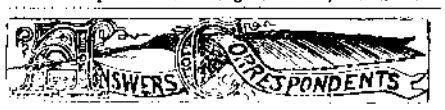

In our answer to H. S. H., p. 15, current volume: "If no heat is lost during compression" should be substituted for "if the temperature is constant during compression.

A. L. M. asks: What is the cost of a machine for making ice? Is a steam engine necessary, and what amount of power does it require? How many pounds will it produce per hour? How much would it cost per hundred pounds, exclusive of first cost? A. Your questions are rather indefinite. A small ice machine, to make from one to two tuns a day, will cost about three thousand dollars. The running expenses would be from five to six dollars a day.

W. F. W. asks: Which gives the most power, a two horse engine or a two horse power of the most approved style? The horses weigh 2,000 lbs. each. How much would one horse raise at the rate of one foot a minute by a good power of the endless floor form? A. Ordinarily, an engine of one horse power will do more work in the same time than a horse, and the engine can be kept at work much longer than the horse.

J. D. R. asks: Would it be practicable to build a wooden railroad (using no iron on rails) on which to run a locomotive of say 7 to 7½ tuns, hauling from 3 to 4 cars at a load, each car and load weighing not over 5 tuns, and to ascend grades of 100 feet to the mile? The rails are to have a bearing surface of 4 inches. What kind of timber would be best for such rails, white oak, rock oak, or maple? A. It would be better to have the rails nearly twice as broad, and to fit the wheels of the locomotive with rubber tires. We would recommend white oak, of the three varieties of timber mentioned.

R. M. R. says: 1. I am building an engine of 2 inches bore and 4 inches stroke, and have finished the cylinder and bed plate. How large ought the balance wheel be, and what should be its weight? It is to take a belt. A. About 10 inches diameter and 2 inches face. 2. How can I make the governor regulate the slide valve? A. There are quite a number of devices in use for regulating the point of cut-off by means of the governor. It would be difficult, however, to make such attachments to so small an engine to any advantage. 5. Would a boiler 4 feet long by 10 inches in diameter with 12 flues ¾ inch in internal diameter, arranged as a return tubular, be large enough to run the engine at 200 revolutions under 60 lbs. of steam? According to my calculation, the engine would be about ¾ horse power if the pressure were 60 lbs. on the piston during full stroke. A. It will be large enough, if properly set.

J. T. S. asks: 1. What is the best cement for filling millstones? If plaster of Paris and alum will do, how should it be prepared? A. Take baked plaster of Paris, steep in a saturated solution of alum, recalcine, and reduce to powder. Mix with water for use. 2. I have a throttle valve which has a small piece of the edge of the seat broken off; it lets through so much steam that I cannot stop the engine without taking off the cam rod. Is there any way of remedying this, other than getting a new valve? A. Possibly the seat can be repaired, or a new seat can be fitted in.

S. A. T. asks: 1. What is the *modus operandi* of plating by the galvanic battery? What causes the metal to adhere? Is the metal visible in the solution? A. The metal is not visible in the solution. The attraction of the fine particles of the deposited metal for the properly prepared conducting surface of the negative plate causes its adherence. 2. What is the action of the hydraulic ram? A. The water with a certain headraises a valve and flows into a chamber; but in making its escape the passage of the water is relieved and allows another weighted valve which was closed before to open. This permits the water to flow again, when its pressure once more closes one valve and opens another. Again a portion of water escapes, again the pressure is relieved, and so on intermittingly. 3. What is chloride of calcium used for? A. It is employed in many chemical processes. Its avidity for moisture is remarkable. Copies of any of the patents issued can be obtained from this office.

B. R. asks: What is the most accurate rule for finding the friction on the slide valve? A. It is about one quarter of the unbalanced pressure on the valve, increased by one quarter of the weight of the valve.

M. F. J. asks: 1. In your last issue of the SCIENTIFIC AMERICAN, the engineer stated that if a piston rod and cylinder head of an engine were lined with lead, it would save an amount of steam. What can I put on the tin so that hot lead when poured on will run evenly over the surface? A. Build a rim around the head. 2. Would copper be better than tin? A. You can use whichever is most convenient.

M. H. H. says: 1. I and a few friends have had an argument as to which was horizontal motion. Some of us contended that a mill burr revolved horizontally, and others that the cylinder of a threshing machine was an example of horizontal motion. We concluded to get your views. A. It is usual to speak of a vertical wheel as one in which the shaft is vertical, and to call it a horizontal wheel when the shaft is horizontal. 2. Why is the equatorial diameter of the earth greater than the polar diameter? A. It is supposed to be due to the action of central forces, when the earth was in a fluid state.

J. H. asks: 1. How are black lead crucibles made? Is the lead mixed with any other substance? A. It is mixed with from one third to half its weight of clay. 2. Could I use plaster of Paris molds for casting small brass boxes? A. Yes. 3. What proportion of copper should I use to make a good box? A. You do not give sufficient particulars. You will find compositions for journal bearings in back numbers.

W. E P. asks: 1. What would be the capacity in gallons per minute of a force pump 5 inches diameter by 10 inches stroke, running at 60 revolutions per minute, with 4 inches suction? Will you give us the formula for the same? A. Multiply area of piston, in inches, by length of stroke and by number of strokes per minute, and divide the product by 231. 2. For cleaning 100 lbs. of cotton waste, how much bisulphide of carbon should be used? A. See p. 44, vol. 29. As to the blower, address the manufacturers.

A. P. B. says: We run our machinery by water, and have a large surplus of power. Is there any practicable and not expensive method of converting the surplus power into heat for warming the shops? What would be the effect of using, say 10 horse, power in condensing the atmosphere into strong radiators, to 100 lbs. to the inch? A. Some modification of your plan would probably answer very well. So far as we know, this is a novel idea, and it impresses us very favorably.

A. A. W. says: An engineer tells us that our gage glasses kept breaking, and he could not get any to stand; upon enquiry we found that he often took his glasses out and cleaned them with a piece of waste tied on to a piece of stout wire. Upon our trying the experiment with a piece of telegraph wire, by thrusting it in and out several times through the bore, the glass broke into fragments in a few minutes. Can you explain it? If the discovery may be of service to engineers and others, in the way of caution, I hope that you will give them the benefit of it. A. Most housekeepers know the fact that it will not do to use iron rods in cleaning lamp chimneys. The trouble is probably caused by the unequal heating or cooling of the glass by contact with the iron, throwing strains upon some portions of the glass.

F. W. R. asks: Does the lateral pressure against the sides of a reservoir of water increase with the enlargement of the reservoir? A. In some cases, yes, and in others, no. Thus, if the depth remains constant, an increase of size does not affect the pressure.

C. E. T. says: The common rule among mechanics for finding the speed of a driven shaft, when the diameter of pulley on the shaft and the diameter and speed of the pulley on the driving shaft is given, is to multiply the diameter of driving pulley by the number of its revolutions per minute, and divide by the diameter of driven pulley. Some of those who should know say that unless one thickness of the belt is added to the diameter of each pulley, the answer will not be the true one. By the latter rule, in driving from a large to a smaller pulley, the result of the calculation is a less number of revolutions than by the first rule, and *vice versa* from a small to a larger pulley. A. The correct method is to add the thickness of the belt. This may be explained as follows: The belt leaves the driving pulley in the direction of a tangent; and neglecting the slipping, the ratio between the velocities of the driving and driven pulleys is the same as would take place with a pair of gear wheels having the same pitch. The part of the belt in contact with the pulley, neglecting the slip, acts as if it were rigidly connected to the pulley, so that the line of connection between the driving and driven pulleys must be in the axis of the wrapping connector, or at the middle of its cross section.

A. R. asks: 1. Are Britannia and white metal the same? A. Yes. 2. What kind of wood is best to use for chucks for spinning? A. A close grained, hard wood.

C. H. C. asks: 1. What can I put on paper to make it impervious to moisture? A. Dissolve 8 ozs. of alum and 8¾ ozs. of white soap in 4 pints of water; in another vessel dissolve 2 ozs. of gum arabic and 4 pints of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture and then hang it up to dry or pass it between cylinders. 2. What do 8vo., 16mo., 18mo., and 4to. mean? A. 4to. means quarto (4 to a sheet), 8vo. means octavo (8 to a sheet), 12mo. means duodecimo (12 to a sheet) and so on. 3. Will the moon eclipse any stars or planets next month? If so, which one? A. Consult the *Nautical Almanac*.

H. S. asks: What ready method is there of precipitating antimony from solutions with other metals? A. There is no general method of separating antimony from all the metals, when they are present in the same solution. If arsenic and tin are absent, the easiest way is to precipitate with hydrosulphuric acid as sulphide of antimony. In answer to your other questions, see our advertising columns for booksellers' addresses.

G. N. M. asks: What is "red acaroid of resin," mentioned in a late number of your journal, as part of a recipe for imitating mahogany? A. It is the resin of *xanthorrhea hastilis*, a liliaceous tree growing in New Holland; also called resin of Botany Bay. It has a yellow color, an agreeable odor, and is soluble in alcohol, ether, and caustic potash. Its potash solution, treated with hydrochloric acid, deposits benzoic and cinnamic acids. Nitric acid converts it into picric acid, and so readily that this resin appears to be the best raw material for obtaining picric acid. By distillation, the resin yields a light neutral oil, which appears to be a mixture of benzol and cinnamol, and a heavy acid oil, consisting of hydrate of phenyl, mixed with small quantities of benzoic and cinnamic acids.

W. F. asks: 1. Will a single cell of a sulphate of copper battery do to work a private telegraph, about 300 feet long? A. Not satisfactorily. 2. How many cells of the above kind would it take to run it? A. If copper wire is used, three cells. 3. How many cells of zinc and lead, as described in the *Science Record* of 1874, would it take to make it work? A. About three. 4. Would copper wire, No. 28, do for the wire to connect the houses? If not, what size copper wire would it take? A. Use No. 12 galvanized iron wire. 5 In making a horseshoe electromagnet, is coarse or fine wire the best? A. Use 22, silk covered. 6. How should it be wound on, the same way on both poles or in opposite directions? A. Wind in the same direction. Connect both inside and both outside wires. 7. In making an induction coil, is it necessary to have the wire insulated? A. Yes. 8. How would it do to have one coil of the primary inside, and then have 4 or 5 coils of the secondary wire, then another coil of the primary wire, then 4 or 5 of the secondary, and so on through the induction coil? A. There would be nothing gained by so doing. 9. In the SCIENTIFIC AMERICAN for April 4, you describe a magneto-electrical machine. About how many feet, and what size of wire does it take to make such a machine, to give shocks? A. Four or five hundred. From No. 32 to 40 will answer.

D. M. T. says: On p. 183 of *Science Record* for 1874, experiments with iodate of calcium are related. Can you inform me how to make this substance? A. Iodide of calcium is prepared by mixing a solution of the iodate of potassium with a solution of chloride of calcium. A large amount of the iodate of calcium thus formed remains dissolved in the water; the remainder crystallizes out slowly. The iodate of calcium is formed by melting iodide of potassium in a crucible, leaving it to cool till it becomes semifluid, and then gradually adding 1½ parts chlorate of potassium the mass becomes fluid, swells up, and solidifies to a spongy mass of iodate and chloride of potassium. It is dissolved in hot water, the iodate left to crystalize, the crystals redissolved in hot water, and the iodate precipitated by alcohol.

J. N. J. and J. B. ask: Is there a solder that will solder aluminum? A. The largest dealers in and manufacturers of aluminum say that there is no solder that will answer. Try the pure metal.

J. F. A. says: In a factory there is a large belt running over two pulleys. A person standing under the belt with his hat off will have his hair lifted on end; if he raises his hand above his head, a light of a violet blue color will escape from the end of his fingers. What causes the electricity? Can it be collected? If so, how? A. The phenomena are those produced by frictional electricity and are due to the friction of the belts. The electricity could be collected by a series of brass needles placed at suitable points, and directed towards the belts and put into metallic connection with a metallic body presenting the required amount of surface.

H. S. B. asks: 1. How can I purify solutions of sulphate of alumina from iron? They have an acid reaction, and give blue and green precipitates with the prussiates of potash. A. To the dilute solution add a slight excess of solution of ferrocyanide of potassium. Allow the precipitate to settle and separate by decantation and filtration. 2. How can I separate napthaline from paraffin? I have a crude heavy coal oil which contains both. A. We find no process for this operation.

B. W. R. asks: 1. Has there been any substance discovered lighter than hydrogen? A. No. 2. Please give me the specific gravity of the following: Oxygen, hydrogen, nitrogen, chlorine, fluorine, and carbonic acid. A. The specific gravity of hydrogen being taken as unity, that of oxygen is 16, nitrogen is 14, chlorine is 35 5, carbonic acid is 44. Air being taken as unity, oxygen is 1 10563, hydrogen is 0·06926, nitrogen 0 97137, chlorine 2·47, carbonic acid 1·524. 3. Please give me directions for making a waterproof glue. A. Add ½ lb. of common glue or isinglass glue to 2 quarts of skimmed milk; and then evaporate to the thickness of glue. See our advertising columns for booksellers' addresses.

H. K. M. asks: 1. Which is the most successful form of magnetic motor? How are the magnets arranged to give the motion? A. It is said that the best form is that in which electromagnets are arranged in the periphery of a large double wheel, while the armatures are fixed and arranged in such a manner that the accumulative force is obtained. 2. What amount of force does it possess? A. One constructed on a large scale has driven a car, on an ordinary rail track, at the rate of 10 to 15 miles per hour.

J. M. asks: 1. How can I make a solution of gold that can be used to plate small articles with by a Daniell's battery? A. Dissolve one ounce of cyanide of potassium in one quart of nearly boiling distilled water. About half fill a porous cell with the solution, and stand it in the vessel containing the bulk of the solution. Attach a piece of sheet copper to the wire issuing from the zinc of the battery and place it in the porous cell. Put a piece of sheet gold, attached to the copper of the battery by a wire, in the outer solution, and allow the whole to remain in action until the solution has acquired about one pennyweight and a half of gold, which may be ascertained by weighing the gold before and after immersion. The porous cell may now be removed and its contents thrown away. The solution is now ready for use, and should be worked at a temperature of about 130° Fah. 2. How is a composition made, of sawdust, used for making small busts with? A. We do not know the composition you mention. Try plaster of Paris for the purpose.

W. F. G. says: 1. I have a battery and all the appliances for silver plating, and succeed in getting a good thick coating of silver on various articles, but I am not able to polish the articles so as to obtain a nice smooth brilliant surface. What tools are used to burnish silver? A. Burnishing tools, which are made for the purpose and are of different patterns, are used. They are rubbed smooth on a damp cloth, and the polish imparted by rubbing to and fro on the silverplated surface with pressure. 2. Can you tell me what kind of chalk is used to mark on glass, and how it is made? A. By mixing powdered chalk and soap and drying the mixture.

H. L. C. asks: 1. In making an electric engine, is it best to use a U shaped piece of iron or two separate pieces? Which is best, wire 1-32 of an inch in diameter, or a fine thread-like wire, both being properly insulated? A. It is customary now to make the magnet in three pieces, the sides being made of bar magnets screwed into a crosspiece, the whole being nearly in the form of a square. Use No. 22 wire. 2. Does the power of the magnet increase in proportion to the number of layers of wire with which it is wound? A. To a certain point, but the size of the coil should not exceed an inch and a half in diameter.

A. B. asks: 1. What is the cause of mustiness in flour? A. A chemical change which takes place in moist flour. 2. What are the chemical properties of musty flour? A. The gluten of the flour undergoes a change of properties, in consequence of which it slowly loses its soft, elastic, insoluble condition, and becomes converted into a substance closely resembling diastase.