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Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles Specialty Works, Chicago, Ill.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

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To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

Scientific American, 34 vols. (2 to 35) for sale cheap. J. D. Rice, 923 Race St., Philadelphia.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 109.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Notes & Queries

J. M. will find on p. 17, vol. 30, an article on the examination of engineers.—J. M. P.'s theory of the chord of an arc, to decide the area of a circle, is correct. Can he find the angle or number of degrees in the arc?—M. N. will find directions for fastening sheet rubber to metal on p. 101, vol. 34. He should use marine glue if he wants a waterproof cement. See p. 43, vol. 32.—T. will find directions for polishing wood in the lathe on p. 139, vol. 35.—G. B. will find directions for preserving natural flowers on p. 204, vol. 28.—T. W. will find directions for putting a polish on starched goods on p. 213, vol. 34.—P. L. L. will find on p. 91, vol. 36, an answer to his question as to marine glue.—W. H. P. will find directions for nickel-plating iron on p. 235, vol. 33. For galvanizing iron, see p. 346, vol. 31.—D. H. will find a description of a pantograph on p. 179, vol. 28.—O. J. S. will find a recipe for a black walnut stain on p. 90, vol. 32. For polishing boxwood, see p. 315, vol. 30.—S. L. M. will find on p. 330, vol. 26, directions for making an anvil-harp.—E. will find on p. 344, vol. 34, a description of the fastest trains on railways.—J. J. will find on p. 106,

vol. 32, a good recipe for vinegar.—McC. Bros. queries as to injectors were answered on p. 91, vol. 35.—A. B. will find directions for removing inkstains from paper on p. 154, vol. 30.—G. L. W. will find an excellent recipe for dried yeast on p. 204, vol. 33.—J. T. B. will find on p. 203, vol. 30, a recipe for cement for fastening leather to rubber.—P. T. will find something on making superphosphate of lime from bones on p. 90, vol. 36.—F. B. M. will find an article on lubricants for drilling iron, brass etc., on p. 43, vol. 35.—W. A. H. will find directions for making rubber hand stamps on p. 206, vol. 35.—L. M. C. should repair his rubber boots with rubber cement made according to the recipe on p. 203, vol. 30.—W. R. R. should apply to the Massachusetts Institute of Technology, Boylston street, Boston.—S. L. M. should abstain from using hair dyes; but a comparatively harmless one is described on p. 188, vol. 27.—A. F. G. is informed that we know nothing of the toughened glass of which he speaks.—T. W. W. will find directions for making cheap telescopes on p. 186, vol. 30.—S. R. S. can blue watch springs or other steel goods by following the instructions on p. 123, vol. 31.—R. D. R. should thin his shoe polish by adding more ink.—J. M. & Co. should read our article on p. 241, vol. 35, and they will find that no decision as to the respective merits of exhibits was made by the Centennial judges.—A. B. W. will find directions for soldering all metals on p. 251, vol. 28. We cannot answer his question as to brick, as we do not know the nature of the clays.—H. A. L. will find directions for galvanizing iron castings on p. 346, vol. 31.—S. W. will find a recipe for waterproofing paper on p. 17, vol. 33.—J. L. T. will find on p. 324, vol. 32, directions for making salicylic acid.—E. E. K. can make his lightning rod of either iron or copper. See p. 277, vol. 35. Copper is a better conductor than iron.—O. A. H. will find directions for vulcanizing rubber on p. 378, vol. 28.—D. H. C. cannot calculate horse power of an engine unless he knows the mean steam pressure in the cylinder and the piston speed, as well as the dimensions of the cylinder. See p. 33, vol. 33.—J. H. B. will find a recipe for a silver-plating fluid, for use without a battery, on p. 403, vol. 32. To bleach beeswax, see p. 299, vol. 31. For a varnish for polished brass, see p. 310, vol. 35.—P. P. H. will find directions for straightening wire on p. 299, vol. 34.—V. A. S. will find directions for making a cheap battery on p. 43, vol. 35.—T. P. H. will find an answer to his question as to molding rubber on p. 203, vol. 35.—W. W. should study the lessons on mechanical drawing published in the SCIENTIFIC AMERICAN SUPPLEMENT.—E. J. B. will find directions for painting transparencies for magic lanterns on p. 330, vol. 35.—A. H. B., C. F. P., T. W., C. E. R., C. H. S., C. M. W., F. B., A. L., R. L., S. M. H. N., F. H., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. E. L. asks: 1. Which is the most economical to heat a dry house with, hot air or steam? Our boiler has capacity to supply steam for a fifteen horse engine, but our engine is but two horse power. A. If you have the appliances, steam will be best for you to use. Enclose a low coil of pipe in the drying room, and admit cold air below it; have registers in the floor for the air to escape, and conduct it to a flue built against or around your chimney; this will insure a circulation. 2. How large a dry house can we heat with steam from this boiler, without robbing the engine? A. This you had better prove by experiment, as so much depends upon conditions.

(2) C. M. F. asks: What shall I use in filling the grooves in a ceiling so as to make it smooth enough for wall paper? A. The usual course is to paste narrow strips of thin cloth over the joints.

(3) S. K. S. asks: How can I easily ascertain which of several sugars contains most saccharine matter? A. The amount of saccharine matter in a given quantity of raw sugar is determined now, almost exclusively, by means of an instrument called a saccharimeter. If a beam of polarized light be caused to traverse a solution of the sugar, and is examined by a thin plate of the mineral selenite, the solution will be found to have caused a rotation of the beam towards the right. A sugar solution of 61 cubic inches (3/4 fluid ozs.), containing 2315 grains of sugar, turns the ray of polarized light, of 7/8 inches length, 20° to the right; with twice the amount of sugar, 40°, etc. The scale is generally graduated to read percentages directly. One of the best chemical tests is the following: Dissolve 617-32 grains of sulphate of copper in 2,469 grains of distilled water and add 5/14 ounces of neutral tartrate of potash in a little water, and 1/4 pints of caustic soda ley of specific gravity 4.12. The solution should then be diluted (with distilled water) to 2-438 pints at 60° Fah.; and 3-1555 ozs. of this solution corresponds to 77-17 grains of dextrose or 73-31 dry sugar. The sugar solution (of known strength) is added to a sufficient quantity of the reagent and boiled for a few minutes in a glass flask. The sugar reduces the copper to protoxide, which is removed from the solution by filtration, and weighed.

(4) H. N. R. says: I have set up a loom for rag carpet weaving, and have on hand a quantity of unbleached cotton warping which I wish to dye red or green. Will you oblige by giving some rough, ready, and cheap way of dyeing with the above colors? A. The aniline colors are the brightest and least troublesome to handle. With these, for the most part, wool requires no mordant. Cotton goods require to be mordanted with tannic acid in alcohol or by animalizing the fibers with albumen. You can purchase these dyes, together with the proper mordants already prepared, with instructions for use from any druggist.

(5) E. J. F. asks: 1. What is the best preparation for promoting the vigor of human hair, and what will prevent its turning gray prematurely? A. See p. 50, vol. 36. 2. What is the best method of restoring the color to faded switches of human hair without resorting to the use of hair dyes which contain poisonous ingredients? A. The natural color cannot be restored in such hair except by the use of dyes. Wash the hair thoroughly with soap and water, and dye with the aniline colors, which may be purchased already prepared, and accompanied with instructions, from any druggist. Do not use these dyes except on loose hair. In general, we cannot recommend the use of hair dyes under any conditions.

(6) J. N. A. asks: Is there any instrument or contrivance to register the changes of temperature? A. In the United States signal service observatories, advantage is taken of the expansion and contraction of very long wires of brass, zinc, and iron; and of the unequal expansion of thin bands of brass and steel, which causes a compound bar of these metals to curve by a slight change of temperature. Some of these latter are in the form of large springs. Besides these, the old photometric method is still in use at some stations. In this, the light is caused to pass into a dark box, over the top of the column of mercury in an ordinary thermometer, where it leaves a record on a moving slip of photographic paper. None of these instruments are in the market.

Is steam used as a motor at as low temperature as 212° Fah.? A. No.

(7) A. W. asks: Is it possible that an ice boat can travel faster than the wind? A. Yes. On smooth ice, the wind blowing with a velocity of fifteen miles an hour, a first-class ice boat may be sailed sixty miles an hour, or three times faster than the wind.

(8) J. L. asks: I am in charge of two boilers, 16 feet x 50 feet, with 56 tubes of 3/4 inches diameter. The boilers are suspended at each end by a column. They have been two years in use, using one at a time. The boilers leak on top of the fire; we had a boiler-maker caulk them, but in a short time they were leaking. A friend proposes to have belts turned to fit and take the place of the rivets (some of the leaks take in 15 rivets). I say the nuts coming in contact with the same will burn, and be dangerous. Which is the better plan? A. The bolts and nuts would answer and would not burn; but to ream out the rivet holes and put in new rivets would probably be the best plan.

(9) M. P. asks: Where can I have failed in my efforts to produce the first-class waterproof blacking, directions for making which are given in your number of September 9, 1876? I have followed the instructions as carefully as possible—both by the aid of heat and without it—I have also varied the proportions of the ingredients given, and all without success; and as I am most anxious to attain my object, I shall be thankful for any help you will kindly afford me. A. The following are the materials and method employed in the manufacture of an excellent blacking, and one which we can vouch. Dissolve 18 ozs. caoutchouc in 9 lbs. hot rapeseed oil by constant stirring. Add to this 60 lbs. finest ivory black and 40 lbs. molasses, with 1 lb. finely ground gum arabic previously dissolved in 20 gallons vinegar, No. 24; the whole to be triturated in a paint mill until smooth. Then add, in small successive quantities, 12 lbs. commercial oil of vitriol with constant stirring for half an hour. Repeat this half hour daily stirring for 2 weeks, add 3 lbs. gum arabic in very fine powder, and continue the daily stirring, as before, for 2 weeks longer. It is then ready for use. Care should be taken to avoid loss of the solvent by evaporation. For blacking in paste, use only 12 gallons vinegar. A good blacking is also made by mixing 3 ozs. ivory black, 2 ozs. molasses, a tablespoonful sweet oil, 1 oz. oil of vitriol, 1 oz. gum arabic dissolved in water, and 1 pint vinegar.

Will you give me directions for preparing a first-class oil for watches? It should be free from gummy matter, and should neither freeze nor act upon metals, and yet have lubricating power. A. For delicate machinery pure olive oil is in general use. For this purpose glycerin has also lately been employed, and mixtures of glycerin with sperm and olive oils. One of the best watch oils now in use is prepared from finest sperm oil. We are not, however, in possession of sufficient information concerning the precise method pursued in its production to warrant us in formulating a recipe for its preparation.

(10) M. J. says: We have built a tank house about 40 feet high and 15 feet square at the base, and 12 feet square under the eaves. The tank is in the top story of a building; it is 10 x 10 x 8 feet, and it leaks. We made the tank out of 1/4 inch matched flooring 6 inches wide; the joints were well tarred, but it was no good. So we laid another layer of common flooring inside of the 1/4 inch layer or outside body of the tank, and used white lead on the joints throughout, and had the floor coated with tar; but it still leaks, and a new difficulty has presented itself in that the water which comes from the tank tastes very strongly of tar. How can I stop the leaking of this square tank without using any poisonous substance, as all the water used for culinary purposes and drinking comes through this tank? A. You would have done better to have made a circular tank secured with iron hoops, the tank increasing in size towards the bottom. Your surest remedy now is to line your present tank with sheet lead, properly put in by a plumber.

(11) G. M. G. says: I wish to make a circular saw arrangement to run by treadle or foot power. If I put a fly wheel on large enough, can it not be made to run all right? The saw is 8 inches in diameter; what must be the size of the fly wheel? A. Use a 3 inch pulley and a 3 foot driving wheel with a heavy rim. If you intend using the saw for sawing short stuff or for cross cutting, a balance wheel on the saw mandrel will assist, as the power stored up in the balance wheel will carry the saw through a short cut.—J. E. E., of Pa.

(12) J. J. G. says: 1. If I pump 130 lbs. of air into a boiler 30 inches in diameter and 20 feet long, in the evening, will I have the same pressure in the morning? A. If the temperature of the air is unchanged, the pressure will remain constant in this case. If the air becomes heated, the pressure will increase; if cooled, the pressure will fall. 2. Is 130 lbs. of air equal to 130 lbs. of steam, and is expansion of air less than that of steam? A. There is not much difference between the expansion of air and steam, for constant temperature; but where there is no gain or loss of heat, the difference is considerable. 3. Has any one invented an air locomotive? A. There have been quite a number of compressed air engines invented. If your device is an improvement over others, it may be worth your while to bring it to the notice of the public.

(13) H. L. H. says: I have 6 oscillating engines 10 inches stroke by 3 inches diameter. I wish to run them 500 revolutions per minute, with 25 lbs. press-

ure. How large a tubular boiler will I need? How much water will be evaporated per hour at that speed and pressure? A. It would be best to make some experiments with one of the engines before building the boiler. But if this cannot consistently be done, it may be well to design a boiler capable of evaporating 34 cubic feet of water per hour. You may allow from 30 to 35 square feet of heating for each cubic foot of water to be evaporated per hour.

(14) S. W. asks: Can you give me a method of rendering soap fat, so as to get the grease free from water? A. The fat is heated, not boiled, in a vat (see article on p. 22, vol. 36) with dilute oil of vitriol for some hours, which treatment separates the fat completely from the scrap, and it, being lighter than the pickle, rises to the surface, where it is allowed to stand for a short time, molten, until the water is eliminated by its superior gravity. By this method the water may be completely separated without difficulty.

(15) J. E. W. says: I have a piece of land of 100 acres, and I cannot get water by digging wells. I have a spring of very best water at the base of a hill which affords 12 or more gallons a minute. I want to force the water 100 feet high into a large tank 1,000 feet from spring, and let half the water into this tank and the other half 50 feet higher to the top of hill, to another tank 500 feet from first tank, making in all 1,500 feet from spring. Which would be the best, windmills or steam power, to pump the water? A. We judge from your remarks that a windmill would answer your purpose very well; and we advise you to adopt it in preference to the steam pump.

(16) R. B. G. says: In the SCIENTIFIC AMERICAN of September 30, 1876, I notice a problem given by C. D. S. to find the radius of a circle, the chord and versed sine being given. The formula given is erroneous. When using the square of 1 and dividing by 1, you do not materially change the result. But take any other number than 1 for the versed sine, and you will readily perceive the catch in your formula. If C. D. S. will use the following old formula he will be always right. Thus: Chord = 6 inches, versed sine = 2".

Then: $2 \text{ rad.} = \frac{(C)^2}{V. S.} + \text{versed sine}$; this gives the radius 22'6". Your formula gives: $\frac{(C)^2}{2 \times V. S.} = \text{rad. } 23'7$. Now the proof is as you

stated. $\text{Rad.} - \sqrt{\text{rad.}^2 - \text{semi-chord}^2} = V. S.$, which shows your formula erroneous, giving the versed sine 0'193 instead of 0'2. A. The two expressions are alike, and will give the same value for the radius, if the proper substitutions are made. By a slight reduction, either formula can be changed into the other.

(17) G. C. R. says, in relation to the subject of testing milk: A solution of subsulphate of iron does the work admirably. I took two wide mouthed bottles of the capacity of nearly 2 ozs. each. In No. 1, I put 1 oz. milk, added 5 drops of the iron solution, and mixed them by shaking, merely closing the mouth of the bottle with my hand. The milk was at once divided into water, containing the excess of the solution of iron, and coagulum. On bottle No. 2, I fixed a small piece of wire gauze in a box, so as to have a border around the sieve. On pouring the contents of bottle No. 1 on the sieve, the water ran through, leaving nothing but the wet coagulum.

(18) B. asks: In preparing books for sewing, will a set of saws 8 inches in diameter, each saw having 8 teeth, cut the paper to 3/4 inch depth as well as a set of the same size having more teeth? A. The more numerous the teeth the better, unless they are so small that the paper clogs them.

(19) H. & F. say: During the recent frosty weather, an upright tubular boiler was caught well filled with water, which froze so hard that the boiler sprung the bolt heads and seams; so that when fire was again started and steam up, it leaked, and let steam escape from many places. After caulking up these places, however, the leaks seemed to be stopped, and she now carries her usual head of steam; but the boiler is very plainly sprung outward, and our anxiety is to know whether she has received any permanent injury from this strain, or been weakened in any manner? A. We have known of several cases resembling yours. It would be impossible for us to say certainly, without a personal examination, whether or not your boiler has been permanently injured; but, as far as we can judge from your account, it seems probable that no serious damage has been done.

(20) T. & H. ask: We wish to put up a steam saw and planing mill run by a 40 horse power engine with governor. At a distance of 150 or 200 feet therefrom is a large building for ginning cotton, requiring, say 10 or 12 horse power, to drive successfully. Which would be the best way to run said cotton gins, by a line of shafting from saw mill to gin house (the land being level), or to put a 12 horse power engine in the gin house, to take her steam from the boilers 150 or 200 feet distant through 1/2 inch steam pipe laid on a level with the ground? A. Use the steam pipe, but jacket it thoroughly to prevent radiation.

(21) W. S. H., Jr., says, in reply to a correspondent who asked for a soldering fluid that will not corrode tools: For the past three years, I have used a fluid the fumes of which do not rust tools (I cannot say what actual contact might do, as I do not spatter my fluid about. It consists of muriate or iodide of zinc in crystals 1 oz., best alcohol 2 1/2 to 3 fluid ozs. It keeps best in a glass-stoppered phial. I have found the above to work full as well as the old kind, and much prefer it to anything I have ever used for the purpose.

(22) W. T. asks: 1. Why will not common charcoal do for the carbons for a bichromate battery? It does work for a short time. A. It will do, but its porous nature and brittleness are great objections to its use. 2. Is it as easy to magnetize a rod of soft iron, 12 inches long, as it is to magnetize one 2 inches long, provided the same number of layers are used? A. Yes, but greater current is required to produce the same degree of magnetization. 3. Will No. 30 wire magnetize satisfactorily