STATISTICS OF TURBINE-PROPELLED VESSELS, MAY 1, 1906.

In 1894 a small vessel of astonishing speed made its appearance among the British fleet in the harbor of Spithead. This was the experimental turbine steamer "Turbinia," of about 100 feet length and 44 tons displacement, and driven by Parsons turbines. The construction of that vessel marks the beginning of the contest between the marine reciprocating engine and the marine turbine, in which the latter has been steadily gaining.

The reciprocating engine has about reached the limit of its efficiency, and is susceptible of little further improvement. The "Kaiser Wilhelm II.," one of the newest of the four great German steamers which have held the speed record since 1897, has four quadruple-expansion engines, yet she is little faster than the oldest of the four, the "Kaiser Wilhelm der Grosse," which has only two triple-expansion engines.

The turbine, especially the Parsons turbine, possesses the merit of comparatively small height—a great advantage in warships, where the height of the engine is limited to a maximum of about 26 feet by the necessity of putting it under the armored deck. Consequently, turbines appealed strongly to naval constructors, despite the waste of fuel and other defects observed in the earliest turbine vessels.

But there were dissenting voices. Chief Constructor Melville, of the U. S. navy, pointed out, in 1901, the excessive vibration of the turbine steamer "King Edward," while in 1905 the chief constructor of the North German Lloyd, after crossing the Atlantic in the turbine steamer "Victorian," reported that turbines were unsuitable for large vessels, that they saved neither space, weight, nor fuel, and possessed only one advantage—that of diminishing vibration!

After making numerous experiments, neither systematic nor very thorough, England has taken the bold step of equipping her newest and largest warships and auxiliaries—the battleship "Dreadnought" and the subventioned Cunard liners "Lusitania" and "Mauritania"—with Parsons turbines. The Cunarders, with a length of 790 feet, 40,000 tons displacement, 60,000 horse-power, and a speed of 25 knots, will be the largest and swiftest merchant vessels afloat; while the "Dreadnought," which was launched in February, 1906, and will have a displacement of 18,289 tons, engines of 23,000 horse-power, a speed of 21 knots and a battery of ten 12-inch guns, will be the largest, swiftest, and most formidable of warships. It is rumored that the British Admiralty intends to equip all new warships with turbines. The only large turbine vessel now in the British navy is the 3,000-ton cruiser "Amethyst." There are also two turbine-driven destroyers, "Velox" and "Eden," while two others, "Viper" and "Cobra," have been wrecked. The merchant fleet of England includes many turbine vessels, nearly all of which have Parsons turbines. The oldest is the Clyde passenger steamer "King Edward," built in 1901. Three years later appeared the "Manxman," of 2,100 tons, 8,500 horse-power, and 23 knots, and the Allan liners "Victorian" and "Virginian," of 11,200 tons. In 1905 the Cunarder "Carmania," 675 feet and 30,000 tons, was launched. Two more 11,000-ton turbine vessels are being constructed for the Allan Line, and the royal turbine yacht "Osborn" is also under construction.

In Germany the Parsons turbine was adopted for the 3,000-ton cruiser "Lübeck," launched in 1904, and torpedo boat "S 125." The performances of both have been satisfactory, though not startling, and in December, 1905, Parsons turbines were ordered for another torpedo boat and the cruiser "Ersatz Wacht," of 13,600 horse-power. The government has also chartered the Hamburg-American liner "Kaiser," which has Curtis turbines.

France has been still more cautious. An experimental vessel, the "Libellule," built in 1905, and torpedo boat "No. 243" have Rateau turbines, while "No. 293" has Parsons and "No. 294" has Laval turbines. No larger naval vessels have been equipped with turbines.

In the United States the scouts "Salem" and "Chester" and the Pacific liner "Creole," of 10,323 tons, have turbines. Italy is building a turbine-driven armored cruiser, the "St. George," and Russia has an experimental 160-ton vessel with Rateau turbines. Japan, confidently following England's lead, has ordered in England Parsons turbines for two new battleships, the "Satsuma" and the "Aki."

It appears, therefore, that turbines have not yet replaced marine cylinder engines extensively except in England, but the reduced height and bulk and other advantages of turbines, together with the impossibility of improvement in cylinder engines, must eventually cause England's example to be followed by other nations.

Within three weeks nearly thirty tons of gold specie have been transferred from England to America.

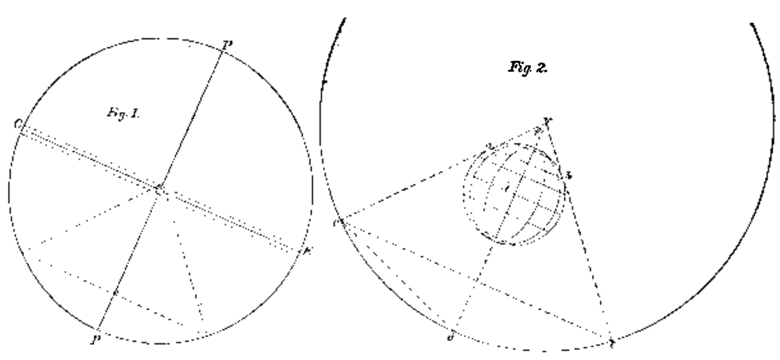
A CASE OF ALLEGED REASONING IN A DOG.

Wilhelm Ament in Arch. f. d. ges. Psychol. relates an anecdote concerning the behavior of a dog, a two-year-old "Zwergpinscher." According to Ament, the dog was accustomed to sit on a chair in front of a window overlooking neighboring houses and yards. One cold day the window was so thickly coated with frost that the dog could not enjoy his customary view. Confronted with this situation, the dog proceeded to lick the frost until a round area about the size of a plate had been cleared away with some difficulty. The dog then took up the more natural canine occupation of watching the cats in the adjoining yard. Several times during the winter the window was similarly cleaned for the same purpose.

Ament, being a psychologist, endeavors to explain this interesting bit of natural history. In very dignified and involved German he concludes that by means of the experience of wiping with its snout, the dog hit upon the licking away of at first the softened layers of ice, and later of the more solidly frozen ones. That the dog straightway hit upon the method of licking Ament does not consider surprising when we remember how often during the day a dog licks himself, everybody, and everything. Ament believes that, all things considered, we seem to have here the correlation of the series of experiences or ideas partly different from one another (wiping with the snout, licking with the tongue), partly analogous (licking away of other things and the licking away of frost on the window) with an end in view (namely, looking through the window).

JAPANESE EARTHQUAKE THEORIES.

While appreciating the value of the researches of Nagaoka, Kusakabe, and Otani, F. Omori, in an article published in the Physico-Mathematical Soc., Tokyo Proc., cautions one against applying the results of their experiments on the elastic and other properties of rocks to the explanation of earthquake phenomena. Kusakabe argues that earthquake vibrations of small amplitude should travel faster than those of larger amplitude. But the velocity of the third phase of the prominent portion of earthquake motion is always 3.3 km. sec., be the earthquake small or large, the vibrations sharp or slow and insensible. According to Nagaoka's views on secondary vibrations the periods of earthquake vibrations should always become longer with increased amplitude; but this the author shows, by examples, does not hold either, the periods remaining practically constant during the principal and the end portions. Moreover, the displacements would be very small and within the elastic limit of rocks. Nagaoka replies to Omori. Statical and kinetic experiments must be distinguished. The quantity, displacement-wave-length, referred to by Omori is arbitrary in vibrating systems, and the objection meaningless. By tapping prisms of sandstone periodically, Kusakabe had obtained summation frequencies up to the eighth order, and difference frequencies up to the seventh order.



THE VISIBLE HEAVENS.

HOW ENGLAND DISPOSES OF OLD SHIPS.

The extent to which British shipowners dispose of old vessels to foreigners is shown in statistical tables published in Lloyd's Register of Shipping. The tonnage cleared off in this way last year was 512,701 tons, comprising steamships of 422,395 tons, and sailing vessels amounting to 90,306 tons. By these sales, which are the largest since 1900, Germany acquired 101,903 tons, Italy 78.671 tons, Japan 66,328 tons, and Norway 59,702 tons. It must be a very considerable advantage, from a British point of view, to have a market like this for "second-hand" vessels. Tables which are included in the registrar general's returns indicate that about 18 per cent of the tonnage removed from the Register because of foreign transfer was built before 1880, nearly 43 per cent before 1885, 62 per cent before 1890, 78 per cent before 1895, and over 90.6 per cent before 1900. In addition to the second-hand tonnage transferred to foreigners, 52,464 tons were transferred to British colonies during 1905, as compared with 37,464 tons in 1904, 62,907 tons in 1903, and 32,603 tons in 1902.

THE VISIBLE HEAVENS.

BY FREDERICK R. HONEY.

Probably the ordinary observer of the heavens does not realize how large a portion of the celestial sphere comes within the range of vision every twenty-four hours during the year. The popular impression in the minds of persons living in either hemisphere is that about one-half of the heavens (possibly a little more) is visible; whereas, at different points on the earth's surface, the proportion varies between one-half at either pole and the whole of the celestial sphere at the equator.

The circle $CPEP'$, Fig. 1, represents the celestial sphere, on the surface of which we may conceive that the stars are situated; P and P' being respectively the north and south poles of the heavens, and CE the celestial equator. The small circle may be taken to represent the earth, with the understanding that it is entirely out of proportion to the celestial sphere, i.e., it should be represented by a mere point. It is enlarged to illustrate the horizon of each pole, which is drawn parallel to CE. When the earth is represented by a point, these parallel lines coalesce and become coincident with the celestial equator. The reader will see that by an observer at either pole nothing can be seen beyond the celestial equator; one-half of the heavens, i.e., CPE, being continually within the range of vision of the observer at the north pole, while the observer at the south pole is limited to the other half, $CP'E$.

In Fig. 2 the drawing of the earth is enlarged, in order to exhibit clearly the range of vision of an observer residing in any latitude, e.g., $a\,b$, which represents the parallel of New York. The circle representing the celestial sphere is drawn within the limits of this page, in order that the reader may understand the explanation which follows. It will be evident, however, that the earth as well as the vertex of the cone touching it along the parallel $a\,b$ would be reduced to a point in comparison with the celestial sphere. The size of the circle representing the latter, however, does not affect in any way the consideration of the proportion which is visible or invisible at a given latitude.

If we draw tangents to the circle at the points a and b, they will meet on the earth's axis produced at v; and if these lines be prolonged in the other direction, they will intersect the circle representing the celestial sphere at c and e. The horizon of a is $c\,a\,v$ produced until it intersects the celestial sphere at the point opposite to c; and the horizon of b is $e\,b\,v$ prolonged to the point opposite to e. During one revolution of the earth the tangent $v\,a\,c$ generates a conical surface, which intersects the celestial sphere in the circle represented by the chord $c\,e$, and which is the limit of a zone of the heavens which is never visible to an observer residing at the latitude $a\,b$. The area of this zone is very small as compared with that of the entire heavens. The area of the zone $c\,d\,e$ is equal to that of a circle described with a radius equal to the chord $c\,d$. The latitude ϕ is equal to ϕ, which subtends this chord; therefore $c\,d = 2 \sin \frac{\phi}{2} R$; and the area of the zone $= \pi \left(2 \sin \frac{\phi}{2} R\right)^2$ The area of the surface of the celestial sphere $= 4\pi R^2$. Comparing these areas, the area of the zone $= \dfrac{\pi \left(2 \sin \frac{\phi}{2} R\right)^2}{4 \pi R^2}$, which reduces to $\sin^2 \frac{\phi}{2}$.

At the pole $\phi = 90$ deg.; and $\sin^2 \frac{\phi}{2} = \sin^2 45$ deg. $= \frac{1}{2}$, i.e., one-half of the heavens is invisible. At the equator $\phi = 0$, and $\sin^2 \frac{\phi}{2} = 0$; in other words, *no* portion of the celestial sphere is beyond the range of vision. At latitude 60 deg. $\sin^2 \frac{\phi}{2} = \sin^2 30$ deg. $= \frac{1}{4}$, or one-fourth is invisible. At the latitude of New York $\phi = 40$ deg. 45 min. $\sin^2 \frac{\phi}{2} = \sin^2 20$ deg. 22.5 min. $=$ 0.12+, or about $\frac{1}{8}$; i.e., seven-eighths of the heavens is within the range of vision every twenty-four hours throughout the year.

A good cement for switchboard repairs, where iron has to be fastened to marble, is said to consist of 30 parts plaster Paris, 10 parts iron filings, and half part of sal-ammoniac; it is mixed with vinegar to a fluid paste for use and made freshly, for it solidifies if allowed to stand.