out to sea? A. The slack water navigation of streams has been long in use, of which the navigation of the Schuylkill River, from Philadelphia to Pottsville, is a notable example. The Sault Ste. Mary Canal is also an example. Tide locks have also been long used in the United States for ordinary canal purposes, and in England for the largest ships. 2. Is there any geographical reason why such locks could not be built in the mouth of the James River, at some suitable place above Newport News, and thus form a motionless level of over 100 miles, and gain at least 4 ft. of water as against low tide? A. There is no reason that we know of to prevent the James River being made navigable by slack water, except the rights of riparian owners. 3. What is an approximate estimate of miles of navigable streams in this country, that could be so improved? A. There are thousands of miles of streams in the United States that could thus be made navigable as well as a source of power. Railroad competition seems now to be a bar to this class of improvements.

(3841) N. M. W. asks: 1. What size and quantity of silk covered magnet wire should be used on a Bell telephone, and to what resistance wound? A. Use enough No. 36 wire to bring the resistance up to 150 ohms. 2. Would No. 32 cotton covered do, and what amount of it, and resistance? A. No. 32 will not answer so well. 3. What number in American or Brown and Sharp gauge corresponds to No. 36 B. W. G, which I have been told to use on my telephones? A. No. 35 American gauge corresponds to No. 36 Birmingham gauge. 4. I have some ⅜ in. by 6 in. steel magnets, very strong. Are they of proper size? A. Yes. 5. My diaphragms are of common tintype plate. Is this proper, or should they be thinner? Diameter of diaphragms, 2⅛ in.; diameter of speaking hole, 1 1/16 in. How far from end of magnet should diaphragm be placed? Where can I get very thin iron or steel for diaphragms? A. Tintype plates will answer for diaphragms. You can get thin tintype plates from dealers in photographic supplies. 6. What dimensions are best for bobbin? Distance from diaphragm to bottom of box about six or seven-eighths of an inch. A. It is not very material. Consult SUPPLEMENT, No. 140. 7. What has become of the "House" telephone, which you described in the SCIENTIFIC AMERICAN some years ago? I think you stated that it would be put on the market. A. We do not know that anything is being done with it. 8. How long a line could be operated with above telephone, without battery, and if battery were used, of what kind should it be, and how connected? A. On a line unaffected by induction, you can probably secure fair results for a distance of from two to three miles. 9. When size of wire is given, without specifying, is the American gauge implied? A. Yes. 10. I have some one quart bichromate of potassa batteries, and some of the carbons are broken, and I wish to replace them myself. They are fixed in brass plates, which have raised pieces running across them on each side of carbon. The carbon seems to be fastened in with lead. Please tell me how it is done. Carbons 1⅞ by 6 in. A. The lead is cast upon the ends of the carbons.

(3842) C. B. says: Can you tell me how to clean brass rifle shells so that they can be reloaded? When I try to clean them with soda it forms a corrosive substance on the inside and outside. A. The corrosive substance was on the shells at first. the soda only dissolving the acid portions. Try a solution of oxalic acid in hot water for a few minutes; after washing with soda, wipe inside and outside with a swab on a stick and finish with a soda wash.

(3843) M. S. asks: 1. Can I get the same amount of power from the simple electric motor, page 498, "Experimental Science," with 6 cells of Fuller battery, as I could if it was made so small as to give its maximum amount of power with 6 F. cells? A. You can always secure the best results by having the motor proportioned to the battery. 2. How much smaller would it have to be made, also how much and what sizes of wire should be used? A. Make the motor about half the size given, and wind it with No. 20 wire. 3. In either case would the 6 cells develop enough power to run a sewing machine? If not, how many would? A. No; six cells of Fuller battery will not run a sewing machine. It will require double that number. 4. How can I, when using Fuller cells cause the motor to run fast or slow, as when running a sewing machine? A. You can vary the speed of the motor by introducing resistance into the circuit or removing it therefrom. 5. My Fuller battery has been set up two weeks and the zincs, which are Leclanche battery zincs, are just about used up. They were amalgamated and the ends immersed in mercury in the porous cups, which are second hand Leclanche porous cups. The solution used was a saturated solution of bichromate of potass. with 10 per cent of sulphuric acid outside porous cup, water inside. The work done by the battery during that time was to light a four candle power lamp one hour and a quarter and to light gas. Shouldn't the zincs have lasted longer? And can you suggest a remedy for the wasting of the zincs? A. Leclanche zincs are too small for the Fuller battery. The zincs should weigh from 1 to 2 pounds each. Use pure zincs and plenty of mercury.

(3844) J. M. says: 1. Suppose a pound of lead and the same weight of wood were dropped from a height of two hundred feet at the same instant, how much difference would there be when the lead reached the ground? If a piece of lead and a piece of wood the same size were dropped from the same height at the same instant would there be any difference between them or would one reach the ground before the other? A. There will be a very great difference in the first case, not so much so in the second case. The friction of the air would retard the fall in proportion to the relative weights and bulk. In the first case the weights will be alike, but the bulk of the wood will largely exceed the lead and furnish a larger area to the resistance of the air. In the second case, the size being the same, the difference in weight will give the lead about fifteen times greater weight, while the resistance of the air is the same with both wood and lead. It is only in a vacuum that the fall would be alike.

(3845) G. W. H. says: Please inform me if there is, and how to make, a paint to be applied inside a tin vessel to prevent it rusting, vessel to contain rain water? A. Paint the pail with red oxide of iron paint mixed with boiled linseed oil, two coats, dry each in the sun, or if you desire a fine finish use Japan baking varnish of any dark color and bake in an oven at about 260° temperature.

(3846) W. F. B. asks: 1. Can a low pressure engine be worked with success receiving steam direct from high pressure engine without steam jacket? A. The two engines as described can be run as a compound engine if properly arranged. 2. What would be the horse power of a compound engine, high pressure cylinder 16×24 in., low pressure 24×24 in., speed of engine 100 revolutions per minute, steam pressure 150 pounds? A. They should develop from 400 to 450 horse power. 3. What is the width of a locomotive fire box and water space when such is inside of frame? A. Width of fire box, about 4 feet 4 inches; water space of legs, 4 inches.

(3847) S. A. K. says: I have 15 pounds of water at a temperature of 60° Fah., and add 2 pounds of steam. What will be the temperature of the mixture? Would there be any difference if I add the same quantity of boiling water instead of the steam? If so, why? A. As you do not mention the pressure of steam, which makes some difference in the result, we assume 5 pounds pressure, which will give you a temperature of 205°, while with boiling water the temperature of the mixture will be but 80°. With steam you add the latent heat of steam, or 950° for each pound of steam.

(3848) J. L. C. asks: Can I construct a battery which will generate electricity enough to supply three incandescent lights, and also how many cells and what size will I have to use? A. It depends entirely upon the size of the incandescent lights. You can run three or six 20 volt lamps with 11 cells of storage battery, and you can charge the storage battery with gravity batteries, using four cells of gravity to each cell of storage. We do not advocate the use of primary batteries for practical electric lighting.

(3849) H. asks: 1. What pressure per square inch would air have if reduced ⅛ its volume at sea level, to ¼, to ⅛? A. 15 pounds, 45 pounds, 105 pounds. 2. Give formula to find pressure at various stages of compression. A. For isothermal compression the formula is $\frac{P}{V}$ —P=gauge pressure. P=absolute pressure of the atmosphere or 15 pounds. For example:

$$\frac{15}{\frac{1}{2}} - 15 = 15 \text{ pounds gauge pressure}$$

and

$$\frac{15}{\frac{1}{8}} - 15 = 105 \text{ pounds gauge pressure.}$$

(3850) D. C. S. says: Being an old subscriber to the SCIENTIFIC AMERICAN, I would like to ask your opinion in regard to the use of a steam boiler in use here; the boiler in question is of steel plate, ¾ inch thick, 12 feet long, 60 in. diameter, with thirty-nine 3 inch tubes, return, and the take-up is over the furnace doors, and has the old style safety valve with a round iron ball as weight on lever arm. The proprietors when ready to start found the engine unable to drive the mill with the weight at the end of safety valve lever, and so they added a 56 pound pea to same, and yet had to add 4 fire bricks to end of lever before the pressure was able to drive the mill. Some claim this to be dangerous, as the ball weight on end of lever is the full capacity of boiler; with all this weight, the steam gauge only shows 100 lb. pressure, and is all the time giving trouble by leaking, etc., and needing repairs, etc. A. This is an example of the dangerous practices resorted to in order to get more work from a boiler than is due to its safe capacity. The very fact of its leaking at 100 lb. pressure shows that it is overstrained. This is the cause of many boiler explosions, and should not be tolerated by engineers.

(3851) J. F. asks if an induction coil can be made with which to light a 16 candle power Edison's incandescent lamp. If so, please give length and diameter of core, size and amount of wire for primary and secondary coils, and number of layers of each. Have 40 jars gravity battery which can be used to furnish primary current. A. An ordinary induction coil will not light an incandescent lamp, as the secondary current generated by such a coil is of very high E. M. F. with low amperage. The induction coils used for operating incandescent lamps, and known as transformers, are designed for converting a current of high E. M. F. and low amperage, into a current of low E.M.F. and, higher amperage, capable of heating the carbon filaments of the lamps to incandescence. The only way you can utilize your gravity batteries for electric lighting is to use them for charging a secondary battery, employing the latter for operating your lamps. With your 40 jars you can charge 10 cells of secondary battery.

(3852) W. F. C. writes: I have a magazine clipping which I wish to separate, so as to paste both sides in a scrap book. Is there any way to split it and not destroy the paper? A. Cover both sides of the clipping with strong paste, and insert it between two pieces of very strong, smooth paper, making sure to have it attached by every portion of its surface to the pieces of paper. Allow it to dry thoroughly, then pull the stout papers apart; this will split the clipping, and the parts may be soaked off, washed, and pasted in the scrap book.

(3853) W. A. B. asks: 1. Can you give me a good remedy for a sprained wrist? I have tried several remedies, such as liniments, arnica and a band around the wrist, but without cure. A. After the remedies that you have already tried, we can only advise you to consult with a good physician. 2. Should a stone fall from a great height, say 500 feet, does it gain in speed until it reaches the ground, or is the speed of the stone the same after it has fallen a certain number of feet? A. A stone falling from a great height will increase its velocity until the resistance of the air due to its area is equal to the weight of the stone, after which it will fall at nearly uniform velocity, but slowly decreasing as the air increases in density.

(3854) M. J. H. asks: What is the comparative cost of tin, galvanized iron and copper for gutters, and what is the comparative durability of each? Will they last longer if painted? A. The cost increases in the order named. Copper gutters will outlast tin or galvanized iron many times. All will last longer by being painted every two years. The comparative cost will depend on the thickness of the metal.

(3855) W. J. says: Our old grist mill had 6 runs of stones. These stones were 48 inches diameter and ran 160 revolutions per minute, making a fine quality flour. What amount of power would each stone require? How many bushels of wheat should be ground per stone, or what should be the output of the mill in bushels of wheat ground and in barrels of flour, for one day or twenty-four hours? A. Each stone will require 4⅛ horse power, and should grind 4⅛ bushels wheat per hour, making a total output of 648 bushels per day of twenty-four hours, with 27 horse power. This does not include power for elevating and bolting, which will require about 4 horse power.

(3856) J. E. L. says: Could you inform me (a subscriber) what is the trouble in regard to the successful operation of a compressed air motor? Is it caused by the friction of the valves, pistons, etc., and the lubricating of the same, as this might be difficult? I have thought it might prevent their successful operation. In steam and water engines this is not necessary, viz, lubricating to a great extent, that is, of the parts mentioned. A. Compressed air motors are in successful use in Europe for power purposes, and compressed air is used all over the world for running rock-drilling machinery and pumps in mines. There is no difficulty in their use. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 765, 721, 684, on the use of compressed air for power.

(3857) J. H. S. asks: 1. What temperature of air passing through petroleum is necessary to vaporize it? A. Crude petroleum may begin to evolve vapor at 100° F. or less, all depending on the sample. To finish the volatilization a high temperature is needed at the end, and some pitch will be left in the still. 2. What is the highest temperature petroleum gas will stand without ignition, mixed and unmixed, with the proper quantity of air for complete combustion? A. 1,000° to 1,500° F. 3. What heat does petroleum gas produce in burning? A. It depends on the gas or the burner. Theoretically, it might give 4,000° to 5,000° F. Actually, not over half these temperatures should be looked for. In Clark's Gas Engine, $2 by mail, you will find these theoretical points considered. We also recommend Robinson's Gas and Petroleum Engines, $5.50.

(3858) A. G. S. and A. T. ask concerning relative merits of shorthand systems. A. It is claimed that Pitman's system is more extensively used than any other shorthand method. We can supply manuals in any system, such as Pitman's "Shorthand or Phonography," 40 cents; *ditto* "Teacher," 10 cents: Munson's "Complete Phonographer," $1.50; Burnz "Fonic Shortˢ hand," $1; Graham's "Hand Book of Phonography," $2; Munson's "Phonographic Phrase Book," $2.50.

(3859) "Danville" asks: 1. What kind of pith is used in making figures for an ano-kano? Will pith out of corn stalks answer the purpose? A. The best pith for the purpose is sunflower stalk pith. The other piths will answer however. 2. Does the box need to be air tight? A. No. 3. Which side of the leather should go out—the black or the red? A. The natural uncolored side of the leather or kid. 4. How much bisulphide of tin does it take to put in the pad? A. As much as will spread over its surface. 5. What is the illuminating paint made of? A. From calcium or barium sulphide; see our SUPPLEMENT, Nos. 229, 249, 497 and 539, and the SCIENTIFIC AMERICAN, No. 10, vol. 65, and No. 19, vol 65.

H. H. asks for a varnishing ink.—S. E. N. asks for a varnish for rubber overshoes.—S. R. asks how to dye brown.—C. P. J. asks: Please describe fully the manufacture of enamel signs and sign letters.—J. C. S. asks how to silver glass by solution.—E. D. asks for receipts for engine oils, cylinder oil, axle grease.—J. H. B. and C. H. M. ask for furniture polishes.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column.

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