A Remarkable Trial and Triumph.

The triumph of Wheeler & Wilson, at the American Institute, New York, withtheir New No. 6 Sewing Machine, was remarkable in many respects. Extraordinary and repeated examinations were made, one lasting from 10 o'clock A.M. until 6 P.M. The parts of six machines were ordered from the manufactory, and a machine was constructed of parts selected by the judges, which was then tested on all kinds of work, from gauze to heavy harness, by foot and steam power. The general quality of the Company's workmanship was ascertained by an examination of machines in their warehouses, and the testimony of many disinterested users of the machines, far and near, was procured to ascertain their practical working.

The five judges, in conclusion, unanimously reported the Wheeler & Wilson New No. 6 Sewing Machine "as a machine which, by the proof submitted, we are satisfied must eventually supersede all others now known with which it comes in competition." And they "recommend for it the highest award which it is in the power of the Institute to bestow."

The Board of Managers unanimously approved the report, and recommended for this machine the Gold Medal of the Institute.

The Board of Direction unanimously approved this recommendation, and awarded the Gold Medal to Wheeler & Wilson, the only gold medal awarded for a sewing machine by the American Institute for many years.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

W. H. C.'s idea for driving a propeller by a spring is not likely to prove practicable.—W. E. H. will find directions for making a storm glass on p. 75, vol. 30.—C. B. will find a recipe for fireproofing shingles on p. 280, vol. 28.—W. C. B. will find an explanation of the moon's variations on p. 251, vol. 31.—R. R. R. will find an elucidation of the weight on an inclined plane question in our recent issues.—M. will find directions for temperiug springs on p. 10, vol. 25.—J. H. L. can harden tallow for making candles by the process described on p. 201, vol. 24.—G. E. O. will find Warven's works on mechanical drawing and Davies & Peck's "Algebra" to be good and practical.—R. W. W. will find a description of the philosopher's or hydrogen lamp on p. 242, vol. 31.—C. H. H. will find full particulars as to Colgnet stone on p. 124, vol. 22.—J. M. will find recipes for hard soap on pp. 331, 379, vol. 31, and for bootblacking on p. 283, vol. 31.—J. J. D. will find directions for tanning skins with the fur on on p. 235, vol. 26.—W. P. P. will find a description of processes for preserving wood from decay on p. 319, vol. 31.—J. F. should refer to p. 213, vol. 31, for a recipe for polishing shirt bosoms.—J. M. H. and others can unite rubber to leather by using the cement described on p. 119, vol. 28.

(1) J. M. asks: 1. What horse power would it take to run a boat 16 feet long by 5 feet beam? A. An engine of ½ horse power would answer. 2. What is the cost of an engineer's certificate? A. See p. 282, vol. 31.

What is camphor composed of? A. It is a crystalline substance obtained from a tree. It contains carbon, hydrogen, and oxygen.

(2) G. G. L. says: I wish to make a large clock dial for my windows, and drive the hands by electricity from a regulator in the shop. Please say how I can make it? A. The electrical part consists of an electro-magnet and armature worked by a battery of two Daniell's cells. The armature is attached to a lever, having a pawl connected at its upper extremity, which moves a toothed wheel. Whenever the regulator closes the circuit, the pawl causes the wheel, which carries the hands, to advance one tooth. The regulator may be arranged to close the circuit every second or every minute, as desired.

(3) J. R. says: 1. Alexander Watt recommends to electroplaters, from personal experience, the following battery: A stoneware jar holding about four gallons receives a cylinder of thin sheet copper, dipping into water acidulated with 2 lbs. sulphuric acid and 1 oz. nitric acid. A solid zinc cylinder is put into the porous cell, which is filled with a concentrated solution of common salt, to which a few drops of hydrochloric acid have been added. What should be the diameter of the copper cylinder inside the stone jar? A. The diameter should be nearly as great as the jar. 2. Should it have a bottom to it? A. It is immaterial whether it has a bottom or not.

(4) C. A. W. asks: How are Callaud's and the Minotti batteries constructed? A. The Callaud battery consists of a glass vessel with a copper plate at the bottom, upon which are placed crystals of sulphate of copper. A zinc plate is suspended near the top and the jar filled with water. The Minotti battery consists of the same materials as the Callaud, and, in addition, a thick layer of sawdust is interposed between the copper plate at the bottom and the zinc plate at the top.

(5) W. L. L. asks: Will electricity give forth a spark sufficiently strong to light a gas jet? A. Yes, whenever it has a sufficient potential. In cold, dry weather, a person may charge himself sufficiently with electricity to light gas with his finger, by walking briskly over a carpet or rug.

(6) R. C. W. and others.—Liquids, complex or otherwise, can be analyzed with the same accuracy as solids. But it is possible so to muddle things that an experienced chemist cannot separate them again; but only by artificial means. Nature never presents such difficulties.

(7) W. C. W. asks: In what proportions shall I mix the acids and alcohols to make respectively sulphuric and nitric ethers? A. The method at present in general use for the preparation of ordinary ether—ethylic ether, sometimes improperly called sulphuric ether—is that known as the "continuous process" of Boullay. It consists in mixing together equal measures of alcohol (specific gravity 0·830), and concentrated sulphuric acid; the mixture is submitted to distillation in a capacious retort, which must be connected with an efficient condenser. Through the tubulure of the retort a tube is introduced, which is in connection with a reservoir of alcohol, designed to maintain a supply of spirit sufficient to keep the amount of liquid at a uniform level in the retort during the course of the subsequent distillation. The temperature is then rapidly raised so as to maintain the liquid in steady ebullition. The liquid which passes over consists almost wholly of ether and water, mixed with a small proportion of alcohol which has distilled over unchanged. The process may go on without interruption until a quantity of alcohol, about 30 times as great as that originally taken, has become converted into ether. Isethionic acid is gradually found in the residue. Nitric ether is obtained by gently heating one volume of nitric acid, of specific gravity 1·40 (to which a few grains of nitrate of urea have been added in order to prevent the formation of nitrous acid), and 2 volumes of alcohol, of specific gravity 0·842; the quantity of the mixture operated upon should not exceed a quarter of a pint; under these circumstances the operation proceeds quietly. The first portion of the distillate contains little except alcohol; but as soon as the liquid which distils over becomes turbid on the addition of water, the receiver must be changed and the nitric ether collected separately: the distillation must be stopped when about three fourths of the liquid has passed over, in order to prevent the ether from becoming mixed with secondary products, which cannot be removed without difficulty. The ether is purified by agitation with a weak solution of alkali, and rectified from chloride of calcium. It burns with a white luminous flame; and if heated to a little beyond its boiling point, it is decomposed with an explosion on the approach of light.

(8) J. C. B. says: A. claims that 1 lb. feathers will be heavier than 1 lb. lead, as the surface of the feathers is larger than that of the lead. Can there be circumstances that will render 1 lb. feathers heavier than 1 lb. lead? A. The weight of a body in a vacuum is increased by the weight of an equal volume of air. Hence, if the feathers displace more air than the lead, they would weigh more, in a vacuum.

(9) A. F. asks: Is there a nozzle, in use by fire departments, that can be made to throw a large or small stream at pleasure? A. Yes. It is quite a common device.

(10) P. W. asks: 1. Can a Leyden jar be charged with voltaic electricity? If so, how? A. Yes. Connect one pole of the battery with the inner coating, and the other pole with the outer coating. 2. Is a simple galvanic Bunsen cell enough to generate electricity to charge a jar? A. One cell would charge it very slightly. 3. How many Bunsen cells does it require to burn metals? A. Fifty cells would burn a small wire. 4. Would it answer the purpose, instead of coating internally, to drop strips of tinfoil in the jar as high as the internal coating should come? A. It would not, unless the strips were connected together so as to be continuous. 5. Should the bottom be coated outside? A. No. 6. Is it necessary for the jar to have a brass cap? A. No. 7. Would an iron wire passing through the cork connecting with metallic filling answer to conduct the electricity? A. Yes. 8. Is it necessary for the rod to have a brass head? A. No.

(11) J. J. J. asks: What makes water in a well look blue when sunlight is deflected on it? A. The blueness is due to a partial absorption of the red and yellow components of the solar ray, leaving the light with an excess of blue, which imparts to it its peculiar tint.

(12) P. T. M. asks: What is the easiest and best way to polish marble, agate, and granite? A. The polishing is differently carried on, according to the nature of the work. For small slabs or objects of an ornamental kind, the highest degree of finish is requisite. Polishing is commenced with pumice stone and water, and with snake stone, after which various rollers or rubbers are employed. If the object be large and flat, the rubber may be a large wooden block faced with thick woolen cloth, or a mere bundle of woolen or other cloth, compressed in a rectangular iron frame, and moved about with a handle. For smaller work, rollers of woolen cloth or list, about 3 inches in diameter are employed; some of these are charged with flour, emery, and a slight degree of moisture, which produces a kind of greasy polish uniformly over the surface. A similar cloth, charged with putty powder and water, completes the process. In some of the more delicate works, crocus is used intermediately between the emery and putty powder.

(13) W. C. B. asks: What is the difference between a high and a low pressure engine, and what effect has the difference on the draft? A. The high pressure engine has no condenser, and frequently discharges the exhaust steam into the smoke pipe, thereby increasing the draft.

(14) J. P. says: I am burning slack under my boiler, and my tubes want cleaning two or three times a week. I am thinking of blowing them out with steam. Will the steam injure them by corrosion? A. No. This is ordinarily a very good plan.

(15) C. S. A. asks: I am using a wire rope, with a windlass and pulleys, subjected to very heavy strain. The rope seems to get stiffer from use. If I heat it red hot and let it cool slowly, it will be more flexible: but will it injure the rope? A. Not appreciably.

(16) B. F. G. says: We are burning Gross creek coal; it is very soft, and very much like the ordinary blacksmith's coal, but is of a high grade. We find that in wet weather we burn more in weight than when dry. A few days ago I weighed very carefully 500 lbs., dry, and afterwards added ½ gallon of water. I then reweighed it, and found that it had gained 20 lbs. I spoke of this experiment to a friend, and he said that it was impossible for it to gain 20 lbs., as the only weight that the coal could gain would be the weight of the water. Am I or is my friend right? A. Even in the face of the very stubborn facts that you present, we agree with your friend, and question the facts. 2. What is the weight of 1 gallon of water? A. A United States gallon of water weighs about 8·3 lbs.

(17) A. F. C. asks: 1. What would be a safe pressure to carry on an upright tubular boiler 15x20 inches, having 52 one inch tubes made of three sixteenths iron? A. A safe pressure would be 100 lbs. per square inch. 2. What would be the bursting pressure? A. About 600 or 700 lbs.

(18) H. K. asks: 1. What, in your opinion, is the best and cheapest method of preventing incrustation in steam boilers? A. In some special cases the tannate of soda seems to act beneficially. 2. What do you think of steam heaters and filters to prevent scales in boilers? A. In general we recommend the use of a good heater and frequent blowing. 3. What is mostly used in the East to keep the boilers clean? Is the water in the Eastern States generally impregnated with lime? A. The water used in boilers at the East ordinarily gives as much trouble from scale as that at the west.

(19) J. C. M. says: With the intention of increasing the capacity of a steam boiler (horizontal, 42 inches in diameter and 18 feet long, with 32 tubes), I introduced some 4 inch tubes under the boiler, commencing just behind the bridge wall and running back the length of the boiler. These pipes had cast iron connections at the bends. I placed them 8 inches below the bottom of the boiler, connected them at the back end of boiler near the bottom, and attached the feed pump near the front, and fed with hot water. The first day they worked well and improved the boiler greatly in steaming capacity; but on the third day, just after starting up, with the first stroke of the pump, the cast iron end on the pipe where the feed pipe was connected burst with a loud report, and for a few seconds nothing but blue steam escaped, and finally water and steam. Thinking the trouble was in pumping in water so near the fire and bridge wall, I changed the connection, putting the feed pipe into the mud drum, and then letting the back connection stay as it was, making a series of circulating tubes. On firing up this time, I was alarmed by a succession of concussions or jars in the boiler that shook the walls; but by firing slowly, we got up steam without any accident. In an hour or two we noticed that the tubes nearest the fire and bridge wall were red hot, and blue steam was escaping from the joints of the connections on the ends of the tubes. We drew the fire and removed the tubes. We found a great improvement by the use of these tubes, and did not like to abandon the use of them. We are at a loss to account for the phenomenon of blue steam being where we expected nothing but water. What is our remedy? A. The trouble seems to have been that the pipes got so hot that they made steam faster than it could be carried off, the circulation being imperfect. It will probably be necessary to use larger pipes, or to discard the return bends, to make the present arrangement successful. The same trouble has occurred with some forms of sectional boilers, whose use has been abandoned on account of the poor circulation.

(20) S. J. P. asks: I have a telegraph instrument, which I wish to attach to a railroad line. Will it work without a relay? A. Not on the main line. A relay will cost about $16.

(21) M. R. H. asks: How can I prevent beech wood lasts, subject to a temperature of 290° Fah., from being affected by the heat? A. There does not appear to be any way to do this, better than well seasoning and drying the wood before using.

(22) H. R. R. asks: A rectangular wooden tank lined with zinc is used in the second story as a reservoir for rain water. Since its erection, we are told that the zinc will soon corrode and the vessel become useless. Is there any way to preserve it, by paint or otherwise? A. The zinc becomes coated with a white oxide which washes off with the water, and by repetition of this process the metal is reduced in thickness and strength. There is a slate paint for application to iron tanks which might be serviceable when applied to zinc.

(23) A. B. C. says: "We have just started a new steam pump in a mine, at 700 feet level. To prevent the steam from exhausting in the shaft, a pipe was fixed to convey it into what we call the suction pipe, and the connection at the suction pipe was a globe valve or chamber, as the valve was taken out, and the exhaust pipe inserted in its place. This was the engineer's plan. I said that I did not think it would answer, as the chamber or pipe where the exhaust steam meets the water was too small, and the steam would cut off the water, or at least some of it; and it so happened that, when they started the pump, it would not pump ⅓ of the stream it ought to, which proved my words true. He took it away from there, and put it to exhaust in a wooden pipe which brings air down to the bottom of the mine, and it would be just as well if he let it exhaust right in the shaft as in that pipe; for the air strikes it, and it condenses, and as a matter of course fills the shaft with smoke. Now I think I can put the exhaust steam into the suction pipe so that it shall work all right. My plan is to have a larger and a more suitable connection with the suction pipe. Do you not think this will answer? The reservoir stands about level with the pump. The suction pipe is of 4 inches diameter." A. You are just entering on a field in which a great deal of money has already been spent for experiments, namely, condensers for steam pumps. The matter has already been worked out practically, and we think your cheapest and most satisfactory plan would be to obtain a condenser.

(24) J. McD. asks: Your article headed suction in your issue of December 5 leads me to make the following inquiry: Suppose a vessel be filled with water, and there be placed in the top of said vessel a tube extending upwards for fifteen feet, and there be attached to said tube two stop-cocks, one at either end. If the lower cock be closed, and the air be exhausted from the tube, after which the upper cock be closed and the lower opened (allowing free access to the tube for the water), will the water rise into the tube from the vessel? A. Yes.

(25) W. A. W. asks: 1. How thick ought a cylindrical boiler of cast iron to be, to sustain a steam pressure of 5, and 6, atmospheres? The cylinder is about 10 inches diameter. A. If not more than 12 inches in diameter, make it from 3/8 to 3/4 of an inch in thickness; but better still, do not make the boiler of cast iron. 2. What should be the diameter of the safety valve? A. Three fourths of an inch.

(26) W. D. and others: Our opinion is that power will always be got from coal for at least one fiftieth part of the cost of getting it from electric motors, using acid and zincs.

(27) T. C. C. says: I have a pump of which the pipe runs 12 feet horizontally and 8 feet perpendicularly. Would there be any difference in the pressure if the same pipe be all perpendicular? A. Yes, as we understand your question.

(28) E. asks: How much more steam does it require at 100 lbs. per inch to produce the same result with a plain oscillating cylinder, taking steam through the side to full stroke (as it must do), than it does with a stationary cylinder, using a slide valve and cutting off the steam at the most economical point? I think that a better result would be attained with oscillating cylinders than could be attained with the slide valve, provided that the slide valve had no lap or lead, taking steam to full stroke, from the fact that the ports of the oscillating cylinders open almost instantaneously and at a point where the piston is traveling at its slowest: whereas, with the eccentric movement, no such rapid change can be attained. A. There are oscillating engines with ordinary slide valves in use.

(29) J. A. C. says: A saw was burnt, and, as the new one came to the mill, the men remarked: "We'll need a blower to make steam enough to drive that big fellow." I said: "I don't think you will need any more steam for the same work than for the little old one." The men were all against me. All things else being equal, does a large saw require more power than a small one? If so, why? A. All other things being equal, the large saw would require the most power, since the resistance is overcome at the end of a longer lever arm, the lever arm to which the driving force is applied remaining the same.

(30) J. E. G. asks: What is a safe working pressure for a flat cast iron boiler, head 3/4 inch thick and 15 inches in diameter? A. About 50 lbs. per square inch.

(31) W. & B. ask: Is there a treatise published, explaining how to set a steam flue boiler, over a brick arch, so as to use the least possible amount of fuel? A. We do not know of any book that gives precisely the information you want. You will find some valuable hints in Wilson's "Treatise on Steam Boilers," and "Heat and Steam Engines," by Professor Trowbridge. See our advertising columns for booksellers' addresses.

(32) H. C. McE. asks: Enclosed find a piece of scale taken from a boiler. What will loosen it from the boiler? A. The best plan is to prevent the formation of scale by the use of a good feed water heater and frequent blowing. You can soften the scale somewhat, by hauling the fire at night, and leaving the water in the boiler until next morning.

(33) Mc. Bros. ask: Is there a work on the care and management of ordinary steam engines and boilers? A. We do not know of any such work. A great deal of information is scattered through treatises on steam machinery, and appears, from time to time, in scientific periodicals. The most valuable information is, however, unwritten, and can only be acquired by experience.

(34) C. M. B. asks: Can the tone of organ or flutina reeds be changed? If so, how? A. It can be done by changing the length of the vibrating part of the pipe or plate. Most wind instruments are arranged so that this adjustment can readily be made.

(35) M. E. J. asks: What is the rule for setting iron buggy axles, front and behind? A. There is considerable difference of practice; and beyond setting them so that the wheels will clear, we do not think there is any definite rule. Some of our readers will please correct us if we are in error.

(36) J. O. S. says: 1. I wish to build a flat bottomed steam pleasure boat, 16 feet long by 6 feet wide, with side wheels. How will a portable engine work in it, to run by a belt, and how many horse power should there be in proportion to that size boat? A. It will be better to discard the belt. Use an engine of from 2 to 3 horse power. 2. Is any license required to run such a boat on a river? A. Yes.

(37) E. S. S. says: I have some boxwood that I wish to make into croquet balls. It requires the whole size of the stick for a ball. Can it be seasoned without checking for next spring's use? A. Allow it to season slowly, in a moderately cool place at first, and finally in or near a chimney corner.

(38) W. E. H. asks: What is the process of manufacturing the small round glass beads which are sold by the pound? They seem to have no fractured edges. A. They are made from tubes cut into the proper lengths, the sharp edges being rounded by fusing, being heated in sand to prevent their fusing together.

(39) D. H. L. asks: Are the trade dollar coins issued by the United States government stamped or molded, to give the impressions? I wish to make similar medals. A. They are struck; but for your purpose it would doubtless be better to cast them

(40) G. M. R. says: Suppose a locomotive engine is running at the rate of 30 miles per hour, in full fore gear, and is suddenly reversed to full back gear. Is there much danger of the cylinder heads being blown out? A. No. The danger would be of breaking some of the moving parts.

(41) J. O'C. says: In your answer in regard to belts on pulleys, you say: "Belts will move towards that part of the pulley where the radius is the greatest." I discovered this high side theory to be a fallacy in 1855. Let a main line of shafting be lined up by any of the usual methods; then the countershafts can be made right by moving them until the belts run even on the pulleys. In most cases, this can be done when the machinery is running. It is an expeditious and accurate method. A. You confound two distinct cases. Our remark had reference to two pulleys whose axes were parallel, one of the pulleys having a swell or convexity. Your illustration applies to the case in which the axes of the two pulleys are not parallel, and different principles are applicable. You will find this case ably treated in Professor Rankine's "Manual of Machinery and Millwork."

(42) R. T. asks: Would the compressing of a bale of cotton at a power of 1,000 tuns injure the staple? Would the oily nature of the fiber of the cotton be impaired when compressed so compactly? Would the density of such packing render it more expensive to the manufacturer in giving it the flexibility required? A. We see no objection to any degree of compression, and the ordinary practice in commercial circles confirms this view.

(43) S. S. B. says: 1. It is stated in Auchincloss "On the Slide Valve and Link Motion" that an engine of the Allen type, under Mr. Porter, attained the rapid piston speed of 1,400 feet per minute. Is this correct? A. Mr. Auchincloss is a very reliable engineer, and such a statement coming from him is worthy of full confidence. 2. How far is it from the Battery to Central Park, through Broadway and Fifth avenue? A. About 4½ miles.

(44) C. H. S. says: I am building a steam yacht, length 18 feet, beam 5 feet, cylinder of engine 3x4 inches. What would be the best dimensions of screw to get the highest rate of speed, and how fast could such a boat be driven, provided that she be very sharp and with good lines? A. Screw, from 16 to 18 inches diameter, with 34 to 36 inches pitch. Six or seven miles an hour would be a very good performance.

(45) C. M. B. asks: Would it be safe to make the firebox of an upright boiler of cast iron, cast in one piece and made very heavy? A. No.

(46) W. G. asks: How many square inches has a 7 inch piston? A. About 38·485. To find the area of a circle, square the diameter and multiply it by 0·7854.

(47) W. W. G. asks: 1. What proportion should the suction pipe of a direct-acting steam pump have to the size of the water cylinder? A. Make it so that the velocity of the water shall not be over 800 feet a minute. 2. What is the velocity of water flowing into a vacuum under atmospheric pressure? A. It will depend upon the orifice, being about the same as water would have in flowing into the air under a head of 34 feet, *plus* the head required to overcome the friction in the pipes.

(48) J. M. says: Let there be four steam engines, similar in all respects with the exception of their cylinders. The mean pressure per square inch, the length of stroke, and the number of strokes in a given time are all equal, but the diameters of the cylinders are 8, 10, 12, and 14, respectively. Would the horse power of the four engines be in the proportion 8, 10, 12, and 14? A. Neglecting friction and other prejudicial resistances, the powers would vary as the squares of the diameters of the cylinders.

Are there any steamers provided with two steam engines, and do these engines work simultaneously? A. Such an arrangement is quite common.

(49) J. F. says: I wish to make my greenhouse tighter by puttying the laps of the glass. Ordinary putty comes off after a year or two. Can you suggest a mixture, to be applied with a putty knife, that will adhere permanently and can be removed, when necessary, for repairs? A. Use soft putty, composed of 10 lbs. whiting, 1 lb. white lead, ½ gill olive oil, and sufficient linseed oil to give the mixture the proper consistenee.

(50) D. D. P. asks: 1. Which kind of wood is best for railroad ties, oak, chestnut, or other kind? A. Oak is the best material. 2. Which is best to preserve them? A. The Bethel process of preservation, used in Europe, and to some slight extent in this country. 3. How long will one last if prepared with coal tar? A. A proper treatment is said to double the duration of service of a tie, making it last from 14 to 20 years.

(51) M. G. asks: 1. How is brass spun, and what tools are used? A. It is secured to a revolving mandrel on which the pattern is fixed, and pressed up against this with a blunt tool. 2. How many pounds pressure will a copper boiler, 3 feet long, 11 inches in diameter, and ⅛ inch thick, stand? A. About 60 lbs. per square inch.

(52) G. asks: How is lead given to the valve of a hoisting engine, running both ways with only one eccentric? The cam or eccentric rod works on an upper and lower hook of a rock shaft. How much should the valve overlap the port? A. The lead cannot be quite equalized by this arrangement, and you can probably adjust it best by a few trials.

(53) J. M. R. asks: 1. What is the composition of the cheapest brass? A. Apply to a cheap brass founder. We have seen so-called brass of such poor quality that but for its color we should have judged it to be lead. 2. Can bronze be cast in other than clay molds, renewed for each cast? A. Metallic molds are frequently used. 3. Is there any composition of metal which, while cheaper than brass, will be as hard and as tough? A. No. 4. What will prevent common gray iron from rusting? A. It can be covered with varnish or other preparation to keep off the air.

(54) W. J. P. asks: What is the best means for consuming smoke? We have two Cornish boilers, 30 feet long by 8 feet diameter, with return flues 2 feet in diameter, and 5 feet furnace. We use soft coal which throws off a very thick smoke. How can we burn it? A. No general rule can be given. There are a number of patent furnaces for completing the combustion.

(55) C. W. asks: Why is it that, when the water in a boiler gets low, the steam becomes blue? A. It becomes so hot that it does not condense readily.

A friend of mine says that the water is not forced into a pump by the air, for if so, how does the water come up the drive wells? He says that there is no air at the bottom of the well. I think that there is air in the ground that forces the water up in the pump. Which is correct? A. The water rises in such a case from the pressure due to a higher source of supply.

(56) B. & H. say: We have put a mortice bevel wheel on our line shafting. The hangers are bolted to joists in the usual form, but it is very noisy. Is there any way to deaden the sound? A. Use cut gears, and some arrangement to make the shaft run steadily.

(57) B. G. says: Blacksmiths often have broken carriage springs to mend; and after getting them welded, it is difficult to get them tempered again. Please give me a good recipe for tempering them. A. Harden the spring in the usual manner, and draw the temper by heating to a temperature at which oil or tallow will just take fire.

(58) D. B. S. asks: What is the best composition to cast in brass molds, to be hard and strong and take a fine impression of small lines, figures, etc.? A. White metal is ordinarily used for such purposes.

(59) S. G. asks: What will be the flow of water per minute through a pipe under the following conditions: The pipe is 3 miles long, 20 inches in diameter, two thirds full, on a descending grade of 23 feet in the whole distance. The head pressure is no more than enough for the supply. Can you give a rule for such a calculation? A. By the aid of the following rules you can readily solve the example: Measure the length in feet of that part of the girth of the pipe which is in contact with the running water, and the sectional area in square feet of that part of the pipe which is occupied by the water, calling the first quantity b, and the second A. Also measure the length of the pipe, l, and the diameter d, taking both dimensions in feet. You can then calculate a coefficient of friction, f, by the rule. $f = 0{\cdot}005 \times \left(1 + \frac{1}{12d}\right)$, and the total friction, F, will be $F = f \times \frac{l \times b}{A}$. Then, calling the head under which the water is flowing, or the total grade, h, and the velocity in feet per second, v: $v = 8{\cdot}025 \times \sqrt{\frac{h}{F}}$. These formulas will give a close approximation having been constructed from careful experiments. There are, however, so many things that are apt to affect any particular case in practice that an absolute result cannot be obtained except by a test.

(60) R. M. asks: 1. At what heat will fowl's eggs hatch in an oven? A. 102° to 104° Fah. 2. How are hatching ovens constructed? A. You will find a full description on p. 428, *Science Record* for 1873. 3. Are chickens so hatched as strong and healthy as those hatched by a hen? A. If proper care is bestowed upon the eggs while hatching, the chickens will be strong and healthy.

(61) H. A. S. asks: 1. What elements may be detected by the spectroscope? A. Potassium, sodium, lithium, rubidium, cæsium, barium, strontium, and calcium are the elements sought for in the usual course of spectrum analysis. 2. What is the usual charge for spectral analysis, when further examination is not required? A. From $1 to $10, according to the difficulty of the examination and the number of the substances to be examined for.

(62) G. P. asks: What is the best part of the States to go to, to shoot prairie chickens and other game? A. Iowa is considered the best State for prairie chicken shooting; but it is rather late in the season for good shooting at these birds. You would probably get the best sport during this month in the State of Georgia, making headquarters at Savannah. The game would be snipe, woodcock, quail, and duck. In some parts of this State, good wild turkey and deer shooting is to be had.

(63) H. J. E. asks: Has skilled labor advanced or receded in price in the United States since the introduction of faetories, machine shops, etc.? A. It has advanced.

How does the gold dollar of the United States compare with the coin of other countries in fineness? A. The law of the United States, passed in relation to this subject, is as follows: "Be it further enacted, That the standard for both gold and silver coins of the United States shall hereafter be such that, of one thousand parts by weight, nine hundred shall be of pure metal, and one hundred of alloy; and the alloy of the silver coins shall be of copper, and the alloy of the gold coins shall be of copper and silver, provided the silver do not exceed one half of the whole alloy. The English pound has 916 grains pure gold in a thousand, the twenty franc piece of France has 898, the Austrian ducat has 986.

What wood is best for lightness, elasticity, and durability? A. Try lancewood. Your other questions are not suited to our columns.

(64) F. E. R. asks: At what speed would an engine having 2 inches bore and 4½ inches stroke drive a boat 18 feet long, 5 feet wide, and drawing 6 inches of water? The engine will have 100 revolutions per minute and 50 lbs. steam. A. The engine would be entirely too small to give a satisfactory result, unless a much higher pressure of steam and greater piston speed were employed.

(65) A. R. & G. K. ask: 1. What number of revolutions is perfectly safe for a 24 inch grist millstone of sectional French burr, imbedded in cast iron band with plaster of Paris? A. Each maker generally gives a table of safe speeds for his mills. 2. How much more power will be required to drive a 24 inch millstone if driven by a 20 feet countershaft than if driven direct from the driver wheel, all things being properly arranged? A. Probably about 5 per cent.

Our water contains iron. Is it safe to use in a boiler that cannot be scoured out or cleaned except by blowing off through the ordinary style of mud valve? A. From your experience, we judge that it is quite safe.

(66) G. W. K. says: I have a foot lathe with only one speed. The driver is 26 inches in diameter by 3 inches face; the driver, on the lathe spindle, is 3 inches in diameter. I want to fix it so as to run a small emery wheel and circular saw, and I purpose to belt from the face plate on to the arbor. How large should the pulley on the face plate be? A. You may have to use a countershaft to get up the speed. A 6 inch emery wheel should make about 2,400 revolutions a minute; an 8 inch, 1,800; a 12 inch, 1,200.

(67) V. M. J. says, in reply to E. M. C., who speaks of difficulty of running his engine on account of heating of bearings: The construction of the engine and the comparative steam pressure has much to do in the case. If the crank is overhung, and high steam pressure is used, 80 or 100 lbs., there will probably be considerable spring to the shaft when the engine is working full, with the size of shaft as given, 3¼ inches. Again, the shaft may not be lined properly, in which case it will be impossible to run without heating or knocking; and although the crank may be in line with the cylinder, it may not be in line with the slides, or the wrist may not put in square with the face of crank. Any one or all of these errors may be the cause of the trouble.

(68) E. B. W. says, in reply to F. J. H., who asked how to calculate the distance between two points on the surface of a globe, angle and radius being given: Multiply the radius by 0·28318, which gives the circumference of the globe; then 360° : the given angle :: circumference: distance between proposed points measured on the surface. The distance measured on a straight line may be found by a simple operation in triangulation.

(69) B. K. W. says, in reply to R. C., who asks if there is any way to test the sourness of vinegar: I find that the pickle manufacturers use the soda test, as follows: Put in a proof glass 1 oz. of vinegar, weigh out a certain number of grains of English bicarbonate of soda, and slowly drop it into the vinegar until it ceases to foam. If it will stand 35 grains, it is fit for their use: but much less strength would do for table use.

(70) A. L. W. says, in answer to R. O. B., who asks for a rule for finding the radius when an arc and its chord are given: The logarithmic sine of ½ the arc is to ½ the chord as the logarithmic cosine of ½ the arc is to the cosine of ½ the arc. That is: $\log\sin.\frac{\text{arc}}{2} : \frac{\text{chord}}{2} :: \log.\cos.\frac{\text{arc}}{2} : \cos.\frac{\text{arc}}{2}$. Then: $\sqrt{\left(\frac{\text{chord}}{2}\right)^2 + \cos.^2\frac{\text{arc}}{2}} = \text{radius}$.

(71) A. W. S. says, in reply to several correspondents, who asked how to keep cider sweet: Fill a barrel with new cider, plug it up with a cork, and through the cork put a lead pipe. Bend the pipe over and put the other end in a pail of water. This will allow the gas from the cider to pass off through the pipe, and the water will keep the air from getting into the barrel.

W. S. M. asks. What chemicals will keep tallow in solution with crude petroleum at a low temperature?—J. E. W. asks: How can I tin small lead castings?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Mind Reading. By W. E. H.
On Coinage Free of Charge. By A. S. S.
On the Spider's Ingenuity. By I. T. T.
On Patents and Patent Laws. By G. W. P.
On Powdered Fuel. By J. J. S.

Also enquiries and answers from the following:
J. H.—W. B. R.—C. T. S.—V.—A. N. W.—J. F. T.—C. L.—D. de F.—A. R. J.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who makes the odontograph, for laying out teeth of gear wheels? Who sells diamond drills? Who sells lithographs of marine engines Who makes the best evaporator, heated by steam Who sells nail making machinery? Who makes drive well apparatus?" All such personal enquiries are printed, as will be observed in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.