THE CLIMATE OF OUR NEW POSSESSIONS.

BY PROF. GUSTAVE MICHAUD, D.S.*

Our knowledge of the climate of our tropical possessions is derived from observations made by Spanish and Weather Bureau observers. The work of the latter, of course, extends over a relatively short period. The series of observations made under Spanish rule are frequently broken, but they are nearly always the work, if not of trained observers, at least of scientific persons.

In Puerto Rico and Cuba, the work of the Weather Bureau, although covering a period of only about two years, has been remarkably thorough. Indeed, it may be said that the importance of the Cuban and Puerto Rican Weather Bureau Reports rises far above that of mere local help given to agriculture, or even above that of the forecasting of West Indian hurricanes, for from the work of the sixty-one Puerto Rican and Cuban meteorological stations the scientific world is now getting its most complete and accurate information on many peculiarities of the tropical climate.

The following chart shows the fluctuations, through the year, of the mean monthly temperature in our new tropical possessions and, by way of comparison, in New York city, during those months only in which the climate of that city bears some analogy to that of tropical regions. Besides mere monthly variations of temperature, these curves show another climatic feature without the knowledge of which it is impossible to get an adequate idea of the effect of tropical heat on the human organism; during the dry season, which, in every island of our tropical empire lasts about six months, the heat, whether great or not, acts on the system about as it does in the course of our summers, that is, the air is neither much dryer nor much damper than in New England in July, but during the other half of the year the atmosphere is extremely damp; evaporation by the skin—the only process through which our organisms resist heat—is thereby restricted, and suffering is greater than it would be in most sections of the United States for a same degree of temperature. In the following chart the shading of the thermic curves is proportional to the amount of rain fallen in the corresponding month, so that one can estimate at a glance the amount of discomfort which may be expected in any particular month, not only from the mere intensity of the heat, but also from its nature, that is, from its being comparatively damp or dry, as the case may be.

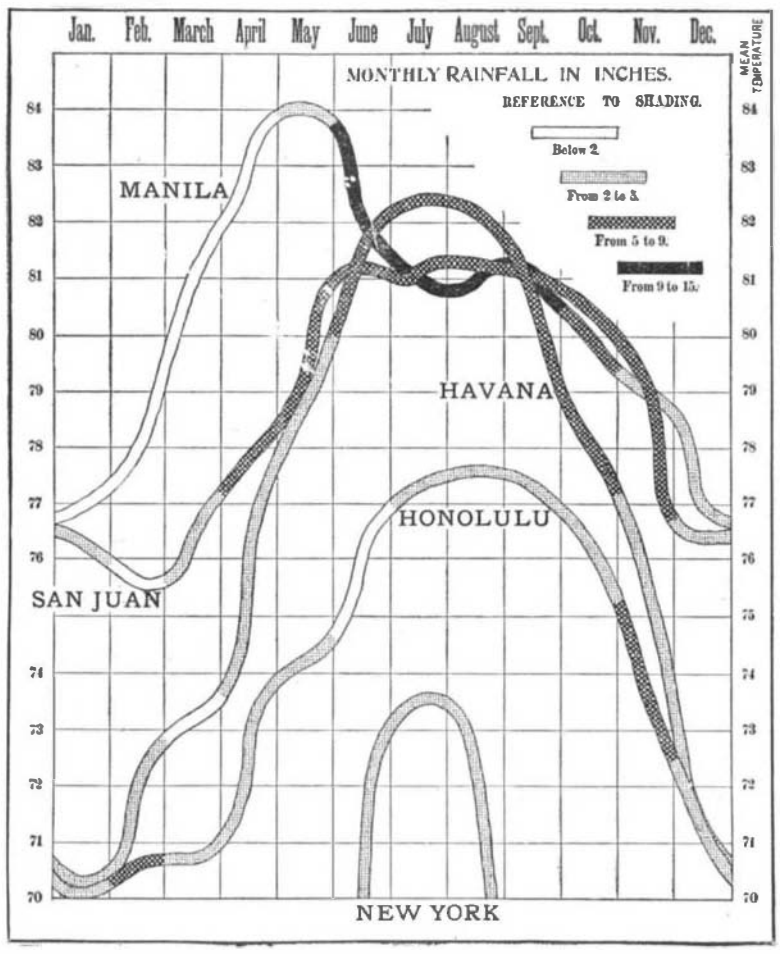

Fig. 1.—TEMPERATURE AND RAINFALL IN OUR NEW POSSESSIONS.

To complete the information contained in this chart, it is necessary to state that in none of our new insular possessions temperature ever rises much above or goes much under the monthly averages shown by the curves. The highest temperature ever recorded at Manila is 100, at Havana 101, and at San Juan 100. Continuance of heat more than its intensity is the character, *par excellence*, of tropical climate. While a tropical and a temperate country may both have, for one summer month, averages nearly identical, there is always between the two this difference, that in the tropical country the thermometer seldom goes more than ten degrees above or below the monthly average, while, outside of the tropics, in the so-called temperate zone, a thermometric monthly average is generally the result of the most extraordinary jumps above and under the number expressing it.

The climates of Manila, Honolulu, Havana, and San Juan represent probably fairly enough the relation existing between the climates of the Philippines, Hawaii, Cuba, and Puerto Rico. Other places in those islands have not always, however, the climate of the capital, for besides latitude, which, within the tropics, has not much influence on the average yearly temperature, two principal factors modify the climate of tropical regions, i. e., altitude, and in places on or near the coast, sea, and land breezes in their combination with the prevailing wind.

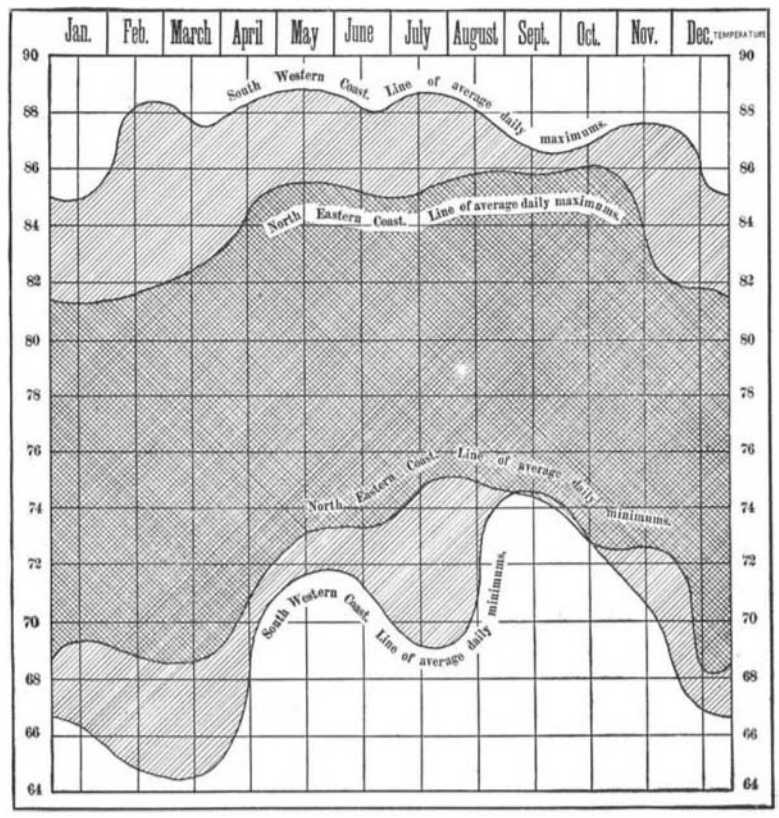

Fig. 2.—INFLUENCE OF SEA BREEZE, LAND BREEZE, AND TRADE WIND ON THE DAILY RANGE OF TEMPERATURE IN PUERTO RICO.

Altitude is the more important of these two factors. Every 300 feet brings a decrease of about one degree in the average temperature and a corresponding change in the vegetation. Tropical agriculture differs widely according to the height of the region. Cocoa is cultivated to the greatest advantage only from 300 to 1,500 feet above sea level; bananas, from sea level to 5,000 feet above; coffee, from 1,500 to 4,500 feet above sea level; tobacco, from sea level to 3,500 feet above; Indian corn, from sea level to 5,000 feet above; vanilla and the rubber tree, from sea level to 1,000 feet above. These numbers, of course, are only approximative. They are the results of random observations, not of scientific investigations. A few years ago, however, experiments conducted at the expense of the Costa Rican government by the author of this article enabled him to ascertain, with more accuracy than would have been possible in the case of other plants, that sugar cane culture for sugar making was the most profitable from 900 to 2,500 feet above sea level and ceased to be remunerative above 4,600 feet.*

Health resorts in Cuba, Puerto Rico, and the Philippines are places situated at heights varying from 1,500 feet up. Such places, however, deserve their name only during the dry season. During the other half of the year, the dampness of a rarefied air lowers in some undefinable manner the vitality of the human organism and seems to be more debilitating than sojourning in the hot, and also damp, but compressed air, some thousands of feet below.

Sea and land breezes, in their combination with the prevailing wind, remarkably improve, although in widely different ways, the climate of many large cities in our new possessions. They are of considerable intensity only in places situated between the sea and some highland and not more than half a score of miles from either. A glance at the map will show that most of the littoral cities in Cuba, Puerto Rico, Hawaii and the Philippines come within these conditions.

Sea breeze results from the action of the rays of the tropical sun on the land. Heated by its contact with the burning soil, the air rises; air blows from the surface of the cool sea to fill the partial vacuum thus produced. Land breeze is the result of the contrary action. During the night, the quick cooling of the soil through radiation causes in the neighboring air a fall of temperature and thereby an increase of pressure and of density, two circumstances which act together to push it down toward the sea. Sea breeze begins to blow at about 10 A. M., and dies away in the evening. Land breeze arises at about 8 P. M. and blows in the opposite direction until dawn. Land breeze is cold from its mode of formation and also because it generally comes from high land. Sea breeze is cool too because the sea never gets heated as land does. Both bring comfort not only through their coolness but also because they quickly renew the layers of air in contact with the body and thereby increase vaporization by the skin.

Sea and land breezes modify the climate of our tropical possessions in two different ways according to the relation which those local winds bear to the prevailing wind (trade wind in Cuba and Puerto Rico, monsoons in the Philippines).

In places where the prevailing wind coincides more or less in its direction with that of the sea breeze, it increases its velocity and decreases that of the night land breeze. As a result of that action, the days cannot be hot and the nights cannot be cool. The climate is remarkable for its small daily range of temperature, that is, for its uniformity.

If, on the contrary, the prevailing wind blows in the direction of the night land breeze, it increases its force and decreases or even annihilates the day sea breeze, thus making the days sultry and creating, during the night, more cold than one would expect to feel under the tropics. The abundant data just furnished by the network of Puerto Rican meteorological stations enable us to give the following illustration of these facts:

In Puerto Rico, the prevailing wind is the northeastern trade. On the northeastern littoral, it blows in the direction of the sea breeze. On the southwestern coast, it adds its effect to that of the night land breeze. Hence two widely different climates exist on the two coasts.

On the northeastern littoral, we find four meteorological stations: San Juan, Canovanas, Luquillo and Fajardo. We have taken, for each month of the year, the average daily maximum and minimum of temperature of these four stations. With those two classes of monthly data, we constructed two curves. The distance extending between them, for any month, is of course proportional to the average daily range of temperature, for that month, on the northeastern coast. The same work was done for the four stations of Mayaguez, Lajas, Yauco and Ponce which covers the southwestern coast, and both diagrams were superposed in order to allow the eye to make instantaneous comparisons.

The data thus charted show that the daily range of temperature is invariably the greater on the southwestern littoral, and that, in February and July, it becomes about twice that of the northeastern coast. Such facts prove the importance of the combination of the local and prevailing wind as a climatic factor in our tropical possessions.

The superiority of the climate of the Hawaiian archipelago over that of our other tropical archipelagoes is due to the truly insular position of these islands. Remoteness of land is also the cause which makes the summer of Puerto Rico less hot than that of Cuba. Again, the neighborhood of the American continent, together with difference in latitude, causes the Cuban winter to be somewhat cooler than that of Puerto Rico. Of all our new territorial acquisitions, the Philippines have the hottest and, in summer, the dampest climate. The curve of Manila in our first chart fully illustrates a popular saying of the Spaniards in the Philippines:

Cuatro meses de polvo.
Cuatro meses de lodo.
Cuatro meses de todo.

Which, being interpreted, means: Four months of **dust, four months of mud, four months of everything.**

* The sources from which I took the data charted in the drawings are the following:

For Honolulu: Manuscript; data compiled for me by the United States Weather Bureau.

For Puerto Rico: 1st. Puerto Rico Section of the Climate and Crop. Publication began in May, 1899. Data was compiled from all numbers, down to June, 1900. 2d. Observations made under the auspices of the Jefatura de obras publicas de Puerto Rico. Published in Report of the Chief of Weather Bureau for 1897-98.

For Havana: Observations made at Belen College. Republished in Report of Chief of Weather Bureau for 1897-98.

For Manila: Observations made at the Observatorio Meteorologico de Manila. Republished in Report of the Chief of Weather Bureau for 1897-98

* SCIENTIFIC AMERICAN SUPPLEMENT, No. 915.

Tesla's Patents Upheld.

Judge William K. Townsend recently gave, at New Haven, Conn., an opinion which upheld the Tesla electrical patents, which had been infringed upon by several parties. The decision was remarkable in view of the fact that it went outside the usual verbiage of the Court which is used in confirming the validity of patents. Judge Townsend said: "A careful study of the evidence shows that Tesla has made a brilliant discovery. It remained to the genius of Tesla to capture the unruly, unrestrained and hitherto opposing elements in the fields of nature and art, and to harness them to draw the machines of man. It was he who first showed how to transform the toy of Arago into an engine of power; the laboratory experiment of Bailey into a practically successful motor; the indicator into a driver. He first conceived the idea that the very impediments of reversal in direction, the contradictions of alternatives, might be transformed into power, producing rotations, a whirling field of force. What others looked upon as only invincible barriers, impassable currents and contradictory forces, he seized and by harmonizing their directions utilized in practical motors in distant cities the power of Niagara."

A New Double Salt of Chromium and Ammonium.

M. Charles Laurent, of Paris, has succeeded in forming a new double salt of chromium and ammonium. He describes his experiments in a paper recently presented to the Académie des Sciences. It is well known that the sulphates of the magnesium series give, with the alkaline sulphates, double salts whose type is the salt of magnesium and potassium, $MgSO_4 + K_2SO_4 + 6H_2O$. The only chromous salt of analogous form known at present is the double sulphate of the protoxide of chromium and of potassium, $CrSO_4 + K_2SO_4 + 6H_2O$; this salt has been prepared by Peligot. The experimenter states that he has been able to prepare another salt of the protoxide, the double sulphate of chromium and ammonium. Experiments with the chromous salts are very difficult to carry out, as in the presence of air these are soon transformed to chromic salts; all the operations must be performed in the presence of an inert gas. In this case carbonic acid gas was used. Bichromate of potassium was taken as the starting point, and from this the chromous chloride was prepared by the usual reaction; this was transformed to acetate, which is but slightly soluble, by adding acetate of sodium in excess. The chromous acetate, freed by washing from the other salts, is decomposed by the proper quantity of dilute sulphuric acid. After having expelled the acetic acid by ebullition, the proper proportion of sulphate of ammonium is added. The liquid, by concentrating and cooling, deposits blue crystals, which are separated from the mother liquor, always out of contact with air, and dried upon kaolin. This is the double salt of chromium and ammonium; it appears in fine crystals of a blue color, resembling copper sulphate. Analysis gives the formula $CrSO_4 + (NH_4)_2SO_4 + 6H_2O$. Water dissolves this salt in considerable proportions; it possesses the reducing properties of the simple chromous salts, and in the presence of air it is transformed rapidly to the chromic salt. The difficulty of preserving it from contact with air does not permit the exact determination of its crystalline form, but by its formula and external appearance it has a close analogy with the double salts of the magnesium series. This compound, into which the protoxide of chromium enters, shows another point of resemblance between chromium and iron.

Ordnance at the Pan-American Exposition.

The display of ordnance and war articles at the Pan-American Exposition will be a most notable one and will vary from a 12-inch rifle to a pocket emergency ration. There will be field batteries of artillery, camp equipage, machine and rapid-fire guns, torpedoes, small arms, and the shipbuilding industries will be fully represented. In fact, everything will be shown that will tend to interest foreign purchasing officers. This exhibit will be a commercial one and will be entirely distinct from the government display. Nearly all the South American countries have declared their intention to send a special commission to this country to investigate the war goods offered. It is planned to have a tunnel built under the bluff on which the ordnance will be located. Guns will be fired through this tunnel, and the conditions will approximate as much as possible those obtaining on government proving grounds. This is undoubtedly an entirely new venture for an Exposition and cannot fail to prove of the greatest interest. The firing range at Buffalo will be over the surface of Lake Erie, and it is hoped to make a new record for long range work. The object of the display is to demonstrate to official commissions of foreign countries the great capabilities of American plants to undertake the filling of all military and naval orders of foreign States.

The Building Edition for September.

The September number of the BUILDING EDITION OF THE SCIENTIFIC AMERICAN has the usual choice selection of houses of various prices, and among the other interesting features are "The Scoville Memorial Library at Salisbury, Conn."; "A Group of Artistic Door Knockers," measured details of interior fittings, "Fireproofing Wood," and other subjects of equal interest.

The Current Supplement.

The current SUPPLEMENT, No. 1289, has many papers of unusual interest. "The Proposed Abandonment of the Port Royal Naval Station" is an elaborately illustrated article dealing with the subject which is now agitating naval circles. "American Engineering Competition," the ninth number of which is published in the present issue, deals with locomotives. "The Fleet of Allied Powers in Chinese Waters" occupies an entire page. "Mechanical Stoking" begins a series on this subject. "Artillery School at Jüterbog" describes some very curious experiments which are carried on at this school. "Exchange Value of Meteorites" is by L. P. Gratacap. "The Automobile Wagon for Heavy Duty" is by Arthur Herschmann, and is fully illustrated.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

POULTRY NEST AND HOVER.—JOHN N. GREEN, Newtown, Ky. This portable poultry-coop is made entirely of metal, whereby the construction is less cumbrous and heavy than heretofore. The inventor has provided good ventilation. One of the novel features of the invention is a door of greater length than width. When placed in vertical position, the door prevents the hen from leaving the coop, but allows the egress of the chicks through a small opening. When placed in horizontal position, the door prevents all egress, but permits thorough ventilation.

CACTUS-BURNER.—LEWIS N. SNOWDEN, Tilden, Tex. The device is used to destroy the "spines" of the cactus or prickly-pear, so as to render it more useful as a food for cattle. Gasolene or other volatile fuel is used, which is thoroughly vaporized and burnt. The burner-nozzel is so arranged that a regulated draft is created to form a hollow or annular flame which is spread over the vaporizing-coil. The down-draft blows out of the nozzle-tip any impurities or scales which are liable to collect therein. A hood confines the flame to the vaporizing-coil until every part has been thoroughly heated.

SEAT ATTACHMENT FOR HARROWS.—OTTO W. SKORKOWSKY, Harrah, Oklahoma Territory. It is the object of this invention to provide an improved wheeled attachment for harrows or like implements, whereby the driver's seat is carried and adapted for adjustment, so as to counterbalance the draft appliances. The improved attachment comprises two bars hinged together at their front ends and fixed to an axle which is formed of two lapped parts adapted to slide on each other. Through the axle and the seat-supporting bar, a bolt is passed, which serves to secure the axle parts and seat-bar in any adjustment.

Electrical Apparatus.

CABLE-HANGER.—CLEMENT E. BEARD, Columbiana, Ohio. This hanger for telegraph and telephone cables comprises two members pivotally connected with each other and provided with prongs for engaging the cable. Hooks engage the hanger-support; and these hooks are arranged to overlap when the hanger is closed. The hooks can not open accidentally; nor is the cable or its envelop liable to be marred.

ELECTRIC MOTOR.—EDWARD A. HENRY, Crestline, Kans. The motor is particularly adapted for operating vibrating fans or other devices requiring little power. In this motor the armature oscillates, for which reason the inventor was chiefly concerned with devising some simple form of controller which would periodically change the direction of the current. The current is fed by an angle-lever, the two arms of which alternately engage two contact-plates connected with the armatures. The current changes in direction as the armatures reach the end of their travel.

ENGRAVING-MACHINE.—CHARLES CHEVALIER, Brooklyn, New York city. Heretofore the design to be engraved upon a watch-case, for example, has been raised or produced in metal on a pattern-disk, necessitating considerable work in routing out the metal around that surface which represents the design. According to the present invention, the design is cut into the metal or made in intaglio; and the cut surface is filled with wax or with other non-electric conducting material; or the design is drawn or painted on the pattern-disk with a material which is a non-conductor of electricity. When an electric tracing-finger engages with the filling in the design, the circuit is broken and the cutting-tool carried away from the surface.

Engineering Improvements.

STEAM-JET FLUE-CLEANER.—HOOKER I. COGGESHALL, Wortendyke, N. J. Steam of high pressure is passed through a blower-pipe into the conical head of the cleaner and highly heats the head. The pressure of the steam causes a current of air to be drawn between spiral-wings over the head and mingled with the steam-jet. As the air-current mingles with the steam, the combined jets coact to loosen and blow out the scale.

VALVE.—DAVID GILCHRIST, Concord, N. H. This valve, for use on expansion steam-engines, consists of a steam-chest connected with the ports of both the high and low pressure cylinders. A main valve, reciprocating in the steam-chest, is arranged to control the admission of the steam to the high-pressure cylinder. An intercepting-valve under control of the engineer, and operating in unison with the main valve, regulates the exhaust of both the high-pressure and the low-pressure cylinder and the admission of the live steam to the low-pressure cylinder.

VALVE.—ALBERT P. BROOMELL, York, Penn. The valve, although capable of general application, is especially designed for use in connection with a steam-heating system previously patented by Mr. Broomell. In this steam-heating system it is desirable to open a vent to the air when the steam is shut off from the radiator. The valve forming the subject of this patent is adapted to vent to the atmosphere when it is adjusted to close or shut off the port leading to the supply.

Mechanical Devices.

LOCK.—WALTER E. EMERY, West Chicago, Ill. This lock is especially adapted for use in connection with switches to hold the switch-point secured, but it may be also used in various other connections. The lock has a bolt adapted to be thrown by the key. A tumbler serves to hold the bolt in closed position and is also adapted to be thrown by the key to release the bolt. A chock-bar serves to hold the bolt in open position during certain periods of the operation of the lock. A keeper-plate fastened adjacent to the chock-bar limits its movement.

ATTACHMENT FOR EMBROIDERING MACHINES.—JOSEPH GRUBMAN, Brooklyn, New York city. The machine is of the Bonnaz or other type; and the attachment thereto stitches braid, chenille, tape, cord, bands, or the like upon the fabric to be embroidered in such a manner as to produce ruching or fluting effects. Mechanically considered, the attachment consists of a sleeve mounted to turn on a reciprocating needle-bar, on which sleeve a carrier is pivoted. A reciprocating nipple and a cam are mounted to turn on the sleeve and actuated by the reciprocating nipple to impart an intermittent rotary motion to the cam and cause a swinging of the carrier.

STAGE-MACHINERY.—CLAUDE L. HAGEN, Manhattan, New York city. The apparatus is to be used in connection with the reproduction of horse and chariot races on the stage. It embodies means for mounting and driving one or more traveling aprons at the rear of the stage, so as to represent the background of the scene, which gives the spectators the impression that the horses are moving forward. The apparatus was very successfully used in the play "Ben Hur," produced in New York city, and was fully described in the SCIENTIFIC AMERICAN for August 25, 1900.

APPARATUS FOR REMOVING MATERIAL FROM BELOW THE SURFACE.—HERBERT F. MUNN, 56 Beaver Street, Manhattan, New York city. Upon the deck of a vessel a compressor is mounted, which forces air downwardly through a pipe leading to the gold-bearing sands in a river-bed. The nozzle of this air-pipe is hinged so that it can be controlled from the deck of the vessel. The compressed air forces the sand through a second pipe adjacent to the first and discharging in a tank on the vessel. The arrangement has decided merits. In the first place, the gold-bearing sand is directly reached without removing the worthless superimposed strata; and, in the second place, the hinged-nozzle can be readily controlled properly to discharge the loosened material into the second pipe.

DEVICE FOR FILLING AND SHAPING CUSHIONS.—FANNIE L. MYERS, 47 Great Jones Street, Manhattan, New York city. Toilet or pin-cushions are held in a mold or shaping-block and the filling quickly packed therein to such an extent that it cannot shift and that a firm exterior surface is obtained of the desired shape.

DRIVING APPARATUS.—WALTER J. LE BARRON, Barre, Vt. The apparatus is designed to utilize the power of the wind for driving various devices, but is best adapted to marine propulsion. The novel features of the invention are to be found in a friction-gearing interposed between the wheel and the part to be driven. The windwheel turns a rotatable plate which is engaged by a friction-wheel. By sliding the friction-wheel toward and from the center, the speed of transmission is varied.

GAGED FEEDING-JOGGER.—ROSS H. PRATT, Portland, Ore. The feed-board or platen is provided with a gage for engaging one side of a sheet; and on the feed-board a pivoted angular jogger-arm is mounted opposite the gage and provided at one end with a jogger for engaging the opposite side of the sheet to move that sheet against the gage. The jogger is automatically moved outward, and is moved inward by a spring. The sheets are held in proper position between the jogger and the gage, while moving off the feed-board; and in case of a platen-press the sheets are brought in proper position, so that each receives the color impression at the proper place.

Railway Contrivances.

DETECTOR-BAR.—WILLIAM H. HIGGINS, Jersey City, N. J. Detector-bars are employed to detect the presence of engines or cars upon a railway-track and to prevent the movement of a switch under the engine and cars. The present invention provides such a bar of any desired length. The lower portion of the bar is furnished with any desired number of motion-plates, the lower surface of which has movement in guides or clips to impart the desired motion to the detector-bar; while the upper surface of the motion-plates serves as guides for the bar, acting in conjunction with guide-surfaces carried by the clips in which the detector-bars have movement.

PNEUMATIC SAFETY-GATE.—WILBUR F. HORN, Carlisle, Penn. The inventor has devised improvements in railroad safety-gates, whereby the gates are operated by the direct power of currents of air, gases, or vapors issuing from or entering the gates on opposite sides of their axes. These currents are produced by pressure appliances automatically actuated at a distance by the railway rolling-stock.

Miscellaneous Inventions.

ADJUSTABLE SCREW-JACK.—JOHN C. F. LONG and JAMES N. BISH, St. Mary's, Ohio. This adjustable screw-jack is especially intended for service in oil-wells in raising and lowering sucker-rods, polish-rods, valves, etc. It contains a hollow screw-rod, with a head having an offset thereon for keeping the screw-rod from turning. Also a set-screw in the head, a nut screwing on the screw-rod, a swivel mounted to turn on the nut and furnished with a head having a bore adjusted on a line with the bore in the head of the nut, and that in the screw-rod. A set-screw is in the swivel-head, with means for holding the swivel against any displacement in the head of the nut.

TOOTHPICK.—GEORGE W. SCHEILENBACH, Joplin, Mo. The toothpick has a hollow tubular body such as a quill. One end is closed and the other is formed with a point. Adjacent to this point and within the hollow body, there is a quantity of flavoring or medicinal substance, held in place by cotton wadding or other packing. When using the pick these ingredients which may be gum-camphor, licorice-root, cinnamon-bark, sirup, honey, or the like, are brought into use. The purpose of the device is to provide a substitute for cigarettes, chewing-tobacco, etc., for the use of which there is a strong inclination after eating.

TOY DRUM.—MORTON E. CONVERSE, Winchendon, Mass. The body of the drum has metallic heads with circular flanges extending toward each other and surrounding the ends of the body. Annular flanges project outwardly from the inner ends of the cylindrical flanges. Hoops surround these cylindrical flanges and rest on the annular ones. The construction of the toy enables the parts to be separated with facility and nested so as to take very little space in transportation, and to be readily put together and secured in their proper positions for use.

NUT-LOCK.—HORATIO E. DOWNING and HARRY L. DORSETT, Seward, Oklahoma Territory. To hold a nut securely so as to prevent any turning after it is screwed up to the desired place, the inventors have provided the nut with a recess extending along the bore of the nut, the bottom of the recess inclining inwardly and downwardly. A tapered locking-slide having an inner sharp corner and fitted to be driven home in the recess, forces the corner inward into the threads of the bolt. A cover removably beld on the nut holds the locking-slide in place.

GARMENT-TRIMMING.—RICHARD G. MARSH, Manhattan, New York city. The fabric folds upon itself and forms a plait, the folded parts being stitched together by a wave-like line of stitching. The portion between the stitching and the folded edge on being removed forms a scalloped edge for the plait outlined by the stitching. This serves to hold the plait in position over the body portion of the fabric. There can be any