Bids for New Cruisers and Gunboats.

In compliance with the advertisement of April 6 last, with subsequent modification, bids were opened at the Navy Department on August 8 for the construction of the cruiser No. 1, of about 4,000 tons, known as the Newark (cost not to exceed $1,300,000); of cruisers Nos. 4 and 5, of 4,000 tons, known as the 19 knot ships (cost not to exceed $1,500,000 each); and gunboats Nos. 3 and 4, of 1,700 tons, of the type of gunboat No. 1, now building. The description of the twin cruisers is in most respects similar in every detail with that of the Newark. The exceptions are that they are to have machinery of 7,500 indicated horse power under forced draught. The speed is to be 19 knots. The rig is that of a three-masted schooner, spreading 5,400 square feet of sail. Their armament is also to consist of main batteries of twelve 6 inch breech-loading rifles.

Cramp & Sons were the only bidders for cruiser No. 1. Their bid for this vessel, upon department's plan for hull and bidder's plan for machinery, was $1,248,000. But two bids were received for the 19 knot vessels—Messrs. Cramp & Sons at $1,410,000 each and the Union Iron Works at $1,428,000. These bids were based upon the department's plans for both hull and machinery. The Union Iron Works' bid was for one vessel only. Several other bids designated as "special" were submitted by the Messrs. Cramp & Sons for these two vessels—one of $1,325,000 each upon bidder's plans complete, and another of $1,350,000 upon modified plans of the cruiser Baltimore, now building by them. In the bids for gunboats Nos. 3 and 4, Cramp & Sons are cut out narrowly by N. F. Palmer, Jr., & Co., the firm with which Mr. Quintard, John Roach's assignee, is connected. According to the department's designs entirely, Cramp proposes to build the gunboats at $495,000 each. N. F. Palmer & Co.'s bid is just $5,000 less—$490,000 each. As the bids go, it would seem that the three cruisers will probably be built at Cramp's yard in Philadelphia, and the gunboats at Roach's yard at Chester. Mr. Quintard says that if the contract is awarded to Palmer, the hulls will be built at Chester and the machinery at the Quintard Iron Works. The Secretary of the Navy is not bound to accept the lowest or any bid, but he is not likely to reject any of them.

The hull, machinery, and fittings of cruisers Nos. 1, 4, and 5 to be finished within two years from signing the contract, and those of the gunboats Nos. 3 and 6 within eighteen months, with penalties for delay. The weight of the engines and machinery, including water in the surface condensers and boilers, is not to exceed 850 tons for the cruisers and 340 tons for the gunboats, under a penalty of $25,000 and $10,000 respectively for an excess of five per cent in weight, and $1,000 for each ton weight beyond that. The indicated horse power is to be 8,520 for the cruisers and 3,400 for the gunboats, with a premium or penalty of $100 for each horse power in excess or deficient.

Although only three firms competed for the construction of these ships, the Secretary seems well satisfied with the results. He says: "The requirements which the contractors assume are more exacting than in the case of any previous bidding. The law for cruisers Nos. 4 and 5 provides that the contracts for the construction of them shall contain provisions to the effect that the contractor guarantees that when completed and tested for speed, under conditions to be prescribed by the Navy Department, the vessel shall exhibit a maximum speed of at least 19 knots per hour, and for every quarter knot of speed so exhibited over and above said guarantee the contractor shall receive a premium over and above his contract price of $50,000, and for every quarter knot that said vessel fails of reaching said guaranteed speed there shall be deducted from the contract price the sum of $50,000. The department has prescribed a four hours' run for the trial—the vessel to be loaded to the mean load draught—so that there is to be no shamming in the conditions of the trial. This contract is bid for by both the Union Iron Works and Cramp & Sons, and it is a requirement which calls for a boat up to the highest point of speed which these cruisers have reached anywhere. Of course the exactions of the bidding drive off people who are not sure of their ground; but I consider that we are very fortunate in being able to place all of the boats with responsible parties with these very exacting requirements."

Velocity of Electrical Transmission.

Prof. Gould has ascertained that aerial telegraph wires on poles transmit electricity at the rate of from 14,000 to 16,600 miles per second, and that the velocity of transmission increases with the distance between the wires and the earth, or, in other words, with the height of suspension.

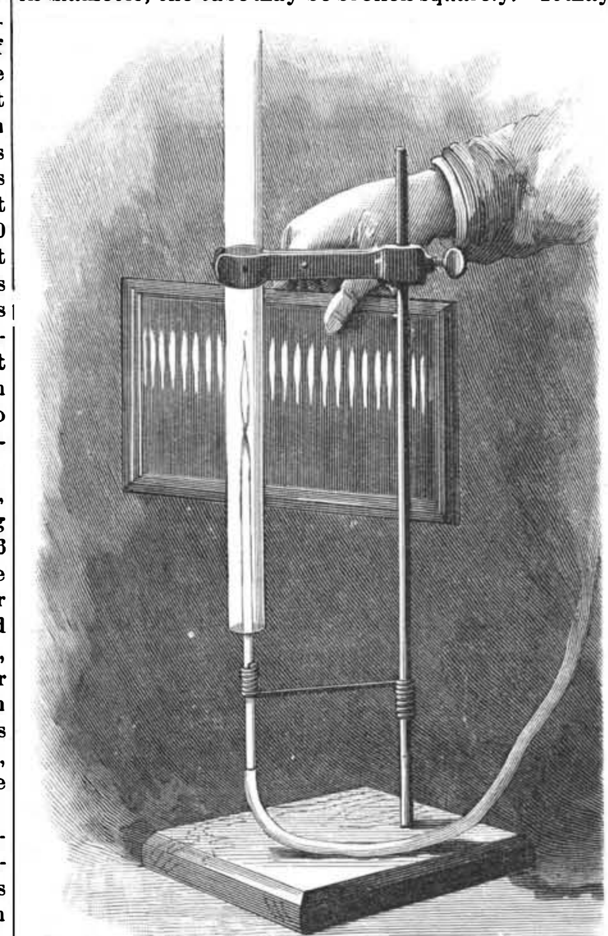
Subterranean wires, like submarine cables, transmit slowly. While wires suspended at a feeble height transmit signals at a velocity of 12,000 miles per second, those that are suspended higher give a velocity of from 16,000 to 24,000 miles. Wheatstone's experiments in 1833 seemed to show a velocity of 288,000 miles per second, but this result has never been confirmed.—*La Lumiere Electrique.*

MUSICAL FLAMES.

BY GEO. M. HOPKINS.

The experiments of Tyndall and others on sounding flames are so interesting and so easily repeated with very simple appliances, that the student of physics, particularly in the department of acoustics, should not fail to repeat them. The production of musical sounds by means of flames inclosed in resonant tubes is especially easy. One form of this experiment is illustrated by the engraving.

For the mere production of sounds, a metal tube will answer, but for the analysis of the flame by which the sound is produced a glass tube will be required. This tube, whether of metal or glass, may be 40 inches long and one inch internal diameter. It should be supported in a fixed vertical position in a suitable support, a filter support, for example. In a lower arm of the support is placed a glass tube three-eighths inch in diameter, having its upper end drawn to a small circular aperture, which will allow sufficient gas to escape to form a pointed flame about 2½ inches in height. The tube is drawn down by heating it near one end until it softens, by continually turning it in a gas flame, then quickly removing it from the flame, and drawing it out as far as possible. By making a nick with a fine file in one side of the tube, at a point where it is about 1-16 inch in diameter, the tube may be broken squarely. It may



PRODUCTION OF SOUNDING FLAMES.

then be tried as a burner. If the flame yielded by gas at full pressure is less than two inches in length, the tube should be again broken off at a point where it is a little larger in diameter, and if the opening happens to be too large, it may be reduced by holding the extreme end of the tube in a gas flame until it partly fuses, when it will contract.

The small glass tube is connected with the gas supply, and the jet is lighted and inserted centrally in the larger tube, and moved slowly upward in the tube until a clear musical note is heard. If the flame is full size, the note will be the fundamental note of the tube. By turning off the gas so as to make the flame three-fourths to one inch high, and again inserting the burner in the tube, a point will be found between its former position and the lower end of the tube at which a tone of higher pitch will be heard. This is one of the harmonics. If the burner with the small flame be carried further upward into the tube, a point will be reached where both the fundamental and harmonic will be produced simultaneously. These tones are produced by rapidly recurring explosions of the gas, the explosions being rendered uniform by the vibratory period of the column of air contained in the tubes.

There are two methods of analyzing these flames. One consists in simply shaking the head, or quickly rolling the eyes from side to side, thereby enabling the eye to receive the impressions of the successive flames in different positions on the retina. The other consists in viewing the image of the flame in a revolving or oscillating mirror. By holding an ordinary looking glass in the hand, opposite the flame, as shown in the engraving, and oscillating the glass, what appears to be a single flame in the tube will be shown as a succession of flames of like form in the mirror.

Another way of showing the intermittent character of the flame consists in revolving a disk having alternating radial bands of black and white, in proximity to the tube, so that the disk is illuminated only by the light of the intermittent flame. When the disk attains a proper speed, the intermittent illumination will cause it to appear stationary. This beautiful experiment is due to Toepler.

By employing a concave mirror instead of a plane one as described above, the image of the flame may be projected upon a screen.

The Berlin Screw Industry.

In reviewing the present situation of the screw industry, the *Berliner Tageblatt* lately remarked that Berlin makes screws in such quantites and of such qualities that its products are esteemed not only in Germany, but in other countries. The principal manufacture is that of fine screws worked bright, from the larger sizes for machinery down to the smaller kinds for watch work, etc.; the materials employed being iron, steel, brass, German silver, etc. Efforts are now being made to increase the production of rough black screws for ordinary wood and iron work; this class of screws having been hitherto principally made in Westphalia, but the development of machinery instead of hand labor in Berlin will, it is considered, alter this situation. There are in the Westphalian district—near Hagen—fifteen screw factories, employing in all about 3,000 workpeople. The Berlin industry comprises twenty-eight factories with about 1,500 workpeople. As these are, however, almost exclusively engaged in the manufacture of screws—while at the various establishments near Hagen only about one-third of the workpeople are employed in this particular industry—it is claimed that Berlin is at least as important a seat of screw manufacture as the Hagen district. Berlin used at one time to draw its supplies of raw material almost entirely from Westphalia, but of late years the constantly increasing employment of ingot iron and ingot steel instead of welded iron has developed the use of Brunswick raw materials—from Peine—which are cheaper than the Westphalian articles, this being partly due to the shorter railway journey they have to make. Steam machinery is exclusively employed for making bright screws, one factory having lately erected a new steam engine of 45 horse power. The screw-making machines in use are upon a system invented by Kernaul some thirty-five years ago, but which has since then been much improved. The manufacture of these screw-making machines constitutes a special branch of Berlin industry. The introduction of the new patent automatic machinery will, it is expected, lead to a further development of the manufacture of screws, more particularly in connection with the making of nuts to go with the larger sizes of normal machine bolts. The history of the Berlin screw manufacture is considered to disprove the assertion that an important metal article can only be made in the immediate vicinity of the works where the raw material is produced. This result is attributed to the intelligence and manual skill of the Berlin workmen. One factory at Kopenik produces annually 2,000,000 steel horseshoe calkins, the steel for which comes from Hagen

Death by Electricity.

A number of interesting experiments have just been made with such electrical machines as are employed in industries, with the view of determining under what conditions they may become dangerous. These have been conducted by M. D'Arsonval, who has already established the fact that what is truly dangerous where these machines are used is the extra current that occurs at the moment the current is broken, and in order to annul this extra current he proposed to interpose a series of voltameters containing acidulated water along the conducting wire. The new arrangement now employed is at once more simple and efficient. It consists of a V-shaped tube made of an insulating substance, which, after being filled with mercury, is interposed in the main current. In order to close the latter it is only necessary to turn a tap, which is arranged similarly to the tap on a gas pipe. In this way the machine is unprimed without its being able to give an extra current spark.

Another arrangement is also made use of, a glass tube being filled with mercury and dipped into a reservoir containing the same substance. This tube is provided with a ground stopper, this not only permitting the suppression of the extra current, but also interposing any sort of resistance in the current. Although these details appear rather technical, they relate to a most important matter. The use of electrical machines is increasing, and it is of practical use to know that currents are not dangerous until a power of 500 volts is reached. It is also of interest to know that the mechanism of death varies with the nature of the electricity used. Thus, with the extra current or with alternating currents, there is no anatomical lesion, and the patient can usually be brought back to life through the practice of artificial respiration, as employed in cases of drowning. The discharge of static electricity from batteries, on the contrary, causes a disorganization of the tissues that renders fruitless all attempts to restore life

Comparative Locomotion.

Their recent researches on the locomotion of the horse and elephant enable the authors to establish certain analogies and differences presented by the posterior member of these quadrupeds compared with the movement of the lower member in man. The parallelism, which is illustrated by several diagrams, bears both on the slow and rapid motion (walking and running) of the three types here under consideration. Contrary to the general opinion, there appears to exist in the step or pace of the quadrupeds a period of double rest, more prolonged in the hind than in the fore quarters. It is also shown that the trot in the horse corresponds unquestionably with the running action of man, but that elephants have no such action, just as man lacks the gallop of the horse, which in this respect thus stands at the head of the series. But, when urged to quicken their speed, the elephants broke into an action somewhat approaching that assumed by man when passing from a walk to a run. In general, both in slow and rapid motion, the action of the pelvic member remains essentially the same in all three types. The difference between them lies in the action on the concurrent limbs, which is slight between man and the elephant, much greater between these two and the horse. —*MM. Marey and Pages.*

Electric Power Service.

BY T. C. MARTIN.

The rapid introduction of electrical apparatus as soon as its efficiency has been demonstrated is being seen once more in the remarkable growth of the electric motor industry. It was the privilege of the writer just a year ago to bring before the National Electric Light Association, in session at Detroit, a few facts and comments on the subject of the use of motors and the electrical transmission of power as it then presented itself. An enumeration was made of the various places at which motors had been introduced, and a few figures were quoted as to results obtained. But the material then offering itself, though striking, was notably scarce as compared with that forthcoming to-day, and to those who are in any way familiar with the development going on, it is evident that the new work already in hand will, within the next year, dwarf into utter insignificance all that has hitherto been accomplished. Thus it may be mentioned, for instance, that one well-known company shows a total output of over 2,000 small motors; that another concern manufacturing small motors up to about one h. p. has built 2,500 since last November; that another company within about the same time—nine months—has sold 1,000 h. p. of motors; that a fourth has, since going into operation, sold about 2,500 h. p., and is now building some 4,000 h. p.; and that large factories have been put up for the special manufacture of motors, employing hundreds of men. The importance of this new condition of affairs is hardly yet recognized, but it cannot be denied. It means for one thing that even to-day the electric light station is becoming the great public reservoir of power, and that from its circuits all engaged in manufacture, and thousands who need power for various minor services and functions, can draw supplies at will. In a very short time the consumption of current for electric power will equal, if not excel, the consumption for light, and it is to this new idea that electric light men and the general public are adjusting their methods. There is not an electric light station building to-day in which provision is not being made, in engines and dynamos, for electric power supply; nor is there a manufacturing industry, within city limits anywhere, in which the use of electric motors is not to be tried or has not already begun.

It is, of course, well known that several hundred small motors are in use at the present time deriving current from primary batteries. It is also well known that a large number of motors, averaging about 15 h. p. each, have been applied to street railway work; but it is through the medium of electric lighting circuits that the greatest demand for motors has come and is to be met. In order to ascertain what is being done in this field, the *Electrical World* addressed inquiries recently on the subject to about 500 of the largest local lighting companies. It has been fortunate enough to secure replies from between 200 and 300 of these, and the replies constitute a very interesting presentation of the work done in all sections of the country. A large part of the information furnished has been published during the last week or two in these columns, but it may be well to bring out one or two points that are suggested by the replies as a whole.

It appears that not far short of a hundred local companies are now operating motors, generally, but not always, on their day circuits. A noticeable feature of the replies from companies not doing any motor business is that they "do not run day circuits." This may often be a sufficient reason, but the inquiry is admissible whether sufficient current could not be stored up from the average nightly run of a station with a spare or extra dynamo to feed a day circuit profitably. This is certainly worth trying in some places, and is being done at Cheyenne, where several motors are on storage day circuit. Another point brought out is that the motors are largely on incandescent circuits, the reason for this being obviously that day running is far more a necessity with incandescent stations than with arc stations. Where motors are running upon night circuits they are chiefly employed on newspaper presses.

A question among electric light men has been whether it is best to sell the motor or to rent it out. No unanimity has yet been attained, or is likely to be reached, on that head, although in a great many cases the matter of purchase is left optional with the customer. The sale outright relieves the company of a large initial outlay, but the leasing system seems productive of a much larger income in the long run.

Another question arising is that as to the desirability of selling power at a flat rate or by meter. Many of the companies are charging meter rates, but, on the whole, the flat rate, based on the capacity of the motor, appears to have a decided preference.

It will be remembered that the National Electric Light Association has discussed the propriety of fixing motor rates for its members. Pending that action, a striking variety has manifested itself. A few schedules will show this. The following are the rates at Pittsburg:

WHERE COMPANY OWNS MOTOR.	Per month.	WHERE SUBSCRIBER OWNS MOTOR.	Per month.
½ horse power	$10.00	½ horse power	$6.00
1 "	15.00	1 "	10.00
1½ "	22.50	1½ "	15.00
2 "	28.00	2 "	20.00
3 "	40.00	3 "	25.00
5 "	60.00	5 "	40.00
8 "	72.00	8 "	55.00
10 "	80.00	10 "	60.00

The company runs its main line to the premises where the motor is to be placed, but all other connections and appliances for the purpose of utilizing the power from that point are made at the cost of the subscriber.

At Buffalo, N. Y., the following rates are quoted:

Size.	Power per month.	Rental of Motor per month.
⅛ H. P.	$3.00	$0.50
½ "	5.00	1.00
1 "	8.00	1.00
2 "	15.00	2.50
4 "	26.00	5.00
6 "	38.50	7.50
8 "	51.00	10.00
10 "	63.50	12.50
12 "	76.00	15.00

The above quotations are based on a service daily except Sunday, from 7 A. M. to 6 P. M. Special prices are made where power is required for a different period. A discount of $1 per motor is made on bills paid on or before the 10th of month following service. To parties desiring to own their motors the company (Brush) furnishes any size or style. Where motor is furnished by the company, a contract for at least one year's motor use is required.

At Laramie, Wyo., the subjoined schedule has been put in force by the Laramie Electric, Gas Light, and Fuel Company:

Horse power delivered to customers.	Rates per horse power per hour.	Rate for one hour.	Rate per month of 26 days in cases where consumer owns the motor.
40	2½ cents	$1.00	$260.00
20	2½ cents	50	130.00
15	2½ cents	37½	97.50
10	3 cents	30	78.00
7½	3½ cents	26¼	68.25
5	4 cents	20	52.00
3	4½ cents	13½	35.10
2	5 cents	10	26.00
1	....	6	15.00
½	....	3	7.50
For sewing machines.	....	....	2.00

The Laramie station is about to supply 40 h. p. at $260 per month, as above, to a large flouring mill about 150 feet away.

At Detroit, Mich., the Edison Company is charging $100 per h. p. per year, the patron buying his motor. At Boston, the Boston Electric Light Company, on the same basis of purchase, charges 50 cents per day per h. p. At Des Moines, the rate is $100 per year per h. p. for 10 hours daily with work at constant load; and $100 is also charged at Auburn, N. Y., Springfield, Mass., Williamsport, Pa., and Fall River, Mass. At Lawrence, Mass., Lowell, Mass., Harrisburg, Pa., and Providence, $125 is charged. At Cleveland, O., Cincinnati, and Baltimore (over ½ h. p.), $10 per month is charged. At Hutchinson, Kan., and Abilene, Kan., respectively, a 5 h. p. motor runs the press for the morning newspaper at $45 per month. At Pawtucket, $100 per year is the rate where the motor is sold, and $150 where it is rented. At Rochester, N. Y., where the prime power is water, $50 to $72 per h. p. per year is charged; and at Elgin, Ill., where the day run is made by water power, $60 per year is charged for from 7 A. M. to 6 P. M., and 15 cents per h. p. per hour for night work. At Cleveland 24 ⅛ h. p. sewing machine motors are run at $1 each per month. At Galveston, Tex., $15 per month is the rate. At Toledo, O., and Kansas City $2 per month for ⅛ h. p. is being charged, and at Reading, Pa., $1.75 per month. In Boston and New York the rate averages about $100 to $125 per year. Of course, in all cases, larger supply means lower rates.

The work done by the motors now running is endless in its variety, and some of the uses are novel and highly ingenious. A large number of motors have found their way into printing offices, and run the press for such papers as the Lawrence, Mass., *American;* the Detroit, Mich., *Tribune;* the Cincinnati, O., *American Inventor;* the Rochester, N. Y., *Pythian Knight;* the Lowell, Mass., *Daily News* and the *Daily Courier;* the Elgin, Ill., *News;* and the daily journals at Hutchinson and Abilene, Kan. At Detroit a 15 h. p. motor operates machinery giving employment to 200 people, and it is noteworthy that a motor factory in New York is now putting in one of its own motors to give it power from the nearest electric light station. In fact, it is a common thing to find a motor driving large floors of machinery and keeping scores of men busy, as for example in machine shops, shoe factories, clothing stores, printing offices, box factories, book binderies, knitting works, and the like. But the motors can also be found, as these returns show, washing bottles, pumping water from artesian wells at two cents per barrel, brushing down horses, running dental lathes, and driving hundreds of ice cream freezers, coffee mills, ventilating fans, elevators, organs, circular saws, plating apparatus, laundry machines, glove machines, and in throwing colors on portraits. At Pittsburg a 15 h. p. motor is being put in to drive dynamos for the Western Union Telegraph Company, and some are now employed here and there running the generators in telephone exchanges.

It is still early for the establishment of special motor circuits, but there are several now up and more are building in the larger cities. It is to be borne in mind that in New York and Boston a distinct electric power supply (Daft) has existed since 1883, that in New York now distributing over 200 horse power to about 60 customers, and that in Boston 90 horse power to about 20. Similar service exists in Worcester and Providence. A special power plant is also enjoyed by San Francisco, and the steps being taken elsewhere in the same direction are too numerous to record.

It remains to be seen whether the power supply will be generally undertaken by special power stations or whether it will chiefly remain in the hands of the lighting stations. In Boston the Edison light station is running 72 motors (Sprague) from ⅛ h. p. to 15 h. p., with a total call for 300 h. p. of current, and in New York the Edison wires feed 45 motors of the same make, with the same range of capacity, taking in all 250 h. p. The Brush companies in New York, Rochester, Buffalo, Galveston, and Philadelphia have a large number of motors of different makes in use, and the Brush Company in Baltimore has about 60 motors (Baxter) on its arc circuits. At Providence the Narragansett Electric Light Company is putting about 30 h. p. of motors (Thomson) on independent circuit.

One interesting development in New York City deserves special note. The Excelsior Steam Power Company, established as a private concern about thirty years ago for steam power distribution, and lately delivering nearly 800 h. p. over an area of four city blocks, went into the electric motor business not long ago, running for the Electric Power Company the Daft service above spoken of. It is now understood that the company has completed arrangements for the generation and supply of 2,000 h. p. electrically, using the same system, and is already busy preparing its plant. This service will be confined to the district on the east side of Broadway, another service being meantime planned for the west side, to go into operation by the beginning of September. The Excelsior Company has been leasing its motors, charging $4 per week for 1 h. p., $6 for 2 h. p., and $3 for every additional h. p. This includes the current, the use of the machine, supervision, and any needed repairs.

Some of the comments made are very significant, and in no case does it appear that the motor is at a disadvantage as an instrument of power distribution when compared with other machines. Thus it is remarked by the local company at Appleton, Wis., that water power is so cheap it would not pay them to run in the day time for electric power supply. Yet it is in Appleton that the electric motor has made a splendid showing on street railway work, the generator being driven by water wheel. As to the size of motors, it may be said that it was at first thought that the bulk of the business would be around 5 h. p., but the demand is as brisk for motors of 10 and 15 h. p. and larger as for those of any other smaller capacity. All told, there are probably over 10,000 electric motors in America to-day, of some fifteen different makes—Brush, Thomson, C. & C., Cleveland, Baxter, Van Depoele, Daft, Edgerton, Sprague, Hawkeye, Bergmann, Griscom, etc. Of one of these motors alone, over 30 types are now being built to fill orders and carry in stock—a point of no small importance as illustrating the remarkable commercial development of this latest electrical application.—*Electrical World.*

FOR making hair oil that is not injurious to the hair: Castor oil, ½ pint; 95 per cent alcohol, ½ pint; tincture cantharides, ½ ounce; oil of bergamot, 2 drachms. Color the mixture a pale pink with alkanet root.