Aleuts of Alaska. Many mummies, to be sure, have been sent from Alaska from time to time, but no man of learning has ever examined the caves themselves. The report which the professor will doubtless prepare will be looked for with some interest.

At Grove City, near Chillicothe, a perfect skeleton of the Mastodon Americanus was found. The tusks measure from 10 to 12 feet in length. Their size and the condition of the teeth, which are well worn, show that the animal was full grown when it died. Other well-preserved specimens have been found in marshy beds in Ohio; but this is said to have been found in clay, a rather unusual circumstance.

The Scotch mineral known as Lanarkshire blackband, which was discovered in 1801, has been practically exhausted, as there are now no pits in the Lanarkshire coalfield where it is worked as a principal product, though a small quantity of a thin blackband is raised with the gas coal at one or two pits. Some blackband of excellent quality is, however, still raised in Fife and Midlothian for smelting in the Lanarkshire furnaces, while the somewhat leaner blackbands of Ayrshire are still fairly plentiful.

The report which Booker T. Washington sends to us of the Tuskegee Normal and Industrial Institute shows a state of affairs that is encouraging. Up to the present time there have grown out of the Tuskegee Institute at least seventy-two schools of considerable size. Perhaps the most important work that Tuskegee Institute, in connection with schools of similar character, has accomplished has been to find the most effective way to elevate the negro and at the same time to make him most useful to the community in which he is to live. In the history of the institution nothing is more striking than the change which has taken place among the negroes so far as their feeling toward industrial education is concerned. Formerly industrial training was by no means looked upon with favor. Now that feeling has completely disappeared. At present students are trained at Tuskegee in thirty-four industries.

In 1851 Foucault originally demonstrated the rotary movement of the earth by means of the pendulum which bears his name. The experiments were interrupted after the *coup d'état* of December 2, 1951. Another demonstration was carried out on October 22 last. Foucault's pendulum, composed of piano wire, about 220 feet long, was attached to the summit of the dome of the Pantheon and from it was suspended a ball weighing 56 pounds. The steel stylus was fixed to the bob thus constituted, and beneath it on the floor was placed a round table upon which the points of the compass were marked. A little heap of sand was run around the table. Flammarion, the well-known astronomer, and Senator Chaumie, Minister of Public Instruction, delivered appropriate speeches in the presence of a large assembly, which included numerous scientists. Then the minister, with a taper, burned a silk cord attaching the pendulum to the side of the table, and the pendulum swung across the table, cutting a trench through the sand, each swing widening the trench slightly until the table appeared to be revolving.

A curious fact has been ascertained during the recent survey of India—namely, that the northerly deflection of the plumb-line, ascribed to attraction by the great mass of the Himalaya and the Tibetan upland, is reversed along a comparatively narrow belt between 22 deg. and 24 deg. north latitude, crossing India from east to west for one thousand miles. Here the deflection is southerly, while the northerly deflection reasserts itself farther south, and is continued so far as 18 deg. north latitude. The zone, so strangely exempted from what has been supposed to be a general law, runs across Central India from the delta of the Ganges to that of the Indus, but well to the south of the great Gangetic plain. These facts are discussed by Major Burrow in a paper read before the Royal Astronomical Society. Major Burrow's theory is that the phenomenon follows the axis of what he calls a subterranean chain of mountains, causing the greater density of the earth's crust in this particular tract. The hypothetical range would, we are at liberty to conjecture, either have foundered bodily in some great catastrophe or subsided gradually and been submerged under alluvium and silt. The fact opens up an interesting subject for the discussion of geologists.