RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

GRAIN-SHOCKER.—E. COWIN, York, N. D. The shocker is adapted to be used in connection with a binder, and has means for receiving the bundles of grain from the binder and arranging them upon a carrier to form a shock, and has means for releasing the carrier, whereby the shock is positioned upon the ground and the carrier withdrawn from under the same by the forward movement of the machine. Used in connection with the binder, it has actuating machinery operable from the driving mechanism of the binder.

Of General Interest.

AMALGAMATOR.—W. F. BEDELL, North Yakima, Wash. The amalgamator is designed for treating placer material, dredge material, and mill and slime material, and is arranged to insure the complete separation of the heavy valuable particles, such as platinum, coated gold and the richer parts of amalgam, from the tailings. The invention relates to amalgamators such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Bedell.

STRINGED MUSICAL INSTRUMENT.—S. W. BUERCKLIN, Prague, Oklahoma. The instrument may be arranged to be picked in the manner of a guitar, mandolin, etc., or played with a bow in the manner of violins, violas, etc. The sound is amplified by the body when a hollow body is used, and is transmitted by the bridge to sound boxes and amplified by horns. These horns are arranged low enough not to interfere with the bow, and one horn may be put out of the way when the instrument is used in the manner of a guitar.

MOVABLE BARRAGE HAVING ROTARY SLUICE-PONTOONS.—E. M. AUDOUIN, 12 Rue du Jardin des Plantes, Poitiers, Vienne, France. The following requirements are met by this invention. Ease and rapidity of working in opening and closing the barrage. Security of the movable parts, especially during floods and frost. Perfect barrage (i. e., freedom from leakage). Possibility of varying at will the level of the water held back. Cheapness of construction. The barrage is constituted by pontoons in the form of closed tanks capable of being floated or sunk to the bottom according to the quantity of water let into them.

WRITING-TABLET.—M. A. DREES, Peshtigo, Wis. The invention relates to letter sheets and tablets therefor, the more particular object being to provide a device in which one or any larger number of sheets of paper may be kept temporarily together, and arranged in connection with suitable parts for facilitating the folding and pasting of the letter sheets.

MOLD.—F. B. HARDING and J. J. BRUBECK, Rockville, Ind. In the present patent the invention has reference to the manufacture of concrete fence posts and like articles, and the object in view is to provide a new and improved mold which is simple and durable in construction and readily adjusted for making posts of different sizes.

FIRE-TANK.—J. W. KANE, New York, N. Y. This invention relates to improvements in fire tanks as are ordinarily located at the top of large buildings for fire extinguishing purposes, the invention being directed to a novel heating arrangement acting to prevent the water in the tank from freezing in extreme cold weather.

ADJUSTABLE SKID.—W. MCCADDIN and G. SUTHERLAND, New York, N. Y. The invention relates to skids designed to be used in unloading heavy rolls of paper. The invention has for its object the provision of means adapted to permit rolls of paper of different length to be readily up-ended from a skid without damage or injury to the paper.

Hardware.

FAUCET.—P. F. CAVANAUGH, La Crosse, Wis. The invention relates to faucets used for plumbing or other purposes, and is especially useful in connection with faucets which automatically shut off the flow of liquid when released. It will not permit the leakage of water when it is not in use, and which is closed by the pressure of the water.

Heating and Lighting.

GAS-LIGHTER.—J. PASTERNAK, New York, N. Y. The object in this case is to produce a device which can be readily attached to an ordinary gas lighter, and which will operate as a shield or cover for the flame so as to protect the chandelier or fixture from the flame in the act of lighting the gas.

COMBINATION GAS AND GASOLINE BURNER.—G. A. MANSHARDT, Naperville, Ill. In this patent the object is to provide a combination gas and gasoline burner arranged to permit of burning gas or gasoline in such a manner that it requires no tedious waiting for producing the desired flame when gasoline is used as the fuel.

Machines and Mechanical Devices.

TIMEPIECE-REGULATOR.—R. G. NORTON, Madison, Wis. The invention relates to chronometers, watches, and like time-pieces, and its aim is to provide an improved regulator, arranged to permit easy and accurate adjustment of the hair spring of the balance, with a view to accurately regulate the vibrations of the balance of the time-piece.

DRILL.—J. D. TULLY, Pearl, Colo. The inventor provides means for operating a plurality of drills from a single source of power, means being such that a gang of drills may be placed along in a row in a straight or crooked line at the same or different levels, and connected to each other and to a single source of power, the particular connecting means being shafts and tumbling joints, to transmit power. Clutches are provided at each drill, so that one or more drills may be stopped as desired, and friction clutches are used, so that if one drill becomes caught its clutch will slip and the others continue to operate.

SHAFT-COUPLING.—W. A. PERRY, New York, N. Y. The invention relates more particularly to that type of coupling which includes a casing surrounding the adjacent ends of the shafts to be coupled, and including a wedge forced into position by the action of a key. The coupling operates with the same efficiency irrespective of the direction of rotation of the shaft, which is easily applied, and cannot possibly work loose.

THERMOSTATIC CONTROLLER.—C. A. DUNHAM, Marshalltown, Iowa. The invention has reference more particularly to means whereby a thermostatic device disposed in one conduit or passage may be operated not only by a variation in the temperature of the fluid in that conduit, but also by a variation in the temperature of a fluid flowing in a conduit separate and distinct therefrom.

Railways and Their Accessories.

CAR-TRUCK.—G. ROUY, New York, N. Y. The invention provides a truck for railway or other cars having the inventor's special truck mechanism applied thereto, and so constructed that the parts of the truck mechanism are rigidly held and braced. Screw posts controlling the brake beams which carry the brake shoes, cross frames and transoms forming supports for the posts, the transoms serving rigidly to brace the frame, and a bolster resiliently supported by the longitudinal frame members of the truck and cross frames are provided.

Pertaining to Recreation.

SCORE-BOARD.—J. P. KEENAN, Waterbury, Conn. The invention relates to games played on bowling alleys. The board is arranged to permit the use of a continuous sheet of plain paper, and allows of cutting off and removing a filled-in portion after the game is finished, thus providing a permanent record of the game and presenting a clean portion of the paper, for scoring the next game.

Pertaining to Vehicles.

MEANS FOR AUTOMATIC CLOSING OF PUNCTURES IN PNEUMATIC TIRES.—J. LINDHARTH, Aaboulevarden 6, Copenhagen, Denmark. The invention has for its object an arrangement and method for the automatic closing of punctures in pneumatic tires of cycles, automobiles and other vehicles, and the like, caused either by involuntary damage during the riding or by willful injury. This is accomplished by introducing into the tube an adhesive fluid of suitable composition and consistency and enveloping the tube by a loosely fitting bandage consisting of a soft, non-elastic and fibrous substance.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Full hints to correspondents were printed at the head of this column in the issue of November 14 or will be sent by mail on request.

(11076) C. M. G. writes: A remark was made about a local drunkard, and it was stated he had consumed enough whisky to "float a battleship." A bystander said that would not be much, as he could float the "Dreadnought" with one gallon of water. By making a skin exact shape of ship under-water body and 1/100 inch larger, he could support ship with one gallon of water. Others claimed that at least the weight of ship in water must be in tank before ship would leave the bottom, and cited the law of gravity, where a floating body displaces exactly its own weight of water. The other "school" claims that if ship was set in dry tank and water was poured in, when water level rose in containing tank to her normal waterline that ship would rise, citing the fact that the head of water, say 26 feet, would exert hydraulic pressure on bottom as per Pascal law and support ship. Personally, I am as much at sea as the alleged ship ever was, and think that the ship and water will act the same one place as another. It is evident that ship in free water of ocean must bear down upon water under bottom with exactly same force as water at head in feet of bottom below surface forces up, else ship would either sink lower or rise higher until such would be the case. Another view is this: Take the 10,000-ton ship, set her down in free water, and she displaces 10,000 tons of water. Place ship in a balance, and the displaced water at other end of balance beam at same distance from fulcrum, and the two will balance. Put the gallon of water in place of 10,000 tons and set ship on, and as party stated it, "the water would be thrown clear over the moon." I have strung this out further than a concise statement of problem would require, but do it to give you the spirit of the argument, and hope you can show us where we are both wrong, as I certainly think we are. A. The argument is not at all an uncommon one, and was discussed at some length in our Notes and Queries some months ago; the question came to us in terms almost identical to those of your letter and the "school" among your friends which discredits the possibility of a ship's being supported by so small a quantity of liquid, may be consoled to hear that it created a somewhat heated argument among some of our specialists, who are at least practised controversialists in such problems as well as trained in physics. All your reasoning on the subject is entirely sound, except where (perhaps quoting another) you refer to the hypothetical conditions arising if the ship could be placed on one side of a balance and the gallon of water on the other. It is unquestionably the case that if a "Dreadnought" were placed in a drydock of so nearly the same shape and size that it were at no place more than 1/100 of an inch away from the hull, and that 1/100 of an inch thick space filled with water up to the load waterline of the ship, the ship would actually *float* (a gallon of water would not begin to fill such a space in the case of the "Dreadnought," it would take 50 gallons at the very least, but the *amount* is beside the point, and may be referred to as a gallon). The gallon of water does not *balance* the ship; it is the difficulty of getting away from the idea of balanced weights that causes so much controversy on the subject. One is inclined to think that the enormous weight of the ship must *squeeze out* the thin film of water and rest on the bottom, forgetting the pressure due to head, which is independent of the thickness of the film. It is of course true that the weight of water displaced by a floating ship is equal to the total weight of the ship, i. e., the ship weighs as much as the quantity of water which *would* fill the space occupied by its submerged part *were the ship not there*. What would balance the ship in your case is not the gallon of water in which it floats, but something that is not there, namely, the quantity of water which would fill the same space were the ship removed, and which would have to be there filling the imaginary dock up to the same level in order to create at the bottom of the dock the same hydrostatic pressure as is caused in the 1/100-inch film by the weight of the ship. That such a pressure may be present in so thin a film to balance the weight of the ship is unquestionable; it is an absolute axiom of physics that the pressure of water is directly proportionate to its depth entirely regardless of the shape or size of the containing vessel. If you have a closed box a foot square and a foot high, full of water, and a pipe of only ¼ inch diameter projecting from the top to a height of 233 feet (the "head" corresponding to 100 pounds per square inch pressure) there will be 14,400 pounds pressure on the bottom of the box, exactly as if the box were a foot square all the way up to 233 feet; and in exactly the same way sufficient hydrostatic pressure to support the ship may be transmitted in your 1/100-inch film. You may therefore tell your friend that as far as purely hydrostatic principles are concerned, he may safely claim that he can drink—not, we hope, at a sitting, but in a month or two—"enough whisky to float a battleship."

(11077) J. M. asks: Am I correct in thinking that the Mitchell lifeboat (a rough sketch of which has been sent you under separate cover) should pull easier against a heavy wind than the lifeboat at present in use on both sides of the Atlantic? This boat, being covered and smooth, pulls fast with only four oars, draws very little water and easily steered, weight 1,400 pounds, seated for 24 persons. It seems to me that a boat made on this plan, large enough to require 8 or 10 oars to propel, that the open boat must be the hardest to pull against a heavy wind with all the men offering resistance to the wind as they sit in their positions; the open boat must also offer a good deal of resistance, especially in descending a wave. I would like to know how the weight of this covered boat compares with the open boat of the same capacity. A. We should certainly say that a lifeboat as shown in your sketch would pull more easily against a head wind than the ordinary lifeboat, supposing it to be submerged to the same depth. Whereas, for the purposes of comparison, it may be considered roughly as an ordinary lifeboat with a lid on, one would at first sight suppose that a boat of that structure would be heavier than an ordinary lifeboat of equal capacity, but on account of the cigar-like shape lending itself to greatest rigidity with least material, we should say that your boat could be built with no more, and possibly even less, weight of material than an equivalent boat of older pattern.

(11078) J. T. asks: Will you kindly explain through your columns a phenomenon observed while looking at moving pictures? The wheels of rapidly-moving vehicles sometimes revolve in one direction, sometimes in another, and sometimes are stationary relative to their axes. I explain this as follows: If the interval from the moment the spoke of a wheel leaves any certain position till the following spoke occupies that position coincides exactly with the interval between each successive photograph, then the wheel will appear not to revolve. If the interval is shorter for the wheel, it will seem to revolve in a contrary direction; if longer, it will revolve in the direction of the vehicle. As this apparent absurdity detracts from the realism of certain pictures, perhaps a discussion of the laws involved may lead to improvements. A. Your explanation of the phenomenon of a revolving wheel on a vehicle in a moving picture is, we think, the correct one. There does not appear to be any way in which it can be remedied. It is inherent in the nature of the motions of the apparatus.

(11079) W. W. S. asks: Will you kindly inform me what causes the compass to point north? Is it the influence of the North Star or the North Pole? Has the North Star any influence or control over the compass? A. The magnetic needle comes to rest pointing north and south because the earth acts as if it were a great magnet. A compass needle would come to rest pointing lengthwise of a bar magnet placed under the compass needle, just as it does under the influence of the earth. For this reason we think of the earth as a great magnet. The North Pole and the North Star have no influence over the compass needle.

(11080) L. G. McA. asks: Kindly advise me in your Notes and Queries column if it is possible to intensify a thin negative which has fairly good details but is in such a condition because taken in such strong light, such cases as happen at the seashore in most amateur photographing. If you can give me a solution with operation for same, your kindness will be appreciated by a reader. A. The best intensifier we have ever used is prepared as follows:

Solution No. 1.

Mercuric bichloride.....	240 grains
Ammonium chloride.....	240 grains
Water, distilled.....	20 ounces

Solution No. 2.

Ammonium chloride.....	240 grains
Water, distilled.....	20 ounces

Solution No. 3.

Part A.

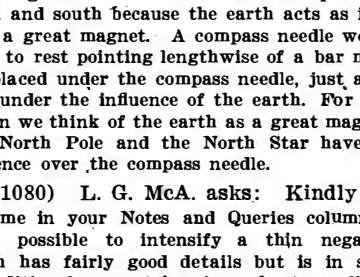
Potassium cyanide.....	120 grains
Water, distilled.....	12 ounces

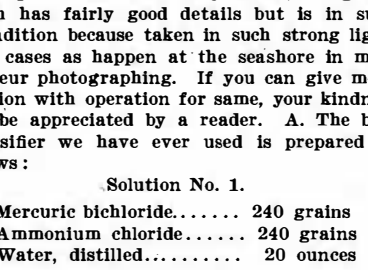
Part B.

Silver nitrate	120 grains
Water, distilled	4 ounces

Add B to A, pouring in a little at a time, with stirring, to dissolve precipitate, as long as the precipitates dissolve. To intensify a plate, soak it in Solution 1 according to increase of density desired. For full intensification soak till completely whitened on the back side. Rinse and soak in No. 2 for a minute. Rinse again. Soak in No. 3 till the film is blackened and all whiteness disappears. Wash thoroughly and dry. Some of the best printing negatives we have seen have been made by intensifying with these solutions. No. 2 may be used repeatedly, filtering when necessary. Nos. 1 and 2 had better not be used more than once for best results. Be very careful with the potassium cyanide. It is one of the most deadly poisons. On no account put the fingers into the mouth after having them in the solution, until they have been washed with soap and water. Mercuric bichloride is popularly called corrosive sublimate. It too should be handled with care. These solutions should both be kept where children and prospective suicides cannot have access to them.

(11081) A. J. B. says: 1. What would be the force in pounds exerted at point *A* in Fig. 1, with the end of the rope fastened at point *D* and a force of 1,000 pounds pulling at point *B*, the other end of the rope? The direction of the two parts of the rope is such as to make the angles between *A* and *D*, *A* and *B*, and *B* and *D* 120 degrees each. A. The force exerted at point *A* is the resultant force of *D* and *B*, or 1,000 pounds.





2. Please explain the term "triangle of forces." A. If three forces acting at the same point balance each other, they are proportional to the sides of the triangle formed by any three straight lines parallel to their directions. Example: In triangle *A D C* of Fig. 2 we have angle *C* equal to 90 degrees and angles *A* and *D* each equal to 45 degrees. Let side *A D* or the hypotenuse of the triangle represent a force of 1,000 pounds. Then, by

the use of the following rule the other two forces $A\,C$ and $D\,C$ can be found. Rule for right-angled triangles: The side opposite an acute angle equals the sine of that acute angle multiplied by the hypotenuse of the triangle.

Therefore $A\,C$ = sine of $D \times A\,D$,
and $D\,C$ = sine of $A \times A\,D$.

From table sine of A and D or 45 deg. = .707
Therefore $A\,C$ and $D\,C$ = 707 pounds.

(11082) C. J. H. asks: What is the most desirable formula for making soap bubbles? I am in doubt in regard to the amount of glycerine and soft soap to use and as to whether there were any other ingredients that could be added to advantage. A. A good soap bubble solution is not to be obtained by simply mixing soft soap and glycerine. It is very difficult to secure a good solution. Only the purest oleate of soda, or the best white soap, white Castile for example, can be used. Only the best glycerine can be used. Price's glycerine is reliable. The manipulation is tedious. If, however, you wish to undertake it, proceed as follows: Take the purest caustic soda 1 part, and dissolve in distilled water 40 to 50 parts. All parts by weight, of course. Take pure oleic acid. Set it for a few days in a refrigerator and decant the clear fluid, if a separation takes place. Of this take 7 parts, and mix with the soda solution. Shake till the reaction is complete. Now add water up to 350 parts with the previous water. To two measures of the oleate of soda add one measure of Price's glycerine. Run no risk with poor glycerine. Let this stand a few days in a cool place, and siphon off the clear solution, which is to be used for soap bubbles. Some add a little ammonia to this, but it works well as we have given it.

(11083) M. E. P. asks: 1. I am operating a single-phase light plant with about 800 lights. My transformer and lines are nearly all overloaded. Could I raise the voltage from 1,000 to 2,000 volts and use 200-volt lamps in place of 100-volt, or would it be better to parallel the secondary coils in the transformer and still run 100-volt lamps and change the generator to 2,000 volts? A. An additional generator to relieve the overload is a more natural solution of your difficulty than to change all your lamps and transformers, since 2,000 volts is a much greater strain on the insulation everywhere than 1,000 volts is. 2. What voltage is required to make a 15-inch spark, such as is given by a static machine? A. We have not exact data at hand for the voltage required to force a spark through 15 inches of dry air under all circumstances. A paper read before the American Institute of Electrical Engineers showed that 150,000 volts were required to force a discharge between points, and that a different pressure was necessary if spheres, disks, etc., were employed. We have from time to time published valuable papers concerning the work of Prof. Trowbridge, of Harvard University, in this direction. These can be had for ten cents each. 3. Is the current or discharge from a static machine giving 15-inch spark, such as is used in X-ray work, dangerous? Will it produce death? A. A discharge through 15 inches of air is a very dangerous current to encounter. Any discharge from a coil capable of giving such a spark should be avoided. The only safe rule is not to touch the secondary while the coil is active; and if necessary to touch any part of the apparatus, to place the hand not in use behind the back. No circuit can then be made through the body from arm to arm. 4. Will the 200-volt lamp last as long as the 100-volt? A. One of the largest lamp makers says of 200-volt lamps: "Owing to the increased strain to which the carbons or filaments are subjected by the high voltage, these lamps are uncommercial except in the lower efficiencies. The efficiency of our regular product is 4 watts per candle, and in its average life and maintenance of candle power it corresponds to our standard 100 to 125-volt 3.1 watt lamp." This shows that it will cost more to run a 200-volt lamp than a 100-volt lamp for the same candle power.

(11084) B. W. L. asks: If a bridged, grounded telephone wire came in contact with one wire of a lighting circuit carrying 5,000 volts, would there be any disastrous effects to either? A. It would be very bad for the telephone. You would need to put in a new one, since there would not be much left of the old. 2. If one wire of this lighting line were to break and fall across the telephone wire, what would be the probable effect. A. If these wires were bare, the best course would be to call out the fire department immediately. In the description which you give of what took place in your case, we judge that there was no contact of bare wires, and perhaps no wires came into contact at all. The swinging of the light wire near your telephone wire would produce all the phenomena you describe; while the fact that you could get no circuit from the ground showed that the wire had not broken and fallen anywhere along the line.

(11085) J. R. H. asks: Do you have a SUPPLEMENT that treats of intercommunicating telephones and setting up and construction of same? A. We have no article giving practical details on this point. You can find various systems described in Miller's "American Telephone Practice," price $4 by mail.

(11086) O. M. S. asks: 1. How may opaque objects be seen under the microscope? A. By the use of the bull's-eye condenser, a lens which will focus the light of a lamp upon the upper surface of the object. One of these usually accompanies a microscope. 2. How can the glimmering of artificial light be overcome? A. If the light is too strong turn the reflecting mirror till the field is illuminated to suit your eye. Shaded glasses can be had from dealers in microscopes which cut down and also color the light agreeably. These may be blue or gray. They are also made so that they are deeper in color in one portion than in another, and a nicer adjustment may be made of the illumination. 3. Will the best window or plate glass do for glass slips to use with a microscope of sixty-five diameters? If not, why? A. Any sort of glass will answer if it is smooth. It is better to buy the regular slips. These are 3×1 inch and are polished on the edges. They present a much better appearance than pieces of glass cut and left rough. 4. What proportion should the liquid, zinc and carbon be for a bichromate cell? A. A good bichromate mixture is composed of water 100 parts, potassium bichromate 17 parts, and sulphuric acid 10 parts, all by weight. The zinc and the carbon may be of any size which the battery jar will hold. It is better to have a carbon on each side of the zinc, two carbons to each zinc. This gives a larger current and utilizes the action on both sides of the zinc. 5. How to make an induction coil which will not induce a current strong enough to kill a person. A. A good induction coil is described in SUPPLEMENT, No. 160, price 10 cents. It is not necessary to injure one's self with a large coil. A simple rule for safety is to put the left hand in your pocket or behind your back when doing anything to the coil with the right hand, if the coil is running. 6. What are the preserving fluids used in the museums and laboratories? A. Alcohol is the fluid ordinarily used in museums for preserving specimens in jars and bottles.

(11087) R. B. asks: Could you please tell me why a lamp chimney becomes heated when placed on a lighted lamp, glass being diathermanous for luminous rays of heat? A. A lamp chimney becomes heated because there is a hot mass of matter inside it. So does the earth's atmosphere by the sun's rays. The atmosphere absorbs about 40 per cent of the rays of the sun, so that they do not reach the earth at all. The flame of a lamp is luminous from solid particles of carbon in the flame. This radiates heat. The glass intercepts much of that heat, and by this it is itself heated. There is no substance which can transmit all the heat which strikes it. Glass becomes hot in the sun's rays.

(11088) L. H. H. asks: 1. What size spark should an induction coil give in order to give satisfactory service on a one-mile wireless telegraph "line"? A. A coil giving a 4 or 6-inch spark will work over a distance of one mile for wireless signals under ordinary circumstances. You will find a 4-inch coil described in SUPPLEMENT No. 1527, and one for a 6-inch spark in SUPPLEMENT No. 1124, each 10 cents. 2. What is a polarized relay? A. A polarized relay is one with permanent magnets, so that the armature is easily drawn over as soon as the current starts. 3. Would a 150-ohm relay such as used on commercial lines work on the above-stated wireless telegraph line? A. We think a 150-ohm relay will be sufficient for a distance of one mile.

(11089) G. W. S. asks: 1. What causes the percentage of oxygen in the air to remain constant when such enormous quantities are being constantly consumed by animals and direct combustion? A. The plant world takes the carbon dioxide which animals exhale and breaks it up again, forming other products and restoring the oxygen to the air again. The processes of nature balance, and there is as much decomposition as there is formation in the long run. 2. Will not a given tank or reservoir empty itself more rapidly of water if provided with a vertical outlet pipe extending in a downward direction and of considerable length, than if provided with the same size hole discharging directly into the air? Would not the increasing velocity of the water as it falls through the pipe cause a partial vacuum in the upper part of the pipe, thus drawing the water out of the tank more rapidly? A. The quantity of water discharged through a vertical pipe is not increased by lengthening the pipe. As the velocity of the falling water is increased, the stream leaves the sides of the pipe and has a smaller cross section. Thus there is an air space around the water in the lower part of the pipe, and the water does not fill any vertical pipe through which it flows freely. You could not draw water out of the side of such a pipe. This would prove that the pipe was not full of water. There is no pressure on the side of such a pipe.

(11090) P. J. L. asks how to make tracing cloth. A. 1. Boiled linseed oil (bleached), 10 pounds; lead shavings, ½ pound; zinc oxide, 2½ pounds; Venetian turpentine, ¼ pound. Boil for several hours, then strain, and dissolve in the strained composition 2½ pounds white gum copal. Remove from the fire, and when partly cold, add oil of turpentine (purified), sufficient to bring it to proper consistence. Moisten the cloth thoroughly in benzole and give it a flowing coat of varnish. 2. Varnish the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry. Try a little piece first with a small quantity of varnish. The kind of cloth to use is fine linen; don't let the varnish be too thick.

(11091) H. H. H. asks: 1. In central station telephone exchange work, where they have party lines with as many as four 'phones connected with the switchboard with only two wires, how is the operator enabled to ring any one of the 'phones she wishes without disturbing the others? I understand they use an alternating current for ringing, and that the 'phones are all alike in construction, that any one of them could be used in place of any other one, that is, they are interchangeable, provided that the connections in the instrument are properly changed. Is this right? Of about what potential is the current that is ordinarily used to actuate the ringer movements? A. The methods for selective calling upon party lines of telephones are divided by Miller into three classes: 1. Those employing step-by-step movements for completing the calling circuit. 2. Those employing currents of different directions or polarity. 3. Those employing currents of different frequencies for actuating the different signals, a harmonic system. These several methods are fully discussed and described for 37 pages in Miller's "American Telephone Practice," which we send for $4, to which we would refer you for further information. 2 In winding the armature of a D. C. shunt motor, to carry a current of say ten amperes, is it necessary to select a size of wire that will carry ten amperes without heating, or is one of a five-ampere capacity large enough? Does not the current, on entering the armature, separate, and flow half around one way, and half the other? And how does the rule apply in the case of a dynamo? A. In a direct-current motor armature as ordinarily wound and connected, the current divides at one brush and goes in opposite directions, uniting at the opposite side at the other brush. Each side carries but half the current, and thus need be wound with wire of a size suitable for half the current. 3. Can you give directions for recharging a battery of dry cells with a dynamo? About how many amperes would you force through, and for how long? Is the voltage of the charging current an essential factor? A. We have had no experience in recharging dry cells with a dynamo or otherwise, and do not think the game is worth the candle. The voltage of the charging current should be about 2 volts per cell in series.

(11092) A. J. C. asks how to polish German silver. A. Take 1 pound peroxide of iron, pure, and put half of it into a wash basin, pouring on water, and keeping it stirred until the basin is nearly full. While the water and crocus are in slow motion, pour off, leaving grit at the bottom. Repeat this a second time, pouring off into another basin. Cleanse out grit, and do the same with the other half. When the second lot is poured off, the crocus in the first will have settled to the bottom; pour off the water gently, take out the powder, dry it, and put both when washed clear of grit, and dried, into a box into which dust cannot get. If the silver work is very dirty, rub the mixture of powder and oil on with the fingers, and then it will be known if any grit is on the work. If the work is not very black, take a piece of soft chamois leather, and rub some dry crocus on, and when well rubbed, shake out the leather, and let the powder fall off that is not used, or rub it off with a brush. Do not put down the leather in the dust.

(11093) J. V. B. says: Is it a scientific fact that when a fluid issues from an orifice, a rectangular aperture for example, the flow, which just after issuing is rectangular in section like the hole, twists about so that a short distance from the orifice the section is a rectangle having its corresponding sides at right angles to those of the hole? A. It is a fact that a fluid, issuing from a rectangular orifice, twists about in position as you describe. This is due to the fact that fluid rushing through the corners of the rectangular orifice tends to flatten out after leaving the orifice, while that part of the fluid coming through at the sides tends to bulge, thus giving the effect of apparently twisting in the flow. We have no SUPPLEMENT articles with regard to this matter, and we know of no published data on the subject.

(11094) B. F. B. asks: I wish to procure the best method for drilling glass. A. For drilling glass make a solution of 1 ounce gum camphor, 1½ ounces spirits of turpentine, and 3 drachms of ether. Keep the end of the drilling tool wet with this fluid. The sharp corner of a freshly broken point of a file is one of the best drilling tools for this purpose.

(11095) L. E. B. asks: Does the space occupied by the spokes in a carriage appear to be filled with black dots when the moving carriage is seen through a lace curtain? I did not notice it when the carriage moved rather slowly, but when it was moving at a brisk rate. A. The phenomenon of the moving wheel viewed through a mesh of lace is due to the persistence of vision. Through the openings in the lace we see only a part of the spokes, and then this part disappears. We thus get a discontinuous view, broken more rapidly as the carriage moves more rapidly.

(11096) W. W. G. says: We would consider it a great favor if you will have the kindness to advise regarding driftwood fire powder. This is a powder which, as we understand it, is thrown on the fire and produces the same lights as driftwood does. Kindly advise if possible where same can be obtained. A. We do not know the composition of the driftwood powder. You can, however, make driftwood for yourself, which will give a color equal to any, by dissolving chloride of copper in water. Use a wooden pail for this, since it will corrode a metal pail. Place pieces of wood endwise in the solution, and allow them to soak till they are well saturated. Then dry them, and throw some pieces upon a bright fire. They will show the colors of the burning copper. A pound of copper chloride will make a great deal of driftwood.

(11097) F. S. J. asks: 1. Can you tell me what a wattless current is? How is it caused? A. The so-called "wattless current" is the component of the total current which is in quadrature with the energy current. It may be found explained in Sloane's "Electricians' Handy Book," which we send for $3.50. 2. Why do telephone companies always ground on a cold-water pipe? I know of a case where a lineman carried the ground wire past a hot-water pipe to a cold-water pipe. Why not ground on a gas or steam pipe? They are all connected to the ground. A. We cannot tell why telephone companies "always ground on a cold-water pipe," since we have just examined ours and find it grounded on the hot-water pipe. It is not proper to infer that a thing is always done in a certain way because we have never happened to notice it done in any other way. There is no reason for grounding on one pipe rather than the other. Gas pipes should not be used because of risk of setting fire, if a break occurs. 3. Is there any point on the American coast where there is no ebb or flow of tide? Is so, where is it? A. We do not know of any place where there is no tide. There are places so situated that a tide flowing one way meets a different phase of a tide from another direction and a very small change of tide results.

(11098) G. A. R. asks: 1. A spark cannot be passed between two electrodes separated by a vacuum. Are we to infer from this that a vacuum is a perfect insulator? A. A perfect vacuum would be a perfect insulator. 2. The distance separating two particles can be halved. This second distance can then be halved and so on—according to mathematics, infinitely—which would require infinite time. Yet practically it can be accomplished in a finite time. How is this explained? A. It is quite true that mathematical zero cannot be reached by the successive division of a number by two, or by halving a certain space. But that need disturb no one. It is easy to reach a value less than any assignable value, and that is practically zero. Thus in the case of our money. When a sum has been halved successively till it is reduced to less than one mill, the process must end, since there is no denomination in which to express the value. Practically the problem you present is a logical quibble, of interest only to a mathematical quibbler. There ought always to be common sense back of logic, but unfortunately it is not always plainly visible.

(11099) A. A. F. asks: 1. How do they get this very low zero you speak of in February 10, 1906, No. 9887? A. Absolute zero is computed from the behavior of gases when cooled. Their contraction leads to the belief among scientific men that all heat would be gone from matter if it were cooled to 459 deg. F. below zero. 2. What is the lowest natural temperature known, and the lowest artificial cold yet produced? A. The lowest thermometer reading ever reported upon the earth is from a self-registering thermometer which was left for a number of years in the Arctic regions. It showed 95 deg. F. below zero. Previous to this the lowest observed was at a place in Siberia, 90 deg. F. below zero. 3. Please explain this. Haswell on page 879 asks: How many fifteens can be counted with four fives, operation

$$\frac{4 \times 3 \times 2 \times 1}{1 \times 2 \times 3} = \frac{24}{6} = 4.$$

A. The formula you give for fifteens to be made from four fives is the ordinary formula for combinations demonstrated in algebra. You will find it in any large algebra. 4. Why is it colder at the south pole than at the north? A. The southern hemisphere is largely covered with water, hence it is colder. The earth is farthest from the sun in July, which is the mid-summer month of the southern hemisphere. This makes the summer there a little colder than the northern summer.

(12000) E. H. asks: Would you kindly inform me where I could find a good description of Marconi's magnetic detector which is used in connection with a Wheatstone recorder? How are the inductance coils that are used in both the receiving and sending station wound and what size wire is used? What is the resistance of the choke coils used in the receiving circuits? A. You will find the Marconi magnetic detectors described in Maver's "Wireless Telegraphy," which we can send you for $2. Several sizes of choke coils are also described in the same book, as also are the induction coils.

(12001) J. D. writes: I have purchased some selenium for the purpose of making electro-light experiments, about which I have read so much in technical papers. I think it must go through some sort of a process before it can be used, for I find it to be a poor conductor of electricity. With a 1,000-ohm telephone ringer not the slightest effect is produced upon so delicate an apparatus as a telephone receiver. A. Selenium is

not a conductor of electricity in any condition. It is a better conductor after it has been prepared than in the ordinary condition. It is kept for several hours at a temperature just below its melting point. It is then spread over the space between parallel wires, better wound upon a porcelain tube, so that the two wires are quite near together. When it has cooled it is in the sensitive state. The current sent from one wire to the other will be increased by allowing light to fall upon the selenium cell, as it is called. The resistance will be several hundred ohms probably at the lowest. We would advise you to apply to the professor of chemistry or physics at the university in your city. These men are always glad to give advice and assistance to others.

(12002) R. S. McF. asks: Would you kindly explain how I could use a 100-volt induction motor on a 110-volt current? I tried one way by connecting a 10-volt lamp in series with it, but had no satisfaction. A. A small resistance coil placed in series with your motor will take up the extra ten volts and enable the motor to run with safety. The wire must be of a size which will carry the current without heating too much. The small lamp you used was not able to carry the current required. Its filament had too high a resistance to allow current enough to flow for the motor, and so the motor did not get current enough to turn it.

(12003) C. W. asks: In your issue of February 10, 1906, page 137, Notes and Queries (No. 9887), you state that absolute zero is —459 deg. Is it a fact that scientists have accepted this as absolute zero? On what is it based? How was it determined? And how is it measured? What does absolute zero mean? Is it a condition of temperature at which no heat whatever exists or is radiated? A. It may be positively stated that all modern scientists accept —273 deg. C. as absolute zero, or the temperature at which molecular motion would cease, all heat would be gone from matter. Astronomers believe that this is the temperature of the space outside of the earth's atmosphere. The degree we gave, —459 deg. F., is the Fahrenheit equivalent of —273 deg. C. The idea of absolute zero is based upon the fact that all gases at the freezing point of water expand and contract by the same amount if the temperature is changed one degree and this amount is 1/273 of their volume if the temperature is changed one degree Centigrade. Since the volume of a gas is dependent upon its temperature it is evident that the cooling of a gas degree by degree will cause it to shrink proportionately till if it is cooled 273 degrees its power to shrink will be gone also; that is, all the heat will have left the gas. This reasoning is not weakened by the fact that the gas would change to liquid before the absolute zero is reached. Dewar has gone within a very few degrees of absolute zero in the attempts to liquefy helium. The absolute scale was devised by Lord Kelvin and is very frequently employed in giving temperatures in scientific papers. It is the only scale in which the degrees have a direct quantitative relation.

(12004) A. N. B. says: Will you kindly let me know how to boil a meerschaum pipe that has been in use some time, so as to color readily? Also how to fix the color in the pipe when it is once there? A. Ordinarily the pipe is boiled for coloring in a preparation of wax which is absorbed, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. They are first soaked in melted tallow, then in white wax. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Where the color has once existed it can be brought back by careful heating, which will drive the color out toward the surface.

NEW BOOKS, ETC.

AGE OF MENTAL VIRILITY. By W. A. Newman Dorland. New York: The Century Company, 1908. 16mo.; pp. 229. Price, $1 net.

The widely-quoted statement of Dr. William Osler, "Take the sum of human achievement in action, in science, in art, in literature, subtract the work of the men above forty, and while we should miss great treasures, even priceless treasures, we would practically be where we are to-day. The effective, moving, vitalizing work of the world is done between the ages of twenty-five and forty," might be the text of this interesting little volume, part of which originally appeared in the Century. The pages show that Dr. Dorland has gone into his investigation earnestly and faithfully; and he has cast into interesting and valuable tabulated form the records of four hundred men famous in all lines of intellectual activity, upon which his conclusions are based. Dr. Dorland is convinced, and most readers will find his claims convincing, that the age of the acme of mental activity, as shown by these fairly chosen records of the famous men of modern times, lies between forty and sixty, and that, provided health and optimism remain, the man of fifty can command success as readily as the man of thirty. It is a stimulating little book.

THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF SEWAGE DISPOSAL WORKS. By Hugh P. Raikes, A. M. Inst C. E., etc. New York: D. Van Nostrand Company, 1908. 8vo.; pp. 414; fully illustrated with photographs. Price, $4.

Whereas the chemical and biological aspects of sewage disposal have been fairly fully dealt with by a number of more theoretical scientists there has been no recent publication dealing as fully with experiment and practice. This need Mr. Raikes's work seems to completely supply, being a record of fifteen years experience of the practical application of approved principles in the design and construction of sewage disposal works. Due credit is given for the initiation of experiments and the publication of valuable reports by the Massachusetts State Board of Health, but the book deals principally with sewage works in England, where the congestion of urban centers is so much greater and more frequent, the pollution of the much smaller streams and estuaries consequently greater, so that the need is more urgent and developments have been more rapid there. Particular methods of sewage disposal highly successful in one case will not necessarily prove equally satisfactory elsewhere owing to wide divergence of local conditions, but Mr. Raikes's experience as a consulting engineer has given him exceptional facilities for collecting, comparing, and coordinating the results of different methods and he presents his information not merely as a collection of clearly classified data valuable to the sanitary engineer desirous of comparing the results of the best practice, but in a manner interesting to the non-technical public.

FORGING. By John Lord Bacon. Chicago: American School of Correspondence, 1909. 112 pp.; 8vo., fully illustrated. Price, $1.

Most of the publications of this school are practical condensations or simplifications, suited to the sometimes limited academic training of its students, of the subject matter of deeper or more complex text books, but we know of none of the contents of which less may be found elsewhere to take the place than the present work in forging. The author has obviously learned his subject in the workshop, but his position as instructor in forge-work at the Lewis Institute has given him a facility in explaining the reasons of what he knows to be the correct method which few expert smiths can possess. The book is full of simple practical instructions, illustrated by admirably clear diagrams for the performance of all simple and more complicated operations in blacksmithing as well as the making of a large number of tools—just the things that every amateur and many a professional smith wants to know but cannot find in large and more comprehensive works on metallurgy and mechanics—and it is brought completely up-to-date by descriptions of the operation of the latest labor-saving devices for mechanical forging and electric welding.

HANDBUCH ÜBER TRIEBWAGEN FÜR EISENBAHNEN. By C. Guillery. Berlin and Munich: R. Oldenbourg, 1908. 200 pp.; 93 ill.

This work consists of an exhaustive description of the construction and details of all the self-propelled passenger, inspection, and similar cars in use on the railways of the world, including electrical, gasoline, and steam cars. The necessity for and use of such cars being much greater in Europe, especially in the composition of multiple unit trains running at regular intervals all day into the suburbs of large cities and consisting of a single car at midday or of as many cars as may be required in the rush hours, it is not surprising to find the English and continental developments occupying most of the space, but the inspection and pay cars of the Union Pacific, Missouri Pacific, and C., R. I. & P. railways receive due attention and comparison. The author expresses no theoretical opinions and confines himself to a careful collection and comparison of methods and designs adopted and results obtained.

STEAM BOILERS. By C. H. Peabody and E. F. Miller. New York: John Wiley & Sons, 1908. 8vo.; 420 pp.; fully illustrated with diagrams and five folding plates. Second edition revised and enlarged. Price, $4.

A considerable amount of new material and illustrations and a chapter on superheating added to the first edition of "Steam Boilers," bring the present work up to date, the latter chapter especially being all that was required for completely covering the subject. Though the book is primarily intended as a college text book, it contains much more that is useful to the boilermaker, fireman, or amateur, than the average text book, and, which is more to the point, extremely little that is not readily intelligible to them. There is little of the mathematics of thermodynamics or strength of materials, such calculations as are given being relative to practical boilermaking, simpler calculations of the stresses in members, and the strength of riveted joints, etc. The customary size, form, method of staying, and system of firing of boilers for various purposes are carefully described and clearly illustrated, tables of properly proportioned grate areas and heating surfaces have been compiled from the best practice, the methods and conditions for testing materials used, and the construction of boilers are briefly described and the results adequately discussed of the most recent investigation on the exact nature, causes, and effects of combustion, corrosion, and incrustation. Not the least valuable feature of a thoroughly useful book is a table of the composition and comparative heating value of all common American fuels.

PRECIOUS STONES. By W. Goodchild, M.B. Ch.B. With a Chapter on Artificial Stones by Robert Dykes. New York: D. Van Nostrand Company, 1908. 12mo.; pp. 309. Price, $2.

After a general discussion of the subject, each form of gem is taken up in detail. Some of the illustrations are so good that it is hoped in subsequent editions their number may be very materially increased. There is an excellent glossary at the end of the book.

ALTERNATING CURRENTS SIMPLY EXPLAINED. By Alfred W. Marshall. London: Percival Marshall & Co. 18mo.; 82 pages. Price, 20 cents.

This is No. 33 of the "Model Engineer" Series, and gives a simple outline of the subject.

HYDRAULIC ENGINEERING. By F. E. Turneaure, C.E., and Adolph Black, C.E. Chicago: American School of Correspondence, 1909. 8vo.; 267 pp.; fully illustrated with diagrams and photographs. Price, $3.

The last of the text books of the Chicago School begins the hydraulics and leads up to the latest developments of modern uses of water power. The necessary formulæ for the measuring and calculation of rates of flow, power possibilities, pressure of, and strains generated by water under all conditions are given, and in accordance with the methods of the school, suitably to the general class of its students the development of each formula is carefully and simply shown. The second part of water power development does not seem to us comparably as good as the rest of the book. It is profusely illustrated with interesting photographs of large water-power works, with no very special reference to the text, and lettered diagrams from a number of sources are sometimes described in the text only by the names of the parts without reference to the principles involved or even to all the letters.

VALVE SETTING. By Hubert E. Collins. New York: Hill Publishing Company, 1908. 8vo.; 210 pp.; fully illustrated with photographs, diagrams, and tables. Price, $2.

In this work Mr. Collins has collected a number of articles by himself and others which have appeared in "Power," but in their collection and arrangement has made a complete series which tells a continued story of the whole art of valve setting. The elementary principles of valve setting and the use of Zeuner diagrams are explained in a manner intelligible to the practical mechanic who may have no theoretical training. The tracing of the action of the valves in detail is more complete than usual and explained by diagrams throughout admirably clear, and the application of the quite general rules first given for plain slide-valve engines to automatic and other cut-off, Corliss and all well-known types of engines is carefully shown.

THE FRESHWATER AQUARIUM AND ITS INHABITANTS. By Otto Eggeling and Frederick Ehrenberg. New York: Henry Holt & Co., 1908. Large 12mo.; 352 pp. Price, $2.

This volume gives clear and complete instructions to the amateur. It describes, and illustrates by some of the finest photographs ever taken from life, the great variety of plants, fishes, turtles, frogs, and insects that may be kept indoors in health and contentment. It furnishes information concerning food, treatment in health and sickness, methods of capture and handling, and what aquatic creatures will or will not live in peace together.

MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By J. S. and D. Reid. New York: John Wiley & Sons, 1908. 8vo.; 440 pp.; fully illustrated with photographs and line drawings. Price, $3.

The present issue constitutes a revised and enlarged edition of a former work under the same name, of which six thousand copies have been sold. The additions probably most valuable to the teacher—the principal purpose of the book being academic—are the assignment of a minimum time of execution to each problem such as would be allowed in a commercial drafting room and chapters on recent drafting room conventions as to the expression of details, bills of material, titles, etc., on working drawings. Beginning with simple instructions as to the use of instruments, lettering, and figuring, the student is taken through a complete course from the simplest to the most complex mechanism. The author professes only to give the elements of mechanic design, but if all the mechanical draftsmen knew as much about the *object* of the different parts of a machine—the slide valve for instance—as is given under "Engine Details" it would save much friction between designer, draftsman, and shop foreman.

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