

steaming, a strong tank with quick-opening door, equal to a steam pressure of 120 pounds per square inch, will be required. An air-tight iron box heated in an oven to the required temperature may be used for small operations. Again, for buttons and small work heated discs may be used. The heating is to be done by a Bunsen burner.

(5642) C. M. W. asks: In selecting coke for cupola purposes, how may the first or best quality be known from poorer grades, without trying it in the cupola, and why is it that the poorer grades resemble so closely in appearance the better grades, making it thereby so difficult to know anything about it without a cupola test? A. The carbon element in coke is the key to its quality for furnace work; 5 to 10 per cent difference in the amount of silica or ash cannot be discovered by surface inspection. An analysis only will show it. The only practical way is to obtain the coke from known sources of good quality by trial. The Colorado cokes appear to have more fixed carbon than the Connellsville cokes. Their faultiness may be in excessive sulphur and phosphorus. The Crested Butte field is said to be the best coking coal.

(5643) G. R. asks: How much work, foot-pound-minute, is the ordinary two horse tread power capable of developing, the tread power being the ordinary portable one as used in the country for thrashing? How much work, foot pound and minute, does the average two horse power gasoline engine exhibit in a friction brake applied to the driving pulley? A. The capacity of the horse treadmill depends much on the weight, strength and steadiness of pull of the horses. The friction absorbs probably 25 per cent of the power, so that the actual power delivered by two good horses may be 1 1/2 horse power. The gasoline engine should have the actual power named in its size, or 33,000 foot pounds per minute.

(5644) J. S. P. says: Will you please give the velocity of steam or the distance it will travel per minute? A. The velocity of steam flowing into a vacuum is about 1,550 feet per second at atmospheric pressure; at 10 atmospheres about 1,780 feet per second. When flowing through a hole in a plate into the atmosphere at 15 pounds pressure per square inch, the velocity is 650 feet; and at 20 atmospheres or 300 pounds pressure the velocity is about 1,600 feet per second.

(5645) W. J. B. asks (1) for a good formula for liquid glue. A. Two ounces gelatine, 4 ounces water, when the gelatin has fully swelled, add 2 ounces glacial acetic acid. It is used for mending china, glass, etc. 2. I have made a drum armature for the hand power dynamo (SUPPLEMENT, 161), but I have used iron wire instead of brass wire for binding on the wire, as is generally recommended. I have tried it, but it does not work very well. Would the iron wire around the armature cause this? A. The iron winding will do no harm. You must settle the position of the brushes by experiment. They should be on opposite extremities of the same diameter. As far as your drawing is intelligible, it would appear that all the bells in the case given would ring.

(5646) R. W. O. asks: Can a sailing vessel sail faster than the velocity of the wind at the time? What is the fastest time ever made by a sailing vessel crossing the Atlantic? A. A sailing vessel cannot sail faster than the wind under any conditions. The American clipper Flying Cloud made 374 miles in one day in 1851; the Dreadnought, New York to Liverpool in 1859, 13 days 8 hours, 3,000 miles; the same in 1860, Sandy Hook to Queenstown, 2,700 miles, 9 days 17 hours.

(5647) C. M. G. asks: Is there any electrical connection between the primary and secondary coils in an induction coil? A. There is none. For induction coil connections see our SUPPLEMENT, No. 160. 2. Also why is it that a needle laid gently in water will not sink for some time? A. It floats in virtue of the surface tension. The surface film supports it somewhat as a thin sheet of India rubber would. There is no question of porosity.

(5648) I. A. M. asks: The best month to cut hickory, so that the worms will not enter the wood when cut. A. January is the best month.

(5649) J. J. A. D. asks: 1. The simplest way to make an air pump for experimenting. A. A large variety of air pumps of various forms have been described and illustrated in SCIENTIFIC AMERICAN SUPPLEMENT. See Nos. 224, 303, 629, 630, 631, 10 cents each mailed. 2. What is the process used in dipping and lacquering brass? Is there more than one way? A. There are many receipts for dipping and lacquering brass work, coloring, bronzing, etc., in the "Scientific American Encyclopedia of Receipts," \$5 by mail.

(5650) W. B. asks for some process by which printing ink may be removed from paper, such as the page of a magazine, etc., without injuring the paper. A. Apply sulphuric ether to the ink with a little cotton wool ball gently rubbing and using white blotting paper to absorb the ink; continue the operation until the ink is nearly all removed. The process is not very satisfactory.

(5651) E. H. P. writes: I wish to make a spark coil and all else that I can toward lighting my gas by electricity, some four or five burners. A. For a spark coil use a core of pieces of soft iron wire eight inches long made into a bundle about one inch thick. Wind it with four or five pounds magnet wire No. 18; a battery in open circuit with it, special electric burners, and a switch or push button are required. Address any dealer in electric supplies for fittings.

(5652) W. K. S. asks: Can a Crowfoot battery be made strong enough to run a motor with any power. A. Yes; but, owing to its high resistance and low voltage, a very large number of cells are required.

(5653) C. T. D.—The specimen sent has been identified by Professor C. V. Riley as being a large Myriapod-spirobolus marginalis, which, although dangerous in appearance, is quite harmless.

(5654) J. V. W. asks: 1. Will the chloride of manganese fume on charcoal before the blow-pipe? What color is the flame? Are there any colors left on the coal? A. Not to any extent. The flame will

show no characteristic color, and the coal will show a brown color, not characteristic. 2. What diluted acids can be used to dissolve the phosphate of manganese? Will the solution stay clear? If not clear, what color will appear? A. Hydrochloric acid or other mineral acid will dissolve it, giving a light pink solution. 3. What solution of manganese will stay green or blue? How prepared? A. None; the alkaline permanganates are dark violet or purple. 4. What is a neutral solution of peroxide of iron? A. A solution containing no free acid and not basic; for each equivalent of ferric oxide six bonds must be supplied by the acid. 5. Will a solution of hyposulphite of soda dissolve the phosphate of silver? A. Phosphoric acid dissolves it.

(5655) W. C. Mfg. Co. asks what the resistance of No. 22 and No. 24 German silver wire is per thousand feet. A. German silver varies in resistance. You may take 215 and 342 ohms respectively for 1,000 feet of No. 22 and No. 24 wire.

(5656) H. M., Jr., asks if cast iron rings can be used in armature of dynamo described in SUPPLEMENT 600. A. No. Use softest possible iron.

(5657) E. S. & S. ask: How would you change the winding of your 110 volt dynamo to produce a potential of 50 volts? A. Use half the number of turns on the armature, with wire of twice the diameter of that given. Wind field for one-half the resistance and same number of turns.

(5658) B. B. K. asks for the required amount of storage batteries to light fifteen 16 candle power 50 volt lamps, with plates of storage batteries 3 inches by 7 inches and ten plates to one cell; also how long it would take to charge them with a three light 110 volt dynamo. A. You will need 10 parallel series of 25 cells each. The dynamo, giving only a small amperage, will charge them very slowly—several days being needed to charge after exhaustion.

(5659) J. E. M. writes: I have the SCIENTIFIC AMERICAN SUPPLEMENT, April 14, 1888, No. 641, in which you give plan and figures for making a dynamo? Cannot this plan be enlarged to make a dynamo of two horsepower to run on an arc circuit? A. Yes. Wind your motor for the amperage of the circuit as if it were a dynamo to develop voltage equal to 746 X 2 = amperage in question. The amperes in arc circuits vary according to the system used.

(5660) S. E. L. C. asks whether two 2,000 candle power lights will throw their rays of light farther than one 2,000 candle power lamp of the same voltage. A. In general terms, the more powerful lights would be seen farthest.

(5661) C. C. N. writes: 1. How long would it take to charge 200 storage cells, each one being 2 X 2 X 4 feet, with a 10 horse power dynamo? A. The dynamo would give a current of about 16 amperes. Divide the amperage of a cell by this figure and multiply by 10 for time of charging. 2. How long would it take to discharge them? A. Allow a rate of 6 amperes per square foot of positive plate. 3. How many horse power would they give on a motor? A. Multiply their amperage by 400 and divide by 746, and deduct 10 to 20 per cent for waste. 4. How often does the fluid have to be changed in storage cells where they are used ten hours each day, and how is the fluid made? A. It is dilute sulphuric acid, and occasionally needs slight additions of water or of acid. 5. What was the size of the storage cells used in the World's Fair electric launches? A. Address Electric Light and Navigation Company, 44 Broad Street, New York.

(5662) M. S. S. asks: 1. Can gravity batteries be used to light an incandescent lamp? A. Not practically. 2. If so, how many will it take to light a lamp of 10 voltage and 8 candle power? A. About 60 cells. 3. Should the number of the cells be increased if the candle power of the lamps is increased? A. Yes.

(5663) W. E. C. says: I have a cylinder, dimension 2 1/2 inches by 10 inches, and wish to force 150 cubic inches of gas in with the air the cylinder contains. How much pressure will it take? Also how much pressure per square inch will the explosion of the gas in the cylinder exert? Does the gas consume the air? If so, what change takes place when the cylinder is opened? A. To put the quantity of gas into the cylinder as stated, the pressure on the pump will gradually increase from 0 to 44 pounds per square inch. It will not be explosive, as there is too much gas in proportion to the air. For the best explosive mixture, 6 parts of air should be mixed with 1 part of gas, when, by exploding, the pressure may rise to 120 to 150 pounds per square inch. When exploded, the product is nitrogen and carbonic acid gas, with a little steam formed by the union of the hydrogen of the gas with part of the oxygen of the air.

(5664) B. M. K. says: Some time ago we dug a new well, the water being soft when found. Since that we have walled the well with limestone and the water is very hard. Did the stone cause this? Will it be permanent? What would be the remedy? A. The limestone is probably the cause of the hardness. By drawing a larger quantity you may modify the hardness to a considerable extent; or if there is a deep water soil beneath the well, a drive pipe in the well and pump should give you soft water from the lower stratum.

(5665) T. A. C. says: I herewith inclose species of scale insect infesting our persimmon, peach, and orange trees. Some know it as "hutton smut scale." Will you let me know its species and any known remedy? This scale leaves a "smut" similar to that of "white fly." The latter is doing great damage in Central Florida, and is spreading rapidly, coming south at rate of about forty miles each season. Reply by Professor Riley.—The scale insect sent, and to which you apply the popular term "hutton smut scale," is the Florida Ceroplastes, also called the white scale and the wax scale (Ceroplastes Floridaensis, Comstock). A full account of this insect will be found in Hubbard's "Insects Affecting the Orange," pp. 58-59. A perfectly satisfactory remedy consists in spraying with dilute kerosene soap emulsion at the time when the young hatch. The principal hatching times are first in April and May, second in July and August, and third in October and November. A full account of what is called "white fly" is to be found in "Insect Life," vol. v., pp. 219-226.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted December 26, 1893.

AND EACH BEARING THAT DATE. (See note at end of list about copies of these patents.)

Table listing inventions with patent numbers and names of inventors. Includes items like 'Acid, manufacture of para-amido-phenol sulphonic', 'Alarm, See Boiler water alarm', 'Bicycle wheel, F. Douglas', 'Bottle box or case, F. W. Becker', 'Car coupling, E. D. Bond', 'Carriage gear coupling, N. A. Newton', 'Cash register, indicator, and check printer', 'Clock winding mechanism, tower, R. B. Carr', 'Clutch cutting machine, A. K. Thyl', 'Clutch mapping machine, E. Gessner', 'Clutch, W. Womersley', 'Clutch lubricating device, P. Diehl', 'Clutch mechanism, friction, Babcock & Schmitt', 'Clutch, self-lubricating, P. Diehl', 'Coat, A. C. Watson', 'Coin-controlled burglar alarm, C. W. Delaney', 'Coke, making, G. C. Hewitt', 'Collar, horse, L. Ingels', 'Commutation and a mid electric commutator, electric, C. E. Emery', 'Compound engine, A. Von Borries', 'Conveying and manufacturing same, T. Wrigley', 'Cooker, steam, R. H. Morgan', 'Copy holder, B. M. Kirkpatrick', 'Cotton gin, roller, M. 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