ANSWERS TO CORRESPONDENTS

F. R. will find directions for repairing rubber boots on p. 155, vol. 26.—V. E. H. will find the aquarium cement described on p. 202, vol. 28, a good one.—J. H. D. should read the directions for tempering drills on p. 186, vol. 26.—F. G. V. will find the description of a storm glass on pp. 123 and 234, vol, 29.—D. H. T. should use the directions for French putty on p. 53, vol. 27.—W. L. C. C.'s query as to a tug and sailing ship was answered on p. 96, vol. 29.—L. D. is right: D. N. is wrong.—G. W. B. will find a recipe for dyeing black on p. 101, vol. 27.—R. B. should use balloon varnish, as described on p. 136, vol. 28.—W. H. R. should see p. 368, vol. 26, for parchment paper recipe.—Mrs. J. B. K. should use Paris green according to the directions on p. 413, vol. 26.—G. J. B. D. and W. A. R. can blue small steel articles by the process described on p. 107, vol. 26.—B. can stop the creaking of his boots by following the directions given on p. 340, vol. 25. See p. 332, vol. 29, for rat poison.—M. can make fusible metal by the recipe given on p. 281, vol. 26.—S. can use the cement described on p. 202, vol. 27, (for meerschaum) for repairing his broken coral.—G. C. will find the directions for tempering mill picks on p. 170, vol. 25.—W. B. R.'s proposed combined rocking chair and cradle is an old idea. See p. 70, vol. 29.—J. C. C. can coat gray iron castings with zinc by the process described on p. 59, vol. 24.—G. H. E. T. is informed that we published on p. 289, vol. 29, all the information that we possess concerning Abbé Fiehol's battery.—J. A. DeM. can temper springs by the process described on p. 314, vol. 28.

C. M. A. says: I have lately set up a German study lamp. The flame, instead of being a remarkably steady one, as I supposed it would be, flickers and sputters a good deal, except when turned down very low. Can you inform me as to the cause, and suggest a remedy? Answer: We think it quite probable that you have not a proper chimney. We have often experienced a trouble similar to your own from this cause.

E. G. A. asks: 1. Can carbonic acid be liquified; if so, how? 2. Can the carbon be separated from the oxygen by electricity? Answers: 1. Carbonic acid can be liquefied by applying a pressure of about 420 lbs. per square inch. It is decomposed by plants, but the manner in which this takes place is not known.

R. L. H. asks: 1. Is there such a material as nickel steel? If so, for what purpose is it used and where is it made? 2. Are not the nickel mines in Pennsylvania the only ones in the United States? 3. Is nickel employed in the manufacture of ware of any kind, except for the purpose of plating? Answers: 1. We think not. 2. We believe they are. 3. Its principal use, besides as a material for plating, is in the manufacture of German silver.

S. S. K.—At the equinoxes, the sun rises and sets at 6 o'clock. The sun requires 22 minutes and 23 seconds longer to return to the same star than he does to return to the same equinox.

M. G. C. says: In graduating a safety valve lever, the rule is that the length of the lever divided by the distance from the fulcrum to the weight, multiplied by the weight of the ball in pounds, gives the pressure at the valve that the ball will counterbalance. The formula is $\frac{Pp}{w}=W$. But I wish to know how the weight of the lever acts, and if it cannot be introduced in the above equation. Must not the weight of the valve and pin be taken into consideration? If so, how? Answer: In all correct formulas relating to safety valves, the weights of all the parts are considered. See Box's formula on p. 363, vol. 29.

H. T. asks: Can I make a boiler, for an engine of about ⅛ horse power, of cast iron, and would ¼ inch be thick enough to stand 50 lbs. pressure? Answer: It would probably be better to make it at least ¼ of an inch in thickness. You might get a section, sufficient for your purpose, from some manufacturer of cast iron boilers, or you might arrange a few shells with suitable connections.

D. R. B.—You can probably carry out your plan by arranging proper connections and mouthpieces.

C. O. asks: Why is it that, of two locomotive engines, one having a small driver and the other a large one, the weight or traction being the same and the length of stroke the same in each, the one with a small driver will draw the most load? And will the same explanation apply to ascending heavy grades? Answer: It is on account of the difference in the throw of the crank and the radius of the driving wheel; so that the tractive force, other things being equal, is greater in the case of the small driver.

J. M. E. asks: 1. Are any of the processes of the New York Artificial Butter Company covered by patents? 2. Does the suet in the process of warming come in contact with the coiled tube in the tank? 3. Is the butter fit for the market as soon as manufactured? 4. Is it possible to get a detailed description of the machinery and the workings of the concern? 5. Would the company object to an examination of their factory, and the working in the different departments thereof? Answers: 1. We do not believe that there are any particular secrets connected with this manufacture, that ordinary skill in manipulation cannot overcome. We understand that the manufacture as described is patented. 2. Live steam is admitted into the suet at the bottom of the tank. 3. The butter is fit for the market as soon as made. 4. A more detailed description would probably be found in the specification of the patents. We would advise you to communicate directly with the company for information as to machinery, and the working of the process, if our description is not detailed enough for your purpose. 5. We think the company would decidedly object to any examination of their factory unless by disinterested parties, or those intending to work under their patents.

W. F. C. asks: How can I ascertain the horse power of a steam engine? Answer: Multiply the area of the piston in square inches by the mean effective pressure of steam per square inch during the stroke, also by twice the length of the stroke in feet, and by the number of revolutions per minute, and divide the product by 33,000.

C. F. S. asks: 1. How can I melt iron in quantities of not more than a pound? 2. What should I make a crucible of? 3. Would clay do for molds? Should I have a small bellows? 4. Would charcoal do for fuel? 5. At what temperature Fahrenheit does iron melt? 6. Also copper? Answers: 1. Probably you can do it in a common blacksmith's fire. 2. Plumbago crucibles will be the best. 3. Yes. For fine castings you may do better with plaster of Paris. 4. Yes, but blacksmith's coal would probably be better. 5, 6. Cast iron melts at about 2,800° Fah. copper at about 1,950°.

F. C. asks: 1. How can I make a white porcelain (or something resembling it) not over one sixteenth of an inch in thickness, capable of being molded in plaster of Paris molds? 2. The books on astronomy tell us that the tides, or rather the tidal wave, lags behind the moon. How is it that every time we have a full moon in the year 1873, the high tide (as the almanac informs us) comes between 11 and 12 o'clock? Answers: 1. Use hot cast porcelain, a glass made from Greenland cryolite. It may be had of any dealer in photographic materials, and may be pressed and annealed. 2. The highest point of the tide wave is usually 46°, or three hours east of the moon, and about 50 minutes later each day. In a landlocked estuary, as at the port of New York, it is not usually high tide until 8 or 9 hours after the moon has passed the meridian.

J. L. G. says: I have lately seen a new kind of wheat, imported from Africa, which, it is claimed, will produce a yield of more than one hundred thousand fold from the seed, or at least six hundred bushels per acre. A gentleman received one grain of this wheat and grew one stock, which yielded fully one half gallon of perfectly clean pure wheat. Is this a humbug? Answer: It would be impossible to give an opinion on the value of this wheat, from the small sample sent, without an expensive analysis. It may be that the plant has all the good qualities that are claimed for it, and still will be of little value. It frequently happens that imported seeds give great first yields, while the second crop is very small, because the plant cannot adapt itself to the change of climate.

W. M. asks: How can a mechanic construct a cheap telescope powerful enough to show Jupiter's moons, Saturn's belts, etc.? Answer: The difficulty and expense of making a powerful telescope lies in the glasses, which must be perfectly ground and free from flaws. We fear it will be some time before useful astronomical telescopes will be accessible to persons of small means.

G. M. R. asks for a rule for calculating the power required to lift 1,000 lbs. with a differential pulley, and for calculating the weight required to support 1,000 lbs. suspended from a horizontal cord running over a pulley. Answers: Disregarding friction and rigidity of cordage, the power required in either case equals the weight multiplied by the distance that it is raised, and divided by the distance that the power moves in raising the weight.

O. asks: Is there no law in regard to incompetent engineers? We have a small pleasure boat which is managed by a boy about sixteen years of age. Now that boy may be a genius; but it does not seem right to see the lives of from ten to thirty persons placed in the hands of a youth who is not fully competent to control the immense power of a steam boiler. If there is no law to keep such children out of the engine room, there ought to be, and it should be enforced. Answer: Most States have local laws relating to the use of steam boilers, and there is a United States law in reference to ocean and river steamers. Either the laws or the manner in which they are enforced seem to be defective, so that improper persons are often placed in charge of steam machinery. We have frequently called attention to the matter, and are always glad to receive communications giving details of neglect or mismanagement.

M. C. says: 1. I had charge of a canal boat boat, of which the engine was an upright, with link motion, and connected directly to the main shaft. We never could get her to exhaust properly. On the lower center she would exhaust very shortly and quickly, and on the upper surface very slowly and laboriously. The valve was all right, and had just as much lead on one end as on the other. 2. Our boiler was an upright tubular, 12 feet by 36 inches shell; furnace within the boiler. It had a very good draft, but for all that we could not make steam enough at times. The chimney was connected directly to the upper end of the boiler, and the exhaust steam passed through it. What was the trouble in these cases? Answers: 1. We think you must be mistaken with regard to the valve being set similarly at the two ends of the stroke. Even if the valve has the same steam lead on each end, it by no means follows that the exhaust lap and lead are the same. 2. We suppose that the boiler was too small.

F. E. H. asks: How can the perspiration stains be removed from light kid gloves? Answer: Where the coloring matter of dyed gloves has been affected, we know of no method of renewal except re-dyeing. Where benzine fails to remove the dirt, you can try the following French invention: Curd soap (in small shavings) 1 part, water 3 parts; mix with heat and stir in essence of citron 1 part. The glove is stretched on a wooden hand of appropriate size and the compound rubbed over the glove (with a piece of flannel, always in one direction) until it is sufficiently clean.

J. E. G. says: I have a door opening toward the east; twice a year the sun shines through the keyhole and strikes the wall on the opposite side of the room, making a spot about the size of a quarter of a dollar. It appears an hour after sunrise for a few days only, I think in June and November. Will the spot be seen in exactly the same place in spring as in fall? Can you give the time in spring if the time in fall is November 10, 7·15 A. M.? Answer: To solve this problem, we find the right ascension and declination of the sun at the time given, namely, November 10. Six months from this time, the earth will have accomplished half a revolution, or the sun have moved apparently through 180° of longitude. The sun at this time, though in an opposite quarter of the heavens, will have the same position, with respect to the aperture, relatively as at first. This time will be in the following spring on May 8, a few minutes later, in the morning. The time by the clock being 15 minutes after 7 o'clock, November 10, add the equation of time (or the difference between solar and true clock time), 3 m. 42 s., making the time at which the phenomenon will take place in the spring 18 m. 42 s. after 7 A. M. The right ascension and declination of the sun not varying greatly each day, the spot will probably be seen in about the same place for a few days

C. E. H. says: How can I construct a simple form of superheater to place in the furnace or the stack? Answer: Probably the cheapest mode of construction will be with short pieces of pipe and elbows. Secure it with rods in any desired position, and make a connection with the steam space of the boiler.

A. C. asks: What is the meaning of the word *crith*, in chemistry? Answer: In referring the specific gravity of a solid body to hydrogen, its value is first reduced to the water standard and then multiplied by 0·0000896 grammes (if the volume of the body be in cubic centimeters), which is the specific gravity of hydrogen referred to water. In order to avoid this long fraction, Hoffman introduced into chemistry the unit crith; which is the weight of 1 cubic decimeter or liter (1·76133 pints) of hydrogen at the standard temperature and pressure.

R. R. R. asks: Can you give me a convenient formula for finding the elevation of a place above the level of the sea by means of a barometer? Answer For the convenient calculation of hights from barometrical observations, it is necessary to have tables, if great accuracy is required, as the reductions are quite tedious Below is given an approximate formula. Difference of level = 60360 × [(logarithm of barometrical reading at lower station — logarithm of barometrical reading at upper station) − 0·000044 × (reading of lower attached thermometer − reading of upper attached thermometer)] × [1 + (reading of lower detached thermometer + reading of upper detached thermometer − 64) ÷ 986]. Example: The following observations were taken by Professor Guyot, in 1851, to determine the hight of Mount Washington:

Reading of barometer at Gorham	29·272
" " " Mt. Washington	24·030
" of attached thermometer at Gorham	70·7°
" " " " " Mt. Washington	54·52°
" " detached " " Gorham	72·(5°
" " " " " Mt. Washington	50·54°

Difference of level = 60360 × [1·4664524 − 1·3807538 − 0·000044 × (70·7 − 54·52)] × [1 + (72·05 + 50·54 − 64) ÷ 986] = 5434·15 feet. Calculated by Laplace's formula, the difference of level, as given by these observations, is 5465·39 feet.

H. J. L. says: I have about 1,000 tuns coal piled up in a yard so as to be exposed both to heat and cold. About two weeks after it was put in yard, it commenced smoking in two places, some 10 feet apart. I could smell sulphur, and the smoke was very light. It was on a very rainy day. After digging down in the places where the smoke came from, the coal did not appear heated, and in a few hours stopped smoking. What was the cause of this? Will coal piled in this way in the open air, without any protection, heat enough to cause spontaneous combustion? Answer: We do not think that this was a case of spontaneous combustion. The rain soaking into the pile, and becoming heated, was probably vaporized, and we have an idea that you saw vapor instead of smoke.

J. R. R. asks: Will a glass journal and an iron shaft cut or wear to any great extent when run up to a speed of 300 revolutions per minute? Answer: We think not, if the bearing is properly lubricated.

G. E. W. asks: 1. How many feet per mile does the line marking the earth's periphery fall down? 2. Upon the ocean two ships are coursing, each toward the other. Fifty feet up in the rigging of each, a man is situated. One man is making, with the naked eye, observations upon his neighbor's surroundings. The other is viewing his neighbor's accompaniments through a glass of twenty degrees of space-penetrating power. Can the unaided eye catch sight of the small upper portion of the rigging, before it can of the larger hull approaching? 3. Can the eye with the lens, at the same time, see any farther down the ship which moves in its direction? Has the assisted organ descried its object before the other has its object? If so, is the interval of time in proportion to the difference in visual capacity? Answers: The following table, giving average depression of a level surface on the earth, will probably serve as a sufficient answer to all your questions.

Distance in yards.	Depression in feet.	Distance in miles.	Depression in feet.
100	0·00215	1	0·667
200	0·00861	2	2·669
300	0·01938	3	6 06
400	0·03445	4	10·677
500	0·05383	5	16·683
600	0·07752	6	24 024
700	0·10551	7	32 609
800	0·13781	8	42·709
900	0·17441	9	54 054
1000	0·215·3	10	66 733
1100	0·26055	11	80 747
1200	0·31008	12	96 095
1300	0·36390	13	112·779
1400	0·42205	14	130·796
1500	0·48449	15	150 156
1600	0·55124	16	170·836

G. L. W. asks: 1. Would a steam cylinder of 8 inches diameter by 2 feet stroke, connected to an air pump, furnish motive power (the air to be worked in a cylinder of increased dimensions) equal to or superior to a steam cylinder supplying the air? 2. Would the power be increased if the compressed air were heated before entering the air engine? 3. Would such an arrangement be feasible, and has anything of the kind ever been used? Answers: 1. The power furnished by the air would generally be less than that required to compress it. 2. There would be a gain by heating the air. But usually the heat developed by compression is so great that the air requires to be cooled to avoid burning out the working parts of the air cylinder. 3. Air compressors, for use in mines and tunnels, are quite common.

J. H. asks: 1. How can I prevent a surveyor's transit from becoming wet when taken down in a mine, where the temperature is from 15° to 30° warmer than on the surface? It takes me a considerable time, wiping and drying the lenses, before I can see through them. Will it hurt them and the cross hairs to have them wet so often? 2. Is the diurnal variation of the needle the same underground as on the surface? Answers: 1. Perhaps if you dry the instrument thoroughly and warm it slightly, before taking it down, you will no longer experience the trouble. 2. We do not know of any observations on this subject. You could readily determine the matter by experiment.

N. S. says: I am constructing a glass speculum on the following plan: The curvatures of the concave and convex surfaces are unequal; so that the rays of light reflected from the concave surface (as no glass transmits all the rays of light) may come to a focus before those reflected from the convex surface come to a focus. The object in thus constructing the speculum is to destroy the secondary image formed by the rays of light reflected from the concave surface. For if the curvatures of the speculum be equal, the images reflected (one from the exterior and the other from the interior surface) will appear near each other, and thus prevent distinct vision. The diameter of the speculum is 10 inches. The focal length of the convex surface is five feet, while the focal length of the concave surface is four feet. 1. Is the above plan a correct one? 2. How high a magnifying power will the above speculum bear for astronomical purposes? 3. What should be the diameter of an eye glass ⅛ of an inch in focal length? 4. What should be the diameter and focal length of the object glass, to a microscope magnifying 400 diameters; also what should be the diameter and focal length of the eye glass? 5. Is there any work published on the construction of optical instruments? Answers: 1. We think your idea is original, but such construction is not necessary, as a glass speculum is ordinarily silvered on the concave surface. There is a good essay upon the relative merits of metallic and glass specula in the *Philosophical Transactions* for 1869. We could not answer your other enquiries satisfactorily in our limited space, and would advise you to read up some treatise on the construction of optical instruments. We can recommend the works on physics by Silliman, Ganot and Deschanel.