Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12096) H. E. asks: We have cast life-size statues in Keene cement, and wish to treat same with paint or gilt. Our experience is that the sweating of the cement will loosen the paint within a short time and same will fall off. Can you advise us how to prevent it, or how long it will take to season the Keene cement statues so that the paint will remain on same? A. Cement may be painted with any kind of paint without "sweating" it off, if the condition is right. The older the cement is, the better: it should be a year old before painting, but may be less. Paint the cement first with water glass (silicate of soda and potash dissolved in water), after two coats of which, if the surface is thoroughly *washed*, it will begin to have a glassy appearance, and one more coat should render it quite impermeable, so that it will take any kind of paint or enamel.

(12097) L. E. D. asks: Will you kindly let me know what are the principal objections for railroads not using steel ties, and if there is a railroad in Mexico using them, and how rails are fastened to the ties? If you have a copy of the SCIENTIFIC AMERICAN that will let me know please forward at once. A. The reason for the comparatively small use of metal railroad ties in this country is apparently that in tests made by several of the leading railways over a period of ten years or more prior to 1890, the results unanimously showed that the increase in life and wearing qualities of metal ties was not sufficient to compensate for their higher cost. We are satisfied that a repetition of these tests would reverse this decision, taking into consideration the increasing scarcity of suitable timber, improved method of manufacture of steel ties, and especially the great improvement in roadbed conditions on American railways in recent years. The previous failure of metal ties seems to have been largely due to deficient roadbed. In Europe, where the density of population is so much higher in proportion to the mileage of railway, and where consequently the larger available capital for the building and maintenance of permanent way produced roadbeds with which our railways have only recently begun to compare, metal ties have been successfully and economically used. Metal ties are in use there, still in good condition, which have been in continuous use for upward of twenty-five years, their longer life much more than compensating for their high first cost as compared with wood. Rails are attached to metal ties in a variety of ways, an essential feature seeming to be an elastic pad between rail and tie to prevent crystallization of the latter by vibration. We can send you our issue, No. 1, Vol. 99, describing the use of steel ties, and have a number of others on wood preservation, which has also militated against the introduction of steel ties. Price, 10 cents each.

(12098) W. L. B. writes: The citizens of this city are trying to get drainage for the lands lying west of the city. Can you assist us in arriving at a solution of the problem by answering the following question: How much water per hour will a concrete ditch dispose of or carry away that is 5,330 feet long, 24 feet wide at the top, 12 feet wide in the bottom, and 6 feet deep? The elevation of the water level of the highest lake is 16 feet above the one to be drained into. A. The quantity of water discharged by such a ditch as you describe is figured by the formula $Q = av$, in which Q = quantity in cubic feet per second, a = cross-sectional area of channel, and v = velocity in feet per second. In your case $a = 12 \text{ feet} \times 6 \text{ feet} + \frac{12 \text{ ft} \times 6 \text{ ft.}}{2} = 109$ square feet $\therefore Q = 109v$. The velocity is figured by the formula $v = c\sqrt{rs}$, in which c is the coefficient of friction between the water and the material of the channel (which has to be determined by experiment), r = the mean hydraulic depth or radius, and s = the slope, or the sine of the angle of the slope. In your case s = 16 feet (the difference between the levels of entry and discharge of the ditch) $\div$ 5,330 feet (the length of the ditch) = 0.00303 nearly, and $\sqrt{s} = 0.055048$; r, the mean hydraulic depth, is the sectional area $\div$ the wet perimeter, in your case $\frac{109}{8.48+12+8.48}$ (supposing the ditch to be running full) or $\frac{109}{29}$ nearly, and $\sqrt{r} = 1.936$. C will be about 142, taking n, the coefficient of roughness, as 0.013 for fairly rough concrete. (For very smooth concrete, higher in cement and well laid, n might be as low as 0.011, in which case C would be nearly 170, and the quantity of water discharged would be greater, but we take the lower figure to be on the safe side.) Substituting these values in the formula $v = C\sqrt{rs}$ we have $v = 142\ (1.936 \times 0.055) = 15.05$ feet per second, and $Q = 109 \times 15.05 = 1{,}640.45$ cubic feet per second, which the ditch is capable of discharging when running full.

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The Prudential

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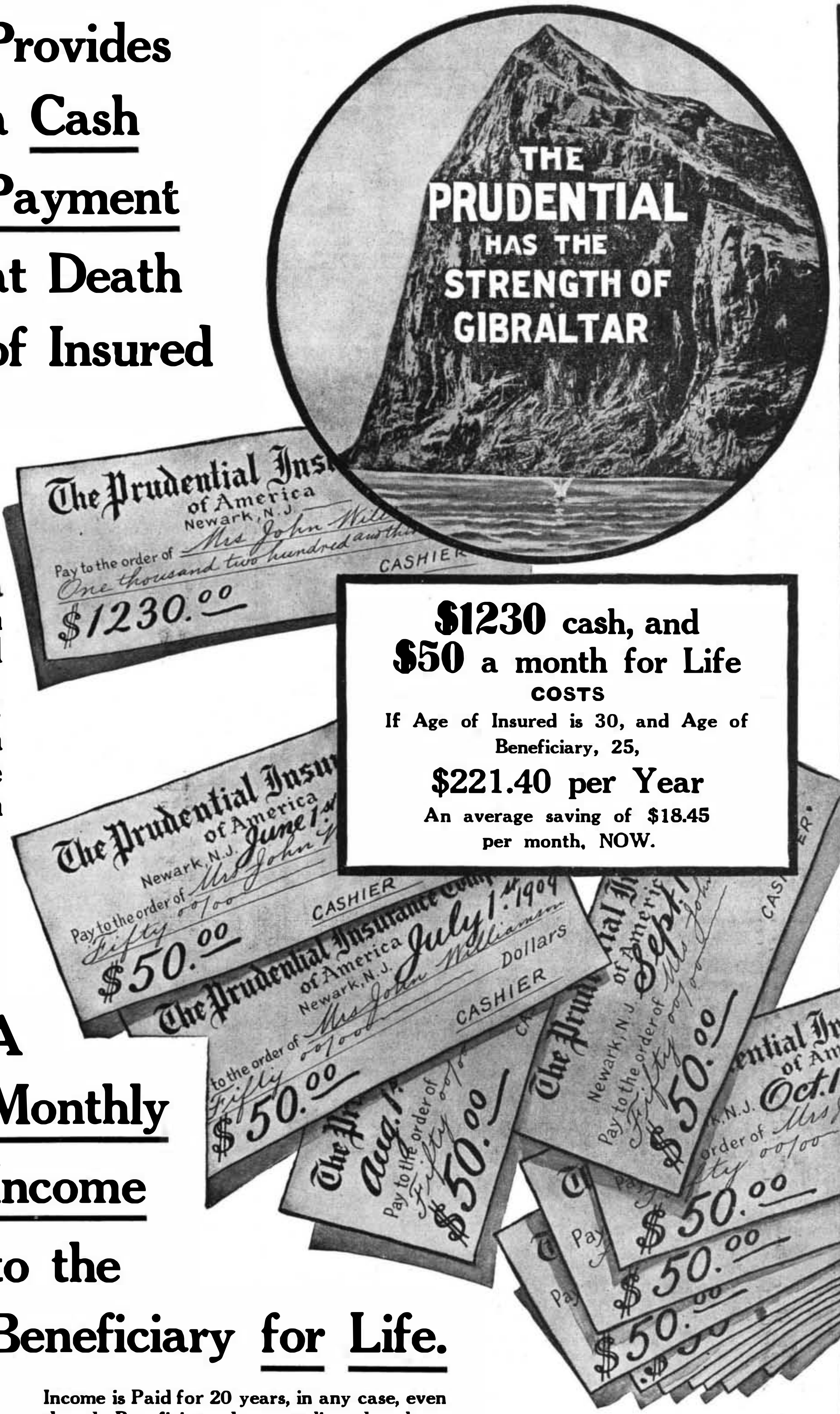

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IMPROVEMENTS IN THE DE FOREST SYSTEM OF WIRELESS TELEPHONY.

(*Concluded from page 457.*)

Dr. De Forest has made an ingenious application of the principle of directive propagation, a refinement of which has also been developed with great success in Europe by Bellini and Tosi.* It was found that if slanting wires were run from a mast to a boom, the intensity of the waves emitted would be much greater in the direction of the plane of the antenna and practically zero at right angles to it. Accordingly, this afforded them an excellent method of directing the waves; and if the whole arrangement were revolved, any desired direction could be given to the wave fronts emitted from the antenna. Dr. De Forest conceived the idea of using this device for sending out danger signals from a lighthouse or other point, and change the direction of the wave by revolving the projecting apparatus so that any boat which received the signals could immediately ascertain its direction from a danger spot equipped with the "aerophore," as the device has been termed, since the apparatus was designed to transmit intelligible signals which differed automatically with the constantly changing direction of the waves as projected. A simple example will illustrate this. When the apparatus is arranged to transmit waves in a northerly direction a certain telegraphic or telephonic signal would be sent out in that direction, and only in that direction. If that message were received on some ship, it would follow at once that the lighthouse was bearing due south of the vessel. For other points of the compass the signals would be different, while a prearranged code would be employed where the aerophore was installed upon a vessel. Thus with the apparatus in operation on both of two vessels, it would be possible as soon as they came within range of each other to determine their bearing, particularly as the signal is first received by an automatic and audible device, such as a buzzer, which would sound in the pilot house and make evident the necessity of picking up the telephone receiver and learning the exact direction of the signals. Dr. De Forest has recently been working on a type of aerophore where an arc light is revolved behind a parabolic mirror, with the movement interrupted successively at the points of the compass where the signal automatically is sent out by wireless, indicating the direction in which the wave is projected. In addition to these signals a microphonic transmitter is connected with a set of bells tuned to the quarters of the octave which are constantly striking, one after the other, several times a minute. These bells have a varying range of penetration, so that when the observer on a boat can hear four bells he knows he is within a certain range of distance of the source of sound. When only three are heard, the distance, of course, must be less, and so on, so that a fair estimate of the distance from the danger point is obtainable.

An improvement that makes possible the satisfactory working of the system is the adjusting of the sending mechanism of all instruments to a "common tune," which differs widely from that of the receiving part of the apparatus, so that when using a single antenna, it is possible to receive the sound whether the transmission apparatus is working or not. When a signal is received, a small lamp is lighted by induction or a buzzer is caused to sound, so that the operator immediately puts on his head telephone in order to find the whereabouts and name of the transmitting station. Aerophore signals will be erected at all the points of danger on the Great Lakes, and will be used on all the signal towers of the Radio-Telephone Company. The device has been tried on the steamship "Wisconsin," and has worked successfully over a limited range.

* See Scientific American Supplement, No. 1745, June 12th, 1909, page 372.

THE AERONAUTIC SOCIETY'S FIRST CURTISS AEROPLANE.

(*Concluded from page 460.*)

weighing 12½ pounds, as well as a gear-driven oil pump, is placed at the same end as the carbureter, while the gear water pump is at the other, or rear, end. One of the gears of this pump is on the camshaft. The motor is very light and compact, its weight complete with pumps, magneto, and carbureter being 97½ pounds. As it is claimed to be capable of developing as much as 30 horse-power, its weight without water and radiator is about 3¼ pounds per horse-power. The radiator weighs 40 pounds, and less than 10 pounds of water is carried, so that the total weight of the power plant is under 150 pounds. It was tested by a 10-hour run driving the propeller.

A 6½-foot diameter, 5-foot pitch wood propeller is mounted upon the engine crankshaft. This propeller develops a thrust of 225 pounds when the aeroplane is held stationary, although 150 pounds is all that is needed to fly it. The blades are but five inches wide. The motor is mounted upon the rear part of the main planes, half way between them, the propeller being at the rear. The aviator sits on a seat at the front edge of the lower plane and about a foot above it, this seat and a foot rest being located upon a pair of inclined braces extending upward from the front wheel to the two special uprights at the rear, which support the motor bed in conjunction with the inclined braces. Two other pairs of braces extend upward respectively from this wheel to the front edge of the upper plane and to the parallel downwardly-inclined poles extending forward from the front edge of this plane to support the horizontal rudder. The tail is carried by two pairs of parallel rods extending downward and upward from the rear edges of the upper and lower planes and meeting some 12 feet behind them. A square automobile-type radiator is placed in front of the motor; the cylindrical gasoline tank is located above it just under the upper plane, and the oil reservoir below.

The control of the new aeroplane is practically as simple as that of an automobile. All the aviator has to do is to pull or push on the steering wheel, which is placed vertically in front of him, in order to steer up or down, while turning the wheel and inclining the body slightly steers the machine to the right or left. The vertical rudder is in reality unnecessary for steering, as this can be accomplished simply by inclining the body and thus setting the balancing planes. These are connected by wires with a frame of steel tubing shaped like a bicycle handle bar and fitting around the shoulders of the aviator, so that when he sways slightly to one side or the other one wing tip is inclined upward and the other downward slightly. The aeroplane, in a run of 75 feet, will attain sufficient speed—about 25 miles an hour—to rise. It flies at more than 40 miles an hour. A plunger brake is fitted to the front wheel tire, to aid in quickly stopping it when it alights.

Several successful trial flights were made at Hammondsport, N. Y., by Mr. Curtiss on June 4th, 5th, and 6th. The longest of these was about 3 miles in the shape of a figure 8. He has shipped the machine to the grounds of the Aeronautic Society at Morris Park race track, New York, and after making some further practice flights, he will attempt to set up a record for the Scientific American trophy at the society's first 1909 flight exhibition, which will be held either the 19th or 26th instant. A new monoplane and several new gliders will also be tried upon this occasion. There will be a wind wagon race, and contests for models, kites, and gliders. The society's new dirigible balloon will also be flown.

LOS ANGELES 200-MILE CONDUIT WATER SUPPLY.

(*Concluded from page 460.*)

division, as it is called, is uninhabited, and it was necessary to transport much of the machinery and all of the food supplies as well as the building material from the desert and mountains in wagons, necessitating the construction of an extensive mileage of roadway.

The tunnels which have been required on the route are notable for their extent. The Coast Range of mountains is pierced by a tunnel, nearly 11 feet in diameter, which is nearly 27,000 feet in length—one of the longest in America. In this tunnel and its approaches, covering a distance of 11 miles, there is a fall from 2,922 feet altitude to 1,520 feet. The head of water thus obtained will be utilized in an electric power plant of 93,000 horsepower at what is known as Elizabeth Lake. This will be by far the largest power plant in connection with the project. Another tunnel is 7,800 feet in length. The conduit does not extend into the city of Los Angeles; but its water is distributed to a series of reservoirs in San Fernando Valley. These reservoirs have a capacity of about 35,000 acre feet, a supply sufficient to serve the needs of the city for a period of several months even in the dry season.

The development of the water power and its use are notable features of the project which is being carried out. As already stated, several stations are being constructed upon the route at suitable sites. Machinery in some of them has been installed for operating the machinery of the cement mill which has been erected for supplying this material to the project; for the operation of several tramroads for carrying material; and also for dredging a lake which is located on the line, the dredge being constructed especially for this purpose, and operated entirely by electric power. The current is also to be utilized in serving a series of large electric pumps, as the supply of water is ample not only for the city, but for irrigation on an extensive scale. It is calculated that at least 20,000 acres of what is at present unproductive land in this section of California will be reclaimed for the planting of fruit, vegetables, and grain. It might be added that the transmission system from the generating stations to the points of distribution will be about 120 miles in length. In fact, the line is one of the longest in the world, and the current of 75,000 volts is the highest ever attempted over such a length of cable. The concrete-incased pressure main which leads the water to the main power house—a gradually tapering pipe, so as to accelerate the force of the water at the turbines—is the first of the kind ever put in use. Furthermore, the conduit which carries the water to this pressure main is the longest tunnel system in use for this purpose.

Construction was commenced on the eastern section, as it was realized that the tunneling and closed conduits would require so much more time than the open canal. The section in the Jawbone district has been by far the most difficult to complete, for the rock work here comprised nearly nine miles and included no less than twenty tunnels. These tunnels are connected by short redwood flumes, but to all intents and purposes they constitute one continuous underground conduit.

A reference to the headworks and the tunnel system makes clear the entire scheme. A dam, thrown across the canyon at the intake, backs the water up for over a mile, forming a large reservoir, from which the water flows into the tunnels in sufficient quantity to fill them to their required depth of 6 feet 6 inches. From this point the river, in the 12 miles to the power house, drops by a succession of falls and steep grades almost a thousand feet; but the tunnel grade has a fall of only 8 feet to the mile, the total fall to the forebay being only 68 feet. Thus, instead of the waters following their natural course far down in the gorge to the floor level of the power house, they are run through the gravity conduit high above the bed of the river, emerging from

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Sewing machine guide attachment, R. Frank 924,157
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Sewing machine spool holder, F. C. Luethy. 923,867
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Shade and curtain pole hanger, J. A. McCaskey 923,989
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Shocking apparatus, M. Kelly 924,079
Shoe, laced, M. Kroell 923,860
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Spittoon, fountain, A. C. Clark 923,946
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Spring fastener, K. & M. Gerisch 924,341
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Stack former, C. A. Hitchcock 923,844
Stacker, hay, J. H. Cope 924,534
Steam jetting device, E. A. Wildt 924,121
Stoker for locomotive boilers, mechanical, J. H. Lowe 924,364

the tunnels in the forebay, 87 feet above the power house, to which they pass through the immense pressure main to the impulse wheels of the generators. Carrying their full load, the tunnels have a capacity of 410 second feet, or 20,500 miner's inches. The conduits leading from the forebay to the power house are steel tubes, which taper from a maximum interior diameter of 90 inches to a minimum interior diameter of 28 inches. The thickness of the shell of the piping is 3/16 of an inch where it has a solid rock backing; but where it leaves this formation, and has only the steel to depend upon for withstanding the pressure of the water, the interior diameter is decreased to 72 inches, and the thickness of the pipe is increased to 1⅛ inches. Over one million pounds of steel were used in its construction.

The pressure main was built in 10-foot sections, which were hoisted over an aerial tramway to the top of the hill, and from there conveyed to an inclined shaft, where they were lowered into place. As each length was riveted, the work taking from ten to twelve hours, the iron workers left and their places were taken by the concrete molders, who formed the concrete casing around the pipe.

The head of water of 877 feet gives a pressure at the impulse wheel of 380 pounds to the square inch. The power is generated in four units, each unit operated by two overhanging impulse wheels carrying eighteen brass buckets. Each impulse wheel is set in a separate masonry compartment which opens directly into the tailrace, where the water is measured before it is returned to its natural channel.

An idea of the immense quantity of material needed for the project is given, when it is stated that the cement alone required amounted to 1,300,000 barrels. Fortunately, large deposits of sand and limestone were found in the Owens River district, and the builders were enabled to manufacture concrete along the route, the largest cement mill having a capacity of 1,000 barrels daily. The volume of water carried by this route will average a flow of over 400 cubic feet a second. The source of the supply, however, the Owens River, is one of the principal water courses in eastern California, and measurements by instrument, which were taken for a considerable period before the work on the conduit commenced, proved that the volume of water it carries is sufficient for the purpose even in the dry season of each year.

The chief engineers of this notable project, and the man to whom the bold scheme for directing the Owens River across the State is due, is Mr. William Mulholland of Los Angeles, who spent several years in looking over the proposition and preparing plans. He is assisted in the construction by Mr. J. B. Lippincott, formerly in the United States Irrigation Service.

It is interesting to remark that the motion of the solar system plays an important part in the shifting panorama of the heavens. Not only do the stars move onward, but the sun, moving also, carries us continually northward, so that our point of view is ceaselessly changing, and looking out from the flying earth, we are like people on a ship which is passing by a squadron of other ships. Their evolutions cause them to appear in constantly changing relations to one another, and at the same time our own motion, shifting the line of sight, produces other changes of view, which increase the complexity of the apparent movements. In short, we are reminded of the remarkable resemblance of the universe to the modern conception of an atom, in which the restless corpuscles are speeding in all directions, so that an infinitesimal being, inhabiting one of those corpuscles, would see the other corpuscles shaping themselves into constellations that would be as unenduring as are the figures that the poetic imagination traces among the stars.

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Stopper puller, E. Sanborn	923,897
Storm shield, A. L. Brown	924,424
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Stove, gas, M. O'Brien	924,183
Strength testing apparatus, J. L. Perkins	924,579
Strength testing machine, C. W. Putnam	924,625
Stress indicator, W. P. Chapman	924,427
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Suction apparatus, hydraulic air and other gas, W. J. Frame	924,335
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Swing, W. Johnson	923,974
Tack puller, insole, L. G. Freeman	923,828
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Tire for vehicles, removable, A. M. Condit	924,429
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Tire, pneumatic, J. F. Palmer	924,572
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