

that the theory that bodies of about the same specific gravity as water float at a certain depth is no longer held. 3. If a body whose specific gravity is less than water is submerged in the water of a reservoir, and is of such shape and so placed on the bottom of the reservoir that no water is beneath it or any part of it, will this body rise to the surface or remain at the bottom? A. It will stay there just as long as the pressure of the water is confined to its top and sides.

(4) D. & N. write: We have been endeavoring to construct a cheap barometer by suspending two air chambers (one open and the other sealed) from opposite ends of a balanced beam, with the expectation that the varying weight of the atmosphere filling the open one would cause them to rise and fall, and thus foretell the weather. The open one will go up on the approach of fair weather, but it will not go down on the approach of rain. Why does it not work both ways? A. The changes in temperature have too much influence upon the action of the barometer that you have made to make it a serviceable instrument for its legitimate purpose. In fact, we cannot see the value of the cylinder with the hole in it over a solid counter weight. The whole as light as possible; and balanced in all positions and varnished with shellac to prevent the effects of moisture that will gather upon the surface upon change of weather. The difficulty is probably with mechanical construction of your barometer; your theory is correct.

(5) J. H. R. writes: I have a hydraulic ram; the air chamber gets full of water upon an average of once in two weeks, and stops the ram. Now, is there any remedy for this? A. A hole one-eighth to three-sixteenths inch diameter at point above connection in drive pipe issaid to remedy the trouble, or possibly there is a small leak about the air chamber.

(6) O. S. V. asks: 1. Are ports 1/4 inch x 1 inch and exhaust 1/2 x 1 inch the right size for a cylinder 2 1/2 x 5 inches? A. Better make them 3/8 x 1 1/2 and 5/8 x 1 1/2 inches. 2. Is a half inch pipe large enough for steam pipe for same? A. Make your steam pipe 1 inch diameter and exhaust 1 1/2 inch diameter. 3. Is a 3/8 pipe large enough for exhaust; if not, what size should it be? What power would the engine have at 300 revolutions? A. For the power refer to rule in SUPPLEMENT, No. 253. 4. What diameter and what weight should the fly wheel be? A. Wheel 18 or 20 inches diameter, and weight about 75 pounds. 5. Will a vertical boiler 16 inches in diameter and 3 1/2 feet high furnish sufficient steam? A. No; it should be at least 20 inches diameter and 4 1/2 feet high. 6. Would a plunger pump 3/4 inch in diameter with 1 inch stroke driven by eccentric on main shaft feed the boiler, and what sizes should feed pipe be? A. No; it should be 1 1/2 inch diameter and 3 inches stroke at least. Make pipe 3/4 inch diameter.

(7) J. A. R. writes: I have an engine of the following dimensions: Cylinder is 8x14 1/2, ports 3/4 x 5, exhaust 1 1/2 x 5; valve is 4 1/2 x 6 1/4; travel of valve 1 1/2. Now, the valve will open but 1/2. Is there not too much lap? If so, shall I cut the valve down? Does the valve travel far enough? Please tell me how to fix it. A. You do not give the lap of the valve nor the width of bridge, hence we cannot say what alteration should be made, but we infer you have too much lap or too little travel, or both. 2. Steam pipe 1 1/2 inch, a short piece 4 inches long from the governor to steam chest, 1 1/4. Boiler 36 inches by 10 feet, two 12 inch flues, 60 pounds of steam, revolutions 160; how many horse power? A. Your steam pipe should be at least 2 1/4 inches diameter. For horse power see rule in SUPPLEMENT, No. 253. 3. I want to run a saw 50 inches; diameter of fly wheel, 48 inches; what should the pulley on the saw shaft be to give 725 per minute? Or should I run engine faster? Pulley now is 20 inches. I think it is too large. Am I right? A. With pulley on saw shaft 20 inches the pulley on engine shaft should be 7 1/2 feet diameter, or you can reduce both pulleys in proportion.

(8) Mrs. C. B. S. asks: Is not electricity visible in St. Elmo's fire, and also in the electric light in which the electric arc is in vacuo; or if we do not see the electricity itself, what do we see? A. It is supposed that electricity itself is invisible. Its effect on certain substances is to render them visible.

(9) H. E. D. writes: 1. I have made a pen (electric) from the directions given in SUPPLEMENT No. 166, but I can't make it perforate close enough; the spark punches a hole and then continues to go through that hole until the pen is moved a sixteenth of an inch or more, then makes another. The coil I use gives a half inch spark. A. Try less current and thinner paper. 2. How can I make a good storage battery? A. See SUPPLEMENT, Nos. 322, 301, 338, 286.

(10) B. G. W. writes: I wish to make an electric circuit to indicate when water is rising above a certain height. What terminals should I use at the water end, the idea being for the rising water to cover over the terminals and hence complete the circuit? And as the space between need be but a fraction of an inch, I suppose the resistance will be but slight, and that the wire terminals should be something that would not rust. A. Mere wire would not answer for a terminal. Use a plate of metal having an area of one or two feet, or operate a pair of metallic contacts by means of a float.

(11) J. B. G. asks how to preserve flowers so as to keep their color and brightness. Also how to preserve butterflies and other insects. A. Flowers may be preserved by immersing them in a bath of liquid paraffine. They are stirred around for a moment, so as to become completely coated with the wax. Insects and butterflies are generally preserved by placing pieces of camphor in the case in which they are kept. Sometimes insects are dipped in a strong solution of (corrosive sublimate) mercuric chloride.

(12) F. T. J. asks how calcimine is made, the different ingredients, etc. A. The process of calcimining depends largely upon the condition of the walls. If they are new, nothing further than a coat of good Paris white with just enough glue size added to bind it is required. If the work is inferior and very porous, it will require a preparation of strong size, soft soap, and a handful of plaster of Paris. Spens' Workshop Receipts, second series, devotes several pages to

various receipts to be used for conditions that are likely to occur; also giving the formulas for the various colored calcimines in use.

(13) T. C. C. asks how to make heavy canvas so water tight, by painting it with some kind of oil or paint, that when anything porous is on the inside, water cannot soak through. A. Linseed oil is generally used for this purpose. See also the SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, which gives descriptions of seven processes by which cloth can be made waterproof.

(14) M. S. asks: 1. What is considered to be the best speed for drills in cast iron, wrought iron, machinery steel, and tool steel? A. The speed depends upon the size of the drill and the condition of the material. The fastest speed we ever used was 1,600 revolutions for a drill of No. 18 steel wire. Machinery steel can be drilled at a higher speed than cast iron, wrought iron, or tool steel. The question cannot be answered definitely unless the size of the drill and the shape of the drill are given. 2. Does the increase twist of a drill take out the chips faster than the regular twist? A. The gain twist of a drill is an advantage in the rapid removal of chips, especially in wet work—oil or soda water. But the drill should have not only gain twist, but increased width of score to act well. 3. How much more duty does a twist drill do than the old fashioned flat drill? A. The twist drill is generally at least twice as effective as the flat drill, requiring less pressure for its work and clearing itself of chips. In some instances it will do fourfold more work than the flat drill. 4. What formula is used in designing cone pulleys so that the belt will run with equal tension on any of the corresponding steps of the cones? A. There is no definite formula. The conditions of desired diameters of largest and smallest cones and of distances of spindle cone and counter cone apart, are necessary. These being known, or at least, the distances apart being determined, lay out a scale diagram and measure the distances, which will give the length of belt. This will determine the diameters of the cones between the largest and smallest steps. It must be remembered that the "slant" or angle of a belt is different from a straight parallel line measurement.

(15) J. A. asks whether soap or ammonia would be injurious to vulcanized rubber, and also what will destroy oil or grease on vulcanized rubber without injury to the rubber itself? A. Soap would not be likely to affect the rubber; the use of ammonia would not be desirable. We would recommend you to use for the removal of the grease a weak solution of either potassium or sodium hydroxide or else ether mixed with alcohol.

(16) T. G. C. asks if slight scratches can be removed from sheet glass by any chemical. A. Ammonium hydroxide (hartshorn) will probably take the scratches off.

(17) A. R. S. asks for a receipt for making a covering or paint for a wooden aquarium, so the water will not penetrate it. A. Use a lining of melted asphaltum. A good asphaltum varnish would likewise be suitable. SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, gives receipts for cements for aquariums.

(18) E. M. asks: Is there any method to your knowledge for removing freckles from skin? A. A compound consisting of two parts sulphocarbonate of zinc, 25 parts of distilled glycerine, 25 parts of rose water, and 5 parts scented alcohol, to be applied twice daily for from half an hour to an hour and then washed off with cold water, is often used for the removal of freckles. We do not recommend such applications, however.

(19) H. M. D. asks for a receipt for a perfectly black and a bright red indelible ink for marking linen with a rubber stamp. A. For the black use 16 parts of boiled linseed oil varnish, 6 parts of the finest lamp black, and 2 to 5 parts of iron perchloride, diluted with one-eighth the quantity of boiled oil varnish; it can be used for a stamp. For color, use 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, 3 part salicylic acid.

(20) J. L. P. asks how he can caseharden strips of tire steel 1 1/2 inch by 1/4 inch 14 inches long. The steel is of too poor a quality to harden in the ordinary way. Can he pack say 50 strips in a box with leather, horn, or bone, heat and allow to cool gradually without opening the box until cold; then heat singly in a common forge fire, and treat the same as good cast steel in hardening? If not possible to do it by this means, what course should be followed? A. If you are making files with low steel, it is the teeth that require the most care. The plan that you have tried should accomplish the purpose with the addition of dipping the files in a saturated solution (hot) of ferrocyanide of potassium (yellow prussiate) before packing in the carbonizing material. As you say nothing about the time that you kept the work at a full red heat, we suggest that you keep up the heat longer than before; you should succeed. A few trials will give you the proper length of time for roasting.

(21) L. A. writes: A tank is full of water; the discharge pipe goes through the bottom of tank and up nearly to the top of the water, say 10 inches below the surface of the water in tank. Will the force of the discharge be increased by shortening the pipe? A. No.

(22) W. S. writes: 1. In cutting rafters, what is termed third pitch? I claim that the rafters raised one-third of the width of the building is third pitch; others say it is not. Who is right? A. One-third pitch is a rise equal to one-third the horizontal line from end to peak plumb line, or the width of the building for a single roof, or one-sixth the width of the building for a double roof. 2. If I take 8 inches on the blade of my square and 5 feet 4 inches on the tongue, will it give the bevels for a third pitch? A. Your figures in second query are not correct; 8 inches by 2 1/2 inches will be correct. 3. In drawing water from a well, over a single wheel, does a 10 inch wheel draw any harder than one 20 inches? A. A 10 inch wheel will draw no harder than a 20 inch if the axle is proportionate and in good order. 4. Is there any part or

place on a locomotive drive wheel that is at rest while the locomotive is running? If so, what part? A. The part of a wheel that touches the rail is theoretically at rest with reference to the rail.

(23) E. E. P.—Common plate is unfit for lenses. Good clear French or Belgian plate, such as the large plates that are put into store fronts, if you can find a broken one or a piece at a plate glass establishment, will make a tolerably fair lens. Flats for Newtonian telescopes should be made of speculum metal. A prism is good but expensive. A lens or glass of any kind is useless for closing the end of the telescope. Use a tin cover when not in use.

(24) M. & B. ask what it is that a cow chews after having been fed. Do cattle have a "cud," or is it the food thrown back into the mouth? Do cattle ever lose their "cud"? If so, what is the remedy? A. Cattle chew their cud, which is a ball of fiber supposed to be derived from their fodder. They sometimes lose it. The remedy is an artificial cud.

(25) F. G. writes: I am a farmer. I want to build a silo of wood because of its cheapness. Expect to lay up solid walls of boards or planks 6 inches wide, and as dry as I can get. Then line this with three thicknesses of tarred paper, and finish with matched pine boards nailed on vertically. Now, the inside of these walls will rot, I fear, being so solid and air tight, and how can I prevent it? Shall I smear every board with gas tar and lime before laying? Shall I bore holes from top to bottom of the wall, and soak the whole with crude petroleum or linseed oil? What? Would any of these things flavor the ensilage, and hence the butter? A. We do not approve of wooden walls for a silo. Anything like coal tar or petroleum will give the ensilage a strong odor that is repulsive to cattle, and may flavor the products of the dairy. We do not think the proposed wooden structure and its preserving material is as cheap in the end, nor will it be as air tight as a concrete wall that can be made with hydraulic cement and gravel or small stone. A silo depends on the retention of carbonic acid gas generated by a slight fermentation for the perfect preservation of its contents from the destructive influence of the air. The gas being heavier than air settles to the bottom, filling the entire silo to the exclusion of air. Hence the necessity of making it gas tight. See Concrete Silo, in SUPPLEMENT, No. 242.

(26) W. H. asks: 1. What acids or what process to put brass through to tin or lead line the brass. A. Dip the tubes in a solution of hydrochloric acid to which zinc has been added. This solution must be rubbed in the inside of the tube; then proceed with the tinning process, for which see the article on Electro-metallurgy, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310. 2. How to mix a solution to zinc cast iron, and how to treat the castings before dipping? A. The solution as just mentioned consists of hydrochloric acid into which zinc is put. The castings are tinned, and soldered with resin.

(27) A. N. asks if all the sparrows seen in our streets are English sparrows, and if all the male birds are distinguished by the dark spot on their breasts or necks. A. All of the English sparrow stock. The males are distinguished by the dark spots.

(28) F. S. asks (1) whether there is any way of inlaying bronze or brass letters in stone except by heating process. Can it be done in a similar way to filling teeth in dentistry? A. Letters and devices cut in gems are filled with gold foil by pressure with small tools. Letters are cast and inserted in artificial stone by making the stone and inserting letters (name and address) before it sets, then finishing off the surface. Letters cut in dovetail in stone may be filled with amalgam of copper filings and mercury, which after setting may be finished with the surface of the stone. Metals may be also deposited in such cuttings by the electrolytic process. 2. Is there any way of filling seams in hard wood by using fine sawdust and glue? If so, how should it be prepared to make it waterproof, as it is for a hard wood floor? A. You may fill seams in floor with sawdust and shellac varnish that will be waterproof.

(29) F. W. H.—The wire is composed of zinc, and is probably alloyed with something to harden it, such as aluminum. It is likely that it will have to be procured by special order. If we knew more of its history, perhaps we could tell more about it.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

R. M. L.—The mineralogical name for the Arkansas oil stone is novaculite. It is found at several localities in Pulaski County, at Hot Springs (there called Onachita oil stone) and at Whetstone Mountain. The amount found is probably small, as less than \$100 worth is annually sold. The stones are prepared by grinding suitable pieces on revolving grindstones.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 20, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Table listing inventions such as Agricultural boiler, Alarm, Anchor, Animal shears, Auger, Automatic brake, etc., with corresponding page numbers.

Table listing inventions such as Belt stretcher, Belter pulley, Bib, Billiard marking apparatus, Blind slot operator, Board, Boiler, Bonnet, Boot or shoe bottom, Bottle capper, etc., with corresponding page numbers.

Table listing various items such as 'Fire escape, J. H. Bowley', 'Fire extinguisher, G. W. Taylor et al.', 'Fireproof fabric, H. W. Johns', 'Flask. See Mould flask', etc., with corresponding page numbers.

Table listing various items such as 'Plow, gang, A. Shaffer', 'Plow, sulky, C. Schmeer', 'Plow, vineyard, B. C. Bradley', 'Pneumatic block, A. W. Fuller', etc., with corresponding page numbers.

Table listing various items such as 'Vehicle running gear, Chamberlain & Harris...', 'Velocipede, water, E. F. Steele', 'Vise, C. Riggs', 'Washing machine, M. R. Pottorf', etc., with corresponding page numbers.

DESIGNS.

Table listing various designs such as 'Actor's shield, C. F. Waldron', 'Biscuit cracker, J. Hartman', 'Button, sleeve, F. F. & J. C. Bioren', etc., with corresponding page numbers.

TRADE MARKS.

Table listing various trade marks such as 'Bedsteads, wardrobe, Spiegel & Co.', 'Matches, Actiengesellschaft Union Vereinigte', 'Zündholz- und Wichse-Fabriken', etc., with corresponding page numbers.

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents.

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