meter. For higher pressure an extra thickness of iron or steel is used, and the horizontal seams double riveted. The failure of a boiler under test pressure when full of water is harmless to surroundings, as there is no magazine of expanding energy to increase the explosive force beyond the instant of rupture, from the fact that cold water is a solid or non-compressible body, totally different from hot water at the temperature due to the pressure, which is ready to burst into a thousand volumes at the moment of rupture.

(495) W. A. asks: 1. What animals are the hides taken from of which belt lacing is made? A. Belt lacing is made principally from Calcutta hides, which are small and thin. Also made from hides of young cattle of the U. S. or South America. 2. Is mesmerism an accepted science? A. Mesmerism is not an accepted science. 3. What material can be used to clean windows of rolling mills that are coated with smoke and gas? We have tried turpentine, naphtha, coal oil, soft soap, etc. A. Try a strong solution of caustic soda to clean the glass, and polish with chalk. 4. I put some sleigh bells in a cleaning cylinder with some dog chains, putting in an unusual amount of leather scraps, almost filling the cylinder, but upon taking them out, the whole thirty were broken. Please tell me the cause. A. Sleigh bells are almost as brittle as glass, and often crack in ordinary use. They break in the tumbler by striking the iron shell as the mass rolls over. 5. The windows in my shop have 10 in. by 13 in. glass in them; there is a part of a particular pane that casts a perfect shadow; we can see through it as well as any other. Can you explain this result? A. By close examination the window glass will be found to have an uneven thickness, which influences the parallelism of the light rays, so as to concentrate the light in some parts and leaving other parts dark, on the principle of a lens.

(496) G. M. writes: 1. Would there be any demand for a loud-speaking telephone, one that could be heard in a large room as loud as a person would speak in a natural tone of voice? A. A practical telephone of this kind would be valuable. 2. Has any such telephone ever been devised? A. Loud-speaking telephones have been made, but they are not as loud as the human voice in ordinary conversation. 3. Why is it that some telephones will reproduce musical tones better than ordinary speaking tones? There must be some reason for it? A. Speaking tones are far more complex and irregular than musical notes, and are more difficultly reproduced. 4. If the theory of conservation of force is correct, and also that electricity is a mode of motion, how do scientists harmonize the two theories as exemplified in the permanent magnet, for they argue that magnetism is caused by electric currents, but to produce an electric current, there must first be motion or energy; but after once magnetized in a piece of steel, we have motion forever, or perpetual motion; but they say there is no such thing as perpetual motion. A. The theory of the conservation of force has long been abandoned as untenable, and in its place the doctrine of the conservation of energy has been formulated. In the permanent magnet, we have a perpetual or long-existing center of force, but not of energy. A magnet cannot drive a machine; if it could, then perpetual motion might be possible. But this never has and never will be done.

(497) C. E. S. writes: 1. I have a lot of electric light carbons; some of them are lighter and more brittle than others, and some are of higher resistance. Will one be as efficient as another for use in batteries, or which would be best? A. Other things being equal, the harder and better conducting the carbons are, the better the results will be in their use in batteries. 2. Why is it that I cannot make a perfect casting in a plaster of Paris mould, using brass type metal or lead? Perfect vent holes and moulds allowed it to dry perfectly before use. A. Plaster of Paris "sets" by combining with and retaining water. This it evolves as steam when heated. This interferes with its use as a material for moulds. It should answer for fusible metals, but will hardly do for brass, etc. See SUPPLEMENT, No. 17, for how to mould in plaster of Paris.

(498) S. H. writes: 1. Is there any cheap material to put into spirits of turpentine so as to give it a pleasant smell? Am not particular to the kind of smell, only I do not wish it to smell of turpentine at all, or at least very little. A lot of people, when they are having their houses painted inside, complain of the smell of turpentine. I thought there might be something put into it so as to give it a perfume. A. We can recommend no efficient treatment. 2. Can you recommend anything to make benzine perfectly odorless, say by the addition of any other liquid? A. Benzine is purified by treatment with bichromate of potash and sulphuric acid.

(499) B. B. B. asks: 1. Is fine clay dust (made in mining coal) explosive? A. Not unless it contains organic matter. Coal dust is the agent in producing mine explosions—not clay dust. 2. If so, what per cent of dust in the air is necessary to make it explosive? A. The exact percentage of coal dust is not known. It often acts to aggravate gas explosions rather than as a primary cause. 3. Is there any mechanical device to ascertain the per cent of dust contained in the air in mines? A. Collect a bottle full of air and let the dust settle. By knowing the volume of the bottle and weight of dust, you have the necessary data.

(500) G. H. R. L. writes: 1. Would a mechanical arrangement that, being once started, and would continue to move until it wore out, have any claim to perpetual motion? A. Not necessarily. 2. Is there any such arrangement? 3. Please describe, and who was inventor? A. We know of none. 4. Please explain best way to cure pork in our hot climate in summer time. Would it be advisable to cut it into small chunks? A. Use strong brine and keep the barrels covered. We can give no special instructions.

(501) H. A. B., Ithaca., writes: Will you kindly inform on the inclosed question in optics, which I cannot solve satisfactorily from anything that I have at hand? A spherical lens will not give a perfect focus, but requires correction for spherical aberration, and also for chromatic aberration. A perfect parabolic lens, of any good glass, will give a perfect focus. Now, will such a lens require correction for chromatic aberration, and if so, why? A. The form or curve of a lens controls only the direction of monochromatic light to a common focus, so that a parabolic lens will bring any of the colored rays composing white light, as blue, red, yellow, etc., to a perfect focus; but as white light is composed of a number of colors, all having different refrangibilities, the glass acts upon the different constituents of light according to their wave lengths, and so separates the different colors into as many different images focalized along the optical center at distances due to the refractive index of each color. These superimposed images, so close together, produce to the eye a common confused image, as observed in the image of all single lenses. To correct this, the discovery of the different dispersive powers of various kinds of glass enabled a correction to be made, as in the achromatic object glass. See Glazebrook on Optics, which we can mail for $2.25. Also, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582, 583, On Astronomical Telescopes and their Object Glasses.

(502) R. E. G. — Study and practice must be combined to make you an electrical engineer. If a college course cannot be taken, a position with an electric company should be secured. For books we recommend and can supply you with Thompson's Dynamo-Electric Machinery, $5; Thompson's Elementary Electricity and Magnetism, $1.25; Electricity in the Service of Man, by Wormell, $6; Practical Electricity, by Ayrton, $2.50; Atkinson's Electric Lighting, $1.50.

(503) C. A. B.—We recommend Locomotive Engine Running and Management, by Sinclair, $2. Also Roper's Hand Book of the Locomotive, $2.50. These will give you full information on the subject you desire.

(504) W. E. P. asks for a recipe by which mercury is made adhesive to glass. A. If a perfectly clean surface of melted alloy is brought into contact with perfectly clean glass, it will generally adhere thereto on solidifying. Mercury is poured upon tinfoil, and alloying with the tin forms an amalgam or alloy of tin and mercury. Perfectly clean glass is caused to slide over the amalgam with its forward edge below the surface. The amalgam, if not too liquid, adheres. Consult any encyclopedia, under looking-glass, to see the process described in more detail. Pure mercury will not adhere to any extent, because it is liquid.

(505) J. C. C. writes: Is there a cement that will adhere to metal, harden quickly, and stand a heat of 240° F. without softening? A. Use fusible solder; we know of no really reliable cement except white lead and linseed oil, or silicate of soda compositions. Good white lead ground in oil might answer.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(506) T. H. S. asks: Can any of your readers inform me how I can remove from an old wooden tavern sign a coat of paint put on it say fifty years ago, so as to leave the original picture painted on it over 100 years ago intact?

(507) C. H. asks: Through what cheap process (preferably a solution) may sheet tin be subjected to give it the appearance of being a composition of metals, such as zinc, brass or copper, and iron, so that the chemical used will have no detrimental effect on the tin?

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(41) To Consume Stumps by Fire.—Crude petroleum, with a little saltpeter added, will render stumps combustible. The petroleum costs about two cents a gallon, the proportion of saltpeter I can't now give. Test or judgment must settle it. Bore a ring of inch holes equidistant between the bark and the center of stump to within a few inches of the bottom, fill the holes and keep them filled up as fast as it is absorbed by the wood. Dig the soil from around the stump some distance down. A temporary cover should be put over the stump to keep off the rain. Six weeks of dry weather will suffice.—T. H.

(191) F. A. L. S. wishes to know how to Restore Oil Paintings that are Cracked.—See paper on deterioration and restoration of oil paintings by R. Liebreich, M.R.S., in SUPPLEMENT, Nos. 149 and 151.

(203) A. T. D.—To Prevent Double Windows from Condensing Moisture and Frost.—In Russia, where all dwelling houses are provided with double windows, the sweating of the glass panes is successfully prevented through the use of a small quantity of sulphuric acid placed in a flat pan or cup between the two windows.—A. TENNER.

(253) M. S.—Resin for Electrophorus.—Make the die of electrophorus of equal parts resin, shellac, and Venice turpentine, and there will be no trouble in electrifying it. The turpentine is not necessary, but will prevent cracking.

(318) E. E. P. — Plastic Composition used for Wall Decorating.—Boil 1 lb. glue in gallon of water, add 2 lb. whiting; 2 lb. plaster Paris; 1 lb. white lead (such as comes in kegs mixed in oil). If above is too thin, add more whiting; if too thick, more water. The more white lead you use the slower it dries. House paint can be added to color, or same can be painted after it has set. Then varnished, gilded, or otherwise ornamented. Use an old whisk broom to apply. Designs can be impressed with sharp stick or finger. The above mixture ought to dry in twenty-four hours.

(329) D. T. M.—If the hardness of the water is due to bicarbonate of lime, add sufficient lime water to convert the bicarbonate into the very sparingly soluble carbonate. This is the Clark process, for a description of which see SUPPLEMENT, No. 270. For softening magnesia-hard water, see SUPPLEMENT, No. 187.

(363) G. W.—Area of Smoke Stacks.—

The formula for chimneys for boilers is area $= \frac{\text{H. P.}}{1{\cdot}45 \times \sqrt{h}}$

in square feet; h=height. A common practice, for iron smoke stacks for medium sized boilers, is to allow 25 square inches of chimney area for each square foot of grate surface. See Nystrom's Mechanics for a valuable table of heights, areas, and horse power of chimneys, $3.50, which we can mail. E. D. L. sends rule: Multiply the h. p. by 112 and divide the product by the square root of the height of chimney for the area in square inches.

(365) S. S. S.—Bass-relief Signs.—Use papier mache alone or mixed with a small quantity of plaster of Paris. Wood pulp may also be used with the plaster. The plaster mache must be used quickly after mixing. It sets quickly and holds the relief cast in shape, and can be cast much faster than the clear papier mache.

(366) G. T.—Domes on Boilers.—From practical experience with steam boilers, I find that a boiler with a dome has a big advantage over one that has none, providing the boilers are of the same style, from the following reasons: The dome serves to carry steam at such an elevation above water line that a much drier steam is obtained, also prevents, to a great extent, the jerking over of water in case of either priming or foaming. There are boilers, however, so constructed, that it is not necessary to have a dome on them.—A. C. D.—

(367) I. P. W.—Street Railway Cable.—The pulling strain on the cable will be about 1,600 pounds, to which should be added the additional friction of grips, in the grooves, for curves and extra roughness of track. This indicates only about 43 horse power on the cable, but the machinery and engine for operating the cable will absorb as much more power, or say 90 horse for a clear straight track under favorable conditions. The possibilities may carry the power to three times the above cable strain.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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