

to a practical conclusion. It has been said that all this time the idea of speech transmission was an undercurrent of thought with him, and he has testified that, before 1870, he avowed his belief that we would one day speak by telegraph. Going through all sorts of experiments, he succeeded in inventing the telephone. He lectured on it before the Society of Arts, in Boston, May 25, 1876, exhibited it at the Centennial in Philadelphia, and in August of the same year speech, it was said, was transmitted over a telegraph line. He has received numerous honors, and has written numbers of papers on his other scientific work, such as the photophone. He has also, for years, studied the subject of speech for the deaf and dumb.

Elihu Thomson was born in Manchester, England, 1853, and at the age of 5 came to this country with his parents, who settled in Philadelphia, where he was educated, graduating from the Central High School in 1870. He experimented a great deal during his boyhood in electricity and chemistry, photography and similar subjects. Graduating at the age of 17, he spent six months as an analytical chemist in a laboratory, and was then appointed Assistant Professor of Chemistry and Physics in the High School, and was promoted to the chair of Professor of Chemistry and Mechanics in 1876. He frequently lectured and continually experimented during this period, in the Artisans' Night Schools, Franklin Institute and elsewhere. He was associated with Prof. Edwin J. Houston in some patents relating to dynamos, and upon these and other inventions based the American Electric Company, since called the Thomson-Houston Electric Company, organized in 1880, and became chief electrician of the company. His invention of electric welding and brazing has been fully described in the columns of the SCIENTIFIC AMERICAN and SUPPLEMENT. His very remarkable experiments in alternating current induction have done much to win for him an international renown. The air blast applied to switches and commutators for blowing away destructive arcs is a type of his practical way of reaching results. Like Edison, he holds a great number of patents.

Nikola Tesla was born at Smiljan, a small place on the Austrian border, and is now 35 years of age. His education was received at Carlstadt in Croatia; he too showed the experimental bent and eventually entered the polytechnic school in Gratz, Austria. Here he studied engineering and devoted his spare time to studying electricity; on graduation he entered the engineering department of the telegraph at Budapest, and in 1881 took up the electric light and the construction of dynamo machines as his especial work. He is said to have been greatly impressed by the drawbacks incident to the employment of the commutator and collecting brushes on dynamos and motors. But his recent work and that which has brought his name more prominently before the world than ever before has been with alternating currents. Employing a dynamo giving 20,000 alternations in a single second, he has produced what may be properly termed the most remarkable experimental results recently attained by electricity. With these alternations used in the production of the most beautiful lighting effects, he succeeded in showing or at least in indicating the possibility of producing electric light without any conductors whatever. Two very striking points brought out were the construction of his apparatus. In his transformer he employs a liquid insulator, the point being that the perforations of its material naturally do no harm, as they instantly close up again. Another point was that these currents of high frequency have no effect on the animal system, being apparently perfectly safe, however great their intensity or high the potential difference developed in their circuit.

#### Production of Quicksilver at New Almaden.

The Quicksilver Mines and Reduction Works of New Almaden are fifteen miles south of the city of San Jose, Santa Clara County, California, in the Santa Cruz Mountains, at an elevation of 1,700 feet above the sea. These mines were first worked for quicksilver in 1845, but the operations were on a small scale, and no record exists earlier than 1850. They have been the most productive quicksilver mines in the world, excepting only the mine of Almaden, in Spain. They are developed to a depth of 2,300 feet, and the workings extend horizontally over an area one mile square.

From January 1, 1864, to December 31, 1891, the number of feet of drifting and sinking in the mines of the company, as shown by the records, amounted to 49.11 miles, at a cost of \$2,191,831.95. This does not include the excavation made in extracting ore during the period named, nor any expenses for the same, while for the ground opened up during the previous period (from 1850 to 1864) 15 more miles of drifting and sinking can be added.

The reduction works consist of eight furnaces, include

the most improved methods for working quicksilver ores, and may be considered as the most complete and perfect in every respect in the world.

The total product of all the mines on the company's



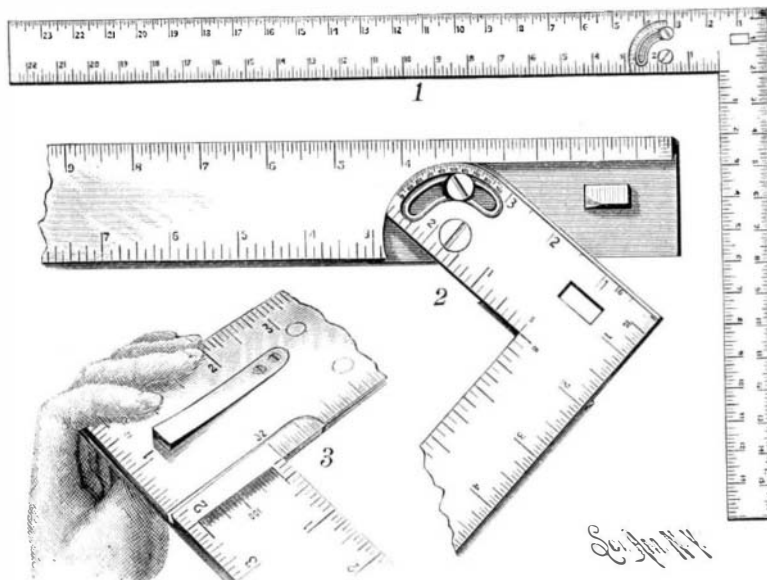
A BIRD'S EYE VIEW OF THE GREAT EXPOSITION.

property for thirty-eight years has been 924,659 flasks of  $76\frac{1}{2}$  lb. each, or 70,736,413  $\frac{1}{2}$  lb.

The total earnings of the company for twenty-one years past have been about \$15,000,000, and the total profits a little over \$5,000,000.

#### AN IMPROVED CARPENTER'S SQUARE.

In this square the arms are pivotally secured together, so that one may be swung with relation to the other throughout an arc of ninety degrees, the joint between the two arms being such that there is a minimum of strain upon the pivotal point, and the bearing of such extent that there will be no liability of the parts wearing so as to be thrown out of a true perpendicular to each other when opened. The longer arm of the square



AN IMPROVED CARPENTER'S SQUARE.

has a shallow recess extending in for some distance from one end, the wall of the recess being undercut, and the recess terminating in a curve. In this recess is pivoted an angled extension of the shorter arm of the square, the curved portion being provided with graduated division marks up to ninety degrees, and between the pivotal screw and the curved end is a curved slot in which is a set screw, by means of which the two

arms may be locked at any desired angle of adjustment. For automatically locking the two arms of the square in the ordinary position for use as a square, a flat bar spring is located in a shallow recess in one side, as shown in Fig. 3, a nose or latch on the free end of this spring projecting through in the path of the pivoted arm as shown in Fig. 2, so that when the latter is swung back it will be locked in the position represented in Fig. 1. It will be seen that this square can be readily folded to go in a regular tool box, and that by its use an angle or bevel can easily be measured or marked out with great exactness.

For further information relative to this recently patented invention, address Mr. F. W. Palmer, agent, Station F, New York City.

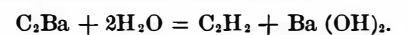
#### THE DEDICATION CEREMONIES.

The ceremonies attending the dedication of the exposition buildings, October 11, 12, and 13, 1892, are to be very elaborate and impressive. The committee having the matter in hand will devote \$300,000 to that purpose. It is expected that the President of the United States and his cabinet, many of the senators and congressmen and governors of the States, numerous representatives of foreign governments, and 10,000 militia and several thousand regulars will be present. A dedication ode and marches, written for the occasion, will be rendered with full choral and orchestral accompaniment. Patriotic and other music, a dedicatory oration, a pageant of symbolical floats representing the "Procession of the Centuries," and magnificent displays of fireworks will be among the chief features of the programme.

A grand dedication ball, probably in the Auditorium, on the night of October 13, 1892, will conclude the exercises dedicatory of the exposition buildings. Many representatives of foreign countries are expected to be present, and the event will be, to an extent, international in character.

#### A New Theory of the Origin of Petroleum.

An interesting compound of carbon with the metal barium, possessing the composition  $C_2Ba$ , is described, says *Nature*, by M. Maquenne in the current number of the *Comptes Rendus*. It may be considered, perhaps, as an acetylide of barium—that is, a compound formed by the replacement of the hydrogen of acetylene,  $C_2H_2$ , by metallic barium. For immediately it is brought in contact with water, pure acetylene gas is evolved with great rapidity. M. Maquenne has obtained the new substance by the direct action of metallic barium, employed in the form of an amalgam consisting of one part barium and four parts mercury, upon powdered retort charcoal. Upon distilling such a mixture in a current of hydrogen, when the mercury had been expelled and the temperature attained redness, an energetic reaction was found to occur between the barium and the carbon, with production of the new carbide or acetylide. The hydrogen took no part in the reaction, and M. Maquenne has subsequently found that it may be replaced by nitrogen; the latter, however, being less advantageous, inasmuch as the carbide produced is then admixed with more or less cyanide. The new substance, as obtained when hydrogen is employed to furnish the atmosphere, consists of a gray, friable mass, which remains quite unaltered when heated to bright redness. The moment, however, it is thrown into cold water it is decomposed, with a rapid effervescence of a gas which possesses the odor of acetylene, burns in the air with a luminous flame, precipitates a red substance resembling acetylide of copper from an ammoniacal solution of cuprous chloride, and, in short, possesses all the properties of acetylene. M. Maquenne adds that the acetylene thus obtained is remarkably pure. The reaction with water may be expressed by the equation—



Barium acetylide would appear to be analogous to the compounds obtained by M. Berthelot by heating the metals of the alkalis in a current of acetylene, and also to the acetylide of calcium prepared by Wohler. The direct formation of this substance from barium and carbon, together with its reaction with water, afford another mode of synthesizing acetylene, which M. Maquenne considers to be of interest from the point of view of the formation of the natural hydrocarbons. He considers it probable that other metals possess this same property of forming acetylides under the influence of high temperatures. If, therefore, as M. Berthelot has attempted to show, it is a fact that

acetylene forms the primary material, or starting point, for the formation of other hydrocarbons, it is quite possible that such compounds of metals with carbon, upon coming in contact with water under conditions of more or less pressure, may give rise to the production of the immense stores of natural hydrocarbons, such as those which exist in the petroleum wells of Russia and the New World.



## RECENTLY PATENTED INVENTIONS.

## Railway Appliances.

**CAR COUPLING.**—John P. Kirwan and James E. Kirwan, Jr., Pittsfield, Mass. This is a coupler of the knuckle type, the body portion of the pivoted knuckle having a downwardly inclined or beveled surface in combination with a coupling pin having at its lower end an inclined or beveled surface corresponding to that of the knuckle, whereby when the pin is raised the knuckle will be forced outward to the uncoupled position. The construction is very simple and durable, and the coupling pin is so formed that the knuckle will have more of a bearing on it than has been heretofore obtained, while it may be manipulated with the least possible risk to the operator.

**METALLIC TIE.**—Edward S. Moffat and Theodore G. Wolf, Scranton, Pa. The body portion of this tie is formed of a section of ordinary track rail, which is given an oblique bend in the middle and placed with its bottom flange uppermost. The end portions of the tie are re-enforced by short rail sections, with their flanges uppermost, the two parts being separated by space blocks opposite their web portions and firmly bolted together. The bearing heads thus formed for the track rails are provided with clips, held thereon by bolts, the clips being adapted to clasp the flanges of the track rails.

## Electrical.

**TELEGRAPH RELAY.**—Charles M. Dyer, Cloverdale, Ind. According to this invention the armature in the relay is supported yieldingly on the front of a swinging armature lever, while a belt secured to the armature extends over a guide pulley to connect with the armature lever, the belt being arranged so that the movement of the armature will impart an opposite movement to the lever, the improvement providing a nicely balanced armature which will be held in proper adjustment without regard to the variations of the electric current.

## Mining, Etc.

**ORE WASHER.**—Samuel C. McLanahan and William F. Kirk, Hollidaysburg, Pa. This is an improvement in that class of ore washers in which one or more shafts having radial blades revolve in a box or tank, the blades serving to agitate and carry the ore forward to the discharge. The stirrer shaft is formed with longitudinal sections of angle iron or steel, the radial flanges extended throughout their length, and the sections secured at their ends to cap plates. The blades or paddles are preferably formed of flat steel plates with twisted shanks connected with the flanges by bolts, the same bolts connecting the blades with the shaft sections and uniting such sections, while the arrangement of the bolt heads and nuts is such that they are but slightly acted on by the ore in the operation of the machine.

**SAFETY KEEPER FOR MINING CARS.**—Inkerman Bailey and Louis Feger, Madisonville, Ky. This is a device for locking a car upon the hoisting cage automatically, and releasing it at the top and bottom of the shaft. A shaft is mounted to rock on the platform of the cage, there being keeper arms on the ends of the shaft, and a pendent weighted rock arm adapted to rock the keepers into an upright position, a device in the mine shaft rocking the arm when the cage is lowered upon it. The improvement is for use on mine cages, whereby coal and other material mined is brought to the top of the shaft in cars, which are transferred from the hoisting cage to a surface track and moved to a point of discharge for their load, or are dumped directly from the cage.

**SMELTING FURNACE.**—Adam J. Schumacher, Butte City, Montana. This invention provides an improved discharge trough, readily applied, to automatically discharge and separate the products of fusion from the furnace, whereby the furnace may be run with greater continuity and less attention. The invention consists of a pipe formed into a trough and connected with a water supply to pass water through the pipe. The pipe is continuous, and bent so as to form the bottom, sides and ends, the bottom having an inlet opening, while one end is somewhat less in height than the sides, so as to form a discharge opening.

**CAR DUMPING APPARATUS.**—Maurice M. Neames, St. Patrick's, La. This invention relates to improvements in inclined railways and cars, providing means whereby cars may be drawn up such railways and automatically dumped at a certain point, being then placed in position to travel down the incline of its own accord. The construction is simple, durable, and inexpensive, and means are provided whereby the car may be quickly and conveniently loaded, and its contents readily delivered.

## Mechanical Appliances.

**SCREW CUTTING LATHE FEED MECHANISM.**—Wendell P. Norton, Mount Vernon, N. Y. To conveniently and rapidly change the speed of the feed screw on screw-cutting engine lathes, according to the requirements of the screw to be cut, an improved feed is provided forming the subject of this patent. The shaft is driven from a series of interchangeable gear wheels, a pinion turning with and sliding on the shaft, and a driving gear wheel in mesh with the pinion, while a second series of gear wheels of various diameters is arranged step-like on the feed shaft and adapted to be engaged by the driving gear wheel.

**BUSH HAMMER.**—Clark Holden, Barre, Vt. This hammer is composed of oppositely arranged body plates having central bosses and transverse gibs fitted between the plates on the ends of the bosses, each gib having a tongue fitting into a longitudinal groove formed in the bosses, while bolts pass through the body plates and through the gibs to hold them in position. The construction is simple, and the blades are securely held in position, while the parts may be conveniently separated to take out the blades for sharpening or other purposes.

**NUT LOCK.**—Ira J. Griffin, Sing Sing, N. Y. Combined with a bolt having a longitudinal groove in one side, and a nut furnished with radial slots or recesses in its outer face, is a spring key fitted to the groove of the bolt and adapted to enter into the recesses of the nut. There is also a series of ratchet teeth in the bottom of the groove in the bolt, the key being adapted to engage the ratchet teeth. The device is very simple and effective, quickly locking the nut upon a bolt, with means for readily releasing the nut.

**BEADING MACHINE.**—James P. Howe, Cass City, Mich. The making of beads on eaves troughs and similar articles, the work being done accurately and rapidly, while the machine is easily operated, is the object of this invention, the machine being so constructed that it will not warp if made of wood and will not easily get out of repair. It consists of a fixed and a movable jaw hinged together and having registering grooves, a roller with a longitudinal groove being held to turn in the jaw grooves, while a block sliding along the outer side of the movable jaw has its outer face inclined, and a transverse bolt or bar extends from the fixed jaw into engagement with the inclined face.

**CAN CAPPING AND CRIMPING MACHINE.**—Mathias Jensen, Astoria, Oregon. This invention relates to former patented inventions of the same inventor, and provides an improved method of capping both ends of the can bodies with rapidity and certainty. This is accomplished principally by arranging two sets of jaws opposite each other, each adapted to close and form a tapered hole, the caps being conveyed one at a time to the narrow end of each hole, and the can bodies presented first one end through one of the holes into a cap and afterward the opposite end through the other hole into another cap, the can bodies following each other, so that the end of one can body is forced into one cap while the opposite end of another is at the same time forced into another cap, the capped cans being released to roll off one after another.

## Agricultural.

**CORN HARVESTER.**—John N. Reimers and Wilhelm M. Schneekloth, Calumet, Iowa. This machine has infold rolls provided with spiral flutes having their front sides inclined upward toward the rear, the rolls being geared to revolve toward each other on their under sides, and having their flutes inclined to diverge rearwardly to feed the stalks rearwardly without tending to crush them to the ground. Combined with the traveling harvester is a husker, having gathering devices for stripping the ears from the stalks, the husking devices having troughs pivoted at their upper ends to the main frame, and mechanism by which the opposite ends of the troughs may be adjusted vertically, as may be desired, according to the grade of the ground traversed by the machine, the troughs being provided with rolls adapted to tear the husks from the ears.

**HOP PRESS.**—Pierce Riggs, Crowley, Oregon. This is an improvement in that class of presses in which the follower operates horizontally within a press box similarly arranged. Combined with the press box and follower sliding in it are two sprocket wheels arranged one above the other, one of the wheels being keyed on the operating shaft, while a chain attached to the ends of the follower passes between the sprocket wheels, there being means for rotating the shaft. Another wheel is provided having a ratchet rim and a rim for receiving a rope, a lever and a pawl acting on the ratchet wheel to produce the initial and finishing movements of the plunger, the operation being practically continuous.

**LAWN MOWER.**—Edward Z. Kidd, Deadwood, South Dakota. To a plate rigidly connected to the front ends of the arms or handles, in front of the main axles, are secured forwardly projecting spear-shaped knives, and a plate fitted to slide transversely over this plate carries other V-shaped knives. The latter plate is attached to a lever pivoted on top of the axle, the rear end of the lever being pivotally connected by a pitman with a crank disk on a shaft whose forward end is rotated by a bevel gear in mesh with a bevel pinion operated from the main driving wheels. The power of the driving wheels is readily transmitted to the cutting mechanism, so that the grass is cut with great ease, and the sets of knives may be readily raised or lowered to cut long or short grass.

**PRUNING IMPLEMENT.**—Jesse M. Morgan, Chetopa, Kansas. This implement has a hook and a reciprocating knife, the shank of the hook having a longitudinal groove in which the back of the knife is fitted, and the hook proper having a slot through which the knife moves in the forward or cutting movement. The construction is such that the knife is guided and braced against being diverted by the resistance of the branch being severed, the knife also, when desired, making a shearing cut while itself having a straight path of movement.

## Miscellaneous.

**PNEUMATIC GRAIN CONVEYERS.**—Frederic E. Duckham, Millwall Docks, London, England. This invention relates to a delivery apparatus for conveyers, for use in unloading or conveying grain, etc., between ships, barges, warehouses and granaries, by the carrying power of a current of air. The hopper-like chamber into which the suction pipe leads is provided with exhausting apparatus by which a partial vacuum is maintained, and beneath this chamber a twin receiver rocks upon a horizontal axis, the upper part of the receiver being curved to an arc to make a comparatively air-tight joint with the mouth of the hopper. The oscillating motion of the receiver is controlled by mechanism whereby a filled receiver is disconnected from the exhaust and falls over to discharge, bringing the other chamber into position to be filled. With this apparatus the grain is transported and deposited by the air current without the admission of sufficient air to destroy the necessary partial vacuum.

**EVAPORATING PAN.**—Jay B. Copeland, Punta Gorda, Honduras. This invention relates to an

apparatus for purifying saccharine juices in the manufacture of sugars and sirup, the purifier consisting of a vessel divided by partitions into a series of longitudinal compartments ranging side, by side, the juice being partially heated in one compartment, highly heated in the next compartment, and so on, the temperature increasing until it finally escapes at the outlet. The scum is automatically removed, and the tendency to mix with the purified juice is overcome, the sediment being detained in the several compartments, to be removed as it accumulates, whereby the juice is brought to as clear and pure a condition as is possible without the first treatment with bone black, etc.

**SUBMARINE BOAT.**—John F. Auer, Nyack, N. Y. This boat has a tubular keel section with an opening in its bottom, and valved air supply and exhaust pipes, whereby the admission of water to the keel and its discharge are controlled by the air pressure in the keel section. The arrangement is such that the boat may be quickly submerged by compressed air and a water ballast, and raised directly to the surface through the medium of compressed air, the water ballast and the action of the air on it being so regulated that either the bow or the stern may be dipped or elevated at will. The storage of sufficient compressed air is provided for in the vessel to meet all emergencies, and entirely dispense with the use of pumps.

**PIPE COUPLING.**—William D. P. Aims, Jr., Philadelphia, Pa. This coupling comprises a case having a thickened end which is externally and internally screw-threaded, the exterior edge of the thickened end being beveled, a cap having its flange internally screw-threaded and with an aperture in its top and an annular space around the top, with an apertured packing. A simple form of coupling is thus provided, for use in connection with air, steam, water, or gas pipes, and one which is designed to make an absolutely tight joint.

**SAMPLE CASE.**—John E. Hitch, Wilmington, Ohio. This case comprises connected end pieces having interior shoulders, a flexible wall pivoted between the end pieces and adapted to be rolled upon the shoulders, supports on the interior of the wall, and catches to fasten the wall in a closed position, with a suitable handle. The case is especially adapted to exhibit anger bits, cutlery, jewelry, and various articles of hardware, holding the articles in a very small compass, and so arranged as to exhibit the goods to great advantage without the necessity of handling them.

**NOTE.**—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

SCIENTIFIC AMERICAN  
BUILDING EDITION.

MARCH NUMBER.—(No. 77.)

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1. Elegant plate in colors of a residence in the Queen Anne style of architecture, erected for F. S. Andrews, at Seaside Park, Bridgeport, Conn. Perspective view, floor plans, etc. Longstaff & Hurd architects, Bridgeport, Conn. Cost \$7,000 complete.
  2. Plate in colors of a cottage at Richmond, Mo. Perspective elevation and floor plans. Cost \$1,500.
  3. A residence at Cleveland, O. An admirable design. Floor plans and perspective elevation. Cost about \$6,000.
  4. A cottage at Gardner, Me., erected at a cost of \$1,900. Perspective elevation and floor plans.
  5. Floor plans and perspective view of a Colonial house at Portland, Me. Cost \$3,800 complete.
  6. Design for an ornamental chimney piece.
  7. A cottage at Portland, Me. Cost \$3,500 complete. Perspective and floor plans.
  8. Floor plans and perspective view of a very attractive Queen Anne cottage erected at Babylon, L. I. Cost complete, \$2,800.
  9. View of the proposed Odd Fellows' Temple at Chicago. To be the most imposing structure of its kind in the United States, and the tallest building in the world. Height 556 feet.
  10. Sketches of an English cottage.
  11. An attractive residence recently erected at Belle Haven Park, Greenwich, Conn., at a cost of \$11,000 complete. Floor plans and perspective elevation.
  12. A residence at East Park, McKeesport, Pa. An attractive design. Plans and perspective. Cost about \$4,000.
  13. A cottage at Asbury Park, N. J. An excellent design. Cost \$5,300 complete. Floor plans and perspective elevation.
  14. Miscellaneous contents: Lawn planting; how to do it and what to avoid, with an illustration.—A suggestion for inventors.—Acoustics.—They bought burning houses.—Timber in damp places.—The taper of chimneys.—Stained cypress.—Low ceilings.—An improved woodworking machine, illustrated.—A fine machine for cabinet shops, illustrated.—Swezey's dumb waiter.—Graphic representation of strains.—An improved door hanger, illustrated.—A new woodworking machine, illustrated.—The baths of Diocletian.—The Stanley plumb and level, illustrated.—The Diamond Match Company.
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References to former articles or answers should give date of paper and page or number of question. Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4152) G. F. writes: I made the eight light dynamo according to description of SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, except I made the yokes (bearings) of cast iron; has that any reducing effect on the dynamo? I made the armature core of ironwire. The dynamo started all right, but the magnet wire on armature becomes so hot as to melt the shellac varnish; what is the cause? I cannot light two carbons between brush and magnet (or a and b on cut); it only gives a large spark and a shock by holding carbons in bare hands by 25 to 30 ohms R. Is there no way to light a 16 candle power 50 volt light on that dynamo? How can I increase the current? I was careful in connecting the coils with the commutator. A. It was a mistake to make the yokes of cast iron as this short circuits the magnets, to some extent. In making anything from carefully prepared directions, you should not depart from the instruction given. However, your machine seems to work very well, and when you learn how to use it, you will doubtless find it quite satisfactory. By placing the carbons in contact in the circuit, you have practically short circuited the armature, thus causing too much current to pass through the armature. Place 15 to 20 ohms resistance in the circuit, then touch the carbons together, and instantly separate them one-sixteenth inch. You will then have the arc, and the machine will run easily. With the carbons long in contact, you are liable to burn out the armature. You should provide some means for separating the carbons one thirty-second or one-sixteenth inch and no more. By connecting from three to eight incandescent lamps in parallel you will have no difficulty in running them. You do not need an increased current. Learn how to use the current you have.

(4153) W. P. asks: 1. If the voltage of an induction coil can be reduced, and the amperage increased after it has been constructed, and how if it can be done? A. Only by using an inverted induction coil corresponding to the converter in the alternating system of electric lighting, the coil being worked by secondary