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Two slight corrections are necessary to our answer about horizontal sun dials, on page 409 of vol. 29. In line 29, T W should be T U; and in line 58, for "from" read "upon."

J. B. H. can make green ink by dissolving binacetate of copper in water, or verdigris in vinegar; or better still, dissolve freshly precipitated hydrated oxide of chromium in ammonia, and add sufficient distilled water.—G. S. T. will find that drying kilns are described in our advertising columns.—J. N. C. is informed that our index of patents contains a list of all the patents issued in each week.—G. B. can probably fasten paper to steel by painting the steel with metallic paint, letting it dry, and then using mullage or glue.—B. D. can produce a crystallized appearance on tin plate by applying to it in a heated state some dilute aqua regia for a few seconds, then washing it with water, drying, and coating with lacquer.—C. E. W. proposes an impossibility.—D. C. does not send data sufficient to explain his meaning.

J. P. asks: Will your directions, on page 283, vol. 29, for making plastic rubber, do for sheet vulcanized rubber, and will it be flexible after it is finished? A. The vulcanized cannot be dissolved as easily as the pure rubber.

E. J. M. asks: What is the proper solder and flux for soldering Britannia metal? A. 100 parts, by weight, of tin, one thousand six hundredth of copper, and one thousand six hundredth of lead. Apply with sal ammoniac.

E. D. S. asks: Will a vessel, sinking in mid ocean, go to the bottom? If not, what is the reason? A. It depends on the weight of the vessel. Water is slightly compressible, and hence becomes heavier as the depth is increased. The vessel will continue to sink as long as its weight is greater than that of an equal bulk of water.

O. H. P. says: 1. I see that petroleum is recommended for removing scales in steam boilers? Is it any good? 2. What are the proper dimensions for a bolting reel to bolt 1 1/2 bushels per hour? A. 1. We do not recommend it. 2. We advise you to correspond with a manufacturer.

F. H. K. asks: How can I temper spiral springs of very thin steel wire? A. Heat over a charcoal fire and harden in oil.

J. T. D. asks: In re-boring a cylinder, is it best to make new heads? If not, how are the old ones best packed? Is it necessary to make a new piston? If an engine uses 60 lbs. of steam where it should take but 50, what am I to do? Shall I bush the exhaust? A. Ordinarily the old heads and piston can be used. It would probably be better to bush some of the leaks than to contract the exhaust.

C. A. B. asks: How are direct acting hydraulic elevators balanced so as to have the same power when 50 feet high as when 2 feet high? A. They are generally balanced by increasing the pressure, as by means of a pump.

C. T. H. asks: 1. Will cotton do as well as silk to wind the wires of an electro-magnet? 2. How can I prepare the impression of a medal in wax for plating with copper? I succeed with the medal itself, but not with the impression. A. 1. Cotton answers very well, but silk is considered the better. 2. The wax impression must be dusted with the finest plumbago and the wire made to connect with the plumbago surface.

G. F. A. J. asks: Is there any known chemical, or combination of chemicals, which would be effectual in counteracting the smell of wood alcohol when used for the manufacture of varnish? A. Wood alcohol is distilled from crude pyroigneous acid or wood spirit. Berzelius recommends the crude spirit to be agitated with a fatty oil to remove empyreumatic matter, and then to rectify it, first from recently burnt charcoal and next with chloride of calcium.

C. A. C. says: 1. What is coal tar naphtha? 2. What is a good recipe for starch polish? 3. What cement is used in unifying glass brackets? A. 1. Coal tar naphtha is a mixture of various volatile hydrocarbons obtained from distilling coal tar. By repeated purification and fractional distillation, benzole, the chief and most important constituent of coal tar naphtha, is obtained. 2. Put a small piece of paraffin about the size of a hickory nut into a bowlful of starch. This is said to give a polish to the starched articles. 3. Soak isinglass in water and then dissolve it in alcohol 3 ozs., add the bottoms of mastic varnish (thick but clear) 1 1/2 ozs.; mix well. Set the phial in boiling water when the cement is to be used.

R. S. B. says: If the moon looks larger when near the horizon because of the peculiar condition of the atmosphere, the angular size would be greater near the horizon; but with an accurate instrument, if any difference were found, it would be that the moon is larger when near the zenith. The cause, instead of being in the atmosphere, is in the eye, being an unconscious greater allowance for distance in one case than in the other. A. The moon at the zenith is 4,000 miles nearer to the earth than at horizon, one sixtieth of the whole distance.

C. M. B. asks: 1. Would a sheet of india rubber, pure or vulcanized, 1/2 inch thick, be impervious to mercury under a pressure varying from 5 to 15 lbs. per square inch, at a temperature of 110°? Would the nature of the rubber be in any way affected by being subjected to this action for several months? 2. When mercury is kept in an iron vessel, is the nature of either metal affected by the contact? A. 1. We do not think pure rubber will be affected. 2. Not under ordinary circumstances.

A. B. H. asks: How can I dry glue in winter without having it frozen? Could you tell me the name of a work on the manufacture of glue and sand paper? A. Glue is dried on the large scale by exposing it to the air for 2 or 3 days, and, when sufficiently firm, completing the process by drying in a stove. See article on glue in Ure's "Dictionary."

W. McK. asks: Is there a premium offered by any railroad company for the invention of a railway gate to close fields, etc., through which they pass? A. No.

C. M. says: We use water from the water works, in a mill which has 150 feet or more fall from the reservoir, and we have a great deal of trouble with the pipes bursting from so great a pressure. Will the pressure be as great on the pipes if the gate or valve half way between the mill and reservoir is partly closed, supposing we are not drawing water below the gate? A. We think the pressure will be just the same, in this case. Your best plan will be to use a stronger pipe.

G. E. asks: Why do veneers, which seem firm and solid when first put on, peel off when they have lain a few weeks? The stock and veneer is perfectly dry, the glue is properly soaked and cooked; we think something is put into the glue stock, to cleanse it when the glue is manufactured, which destroys the life of the glue, or else the glue is adulterated to make it heavy. It has every appearance of being good glue. A. If the veneer and stock are as described, we know of no reason why glue properly prepared and applied should not adhere, unless it is of poor quality or has been adulterated. There is a prejudice among some workmen in favor of a dark colored glue, with somewhat of a strong odor. These properties, however, are indicative of impurity and bad preparation. The best glue is pale colored, hard and solid, and has a brilliant fracture. It should merely soften in cold water, not dissolve; and the more it swells without dissolving the better generally it is. For use, it should be broken into small pieces, allowed to soak for some hours in cold water, and then put into a boiling water bath, but never boiled itself. It is often injured by the use of too much lime in its preparation, and too long boiling, and can be adulterated with lime and phosphate of lime.

M. W. H. asks: Would any given load require more pounds pressure to push it 60 miles per hour than it would 30 miles, provided there were no resistance from the atmosphere? 2. How many pounds pressure (minus resistance of the atmosphere) will it require to propel a light car, weighing a ton, on a smooth level track? 3. If steam be confined, what will be its pressure at 300°, at 400° and at 500° Fah.? 4. What speed should the rim of a 6 inch circular saw (driven by foot power) run, to saw the fastest? 5. The fast motion of my foot lathe will not saw as fast as the slow motion; why is this? A. 1. Yes, under the circumstances stated. 2. About 8 lbs. 3. You will find rules, by which you can answer this question, on page 81, volume 29. 4. 9,000 feet per minute is the speed generally recommended for the rims of circular saws of all sizes. This would give about 6,000 revolutions per minute as the speed for your saw. 5. We cannot tell, from your meager statement, why you do not get good results by increasing the speed.

P. T. R. asks: 1. May any one make copies in white metal of United States and continental copper coins, and of all kinds of ancient coins and medals, and be on the safe side of the law? 2. What is the best method of making copies of coins and medals in soft metal? 3. May anyone make copies of any kind of medals that do not show on their face that they are copyrighted? A. 1. We do not think there is any law against making such copies. Much expense is required to enable one to make fine castings of coins and medals. 2. A fusible alloy, which melts at a low temperature, is used. This can be made by melting together 8 ozs. bismuth, 3 ozs. tin, 5 ozs. lead. To obtain a sharp casting, the alloy should first be poured into a box, of the size of the coin, and the latter is to be pressed upon it just before it solidifies. 3. Unless the fact that an article is copyrighted is marked thereon, the owner has no claim against an infringer.

R. H. W. A. asks: 1. How can I cement glass to metal? 2. How can I dissolve enamel, used in enameling jewelry, so that when applied it will harden? 3. How can I remove tin solder from gold or silver? 4. How can I amalgamate the zinc plates in a Smee's voltaic battery? A. 1. Mix together equal weights of white lead and red lead, for the cement required. 2. Metals are enamelled by covering them with vitrifiable compounds, that is, such as form a glass by exposure to heat. You cannot dissolve this enamel or apply it in any other way. 3. You can melt it, and scrape it off without injury to the other metals. 4. Wet them with dilute sulphuric acid, and at the same time rub mercury over them till a bright coating is produced.

C. says: I am running an engine, of which the governor does not work well. There is no place to oil the valve, and it sticks. I say that it would help it to put a lubricator in the pipe to oil the valve. Another man says that it will do no good. Which is right? A. We do not think the trouble is in the valve. It is probably caused by having the valve stem packed too tightly, or by some imperfection in the connections.

J. H. P., of Pa.—Minifie's "Mechanical Drawing," price \$4.00, and Joyson's "Machine Gear-cutting," price \$2.00, are the two works you need. They may be had of Baird, Philadelphia, Pa., or of Van Nos, Grand, New York city.

D. E. B. says: Having read of the primeval copper tools found in the old and new world, I should like to ask: 1. Is it true that they will cut hardened steel? 2. What is the texture of the hardened part? 3. Is the tool hard all along, or is it like our cold chisels, only tempered at the point, or where needed? 4. Does heat destroy the temper? 5. What are the electric and magnetic powers? A. We are not able to give you much information on this subject. It is true that the ancients made tools and instruments of bronze, which seemed to possess all the hardness of those made of steel, but the process of manufacture is purely a matter of conjecture.

A. F. asks: Is there any process by which nitrogen can be separated from the oxygen in atmospheric air, and if so what is it? Is the oxygen thus separated lighter than common air? A. Nitrogen can be separated from oxygen in the atmosphere by burning the oxygen out of the air. This is accomplished by setting fire to a small piece of phosphorus contained in a small vessel floating on the surface of water, and inverting a bell glass over it. The phosphorus will burn out or chemically combine with nearly all the oxygen contained in the jar, leaving the nitrogen behind. This can be afterwards freed from impurity and dried by passing it first through water and afterwards through concentrated sulphuric acid. Nitrogen is lighter than the air, its specific gravity being 0.9713, while free oxygen is a little heavier, weighing about one tenth more than the atmosphere.

O. S. says: I am trying to heat my house with a hot air furnace; and in order to avoid the trouble and mutilation of plastered walls, incident to conveying heat by separate and distinct flues to every room, I purpose to have one large register directly over the furnace, which is in the cellar. Then three ventilating registers overhead are to warm three rooms which are right above. Can I do this successfully? A. Experiment shows that the most satisfactory results are obtained in the operation of a hot air furnace, by keeping the ascending current of air as independent of one another as possible. Heated air is sometimes conveyed from a furnace to a third story room through a pipe which also supplies a portion thereof to the first and second story rooms by means of a separate register in each of these stories; but this arrangement is seldom satisfactory. We understand the plan of our correspondent is to receive the whole volume of warm air into a first story room, and then by three openings in the ceiling of this room admit the same air into three rooms in the second story. If the upper rooms are perfectly tight, very little air will

pass through the openings in the ceiling; but if open, and provided with open ventilators in the fire flues, a capricious supply may be obtained. The passage of sound, however, through these openings will make them very disagreeable. If ventilation is provided for the first story room, the warm air may pass out in this way and not ascend to the upper rooms; but without ventilation, all the foul air of the first story must ascend to contaminate the air in the second story. Probably the furnace illustrated on page 295 of our volume 29 is one that is planned more strictly in accordance with this view than any other. In this furnace, the cold air itself is divided into separate pipes before it enters the furnace; and the air, warmed in the pipe, is kept separate from the other currents until discharged at its destination. Our correspondent will find it best to have separate pipes to each room if possible; and these he may be able to insert in his chimney flues, and so avoid cutting away his partitions.

J. H. B. asks: How can rubber be reduced to a liquid state, so that it will always remain so? I have tried benzine and wood alcohol; the latter I find to work the best, but it will only dissolve a very little. I have tried linseed oil, setting it in the sun. I wish to dissolve the rubber without heat. A. The difficulty is that most of the solvents of caoutchouc are volatile, and those that are not, like linseed oil, require heat. We would suggest dissolving the rubber first in caoutchoucine, a liquid distilled from india rubber, and while liquid adding linseed oil, and stirring until a homogeneous fluid is obtained, as the oil is also dissolved by caoutchoucine. As the latter evaporates, add the oil, with frequent stirring until thick enough.

J. S. S. says: Please answer through your invaluable paper: 1. Where can I get a permanent magnet that will lift 8 lbs., and what will be its probable weight? 2. What force would it exert at a distance of one sixteenth of an inch from the poles? A. 1. From any good maker of physical apparatus. Horse shoe magnets of 1 lb. weight have been made to sustain more than 26 lbs. 2. You had better determine this by experiment.

J. P. C. says: I have an engine house some sixteen feet from a well. The well has a cucumber pump in it, and is 26 feet from platform to bottom. If I tap a pipe into the pump stick, either above or below the stationary tube or box, and carry the pipe into the engine house, and there attach a lift and force pump, will it work satisfactorily? A. We see no reason why the proposed plan will not work satisfactorily. We never recommend any particular make of machinery in these columns.

B. asks: How can I make alloys of metals that will melt at 315° and 325° Fah. respectively? A. The rule for making these alloys is as follows: Melting point of alloy = per cent by weight of first metal x its temperature of fusion + per cent of second metal x its temperature of fusion, + etc., if more metals are used. It is found, in practice, that this rule does not always give the melting point with accuracy; and it will probably be necessary for you to experiment a little, using the rule as a starting point.

S. A. says: A dispute has arisen between a friend and myself as regards the heat of water in a boiler when under a steam pressure. A says that water boils at 212° at the pressure of the atmosphere, and the higher the pressure the higher is the boiling point of the water. B says that the boiling point does not rise, that it is always 212° Fah. Which is right, and what is the ratio of the increase, if any? A. A is right. You will find the rate of increase given in a formula on page 81 of volume 29.

H. A. S. asks: How can I make a soft solder for cans, that can be easily cut with a knife? A. The usual plan, when it is desired to fasten on a cover that can be easily removed, is to use very thin plate for the cover, and fasten it with a small amount of common soft solder.

J. G. says: I am running a 8 x 12 inch engine at 100 revolutions per minute. Steam varies from 35 to 70 lbs. on the gage. The boiler is an upright, 42 inches diameter and 7 feet high, with 36 three inch flues. In the month of September I burned 190 bushels of soft Illinois coal in 24 days of 10 hours each (80 lbs. to the bushel). How many lbs. of coal per horse power per hour am I burning? Is the engine doing good duty? It is a plain slide valve engine with lap cutting off at about 1/4 of the stroke. Answer: From the data sent, we are unable to make the calculation you desire, as we have no way of determining the mean and back pressure. Send us a sketch of your valve and ports, with note of dimensions. If the point of cut-off is as stated, you must have a very large exhaust port, or a distorted action.

M. asks: Given a rotary air pump of ordinary construction, by what simple rule can I calculate how to increase or diminish the size, keeping the different proportions correct? A. We do not think there is any safe rule by which you can calculate the details of a pump of larger or smaller size, from another of given dimensions and different size.

E. A. says: Sheet iron pans are used for the evaporation of sap; a pan 8 feet long x 3 feet wide would give 24 feet heating surface. How much would it add to its evaporation to put in 14 three inch flues and let the fire pass through them and over the 24 feet heating surface? Would it make any difference how close together the flues were? Would smaller or larger flues be any better? A. The proposed plan would work well, if it did not heat the sap too much. It will make little difference what size and number of flues you employ, if you are careful to give them sufficient area to ensure a good draft.

E. S. A. says: 1. The atmosphere at the equator has a velocity of rotation less than the earth, equal to the velocity of the trade winds. Let us assume, however, that it is the same. The force of gravity at the surface of the earth is 289 times greater than the centrifugal force, and decreases as the square of the distance from the center of the earth. The centrifugal force increases as the distance from the center of rotation. Is there then any reason why the atmosphere may not attain a height (from the surface of the earth) of 6 1/2 times the semi-diameter of the earth? 2. If the atmosphere were influenced solely by the two forces above mentioned, the highest part would be over the equator, that is, the plane of the greatest diameter of the atmosphere would coincide with the plane of the celestial equator. But when we consider the influence of the attraction of the sun and moon, and the extremely mobile character of the molecules of the atmosphere, would not the plane of the greatest diameter be inclined from the plane of the equator towards the plane of the ecliptic, so as to almost coincide with it? 3. What is the average velocity of the trade winds? I do not find it stated in any of my books. 4. In what work will I find these subjects most thoroughly discussed? A. The earth, when fluid, assumed its present form of equilibrium, an oblate spheroid. Therefore the atmosphere would be of uniform depth, as regards centrifugal force, if the earth