RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — Ephraim H. B. Knowlton, Watertown, Dakota Ter. This invention covers a novel construction and arrangement of parts in which the drawheads are counterparts of each other, and each also provided with the ordinary coupling link and pin, the coupling hook provided by the invention being fitted to have a vertical movement on a pivotal pin.

RAILWAY CAR. — William L. Covel, Biloxi, Miss. The car or locomotive has at its end a three-sided platform, one side formed in line with the car body and the other side inclined to the direction of motion, so that cars or locomotives meeting will be directed off to opposite sides of the track, and the cars will be prevented from telescoping.

RAILWAY. — Robert P. Faddis, New Mexico Ter. According to this invention the rail seats are held in a crib frame, anchor rods being passed through openings in and secured to the base of the rail at opposite sides, and extended and secured to the lower portion of the crib frame, with other novel features, increasing the solidity and firmness of the construction.

TRACK CLEANER.—Augustus F. Priest, Fort William, Ontario, Canada. This device is made with two knives hanging on bolts so that the lower edges of the knife bars are about on a level with the bottom of the nose of the pilot of the locomotive, and adapted to clear the track entirely across between the rails, the apparatus being supported upon the pilot and forward truck in such way as to be readily raised by the engineer.

Mechanical.

LOOM.—John L. Aldinger, Syracuse, N. Y. This invention covers a warp tension regulating device for looms, specially adapted for wire looms, and by which the warp beam or drum is dispensed with, the warp threads being run from the spool to the harness, while at the same time the necessary tension is given to the warp threads or wires.

PRINTING MACHINE.—Henry H. Harrison, New York City. This invention covers a novel combination and arrangement of parts designed to provide a machine for printing cards, circulars, or other small matter, upon one side of the paper only, and cut the paper into sheets as rapidly as printed, the paper being printed from a continuous ribbon upon a drum.

WINDMILL. — Franklin B. Kendall, Turnwater, Washington Ter. Rods are connected with the spokes of the windwheel and with a sliding rod operating on a drum carrying the vane, with other novel features, whereby the windwheel is turned out of the wind automatically as soon as the wind blows with more than normal pressure.

DIAMOND CUTTING TOOLS. — Hugo Keller, New York City. The method of securing diamonds in the tools is covered by this invention, a longitudinal recess being provided in the cutting edge of the teeth for the insertion of the diamonds, which are held in place by a clamping plate riveted or brazed on, brazing material being used to fill up any spaces in the diamond socket, so that when the tool becomes worn the diamonds may be readily removed.

Agricultural.

CORN HARVESTER.—James McKivett, Garrison, Iowa. This is a machine designed to cut corn, whether it is planted in rows or not, as the machine is driven across a field, in the same manner as mower or reaper is driven through grass or grain, the machine also removing the husks, the latter remaining on the stalks, cleaning the husked ears, and delivering them into a bag or a wagon traveling beside the machine.

HAY STACKER.—Jesse Morris, Sioux Rapids, Iowa. This is a machine in which the fork is operated by ropes passing over pulleys at the top of inclined beams and thence under pulleys located near the bottom of the main frame, the hay being deposited upon the tines of the fork, and the ropes then drawn upon by a horse hitched thereto.

DIVIDER SHOE. — Charles W. Love, Fairpoint, Ohio. This invention covers an improvement in outer divider shoes for the cutters of mowers and reapers, to so construct the seat for the finger bar that the seat may be readily trimmed out to fit any of the ordinary finger bars now in use, the invention also embracing other novel features.

CULTIVATOR AND HARROW.—Thomas E. Carter, Augusta, Kansas. In this machine the cultivator teeth are so fixed as to effectually cultivate the ground adjacent to the corn, while a series of harrows may be projected from the body of the cultivator proper, the harrows being adjustable, and there being at the rear of the frame scrapers adapted to convey the loose dirt into the roots of the corn.

Miscellaneous.

HOT AIR FURNACE. — Benjamin F. Price, Bloomington, Ill. This furnace has a conical inner casing, bottom casing, and upright outer casing forming an inclosed air space, in combination with a dome, tube plate with short tubes, and other novel features, designed to secure perfect combustion of the fuel and thorough utilization of the hot air.

STEAM HEATER.—Daniel D. G. Langlands and Otis E. Moulton, Dover, N. H. The boiler of this heater has a large heating surface, large steam space, and comparatively small water space, and is not liable to become water-logged, the apparatus being adapted to be readily introduced into or incorporated with any casing.

GRAIN WEIGHER. — William H. H. Brunton, Elk City, Kansas. This invention covers various novel details and combinations in a machine designed to automatically measure and register the quantities of grain delivered by an elevator connected with a thrashing machine or grain bin.

GAS MANUFACTURE.—John C. Garvin and Henry Moody, Leadville, Col. This invention covers a novel construction and combination of parts for manufacturing gas from hydrocarbon and other liquids, such as oils of various kinds, and for cleaning the retorts and pipes used without disturbing them, the liquids being decomposed and converted into gas by being brought into contact with suitably heated surfaces.

SAW.—George H. Holmes, Ogdensburg, N. Y. This is a band saw for cutting wood, having an annealed back and the rest of the blade and cutting edge tempered with the ordinary temper of wood saws, the back of the blade being thin and the rest of it of even thickness, making a saw designed to work smoothly without being liable to crack or break.

WIRE TIGHTENER.—Louis S. Flatau, Pittsburg, Texas. This tightener is more especially designed for use in taking up the slack in wire fences, the frame having guides for the wire and a threaded bearing in which turns a screw with a hook to engage the wire, there being a shackle for keying the hook to the screw, the device being also capable of use in tying packages with wire and for other purposes.

THILL COUPLING.—Isaac Clark, Morris Plains, N. J. This coupling is adapted for use in connection with an ordinary clip, bolt, and nuts, the invention covering novel details of construction and arrangement of parts designed to afford a coupling that is simple, strong, and convenient in use, while being easy to couple and uncouple.

TRICYCLE. — Patrick Gallagher, New York City. This invention covers an improvement on a former patented invention of the same inventor, a fly wheel being applied to the driving mechanism and a brake capable of application to the driving wheels, whereby the operator can readily regulate the speed of the vehicle without changing his position on the seat.

HAT MARK.—Henry H. Wright, Paola, Kansas. This is a device, the use of which is designed to prevent parties taking the wrong hat, and consists of a frame adapted to be secured to the inside of the hat with a name-plate hinged on the frame and locked in place thereon by a pin, the device being adapted to be held permanently on the inside surface of the hat.

SUSPENDER BUCKLE.—James England, New York City. This buckle has a base plate with outwardly extending ears in which a bar is journaled having a longitudinal row of teeth, with one or more of the teeth in the row inclined at a different angle from the others, but so that both rows of teeth may be moved out of contact with the web.

BOTTLE FAUCET.—Felix Stefany, New York City. This faucet has two valves operated independently of each other, one serving to open or close the inlet and outlet pipe and the other adapted to open or close a vent, the device being specially designed for conveniently filling a bottle with a liquid under pressure, and for sealing the liquid in the bottle and discharging the contents as required.

CAN FASTENER.—Calvin Keeler and Harvey Lewis, Hobart, N. Y. This fastener consists of a grooved casting in which is fitted a sliding hook adapted to engage the wired rim of a can, a cam lever being pivoted in the casting and arranged to bring the hook into engagement with the wired ring, the device being especially adapted for use with milk cans.

MATCH BOX AND CANE.—Simon B. Simon, New York City. This is a box for use in connection with canes, umbrellas, and similar articles, and is made with a sliding lid, of such form that it will not readily open when the cane or umbrella is carried.

THEATRICAL APPLIANCE. — Fred Wilson, New York City. This invention combines with a stage a mechanical structure representing the interior of adjoining compartments, a chair having a balanced pivoted body with electric lamps sunk therein, and connected with electrical apparatus in the adjoining room, affording convenient means for flashing light and manipulating the chair.

AUTOMATIC ALARM. — Emil Meyer, Ottleben, Prussia, Germany. This invention provides an apparatus whereby watchmen, firemen, etc., may be reminded of recurring times to give attention to particular duties in connection with furnaces and other matters, and whereby, in the event of failure, an alarm bell will be rung, the latter to be connected, if desired, with an alarm bell in the office of the superintendent or manager.

SEWING MACHINE.—William C. Foster, Jersey City, N. J. This is a machine for forming a double row seam, or "whip stitch," wherein the side loops are bound at the lock formed by the chain stitch, the invention consisting principally of a hook and means for reciprocating it, whereby each side loop or stitch is shifted laterally to have the chain stitch loop thrust through it.

STITCHING FABRICS.—William C. Foster, Jersey City, N. J. This invention covers the method of stitching by the above machine, consisting of passing two loops through the fabric, a short distance apart, one to be formed into a chain stitch and the other into a transverse loop, the latter occupying a position between the chain stitch loops and the fabric.

PIANO KEY BOARD. — Enoch L. S. Osborn, Waxahachie, Texas. This key board has all the keys of uniform size and color, a sliding attachment being arranged above the keys with stripes to represent the usual white and black keys, the keys also having numerals and letters forming guides for the adjustment of the sliding attachment, whereby the scale may be transposed, the invention being intended to facilitate teaching.

SHADE FOR BURNERS. — James and William J. Stratton, Brooklyn, N. Y. The shade is formed with an elliptical top, and has a funnel-shaped ray conductor, a wire coil or ring carried by the shade being adapted to receive a burner tip, the construction being such that the flame will not impinge against the shade when the burner is inclined from the vertical position.

MUSIC OR BOOK HOLDER. — Herbert O. Brown, Auckland, New Zealand. This holder has an attaching portion with spring arms to engage a shelf, a finger being pivoted at the outer ends of the attaching portion to swing at right angles to the spring arms, and having on its lower end a weight.

CHIMNEY COWL.—David Teets, New York City. In this cowl a series of vertical equidistant strips separated by slots are combined with a series of semi-cylindrical plates arranged vertically, covering the slots and serving as smoke conductors, making a ventilator cowl designed to promote draught and avoid down draught.

VEHICLE SPRING.—James F. Thomas, Alexandria, Neb. This is a novel form of side spring, the springs being bowed at their centers, with means for securing them at their central portion to the framework of the vehicle, whereby they are restrained from torsion at their centers when the load is on, the invention being an improvement on a former patented invention of the same inventor.

SAW.—Nicholas Petry, Rockport, Mo. This is a device for sawing tenons and gains and to save the time and labor of measuring them, the heads or holders of the frame having slits in which saws are adjustably held, so that one saw can be dropped below the other, to permit cutting of tenons having one side longer than the other, or both saws can be lowered, when the frame will form a gauge.

HAY PRESS.—Michael McCarty, Montrose, Col. This press has combined with it a horse power mechanism for operating the plunger, and the hay or material to be compressed is fed in batches to the press box, where it is compressed by the reciprocating motion of the plunger, being compressed at each forward motion and pressed out of the opposite end of the press chamber.

WATER CLOSET.—John J. Balls, Jacksonville, Fla. This invention covers a novel construction and combination of parts in water closets of that class in which the bowl is flushed automatically by the action of the movable seat.

WIRE STRETCHER.—George R. Hughes, Savoy, Texas. This device has an essentially T-shaped body, the members of the head having a series of teeth, combined with a pivoted lever and clamping jaws, whereby the device can be readily attached to a post and engaged with the wires to be stretched.

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References to former articles or answers should give date of paper and page or number of question.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(411) R. G. D. —The so-called perpetual motions are not perpetual motions in a mechanical sense. They derive their motive power from some change in the physical elements, principally heat. The change of temperature during the day and night may be made to keep a machine or clock constantly running. There is power expended here, no matter if it comes from a natural change of temperature, the blowing of the wind, or falling of water. It is a derivative power, and not the mechanical perpetuity that has crazed too many otherwise good and useful minds. The deep sea soundings are made with a fine steel wire carrying a shot that is detached when it strikes the bottom. The wire is wound on a large reel driven by a steam engine.

(412) A. S. asks: What kind of a battery to use to explode gunpowder, and also how he could make one, and of how many cells it should be? A. Use two or three cells of a plunge battery, such as described in SCIENTIFIC AMERICAN, of December 17 or August 20, 1887. A small length of iron or platinum wire No. 36 must be placed in the circuit embedded in the powder.

(413) F. S. S. asks how to make a battery of sufficient power to run the simple motor? What would such a battery cost? Would it be practical to reduce said motor in all dimensions 50 per cent? Also could you mention a book, of reasonable price, on batteries of different kinds for different uses? A. See

SCIENTIFIC AMERICAN of August 20 and December 17, 1887, and September 3, 1881, for batteries; for an excellent method of making battery plates consult the SCIENTIFIC AMERICAN of October 27, 1888. The battery would cost from two dollars upward. You can reduce the motor, using wire three or four numbers smaller. For general description of batteries, we refer you to SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 157, 158, and 159.

(414) J. E. A. asks: Are there any locomotives built that are driven by electric motors driven by galvanic batteries? If so, what kind of galvanic battery is used? A. Street cars are driven by electricity, the current being derived from secondary batteries. Generally, each car is self-propelling, and is hardly to be denominated a locomotive. A Daft electric locomotive has been tried on the N. Y. elevated road with success. See SUPPLEMENT, No. 687. Primary batteries are too expensive as a source of energy.

(415) J. D. P. asks how talc can be determined, and if there is any market for same? A. Talc occurs in several forms. As massive rock or steatite, it is used in commerce for grate linings, griddles, and similar uses. The finer varieties are used by India rubber manufacturers, tailors, for marking cloth, paper makers and other trades. Its general appearance, slippery or soap-like surface, and softness enable it to be recognized. It can be scratched easily by the finger nail.

(416) C. F. W. asks: 1. Can I use German silver wire in place of silver wire for the single fluid batteries described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157? A. German silver will answer for sulphuric acid solution, but will give inferior results. 2. What kind of batteries would be better for a small electric light, the plunge batteries or the single fluid batteries as named above? A. Use a good sized Bunsen or plunge battery.

(417) P. D. H. writes: 1. I have a quantity of battery cells, and wish to construct glass covers to prevent evaporation. Can you tell me how to proceed to make a hole through the covers to hold the carbons and zinc plates? A. Select a copper or brass tube of the size the holes are to be. Cement a cork the exact size of the bore of the tube upon the glass plate, where the hole is to be. Secure the tube in a brace, place it over the cork, and feed with emery and water, and turn it. The glass must rest very solidly upon a good surface. The tube will soon cut a hole through it. 2. Has the motor described in SUPPLEMENT, No. 641, a reversible motion? A. None has been arranged for it yet. You can do it by shifting the brushes, hut you should have an extra set faced the reverse way. 3. Will ammonia evaporate when subjected to heat, or rather what is the effect when boiled? Does it lose its chemical properties? What are the chemical changes? A. Ammonia evaporates when heated; there is no chemical change, unless we consider that when an aqueous solution is heated, the molecules of ammonic hydrate (NH_4OH) are broken up into ammoniacal gas (NH_3) and water (H_2O). 4. Is there any known formula for regenerating carbons—after being depolarized in use in a sal ammoniac battery—to make them fit for use again? A. Let them stand, or heat them in an oven. 5. Which of cast iron or wrought iron is the best electrical conductor? A. Wrought iron.

(418) D. F. H. writes: What causes the singing of the telegraph wires? Here on the prairies it is sometimes almost defeaning. A. The wind sets them in vibration on the principle of the Æolian harp. They really form an immense harp of this character.

(419) A. G. asks for the best method for making a permanent magnet—shape, temper, and steel? A. Use chrome steel or other good quality of tool steel, drawn to a straw color. Surround it with a coil of insulated wire and pass a strong current of electricity through the wire. This will magnetize it. The shape may be what is known as horseshoe or bar. You will find magnets described in our SUPPLEMENT, Nos. 2, 218, 302, and 318, which we can send you by mail for 10 cents each.

(420) E. P. B. writes: I have a circular glass plate (common window glass), diameter 2 ft. 4 in. I intended to use it for one of the wheels of a Holtz electrical machine, but dropped my plan because I could not get a hole (for the axle) through the center of it. Wearing it with sand takes too long. A glass cutter refused to take the risk, and acids are too expensive. Please let me know several good ways which will accomplish the result, *i. e*, put the hole through center. A. You can drill the hole with a copper tube. See answer to query 417. Experiment on several pieces of glass before you try it on your disk. The glass must be very solidly supported from below. For directions for mounting a plate, with or without drilling a hole in it, consult Bottone, Electrical Instrument Making, pp. 30-36, which we can send you by mail for $1.20.

(421) B. D., Jr., asks: How much of the wire used in making the electric motor should be insulated? A. All the wire should be varnished, and if cotton wound also, the motor will be more efficient.

(422) F. S. writes: 1. Will you kindly inform me through the columns of your valuable paper, the SCIENTIFIC AMERICAN, of which I am a subscriber, which is the heaviest, salt (sea) water or fresh? both being the same temperature, and if there is a difference, what is the cause? A. There is a difference in the gravity or weight of salt and fresh water, due to the weight of the salt held in solution. For sea water, this amounts to $\frac{33}{1000}$ in excess of the weight of an equal volume of fresh pure water. 2. My parents are both German, but I am American born. Am I an American or German-American? A. You are legally an American citizen, but in speaking of your descent, the expression "German-American" is customary and proper.

(423) R. Williams writes: Can you give all the reactions in the preparation and use of a Plante storage battery? A. The lead in the forming process is converted at the one pole into binoxide at the expense of the oxygen of the water molecule by the action of the current (*a*). Then the direction is reversed, and the other plate is oxidized, while the binoxide of lead is reduced to the metallic state (*b*). When ready for action, one electrode is coated with binoxide of lead and the other with spongy lead. When the circuit is completed, the spongy lead takes up oxygen from the water, becoming protoxide (*c*). The hydrogen that goes to the other pole takes up oxygen and reduces the binoxide of lead to the form also of protoxide (*d*). While this is going on, the sulphuric acid in the cell combines with the protoxide of lead, forming plumbic sulphate at both poles (*e*). In the charging process this acid is set free, the sulphate of lead by the electrolytic process being converted into metallic lead on the positive electrode (*f*), and into binoxide of lead on the other plate (*g*). The sulphuric acid thus set free increases the specific gravity of the solution, so that by observation, with a hydrometer it can be determined when the battery is charged. When the lead is completely reduced on one pole, gas is evolved, and this also is an indicator of complete charging. The reactions alluded to above by letter are:

(*a*) $Pb-2H_2O$	$=PbO_2+4H$	forming.
(*b*) PbO_2+Pb	$=Pb+PbO_2$	
(*c*) $Pb+H_2O$	$=PbO+2H$	
(*d*) $2H+PbO_2$	$=H_2O+PbO$	discharging.
(*e*) $PbO+H_2SO_4$	$=PbSO_4+H_2O$	
(*f*) $PbSO_4+H_2O$	$=Pb+H_2SO_4+O$	charging.
(*g*) $PbSO_4+O-H_2O=PbO_2+H_2SO_4$		

(424) W. S. P. asks (1) the formula for carbonated glycerine, an explosive used in shooting gas wells. A. For high explosives see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 674, 627, 552, 466, also a complete work on modern explosives and their use, by Eisler, $4.00, which we can mail. 2. The formula for a white fire suitable to burn in a closed room, and made by dipping sheets of paper in some preparation which is dried and when used the paper is fired. A. Dip in gum water, dust over with magnesium powder and dry. See Techno-Chemical Receipt Book, $2, on explosive agents. 3. The directions for making a megascope, an instrument for throwing an enlarged picture of opaque objects or wood cuts upon a screen. What kind of lenses, the size and length of focus, the focus or curvature of the reflector, and distance from lenses, and the angles of the picture to the lenses and reflector and position of the light? A. For a megascope: Plano-convex lenses of 2, 3 or 4 inches in diameter may be used. The focus may be four times the diameter, set with convex sides toward each other, and ¾ their diameter apart. The general arrangement will be seen in the description of an electric megascope in SCIENTIFIC AMERICAN SUPPLEMENT, No. 640. The reflector may be a little larger than the lenses, of from 3 to 5 inch focus, set behind the light at a distance that the reflected image of the light may just cover the picture, the light being placed at one side, or if two lights are used, then one on each side of the field of the lenses, so that no light will interfere by passing out directly through the lenses.

(425) L. F. writes: 1. I wish to light four rooms of a house with incandescent lights. I wish to run them with a battery. How many cells will it take? What will be the cost to run it by the hour? What will be the probable cost of the lamps, batteries, etc.? A. Your lamps, wire, and general connections will cost about $25. The battery will cost $50 to $100. You will need twenty to thirty cells for each lamp that is run simultaneously with the others. For each lamp allow an expense of 2 to 5 cents an hour. 2. Please give a receipt for the article called sea foam, used by the barbers on the hair. A. Try the following formula:

New England rum	1 pint.
Bay rum	¾ "
Glycerine	2 oz.
Carbonate of ammonia	1 "
Borax	2 "

3. How to make a (cotton) web razor strap? A. Rub the surface with a mixture of washed emery and lard. 4. Also a leather strap. A. Use Russia leather or the skin from a horse's tail. No preparation is needed.

(426) L. E. F. writes: 1. Can you inform me of an economical process of making a good and cheap carbon for Grenet batteries? A. For an admirable method of making carbons from electric light pencils, we refer you to the SCIENTIFIC AMERICAN of October 27, 1888. 2. Also if the current developed by the telephone generator is continuous or otherwise, and what the strength of it is? A. It alternates in direction, and presumably stops for an infinitesimal period as the direction changes. Its strength is exceedingly slight. Mr. W. H. Preece has lately determined that a Bell telephone will respond to a current represented by 6×10^{-13} ampere, or 0·000,000,000,000,6 ampere. One gramme degree of energy would suffice to make a telephone continuously sound for 10,000 years.

(427) G. J. S. writes: 1. What is understood by the technical term or word *volt*, and how applicable in electrical science? A. Volt means the inducing cause of an electrical current, bearing the same relation to electricity that "pounds pressure per inch" do to steam or "head" does to water. One cell of gravity or Daniell's battery gives about 1·07 volts potential. 2. What is understood by the technical term or word *ohm*? A. The unit of resistance offered by a wire or other conductor to the passage of an electric current; 1,000 feet No. 10 pure copper wire represent a little over one ohm. 3. What is the difference between a primary and a secondary current in telephoning? A. The secondary current is an induced current derived from the secondary circuit of an induction coil. 4. What is a storage battery? A. Many are described in our SUPPLEMENTS. Generally speaking, it is a battery that is brought into the active state by the passage through it of an electric current from a dynamo or primary battery.

(428) J. G. asks: 1. What is the value and weight of a cubic inch of pure gold? A. A cubic inch of gold bullion weighs 0·6965 troy pound, and at its present price, $20.66 per troy ounce, is valued at $230.23. 2. Value and weight of a cubic inch of pure silver. A. A cubic inch of silver bullion weighs 0·3788 troy pound, and at its present price of 98 cents per troy ounce, is valued at $5.89. 3. What kind of a small crucible is best to melt these metals in, and can they be melted in a charcoal fire with the aid of bellows? If not, how can they be melted without the aid of a furnace? A. Use the ordinary Hessian or sand crucibles, which may be obtained through the hardware trade, for melting gold and silver, or the black lead crucible, which is safer from breakage. A charcoal fire in a cylinder, with small bellows, or an ordinary cylinder stove with a good draught, are suitable for melting small quantities of gold and silver.

(429) C. A. F. writes: A client of mine is building an apartment house 120 feet by 140 feet, six stories high, in the central portion of this city. He has drilled an artesian well which brings the water within 35 feet of the top of the ground; the well is 223 feet deep, 35 feet being limestone rock, 125 feet white sandstone, the balance very hard limestone. There will be a tank 123 feet from water level at the top of the building. Now the questions are: Where would be the best location for the pump—at the water level, or on top of the ground? How many gallons of water would be needed for say 250 people, hot water, steam for elevators, etc., including provision in case of fire? The well is supposed to have a capacity of 400 gallons per minute. How can we test it? Give the name of a good manufacturer of force pumps. We would like to get at their capacity of gallons per minute. Will the sand rock give way and disintegrate when the pump is at work and the water agitated? Would it not be better to pipe it? Does the water in an artesian well fluctuate, or remain about a normal height? A. The supply of water in various towns for family use, fire and other purposes has a large range in the United States, running as low as 30 gallons per capita in small towns to as much as 100 gallons or more in large towns, or where the sources of supply are abundant. Probably for the above building a daily supply of 50 gallons per capita will be in excess of all demands. This will be 12,500 gallons per day, which should be pumped within 10 working hours, or at the rate of 21 gallons per minute. This will require a vertical deep well steam pump equal to double the required supply, with extra long stroke. The pump bucket should work in the lower end of a tube at about 100 feet down to insure a flow of water at the rate of pumping. This is the cheapest way to test the capacity of the well, for as you have the pump of sufficient size, you have only to lengthen the pipe and rod, if the pump draws the water below the bucket without giving the required quantity. The length of the pump pipe should be so proportioned as to be equal to more than the whole supply required, including the lowering of the water level, or say 200 feet. The pump should be located just above the top of the well. You will require no tubing for the well, as the water probably comes from the sand rock. There are causes that will make the static level of the water in the well fluctuate through the seasons. Address the Deane Steam Pump Company, New York, and American Well Works, Aurora, Ill., for artesian well pumps.

(430) A. D. asks how much pressure there is to the inch in a rifle of 45 caliber, using 75 grains powder and 350 grains lead, and twenty-eight inch barrel. A. The explosive pressure in a rifle is from 30,000 to 40,000 pounds per square inch, according to the quality of the powder and the proportions of weight of powder and ball. 2. And also how much more the pressure is behind the bullet than it is in the front of it after leaving the shell? A. The pressure in front of the bullet increases as it moves toward the end of the barrel, but is only a very small percentage of the pressure behind. 3. When will a wagon run easiest—if the most of the load is put on the hind or on the front wheels? Who can take the biggest load—a good horse weighing 1,500 pounds or a good ox of the same weight? A. Most of the load should be placed on the hind wheels for easiest hauling. A horse can pull a heavier load than an ox of the same weight.

(431) C. F. M. writes: Some time since there appeared at my place of business here, a party engaged in the nickel plating of cutlery, whose claim to the above mentioned mode of plating I think was unfounded, the coating appearing to me to savor more of galvanizing. As an adjunct he had an iron pot in which it appeared he melted zinc, solder or spelter, after which the blades of the knives or forks were put into some sort of acid solution, allowed to stand for the space of possibly 15 minutes before being subjected to the substance melted. Upon removing the articles from the pot containing the melted substance, he put them in some kind of oil, after which they were rubbed dry. Will you kindly inform me through the columns of your issue as to the ingredients that were employed to produce the results attained? I forgot to mention that after the knives were withdrawn from the supposed acid solution, a kind of powder was put into the pot for the purpose, I suppose, of clarifying it. Now, what was the kind of powder used and the substances placed in the melting pot? A. We presume that the knives were plunged in a bath of metallic tin, and that the powder was sal ammoniac. They were not nickel plated, in any sense. The acid may have been muriatic acid; the oil may have been cotton seed oil, or lard oil; the metal may have been block tin or possibly solder. We doubt if it was spelter.

(432) J. H. B. writes: I wish to construct a dry pile. The books say cover a sheet of porous paper on one side with tin foil, on the other with a paste made of powdered peroxide of manganese, etc., cut into disks one inch in diameter, etc., and place in a glass tube. 1. How much of an interval is required for the electricity to acquire sufficient tension to pass through the paper, etc.? A. An hour or more may be required to recuperate the pile after exhaustion. 2. Can a dry pile be constructed that will give a continuous current? A. Through high resistance it will do this when constructed as described. 3. What will be the effect of dampening the pile? The books say such a pile lasts for two or three years as to current and durability. A. Dampening will tend to destroy its action by short circuiting. 4. Can you indicate what the tension would be of such a pile, of say 500 elements? Would it give a slight shock to the nerves? A. Perhaps 100 volts. It will probably affect the nerves a little.

(433) C. A. Y. writes: In this neighborhood is a well which exhibits a peculiar phenomenon. It is on the side of a west slope, about 100 yards from a small creek and is 30 feet in depth. Apparently it is not connected with the creek, as it is not affected in the least by rains, nor have I ever noticed any current of air flowing either in or out of the well. But in the winter ice forms at the bottom sufficiently thick to resist the hardest blows of a heavy well bucket, while between this well and the creek is another well 20 feet deep, the water of which shows scarcely any difference of temperature during the year. This is the only instance of the kind in this country, to my knowledge. Is it a common occurrence or not, and is there any known cause? A. The water in the water-bearing strata where wells are sunk is supposed to be always moving toward a lower level at a rate corresponding to the declivity of the strata and coarseness of the sand. In wells where this movement is large the water is always sweet by circulation and not liable to freeze in coldest weather. In wells that happen to be located in a sluggish current, or in a pocket that only draws its supply scantily from every direction, there is more liability to become foul in summer and to freeze during the coldest weather. Such wells require frequent cleaning. It is the circulation of the cold air by gravity in contact with the still water that causes freezing.

(434) D. E. writes: Will you tell what sizes of wire to use to wind the simple electric motor, so as to use the Edison current instead of battery? Also you say in one number that it would double the power to increase the lineal dimensions one-half. Does that mean to make the spool three inches long instead of two and of no larger diameter? A. Connect it in shunt on the Edison circuit. Increase all lineal dimensions in same ratio, make the spool half larger diameter, etc.

(435) E. W. W. writes: Can I use Leclanche cells for lighting a one-candle Edison lamp for periods of from five to ten seconds, three or four times in twenty-four hours? If so, how many cells will it require? A. They are well adapted for this use. You will need five cells.

(436) A. P. G. asks: What is the process for printing from plate engravings, that is a flat copper plate engraved backward? Is a common letter press used for it? A. A roller press is used. The plate is inked and the smooth surface is wiped clean, the engraved lines retaining the ink. The paper and plate are then passed between the rollers of the press, when the ink is transferred to the paper.

(437) P. Van S. asks how the solution of annatto is made and what from. A. It is extracted from the outer part of the seed of *Bixa orellana*, an evergreen, a native of Brazil. Alcohol may be used for its solution.

(438) A. G. writes: I would like to know how to color a meerschaum pipe or cigar holder so that it will be black as ebony, without smoking it? A. Try aniline blacks, or logwood extract in water, followed by treatment with a solution of copperas.

(439) F. B. writes: In edition No. 3, vol. 60, I see question No. 161, F. B. C. asks: Could I charge storage battery of one cell, with static electricity generated by a belt? You answer him, practically, no. What is the matter with using an old incandescent lamp or other form of Leyden jar as a discharger grounding through an inverted induction coil or transformer? (Please remember I am only asking a question.) The static discharges being always in one direction, would the low potential discharges be in one direction also, or would there be two impulses, due first to magnetizing, and a second to demagnetizing? If the static electricity from the many belts of large mills could be used this way, would it not be of some use? A. The method seems impracticable, as there is but little electricity given off by a belt, and, when redneed in potential it would be hardly perceptible. The induced discharges would be in two directions. If the belts produced any quantity of electricity, they would run stiff in proportion to the electric energy developed. You cannot get something out of nothing.

(440) D. O. B. writes: What power is required for an eight-light dynamo, and is there a small engine built that would run the dynamo mentioned? A. You need about one horse power. For addresses of engine builders, consult our advertising columns.

(441) H. & R. ask: Cannot a high grade of steel be told by the color and the grain? Are they not evidences of high grade and fine quality? Also, is not a fine quality of steel susceptible to taking and holding temper, as a coarse or loose grained steel is not. Our remarks are in connection with cutlery steel? A. Much information as to the quality or grade of steel can be had directly from observation of the grain by fracture and its ease of breaking. The fineness of the crystalline surface and its color, as well as its toughness in breaking, are the leading points of observation with buyers of steel at first sight. Its qualities in hardening are the final test, and require much care, as most grades of steel require special manipulation in amount of heat and manner of hardening and tempering for various kinds of tools. The finer crystallization is generally preferred for high duty tools. Cutlery steel requires elasticity, and is generally made from the lower grades, which have special names, as double shear, shear, or spring steel. These have a coarser grain than the fine tool steels. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 505, for an interesting article on steel.

(442) S. P. F. asks about a wheel revolving along the ground. (Plane surface.) 1. Does the wheel revolve around its center or not? If not, why? A. Every revolving body has a center of revolution. The center is not a revolving body, but is an imaginary axis occupying a neutral point within the forces generated by revolution. 2. Does centrifugal force act with equal intensity on all points equidistant from the center of the wheel, or not? A. Yes; in a perfectly balanced wheel, in which the materals contributing to centrifugal force are equally distributed throughout the mass. 3. Are not the top and bottom of the revolving wheel the extremities of an infinite number of straight lines drawn through its center perpendicular to the infinite number of points of contact with the ground, in other words, a line parallel to the surface along which the wheel is revolving? A. Yes. 4. Does the top of the wheel revolve with greater velocity than the bottom, or than any other point equidistant from the center? A. The top and bottom of a wheel rolling along a straight surface move in a straight line, yet the wheel revolves around a common axis. The top and bottom of a rolling wheel move only as fast as the axis. The peripheral velocity at the top of the wheel is twice as

great as the rectilinear velocity of the axis. The periphery does not move at the bottom. All parts of the periphery move with equal velocity around the axis.

(443) M. A. P. asks (1) how to make paste such as bookbinders use. Do they use glue or flour paste? A. Ordinary flour paste is generally used, though sometimes a little glue is added to make the paste tougher. Some antiseptic, such as carbolic acid or alum water, is added to prevent souring. 2. How engravings are made by the process known as "zinc etching." Is it the same as producing engravings from zinc plates by the action of acids? A. The process is the same in principle, but in the ordinary "process" plates, for printing with types in a form, the blacks are in relief and the whites sunken, while in an etched plate the whites are in relief and the blacks sunken, the printing then being done as that of a steel engraving. Nitric and muriatic acids, of various degrees of strength, are used in each case to bite out the metal. 3. Where can the zinc plates be procured, and what are their cost? A. Most large electrotyping establishments could furnish them to order. They are not on sale by dealers, and are specially prepared of soft zinc, with a surface as smooth as glass, by an expert in this line. 4. Would like a short description of how electrotyping and stereotyping are done. A. For electrotyping, the type form is well brushed over with plumbago—a wax mould is then taken, and a thin electro deposit of copper made therein. This thin deposit of copper is stripped off and baked with type metal flowed on. For stereotyping a plaster cast is made of the face of the type to form a mould—or the mould may be made of a kind of papier mache substance beaten into the face of the form. The face moulds so made are placed in another mould or form to give the proper body or backing and receive the melted type metal.

(444) D. T. E.—Printers' rollers are not usually made with India rubber, except such as are used on newspaper presses maintaining a high rate of speed. For ordinarily fast presses on book work the following is a good composition: 10½ lb. best glue, 2½ gals. black molasses or honey, 2 oz. Venice turpentine, 12 oz. glycerine. The quantities of glue and molasses will be slightly varied according to the season, comparatively more glue being used in summer than in winter. If French glue is used, it will be necessary to let it soak overnight to take up the right quantity of water, but most domestic glue will take up sufficient water in about two hours. The turpentine and glycerine should be added and well mixed with the composition just before pouring. When rubber is used to make the black composition described in the SCIENTIFIC AMERICAN of January 12, the rubber should be cut in fine shreds and dissolved in benzine, ether, or bisulphide of carbon, *not* in alcohol. It should be mixed with the turpentine and added to the composition the last thing before pouring, the glycerine and vinegar being mixed with the glue and molasses a short time earlier, after the latter has become well combined in a kettle in a water bath over the fire or in a steam-jacketed kettle.

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.

(445) M. E. G.—Please state why throwing salt upon a fire will put out a burning chimney? Also please state how the magicians do the trick of raising tables, chairs, etc., by simply laying their hands upon them? This is an old performance, and is now being done by Kellar.

(446) H. B. H. writes: Will you please advise us of the mixture used for coating iron so as to give it the dull black finish seen in chandeliers and andirons? It is called Berlin black, and will not rub off.

Replies to Enquiries.

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

(20) Halifax.—Relief Maps.—Although not sure of the method used in Germany, there is one way which, although it involves considerable expenditure of time and materials, produces a map in relief which is extremely accurate and would command extensive orders were the work carefully and accurately performed. Suppose you have a map of a section of country on which are marked contour lines made by passing horizontal planes at vertical distances of ten feet, or any other distance. Take sheets of cardboard so that the thickness shall represent one foot, then ten superposed will give ten feet. The thickness of the cardboard is of course the unit of your scale, both vertical and horizontal. Now cut out pieces of cardboard of the same size and shape of the horizontal space embraced by the different contour lines. Then on your map draw in between the contour lines and approximately parallel to them nine other lines, and cut pieces of cardboard corresponding to them. Superpose these in their regular order, and you have the rough formation in relief of your map. The pieces of cardboard are pasted together and carefully pressed to keep the whole mass uniform. Then smear wax over the whole, in order to make a smooth surface. Different colors will represent roads, grass, rivers, etc. Trees or forests can be represented by dried green moss. Houses and other buildings and constructions are made of wax. In the practical work of making such a map, other details may come up, but they will generally be such as will present little difficulty to any one at all conversant with modeling. The chief difficulty lies in procuring maps with contour lines marked on them.—S. R., Jr.

(245) C. T. I.—Battery Zincs.—The writer has had very good results from zinc plates, built up from thin sheet zinc (stove zinc, the only zinc to be had at the time). These plates were built up by folding over and over and hammering down the fold each time, so as to produce a compact plate of the size required. Building up by cutting several pieces, all to the size required, and then fastening together, was very good, but not so good as the building by folding a long strip. No trouble was had in amalgamating, as the thickness of the plate, after being built up, made it stiff enough to stand well, though the mercury struck clear through each sheet, as was the case. The extreme top of the plate, to which the copper wires were fastened, was not amalgamated, for say a half an inch, to avoid breaking and the brittleness that would have resulted had this end been amalgamated. These plates stood long and severe use, kept their amalgamation perfectly, and consequently never showed any local action. Riveting the plates could not well be done, unless zinc rivets were used. Any other metal would at once make local action from the galvanic couple that would be set up by its presence in the zinc plate, even though it was amalgamated. The four-cell battery mentioned would prove all right if the motor is wound for a low tension current. It would be better yet to use five carbons and four zincs, so as to have a carbon plate for the outside on each side of the cell, and so reduce resistance by having each zinc plate with carbon plate on each side of it. The size of receptacle will, of course, determine whether this can be done or not, and the winding of the motor will determine whether four or eight cells should be used.—C. D. P.

(320) S. L. F.—Stay Bolts.—The pressure or strain upon a stay bolt in series forming squares is the square of the distance multiplied by the pressure on the boiler, or in your case 6 in. × 6 in. × 100 lb. =3,600 pounds strain on the stay. If the areas are not squares, divide the distances between stays and average for the area.

(321) S. H. P.—Propeller.—You will require 65 horse power, besides power required for friction of engine and shaft, and a propeller of four blades, 38 in. in diameter.

(329) D. Y. M.—Softening Water.—See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 629, 270, 187.

(329) How to Soften Water.—If the hardness is due to calcic carbonate, it can be removed by boiling the water. If it is due to calcic sulphate, it can be removed by adding sodic carbonate (common washing soda). In the last case two new substances are formed. One is insoluble and settles, the other is soluble, but does not act on soap.—W. F. W.

(330) S. T. R.—Steam in Boiler Furnaces.—Steam from the boiler or exhaust has been used many years for increasing the intensity of the fire by injecting it under the grate when the draught is otherwise good, or otherwise by using a steam blower which carries a portion of steam under the grates with the air. One of the oldest practices among engineers or firemen is to wet the ashes or throw water on the ash hearth, which evaporates and feeds the fire with moisture. The steam in contact with the hot coal is decomposed, producing carbonic oxide and hydrogen, which are both combustible in contact with air.

(334) W. L. G.—1. Starch granules may be well mounted dry, but best in Canada balsam. If the grains are laid upon the slide, and as small a portion as possible of balsam diluted with turpentine be applied, they will cling to the slide and allow pure balsam to flow over them without making air bubbles. To mount blood corpuscles, cover the slide on the spot required with a coating of blood as thin as possible and allow it to dry. Fasten on cover with a ring of varnish. 2. Raphides are often mounted dry, but are easily mounted in balsam. 3. The highest power of the Lick telescope is about 4,000 diams. For microscopic mounting consult Mr. Davies' useful little book on "The Preparation and Mounting of Microscopic Objects."—Wm. H. P.

(335) L. W. S.—Cyclones.—1. In the first place, do not call them cyclones; that is a misnomer that the public has fallen into, thanks to the daily newspapers. They are *tornadoes*, not cyclones. Cyclones are storms of a very different character. They are like tornadoes only in one respect, namely, they are both rotary storms. The tornado is a funnel-shaped column of disturbed air, generally about forty or fifty yards in diameter, rotating about a nearly perpendicular axis. It forms in the upper air a few miles overhead and works down to the earth. Its track is generally not more than twenty-five miles until it disappears into the upper air from whence it came. They are caused by strata of warm and of cold air struggling against each other. Take, for example, the tornadoes which struck Pittsburg, Reading, and Brooklyn, last January. They were only local incidents of a general storm, the diameter of which was about 500 miles. The center of the storm was between Chicago and Grand Haven, Mich. Draw a circle of 500 miles radius from the general storm center, and you will find that in the southeastern quadrant of that circle tornadoes will form and will move toward some point in the northeastern quadrant. At 8 o'clock A. M. on January 9, there were southerly winds and very high temperature along the south Atlantic coast. In Florida the temperature was over 70°, while in Pennsylvania it was below 30°. The isothermic line for that day bulges up at Chicago and drops violently downward through Pennsylvania and Northern Virginia. The hot air south of the isothermic line was struggling to get northward, and the cold air north of the line was struggling to get south. It was this struggle that caused the tornadoes. Normally the air is much warmer on the earth's surface than it is skyward, but on January 9, if you had gone up in a balloon at Pittsburg, you would have struck warmer air as you went up. The line where the warm and cold air comes into closest contact was the line where the tornadoes formed. 2. There were probably just as many tornadoes then as now. Remember that they are storms of a very limited area, and in a sparsely settled country they would easily escape observation.—H. S. W.

(336) E. W. T.—Gold Lacquer for Tin.—Use thin copal varnish slightly colored with turmeric and bake in an oven. You can buy the varnishes of any required color for stamped tin work from F. W. Devoe & Co., New York.

(364) M. S. O'K.—Stationary Point in Piston Stroke.—The piston stroke of an engine comes to a dead stop at the end of each stroke in theory as well as in practice. So far as visible means can tell it starts immediately on its return stroke, but actually in theory and in practice it stops for a space of time varying, it may be, with the number of strokes per second, friction, etc. The well known formula for space, s, passed over in time, t, in seconds at a velocity, v, feet per second, is $s=vt$, make $v=0$, as it must be at the end of the stroke, and $s=0$, which indicates theoretically a state of rest.—S. R., Jr.

☞ 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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