propulsion of torpedo boats which is said to be free from the somewhat serious defect of the Parsons turbine. The latter can only run in the forward direction, and it has been necessary to install a separate motor to drive the ship astern, an obviously uneconomical arrangement. The new motor has a further advantage in its moderate speed—about 600 revolutions against 2,000 in the Parsons machine.

PETROLEUM FUEL.

It is also gratifying to learn that the experiments which the Bureau of Steam Engineering is carrying out in the Stiletto in the use of liquid fuel are meeting with complete success. The great advantages of liquid fuel are that it may be run into the bunkers or tanks by gravity, thus doing away with the tedious and costly loading by hand. It can be brought into the furnaces without handling, thus reducing the number of stokers, and it produces no ashes. A ton of oil, moreover, contains about twice as much heating power as a ton of coal, and hence the amount of fuel supply may be doubled without adding to the weight of the vessel. With a combination of liquid fuel and the turbine in the same vessel we may look for some great developments in the present government experiments.

A THIRD EAST RIVER SUSPENSION BRIDGE.

The new commissioner of bridges of New York strongly advocates the erection of another bridge across the East River. It is proposed to build a great suspension bridge which shall be used exclusively by the various railroad systems, both street and elevated. The site would be chosen with strict regard to the location of the various lines of railroad, so as to serve as a connecting line which would intersect them at the most convenient points.

The proposal is largely the outcome of the recent agitation for running elevated and surface roads across the existing New York and Brooklyn Bridge, and it is urged that the building of such a bridge is the only satisfactory solution of the railway traffic problem. More than one site has been suggested; but the two most favored lie between the present bridge and the new bridge now building about a mile further up the river, and just below the present bridge on a line between the New York and Brooklyn post offices.

GOVERNMENT TESTS OF TIMBER.

It is surprising that in these days, when the strength of all structural material is carefully determined, we should possess such imperfect knowledge of the strength of the various woods which are used in construction and manufacture. There is lacking to-day a thoroughly reliable table of the strength of woods. We say this with the full knowledge that all the text books and engineers' and mechanics' pocket books give such tables; but unfortunately the data upon which they are founded is not of that comprehensive or scientific kind which alone can give such tables their proper value. Most of the investigations of the strength of timber already made have been carried out by individuals who had neither the time nor the means to do the work as thoroughly as it should be done. The first investigation of the subject on an adequate scale is now being carried out by Dr. B. E. Fernow, of the Forestry Division of the Department of Agriculture. To examine and test a sufficient number of specimens of any given species is a costly undertaking; but the department has shown good judgment in preferring to expend its appropriations in doing thorough work on a limited number of species rather than in doing more or less superficial work upon a larger variety.

During the past year, owing to the failure of government to provide funds for carrying on this work, Dr. Fernow rented a testing machine with which to carry on his investigations. In the course of his work he made the important discovery that a constant mathematical relation exists between the compressive and the tensile tests of any species of timber, and that henceforth it will be sufficient to make a laboratory compressive test, the tensile strength being calculable from the data so obtained. Dr. Fernow gives the credit for this important discovery to Mr. S. F. Neely, one of his assistants. It is needless to say that the cost of completing the investigation of American woods will be greatly reduced, and it is to be hoped that Congress, encouraged by this fact, will grant the appropriations asked for the coming year's work.

JAPANESE CRUISER LAUNCHED AT CRAMPS' YARD.

Special importance attaches to the launch of the Japanese cruiser "Kasagi," at the Cramps' yard, Philadelphia, which took place on January 20. This is the first warship of the modern type to be built in this country for a foreign power, and if this should prove to be the forerunner of other foreign orders to follow, an important industry will be opened up which will go far to remove the stagnation which has settled upon many of our shipbuilding yards. At the time when the "Kasagi" was ordered a contract was made for a sister ship to be built at the Union Iron Works, San Francisco. This vessel was illustrated in the SCIENTIFIC AMERICAN for July 3, 1897, and its launch will take place at an early date. The high character of the work which is being put into these vessels will speak for itself and establish our reputation with the various governments which purchase their warships abroad. The "Kasagi" is modeled on the lines of the fast and powerfully armed protected cruisers which have been built by Armstrong, of England, for the Japanese and other foreign navies. She is 396 feet long, with 49 feet of beam and a draught of 17 feet 9 inches, her displacement at this draught being 4,900 tons. She is to show a speed of 22½ knots. Her horse power is 17,000, and she will carry enough coal to cruise for 4,000 miles at 10 knots an hour. Her armament will be supplied from England, and will consist of two Armstrong 8-inch and ten Armstrong 4·7-inch rapid-fire guns. She will rely upon a protective deck and her coal bunkers for protection, the former being 1¾ inches thick on the flat portion and 4½ inches thick on the slope. The 8-inch rapid-fire guns have a speed of fire three times that of the old slow-firing type, so that these two guns alone would equal the six 8-inch guns carried on our own "New York," a ship of 8,000 tons displacement. As the energy of each shell from the "New York's" 8-inch guns is 7,498 foot-tons and that of the shells from the "Kasagi's" 8-inch guns is 10,662 foot-tons, we see what an enormous advantage is gained by the adoption of the rapid-fire system. In the present instance it brings the offensive power of a 4,900-ton ship up to and beyond that of an 8,000-ton ship. This comparison is an important commentary upon the urgent plea of Assistant Secretary of the Navy Roosevelt for the arming of our cruisers with guns of the rapid-fire type.

ANNUAL SESSION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The forty-fifth annual meeting of the American Society of Civil Engineers was begun in the new house of the society under the presidency of Benjamin H. Harrod. The membership of the society was announced as 2,079, the number of non-residents being 1,604. It was announced that the Norman medal had been awarded to Julius Baier for his paper on "Wind Pressures in the St. Louis Tornado, with Special Reference to the Necessity of Wind Bracing for High Buildings," and that the Thomas Fitch Rowland prize had been awarded to Arthur L. Adams for a paper on "The Astoria City Waterworks." No award was made of the Collingwood prize for juniors.

It was moved that a special committee be appointed to examine into the question of paints used on structural work, and that another committee be appointed to consider the subject of rail joints for standard steam railroads. W. W. Crehore offered a resolution that the society "hereby record its disapprobation of the Department of Public Parks" of New York in employing a firm of architects to design the new bridge across the Harlem River at Lenox Avenue, "and protest against the selection by public officials of a person or persons outside the engineering profession to design and prepare plans for a distinctly engineering work of such importance and magnitude."

The result of the annual election of officers was as follows: President, Alphonse Fteley, New York; vice presidents, E. P. North, New York, and Frederick P. Stearns, Boston; treasurer, John Thompson, New York. The members of the society, after the installation of the new president, formed into three parties, one of which visited the Jerome Park reservoir, another the Bowling Green building, and a third went to Columbia University and inspected the new buildings.

COMMERCE ON THE GREAT LAKES.

The lake navigation season just closed was one of the most active on record, and the statistics now published, says The Pittsburg Dispatch, give their own evidence of the restoration of prosperity. The first part of the season business was lighter than usual, but the deficiency was more than compensated for in the later months. A total of 18,218,400 tons passed through the canals at Sault Ste. Marie during the year, an increase of over 2,000,000 over the shipments of 1896.

A notable feature of this business is that it was carried by fewer vessels than were in service the year before, the modern carriers being of much greater capacity than those of a few years ago. The deepening of the channel and the completion of the new American lock permitted the new vessels to load all they could carry. This year the navigators believe the lake trade will be larger than ever, and they are preparing to carry it with fewer ships than they had in service in 1897.

So much has been said of the magnitude of this internal commerce, compared with the seagoing trade of this and other countries, that every one is familar with it. But for Pittsburg the fact has a peculiar interest. To no other point does as large a proportion of the total tonnage go as goes there, and at no point does a larger proportion start than in the Pittsburg region.

THE HEAVENS IN FEBRUARY.

BY GARRETT P. SERVISS.

The Milky Way has become an object of increased interest since Barnard made his exquisite photographs of its star clouds and star gaps, and every observer of the heavens should note its position and appearance from month to month. At 9 P. M. in the middle of February it forms an arch completely spanning the heavens and passing not far from the zenith. Rising from the horizon in the north-northwest it passes just east of Sirius, which is then near the meridian, and between the head of Orion and Gemini, the latter being nearly overhead in our latitudes. Then it traverses Auriga, to the north of Taurus, and descends through Perseus and Cassiopeia, leaving Andromeda on the west, until it disappears behind the hills in the south-southwest. At the same hour the Great Dipper is seen rising in the northeast with its handle pointing downward.

THE PLANETS.

Mercury is a morning star, and can be seen before sunrise in the first part of the month. It is in the constellation Sagittarius at the beginning of the month, but at the end it will have passed across Capricornus into Aquarius. A close conjunction of Mercury and Mars will occur on the 11th. The two planets will be only one minute of arc, or less than one-thirtieth of the moon's diameter, apart. Unfortunately, their closest approach will occur at 1 o'clock P. M., eastern standard time, but they will be near enough together just before sunrise of the same day to present an interesting sight if the eastern horizon is clear.

Venus is also a morning star during the first half of the month, but too near the sun to be well seen. She is in Capricornus at the beginning of the month and in Aquarius at the end. She passes behind the sun (superior conjunction) on the afternoon of the 15th and then becomes an evening star, but still too near the solar orb to be seen.

Mars is likewise in the morning sky, very near the sun. He passes from Sagittarius into Capricornus about the 12th.

Jupiter is gradually coming into a better position for observation. He is in Virgo, not far from the double star Gamma, and rises about 10 P. M. at the beginning of the month and about 8 P. M. at the close.

Several interesting phenomena arising from the motions of Jupiter's satellites occur on the night of the 12th at fairly convenient hours for observation. At about 10:19 P. M. the shadow of Satellite II will be seen passing upon the planet's disk. The transit of the satellite itself across the disk will begin at 12:10 A. M. In the meantime, at 11:08 P. M., Satellite III will come out from behind Jupiter, or reappear from occultation. At 12:55 A. M. the shadow of Satellite II will pass off the face of the planet, and at 1 o'clock 2 minutes and 46 seconds A. M. Satellite I will be eclipsed by passing into Jupiter's shadow.

On the night of the 13th Satellite I, preceded by its shadow, may be watched passing across Jupiter between the hours of 10:12 P. M. and 1:18 A. M.

The observation of Jupiter's satellites requires the use of a telescope, but a good 3½ or 4 inch glass will amply suffice. The time given is Eastern standard.

Saturn is in the constellation Scorpio, very close to the border of Ophiuchus, and will pass into the latter in the course of the month. It is a few degrees northeast of the red first magnitude star Antares. It rises on the 1st shortly before 3 A. M., and at the close of the month about 1 A. M.

Uranus is also in Scorpio, about a degree east of the pair of little stars called the Omegas, just below the well known double Beta Scorpii.

February both opens and closes with a waxing moon. The first moon fulls on the 6th and reaches last quarter on the 13th. The new moon of the month occurs on the 20th, reaching first quarter on the 28th.

The moon will be in perigee, or nearest to the earth, early on the morning of the 17th, and in apogee at midnight on the 28th. The greatest libration east occurs about midnight on the 8th and the greatest libration west about 11 P. M. on the 22d. It is owing to the libration of the moon that we are able to see a portion of that lunar hemisphere which is perpetually turned from the earth. We look first a little around one side and then a little around the other side.

A STUDY of ozone from a technical standpoint, by E. Andreoli, appears in The Journal of the Society of Chemical Industry. Theoretically, one should be able to produce a kilo of ozone per electric horse power, but in practice only 10 or 12 grammes are obtained. By improvements in the apparatus for producing ozone, the author increases the production to thirty and even fifty grammes per horse power, making the cost about 75 cents a kilo. The author proposes practical applications of ozone, such as purification of drinking water, cleansing of beer casks, preparation of wood for instruments and furniture, bleaching of starch and dextrin, oxidation of drying oils, purification of wine and brandy, etc. It does not appear, however, that any of these proposed uses have been tested practically and on a large scale.