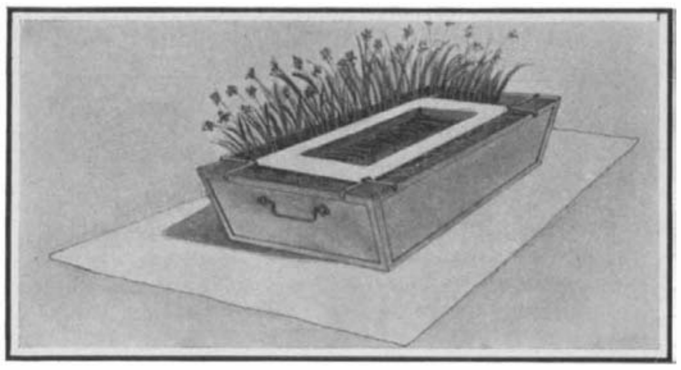
A POLLEN-GATHERING PATENT DEDICATED TO THE PUBLIC.

Mr. E. Moulié of Jacksonville, Fla., has invented a pollen-gathering device, patents for which he has dedicated to the public for the general good. Furthermore, he will place the device at the disposal of scientific men who are interested in the gathering of pollen. The apparatus is suitable for universities and colleges, and such institutions where botany is taught.

The importance of the invention may perhaps be gaged if we consider the previous methods of gathering pollen. With the first of his machines Mr. Moulié, under the most favorable circumstances, gathered one and a half ounces of pure pollen of the ragweed (*Ambrosia Artemisafolia*) in three days, and this with three charges of twigs, one for each day. It was the opinion of the late Prof. A. A. Curtiss, a prominent botanist, formerly connected with the Smithsonian Institution, that to collect that amount of pollen it would have taken one hundred persons thirty-six hours.

Mr. Moulié's device consists of a vessel provided with means for holding the slips or twigs bearing the blossoms from which the pollen is to be collected. The vessel is filled with water, so as to keep the twigs fresh and ripen the blossoms. The blossoms overhang the edge of the vessel, so that the pollen falls upon a paper sheet spread closely around the bottom of the vessel, which bottom is narrower than the top of the vessel, so that the paper is free to be removed without touching the vessel. The vessel or tank is made of sheet metal. Over the top of the tank is a sheet-metal plate supported over two longitudinal and two transverse rods, the edges of the plate being bent around the rods. This cover plate is smaller in area than the top of the tank, so that a narrow channel or opening is formed around the entire perimeter of the plate. The rods project across this opening, their ends being bent over the rim of the tank. Into the openings around the plate the twigs and branches are inserted, their lower limbs being immersed in water. The branches are tilted, so that their upper ends project beyond the sides of the tank. To keep them in this position, and to prevent them from sliding too far into the tank, the cover is cut at the center to form a pair of flaps, which are bent outward and engage the stems. As previously stated, the tank is surrounded by sheets of paper, on which the pollen falls as the blossom ripens. The ripening is brought about by the gradual rise of temperature in the room where the operation takes place. When desired, the water in the tank may be drawn off without disturbing the branches, through a tube connected with a stopcock near the bottom of the tank. Fresh water can be poured through an opening in the cover plate. The device renders it possible to collect the pollen of flowers in unlimited quantity in its full state of fertilizing power, a thing impossible to be sure of by the ordinary process, hitherto the only method available. The ease with which much pollen can be collected at practically no cost renders it possible to obtain a sufficient quantity for accurate and exhaustive analysis, and to add to our knowledge of that wonderful mystery of nature, the breeding of plants. Moreover, an antitoxin for diseases such as hay fever could probably be prepared from the pollen of the ragweed. If the device served this purpose alone, it would reflect considerable credit upon its inventor.

To obtain pollen from the ragweed, Mr. Moulié selected a room having a single window exposed to the east, two windows exposed to the south, and one window exposed to the west. The apparatus was charged with twigs bearing ragweed flowers which were not quite open. The charged apparatus was placed upon a table extending from one end of the room to the other, with a space of two feet between the apparatus and the walls. The vessel was filled with clean water poured in through the opening at the top, care being taken not to spill any of the water on the flowers. The paper was then spread around the apparatus, so as to cover a sufficient space from the bottom of the apparatus to about six or eight inches beyond the perpendicular line of the top of the twigs, so that the pollen could not drop outside of the paper. The paper employed was a thick Manila brand. After the apparatus was installed, all the windows and adjacent doors were closed, and a Rochester kerosene lamp having a burner one inch in diameter was placed on the floor. To avoid the danger of fire, the lamp was placed in a large tin can. After the lamp had been lit, the apparatus was left to itself, and the door of the room locked until the next morning.



MOULIÉ POLLEN GATHERER.

The twigs selected must be used as quickly as possible after they are gathered. Moreover, they must be gathered in the morning before the sun is too high, but not before they are free from moisture (dew or rain). This brings the work of gathering to about noontime. After the room is opened, care must be taken in opening the doors, so as not to create a draft which might blow the pollen off the sheets upon which it has dropped during the half day and night. The door must be closed immediately for the same reason. The temperature at that time ought to be between 85 and 88 deg. Fah. In order to gather the pollen, Mr. Moulié took one sheet loaded with it, and placed it on a table in an adjacent room, closing the connecting door between the rooms as well as the windows and other openings. The pollen was collected by means of a feather and dropped into wide mouthed two-ounce jars, similar to those in which vaseline is sold. The jars were filled to about one-half inch from the bottom. The collected pollen contains a certain amount of moisture, which must be evaporated for safe keeping. To effect this, Mr. Moulié placed the jar or jars behind the windows in the room where the apparatus was installed, and arranged them so that they touched the windows. The rays of the sun streaming through the window pane and the glass jar caused evaporation to take place in about thirty minutes. Then after shaking gently until there were no more lumps, the jars were brought into the next room, and left there for one hour before they were corked. The corks selected were of the best quality and wrapped with a fine paraffine paper, so as to effect a tight closure.

Small quantities of pollen can be poured in a single jar to the height of the neck. Very few readers of this journal realize what an ounce of pollen means. Perhaps some conception of the task may be had, if one imagines the collecting of an ounce of dust from the wings of butterflies.

PHOTOGRAPHING A STAR SPECTRUM.

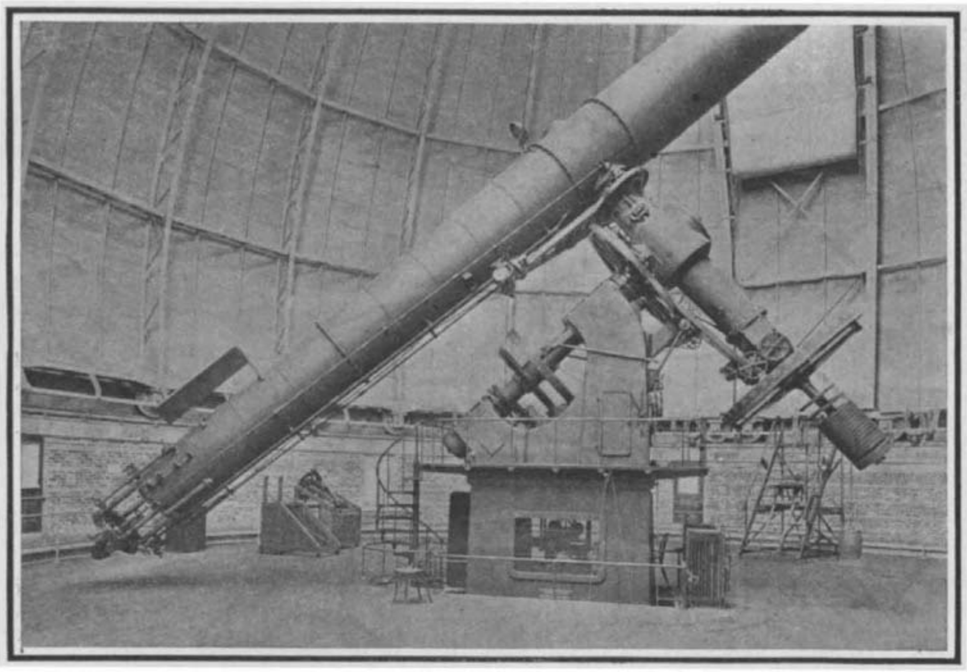
BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

If one should go to the Sandy Hook lightship off the entrance to New York Bay, and at night should see the lights of a steamer headed for the harbor, it would be practically impossible, merely by looking at these lights, to learn how fast the steamer was approaching. A rough guess might be made by watching the lights grow gradually brighter, but it would be the roughest sort of an approximation. But the astronomer with his telescope, observing the distant stars millions on millions and millions of miles away, can tell to an absolute certainty just how fast a particular star is moving toward us or away from us, giving the motion accurately to the fraction of a mile per second. Nor is this result obtained by watching the increase or decrease in the star's light, due to its approach or recession, for the stars are so far distant that no change in their brightness would be observed in a thousand years from their change of distance alone. The measurement of a star's motion in the line of sight is one of the new fields for the astronomer, and many and valuable are the scientific results accruing from this line of work.

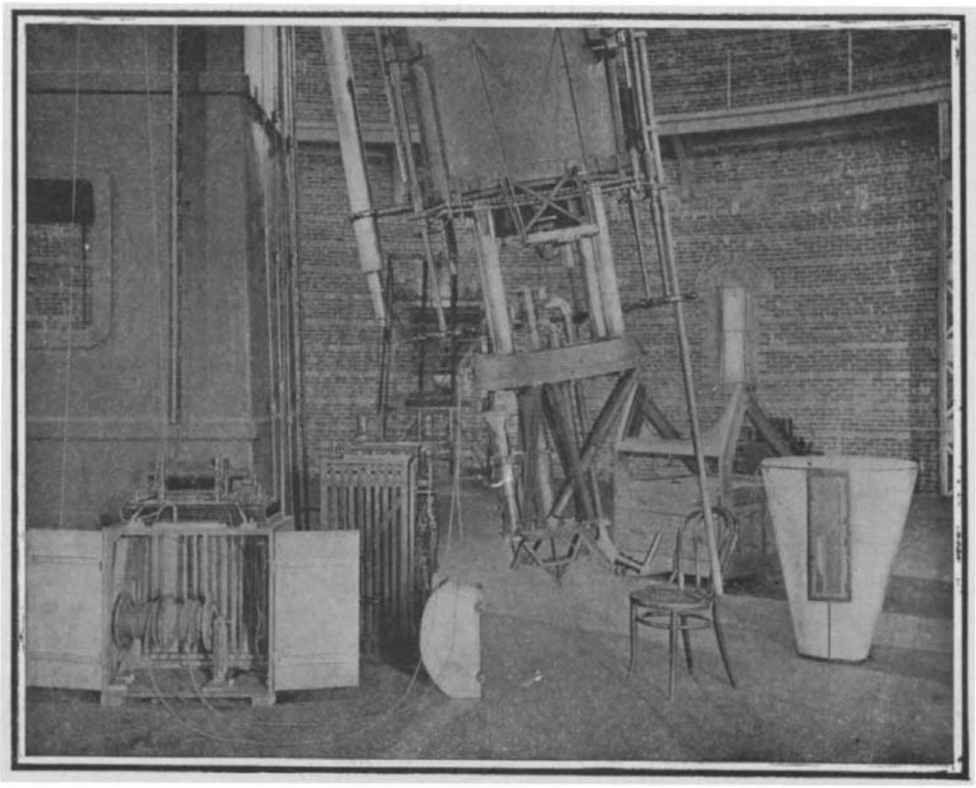
The writer was at the Yerkes Observatory last summer, taking part in the campaign for measuring the radial velocities of all the brighter stars that can be seen from northern latitudes, and assisting in photographing the spectra of stars with the 40-inch telescope and its attached spectrograph. And what a magnificent instrument this greatest refractor in the world is! To work with this great telescope causes a feeling akin to awe in realizing that puny man, on this infinitesimal speck in the universe, called earth, by the aid of such an instrument, is able to fathom the depths of space, and reveal the secrets of stars millions and millions of miles away. Truly, there is no science which can show the matchless power of the human mind quite so well as does the old science of astronomy. the parent of all the sciences. A view of the largest refractor in the world shows also the high degree to which engineering skill has advanced in recent years, again attesting to the close union between pure and applied science.

The observatory, presented to the University of Chicago by Charles T. Yerkes, is situated seventy-five miles from Chicago on the shores

(Continued on page 495.)



The Yerkes telescope with floor raised to highest position.



Bruce spectrograph fitted to the Yerkes telescope.

PHOTOGRAPHING A STAR SPECTRUM.

PHOTOGRAPHING A STAR SPECTRUM.

(*Continued from page 485.*)

of Lake Geneva, the summer home of many of the Windy City's millionaires. On high ground to the north of the lake, the observatory presents a fine appearance with its great dome to the west and two smaller domes to the east of the buildings. Passing through the main doors, one enters a fine rotunda, and going up a flight of marble steps comes into the great dome, 90 feet in diameter, and gazes on the great telescope towering aloft. One beholds a massive iron stand supporting an immense steel tube of boiler plate sixty-two feet in length, five feet in diameter at the middle, tapering to three and a half feet at either end. At the upper end of the tube is the object glass, with a clear aperture of forty inches; at the other end the eyepiece and micrometer, for viewing and measuring the planets and stars, or these may be replaced by a camera attachment for photography, or by a spectrograph for obtaining the spectra of stars, planets, or sun. The telescope tube is so long that the eye end is about thirty feet higher when an object is viewed near the horizon, than when looking at a star directly overhead. To use such a telescope, requiring as it would a long system of ladders, would be well nigh impossible, were it not for an invention of Sir Howard Grubb in making the whole observing floor an elevator. The front page illustration shows the floor at its lowest point, while another view shows the floor raised as high as possible. At Yerkes the floor, seventy-five feet in diameter, big enough to seat six hundred people, can be raised and lowered through a distance of twenty-three feet, and thus the observer when working with the telescope may keep the floor at a convenient distance below the end of the telescope, the operating power being electricity. In the front-page illustration are shown two of the four counterweights that balance the floor. An idea of the size will be obtained by remembering that the dome is ninety feet in diameter. When the astronomer wishes to observe a particular star, it is necessary to turn the slit of the dome in the direction of the star, and hence the dome must be revolved. This is ninety feet in diameter and weighs one hundred and forty tons, but again by the aid of electric motors it can be rotated at will by turning on the current from the rising floor.

Turning to the telescope, we find a machine of fifty-three tons in weight, wherein the movable parts weigh twenty tons. This weight the astronomer has to put in motion when he turns the telescope, yet ball bearings and the refinements of modern engineering permit him to move the great machine, using only his own physical strength. For quickly turning the telescope, electric motors are used. The telescope is set up by what is known technically as the equatorial mounting, one axis, the polar axis, in the meridian parallel to the earth's axis of rotation, the other, the declination axis, at right angles to it. Circles on these two axes give the astronomer the means of locating the star by its hour angle and declination. When the star is once in the field of the telescope, it is kept there by a clockwork mechanism driving the telescope about the polar axis at a speed exactly equal and opposite to the earth's rotation. The writer of this article has used the telescope when the thermometer stood at 26 deg. below zero Fahrenheit, and yet at this temperature the mechanism worked to perfection, which speaks wonders for the excellence of this mounting made by the well-known firm of Warner & Swasey. Indeed the professional astronomer has a hard life of it, which requires a great amount of physical endurance. In the summer nights when the temperature renders life comfortable, the nights are short, the astronomer might then be permitted to join a labor union; for he can

(*Concluded on page 496.*)

(*Continued from page 494.*)

Initiation device, U. S. De Moulin........ 943,219
Insole, O. F. Fogelsong.................. 943,243
Internal combustion engine, F. & E. Carter. 942,886
Internal combustion engine, C. O. Hedstrom 943,072
Internal combustion engine, J. O. Heinze... 943,408
Internal combustion engine, I. Hovey....... 943,598
Internal combustion engine, double acting, Horner & Boyland.................. 943,597
Invalid handling device, E. Cleaves........ 943,003
Iron and steel, metallurgy of, Simpson & Oviatt 943,574
Ironing board, L. Stowe 943,485
Jar or receptacle, R. H. Wolff............ 943,585
Jewelry, L. Adler 943,291
Keyless socket, H. Hubbell 943,076
Knife, T. C. Fradsham.................... 943,184
Knitting machine, A. M. Pigeon.......... 943,230
Lace and the like, shoe, H. F. Schelling... 943,607
Ladder, extension step, Binger & Burgstaller 943,511
Lamp, berth, Hamm & Legge............ 942,963
Lamps, carriage for electric, R. S. Beard.. 943,174
Lamps, pressure controlling valve for automobile, F. C. Bargar.................. 942,995
Land drainer, mechanical, J. Scott........ 943,571
Land roller, W. J. Dunham 942,892
Lap fastener, F. A. Boyer 943,135
Latch lock for swinging doors, Buetikofer & Hoffman 943,615
Latch, night, R. A. Chase 943,216
Laundry marking machine, T. L. Taylor... 943,203
Lavatory, W. Podmore 943,458
Lawn sprinkler, C. Ballreich 943,172
Lens drilling device, L. Wilhelm.......... 943,289
Lenses for spectacles or eyeglasses, manufacture of, H. Orford................ 943,449
Light extinguisher, J. H. Burdock......... 943,176
Link, detachable, J. Dufour 943,220
Liquid fuel burner, A. E. Stevens......... 943,482
Liquid indicator, E. E. Hans.............. 943,596
Loader, foldable, C. A. Radcliff........... 943,099
Lock, R. Schoell 943,471, 943,637
Locking mechanism, combination, H. Van Hoevenberg 943,493
Loom, L. H. Landry 943,028
Loom for weaving tufted fabric, H. Wyman 942,953
Loom harness motion, D. D. Miller........ 943,262
Loom, shuttle changing, B. F. McGuiness.. 943,038
Loom templet L. H. Landry 943,150
Loom thread guide, J. Robinson........... 943,270
Loom, wire fence, V. Hoxie 943,412
Looms, pick counter for, M. L. Stone..... 943,049
Looms, tulf yarn carrier for pile fabric, C. C. Brinton 942,999
Magazine, F. Smithson 943,479
Magneto motor, C. S. Kershner............ 943,420
Mail bag catching and delivering apparatus, H. J. Hansen 943,071
Mail carrier, Buck & Willis 943,136
Mail catcher, A. M. Bridgewater.......... 943,336
Mail chute, J. W. Cutler 943,183
Manifolding apparatus, A. Lewis.......... 943,195
Mantle, incandescent, T. Terrell........... 943,488
Marking board, upholstery goods, Hulse & Schramm 942,908
Match boxes, machine for pasting the inner boxes or slides of, C. S. Nyberg...... 943,158
Match safe, E. & D. C. Pooler............ 943,098
Matrix retainer, J. W. Ivory.............. 943,353
Measuring device, skirt, C. W. Smith...... 943,278
Measuring granular materials, device for, O. D. Havard 943,405
Mechanical movement, R. A. Schoenberg.. 943,274
Megaphone, H. Meredith-Jones 943,252
Merry-go-round, G. Schmid 942,937
Merry-go-round, J. & J. Setecka........... 943,276
Metal, forming ribbed expanded, J. Kahn. 943,417
Metal, reclamation of purified, W. C. Hyzer 943,248
Metals, protecting molten, Rockey & Eldridge 943,161, 943,639
Mine ventilating system, M. Ward........ 942,950
Mineral classifying apparatus, R. H. Richards 943,101
Mirror, hat, C. L. Cruver 943,005
Moistener and sealer, envelop, F. Roth.... 943,318
Moistening apparatus, air, W. H. Webb et al. 943,638
Mold. See Vulcanizing mold.
Molding press, E. C. Willliams............ 943,504
Motor control system, electric, A. C. Eastwood 943,011
Motor starting and stopping apparatus, electric, C. Spannagel 943,047
Motor starting switch, electric, E. Garside 942,960
Mouth brace, C. Mayer 943,361
Moving implement, J. H. Fichter.......... 943,013
Mower starting device, J. C. Oliva........ 943,044
Mowing machine, W. Crain 943,181
Mowing machine, C. H. Pelton 943,266
Muffler, exhaust, J. Boyle 943,233
Muffler, exhaust, C. L. Hensley........... 943,544
Music leaf turner, R. J. Trice............. 942,949
Music rack, R. W. Mills 943,091
Music sheet guiding mechanism, T. P. Brown 942,956
Musical instrument, pneumatic, P. B. Klugh 942,915
Nailing machine, H. W. Morgan........... 943,035
Ne le feed mechanism, A. G. Fenn....... 942,895
Needle guide, A. Leach 942,919
Nipple flange, Reynolds & Smith.......... 943,123
Nitrids, producing, C. E. Acker........... 943,132
Numbering machine, F. Wosinski......... 943,210
Oil burning and steam generating apparatus, J. W. Spurrier.................. 943,481
Oil from wax, process and apparatus for the extracting of, J. C. Kuebler...... 942,917
Ore cooler, F. D. Baker 943,294
Ore grinding machine, J. C. Tatman...... 943,486
Oven, baker's, W. D. De Vaughn......... 943,395
Oven door, E. H. Huenefeld......943,546 to 943,549
Overshoe holder, Wessels & Ingraham..... 943,582
Oxygen with other gases, process and apparatus for burning, A. R. Bullock... 943,385
Packing case, A. T. Kruse................ 942,966
Packing for piston rods and the like, G. Huhn 943,019
Packing for stuffing boxes, G. Strance et al. 943,169
Packing, pneumatic, E. S. Johnson........ 943,023
Padlock, I. M. Bremer 943,379
Paper bag, J. Sofge...................... 943,126
Paper bag machine, W. Liddell........... 943,428
Paper bag machine, W. C. Fuller.......... 943,534
Paper box and making the same, B. S. Morgan 943,034
Paper cutting machine, E. A. La Due...... 943,258
Paper feed mechanism, P. J. Meahl....... 943,261
Paper feed mechanism, W. Benjaminovitsch 943,622
Paper holder, E. C. Smith................ 943,279
Paper package closure, C. F. Jenkins...... 943,307
Paper receptacle, B. C. Cockrell.......... 943,389
Paper slitter, S. M. Langston............. 943,357
Paring machine, G. Jahansan 943,249
Paring machine, vegetable, H. Robinson... 942,932
Peach pitter and slicer, W. I. Irwin...... 943,193
Pencil sharpener, A. W. Gifford.......... 943,223
Percolator, coffee, Mowbray & Geist....... 943,036
Phonograph, H. S. Mills 943,313
Phonograph horns, means for supporting, Turner & Glover 943,492
Phonograph records, mandrel for, W. C. Runge. 943,568
Photographic pictures, projecting continuous, L. L. Thurstone................ 943,326
Picking motion, L. H. Landry............ 943,027
Picture frame, E. Oldenbusch 943,367
Pipe coupling, J. C. Yearke.............. 943,330
Pipe coupling, G. H. Reynolds........... 943,461
Pipe joint molding apparatus, J. F. Milam 943,558
Pipe joint, rotary stand, W. S. Phelps.... 943,267
Pipes, removable cap for, Carter & Houle. 943,338
Plane, combination wood working, M. L. Carter 943,178
Planer tool, A. F. Liden 943,086
Planter, corn, E. H. Snyder.............. 943,283
Planter valve mechanism, corn, F. P. Murphey 943,634
Planters, valve mechanism for corn, F. P. Murphey 943,441
Pliers, P. Broadbooks 943,381
Plow, C. W. & A. W. Landers............ 942,918
Plow, H. Moore 943,092
Plow, C. C. Whittington 943,584
Plow point attachment, W. L. Camp....... 943,001
Plow, reversible moldboard, J. W. Buchanan 943,516
Plow scraper, reversible disk, H. S. Austin. 943,372
Pneumatic despatch tube system, F. H. Wolever 943,329
Post or telegraph and telephone pole, H. E. Atchison 943,134
Potato cutter, seed, L. F. Miller.......... 942,969
Potato digger, H. P. Stewart 943,325

(*Continued on page 496.*)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The Nat'l Co-op. Real Estate Co., Suite 378, Marden Bldg., Washington, D. C.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

ITALY.—Important technical office, having widest connection in Italy, is prepared to treat with a first-class Machine-manufacturing firm. For full information and particulars, write to Ing. Michele S. Foa, Turin (Italy), Corso Oporto 31bis.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

EDUCATIONAL.

CIVIL SERVICE EMPLOYEES are paid well for easy work; examinations of all kinds soon; expert advice, sample questions and Booklet 40 describing positions and telling easiest and quickest way to secure them free. Washington Civil Service School, Washington, D. C.

Inquiry No. 8990.—For information regarding shoes not made of leather but similar to the same and are as durable.

PATENTS FOR SALE.

PATENT FOR SALE.—Something New, Automobile Automatic Drop Brake. For further particulars, address Box 45, W. Enfield, Maine.

Inquiry No. 8996.—Wanted addresses of manufacturers of machinery for working orange wood manicure sticks.

FOR SALE.—States' rights or outright, Patent 937,891 for Safety Gas Hose Connection. Instantly and absolutely seals hose on detachment from stove. Can't suicide by Safety Hose. Dennis Tangney, 213 So. 6th St., Philadelphia, Pa.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE.

FOR SALE—Engine lathe, swings 9½ in., takes 25 in. between centers. Complete with full set change gears to cut all size threads, 3 to 40 in. Price only $43.50. Address L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9016.—Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

WANTED.

WANTED TO BUY Water Cooled Stationary Gasoline Engines, from 1 to 10 h. p. from manufacturers of same willing to furnish under our own name, in carload lots, or large quantities, for cash. Manufacturers state full particulars to Water Works, Box 773, New York.

Inquiry No. 9023.—Wanted, to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9025.—Wanted, address of rubber manufacturers in Germany.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9029. — Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

Inquiry No. 9034.—For manufacturers of machinery that could reduce stumps to kindling wood.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

Inquiry No. 9044.—Wanted to buy outfits necessary for agate polishing.

Inquiry No. 9046.—Wanted, machinery used for the manufacture of all kinds of fruit boxes, baskets and crates.

Inquiry No. 9048.—Wanted, address of manufacturers of metal table slides for extension tables.

Inquiry No. 9049.—Wanted, to buy rotary brushes suitable for a shoe shining machine.

Inquiry No. 9052.—Wanted, to buy machinery, etc., for a beer plant, that manufactures beer by means of glucose.

Inquiry No. 9053.—Wanted, address of firms who install plants to manufacture nitrogen.

Inquiry No. 9054.—Wanted, address of manufacturers of articles made from mica.

Inquiry No. 9055.—Wanted, address of parties interested in Log Cleaning Machines.

Inquiry No. 9056.—For manufacturers of window shades.

Inquiry No. 9057.—For manufacturers of glass and china balls, used as fixtures or ornaments on lightning rod equipment, also weather vanes for same purpose.

Inquiry No. 9058.—Wanted, firms who make machinery used for pulverizing soap-stone.

Inquiry No. 9059.—For manufacturers of flexible steel chain mail.

(*Concluded from page 495.*)

work but eight hours. But he would be obliged to resign from the union in the winter time; for observing starts at five in the evening and continues till seven the next morning, fourteen hours without a break. And how pleasant this is with the thermometer twenty-six degrees below zero! It needs quite a deal of enthusiasm to keep one from freezing to death!

To photograph the spectrum of a star, a spectroscope or rather spectrograph is attached to the eye end of the telescope. The object glass focuses the star's light on a fine slip not more than one hundredth of an inch in width and one-eighth of an inch in length. After the light passes through this slit it passes through the collimating telescope, then through the prism or prisms which break the star's light up into its component colors or spectrum, then through the camera lens and is finally brought to a focus on the photographic plate where is obtained a photograph of the star's spectrum. Much careful thought and many refinements were necessary before the spectroscope was brought to its present great degree of precision. To mention a few of them. How is it possible to keep the great telescope tube so accurately directed to the star that its light is focused on the center of the slit one-hundredth of an inch wide, for if the light does not pass through the slit it will not fall on the photographic plate. This was made possible by making the slit jaws of polished silver, and watching the stray light reflected from the silver jaws by combining prisms and lenses in a rather curious fashion. The observer keeps his eye at an eyepiece where he can see the star image on the slit, and causes the star image to remain centered there by using the slow motions of the telescope. The exposure necessary to make a photograph depends on the brightness of the star and may last from a few minutes to two, three, or five hours, or in some few cases to eight or ten hours. During this long exposure the temperature has probably fallen a number of degrees, and the instrument has been affected by all its parts contracting. This might result in a change in the prisms with the consequence that the photographed spectrum will not be sharp and in as good definition as it might be. To overcome these difficulties, the whole spectrograph was inclosed in a tight aluminium case lined with glass work so as to be non-conducting. Fine wires were placed inside this case. While the exposure was being made a thermometer inside the case was watched through a glass window, and if the temperature dropped, a current of electricity was turned through the wires inside the case, and kept turned on till the proper temperature was reached. Within the past year a thermostat has been introduced and the temperature is automatically kept constant. And hence while the exposure is being made the spectrograph is kept at a constant temperature, there is no change in its several parts and a sharply-defined spectrum will result. A wonderfully accurate instrument this makes leading to results of the highest degree of precision.

AN AERIAL PASSENGER RAILWAY.

(*Continued from page 488.*)

haulage. From the haulage cable, which is one and one-half inches in diameter, the buckets are suspended, their entire weight being sustained by two steel four-inch flanged wheels running over the stationary cable.

These buckets are constructed of heavy wrought iron, six feet long and four wide, with a door opening on the right side, which door is securely bolted when the bucket is *en route*. There are twenty-six buckets on the line, carried by the haul-

(*Concluded on page 499.*)

(*Continued from page 495.*)

Potato sorter, W. Pertzsch 943,097
Power transmission mechanism, E. E. Keller 942,913
Printing machine, L. W. Southgate 942,980
Printing press, G. E. Pancoast 942,923
Printing press, W. F. S. Ferry 943,629
Printing press brake, C. A. Wright 943,507
Printing press ink fountain, A. M. Cottrell 943,218
Propeller, marine, D. Urch 942,986
Propeller, vibrating, E. Hildebrandt 943,074
Pulp digesters, charging, E. F. Parker 942,924
Pulp feed regulator, A. Schultz 943,165
Pulp, machine for saving waste, E. F. Parker 942,925
Pulverizer, land, L. Traub 943,490
Pump attachment, oil, Aggas & Rabbitt 942,954
Pump, double acting, R. G. Holekamp 943,018
Pump, governed, N. McCarty 943,095
Pump rod coupling, C. L. Kenyon 943,080
Pump, vacuum, T. W. Lowden 943 556
Pumps, automatic device for controlling the operation of, W. F. Otto 943,369
Pumps, operating mechanism for double-acting, O. F. Preslar 943,201
Puzzle, J. F. Collins 943,390
Puzzle, A. Weigt 943,496
Rack. See Display rack.
Rail bonds, manufacture of, G. A. Mead 943,438
Rail chair, A. Wardle 943,206
Rail clamp, guard, M. Burpee 943,138
Rail frog, continuous, Suverkrup & Owens 942,947
Rail joint, Deer & Smith 943,394
Rails, step joint for, J. H. Allen 943,057
Railway construction, E. D. McDonald 943,198
Railway crossing gate, H. J. Richendrfer 943,566
Railway crossing gate, electrically operated, T. Hummel 943,352
Railway fastener, C. H. Cornell 943,520, 943,521
Railway fastening, C. H. Cornell 943,522
Railway lining block, A. Barnhard 943,295
Railway rail splice, I. N. Prenovich 943,619
Railway rails, nut holder and joint supporter for, G. W. Henry, Sr. 943,543
Railway switch, F. Bayless 942,996
Railway switch, P. E. Vail 943,053
Railway switch, Reinoehl & Weaver 943,269
Railway switch mechanism, F. P. Perkins 942,927
Railway system, electric, G. H. Maire 943,196
Railway tie, C. A. Reed 943,268
Railway tie, H. L. Hollis 943,409, 943,410
Railway tie, metal, L. J. Sparks 943,048
Railway tie plate, T. A. J. Hendricks 943,073
Railways, junction signal for mining, W. Kleman 943,114
Range finders, means for supporting and working heads of, Barr & Stroud 943,296
Razor blade stropping device, O. Kampfe 943,355
Razor stropping device, C. F. Benedict 942,880
Refrigerating apparatus, ammonia, T. C. McKee 943,040
Registers, wall frame for air, R. O. Brown 943,298
Rein holder, A. Bing 943,376
Rein holder, H. Green 943,537
Resizer, F. W. Moore 942,921
Ribbon feeding mechanism, Craig & Coffman 943,624
Rifle rear sight, W. R. Hatfield 943,542
Road-bed cutting apparatus, L. D. Craig, reissue 13,055
Rock crusher, E. S. Philips 943,455
Rolling mill, H. Grey 943,633
Rope coupling, Shufflebottom & Kenworthy 943,168
Rotary gasoline engine, T. E. Braley 943,592
Ruling device, E. A. Auerbach 942,877
Sad iron, J. Kadiera 943,254
Sad iron, F. W. Emerson 943,302
Safe, protecting, Martin & Smith 943,437
Sardine tins and the like, key for removing lids from, Read & Miles 943,459
Sash and door check, combined, G. F. Ehemann 943,401
Sash balance, window, Greear & Cox 943,014
Sash fastener, J. A. Dillow 943,301
Saw blade, R. E. Martin 942,920
Sawmill stock lifter, E. J. Gibson 943,304
Scaffold, flying, Martens & Schulz 943,436
Scale, D. C. Stauffer 942,945
Seeding device, combined disk and shoe, N. L. Heckman 943,406
Self-adjusting wrench, R. H. Anderson 942,992
Sewing machine, C. F. & M. T. Goforth 942,899
Sewing machine structure, V. Bloom 943,623
Shade machine knife, window, E. O. Engberg 943,221
Shade supporting device, E. H. Lunken 942,967
Shaft or pulley coupling, T. White 943,209
Shaft reversing means, H. F. Seybert 943,477
Shaft support, Stansbury & Hutchison 943,576
Sharoener, knife, B. F. Emery 942,959
Sheet metal culvert, corrugated, H. W. Harry 943,306
Sheet metal, galvanizing, A. Niedringhaus 943,264
Sheet metal wiring machine, W. R. Magie 943,118
Shock absorber, J. H. Friedenwald 942,896
Shock deadener, Mayesky & Boileau 943,119
Shock loader, J. B. Schuman 943,473
Shoe tree, A. H. Taft, reissue 13,057
Shoe trimming machine, A. Vose 942,987
Sifter, ash, S. J. Phreaner 943,457
Sign, electrically illuminated, J. H. Goehst. 943,246
Signal light apparatus, G. Dalen 943,300
Signal system, automatic, P. O. Adams 943,587
Signaling apparatus, selective, O. M. Leich 943,115
Siphon for dispensing liquids, A. Kleinfeldt 943,421
Sled, resilient, F. G. McPherson 943,448
Sled runner, D. L. Blocher 943,513
Slime separator, centrifugal, O. M. Kuchs. 943,083
Snow sweeper, W. J. Cooke 942,888
Sockets, detachable chain guide for pull, H. Hubbell 943,077
Sound box, W. A. Chapman 943,339
Sound reproducing machine records, manufacture of, R. L. Gibson 943,631
Sounds, apparatus for receiving submarine, Garrett & Lucas 942,897
Spectacles, eyeglasses, and the like, S. S. Lawrence 943,085
Speed mechanism, E. E. Keller, 942,910 to 942,912, 942,914
Spittoon, J. Escuder 943,527
Sprag remover and retainer, J. T. Harcarik 943,538
Spray burner, A. Rohrbach et al 943,567
Spring. See Window spring.
Spring wheel, J. A. Dieterich 943,397
Square, T. C. Howland 943,351
Stair tread, R. T. Kanski 943,418
Stall, cow, C. S. Torrey 943,489
Stamping devices, cushioned support for, J. Dubisee 943,342
Staple forming and discharging mechanism, V. Hoxie ..... 942,904 to 942,906
Staple machine, J. Buckley 943,235
Steam boiler, J. C. Parker 943,452
Steam generator, B. F. Silliman 943,277
Steam generator for submarine boats, R. D. Montjustin 943,153
Steam generator, superheater, and feed water heater, F. A. Haughton 943,189
Steel, making, L. M. Atha 943,171
Steel, refining, E. Humbert 943,192
Stool and foot rest, combined, M. L. Porter 942,975
Stool, shoe fitting, H. H. Kramer 942,965
Stop mechanism, automatic, V. Hoxie 943,411
Storage battery, L. H. Flanders 943,345
Stove, pocket, B. Scamardi 943,569
Stovepipe anchor, J. Murchie 943,037
Street sweeper, J. R. Pollock 943,122
Stropping machine, J. Lorenzen 943,311
Stuffing box bland, F. Keeler 943,356
Suction apparatus, M. Lebenberg 943,426
Suit case, B. F. Becker 943,333
Superheat gage, Lothrop & Bradshaw 943,260
Superheater, F. D. Potter 943,606
Support or bracket, J. H. Cook 943,237
Surface gage for parallel lining, C. O. Dost 943,010
Surgical forceps, E. Moraweck 943,263
Sweeping machine, Nathan & Heuser 942,970
Switch handle, C. Schuster 943,124
Swivel, detachable, Carson & Gilkerson 943,299
Tapping and drilling tool, J. H. Dorman 943,009
Tar and debris trap, G. R. Evans 943,628
Tarsia work, manufacturing, F. Kohn 943,309

(*Concluded on page 499.*)