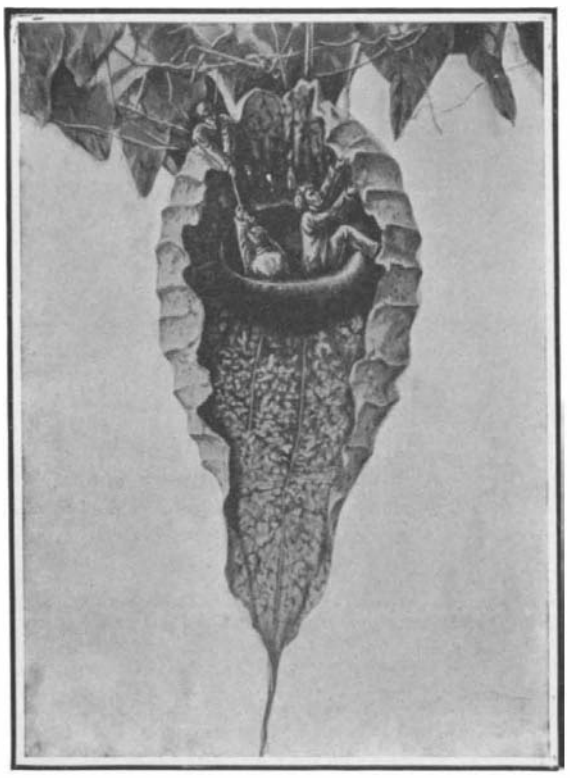
CARNIVOROUS PLANTS OF THE FUTURE.

BY S. LEONARD BASTIN.

It is a fact recognized by botanists as beyond dispute that the carnivorous habit among plants is more widespread than it was formerly supposed to be. The specialized sundews (Droseras) are but the advance guard of a large army of species which depend for their existence more or less upon the absorption of animal salts through their foliage. There is no gainsaying the statement, recently put forward by more than one scientist, that the tendency to rely upon a carnivorous diet is on the increase. Of course, this is only in a line with the simplest evolutionary principle. It is possible to trace the steps by which the highest types of species, which seize and hold their prey, such as the Venus fly trap (Dionæa), have been evolved from those which merely capture their victims by the use of an adhesive fluid, such as the fly catcher of Portugal (Drosophyllum). Still lower in the scale are the plants, such as the teasles (Dipsacus), which drown the insects in strange bucket-like contrivances located at the base of the leaves. Flies which may chance to fall into the water are of course drowned, and the plant absorbs the nitrogenous elements from their decaying bodies.

It is a startling conception that in ages to come the plant world as a whole may become so advanced in carnivorous tastes as to be a real menace to animal creation. Dreadful indeed must be the sundews and the Dionæas to their insect victims at the present time. The unfortunate fly which is captured by the leaf of the sundew finds itself held down by strong arms which are able to resist its violent struggles. The largest Drosera on earth at the present time produces leaves which are perhaps nine inches in length. Magnify this plant until the leaves are ten feet in length, and we have an exceedingly formidable specimen. Many of the palms and other tropical species have foliage which is much in excess of this measurement, so that the idea of leaves as big as this is not altogether fantastic. To be in proportion, the tentacles could scarcely be less than ten inches in length, and these would be able to grapple with birds of considerable size. We may conceive that the giant sundew would be able to hold out some special inducement for its intended victims to visit the leaves. Probably the bait would be in the form of some sweet-tasting secretion. On alighting, the birds would probably not find the adhesive fluid which the leaves would produce more than slightly annoying. The movements which they would make, in an endeavor to free themselves, would be all-sufficient to give the stimulus to the sensitive tentacles. These would rapidly close in on their prey, and in a few moments escape would be out of the question. Finally, the unfortunate birds would perish miserably, the bodies in their decay yielding to the plant the nitrogenous matter desired.



Possible enormous aristolochia flowers of the future which may lure even men.

The Pinguiculas or butterworts are at the present time innocent-looking plants rather attractive in appearance. These species, as is well known, find their home in boggy tracts, where they spread their foliage on the surface of the ground in the form of a rosette. If the leaves of the butterwort are closely examined, it will be seen that they are thickly covered with two sets of glands, one set of which is plainly visible to the naked eye. This visible set resembles a miniature mushroom, while the other set is microscopic and is formed of eight cells grouped after the manner of a wart or a knob. It is the practice of these glands whenever they come into contact with any object to pour out copiously a mucilaginous fluid, which acts much in the same way as bird lime. Acid secretion is also produced, which aids the leaf in the digestion of the object—supposing that the capture should be an insect. In order to make assurance doubly sure, the

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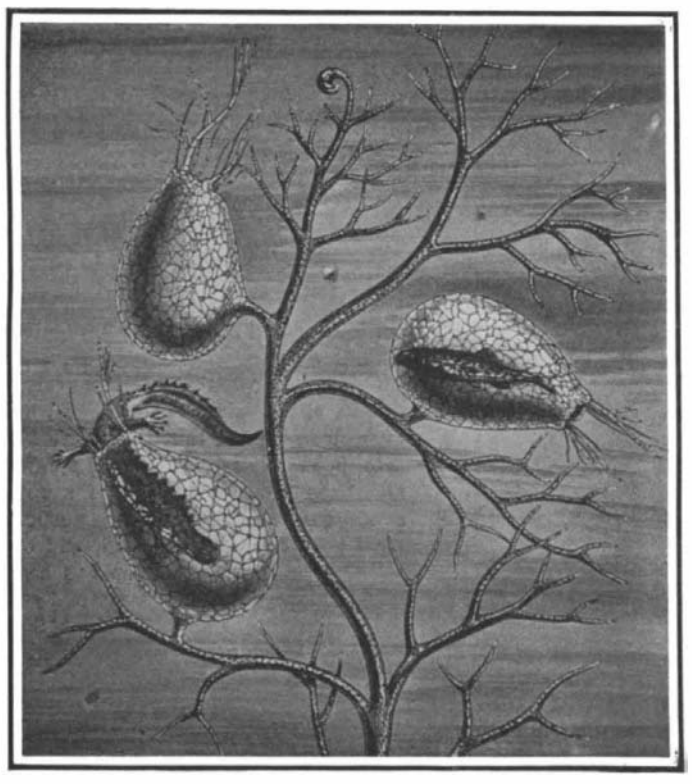
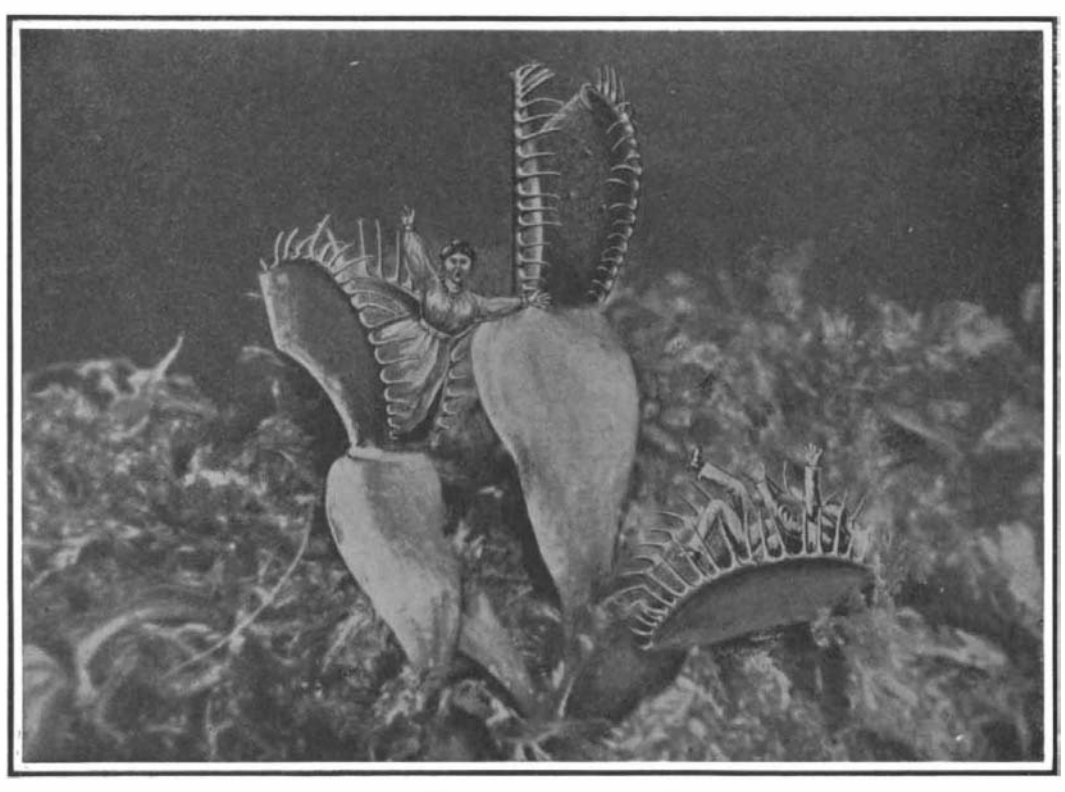
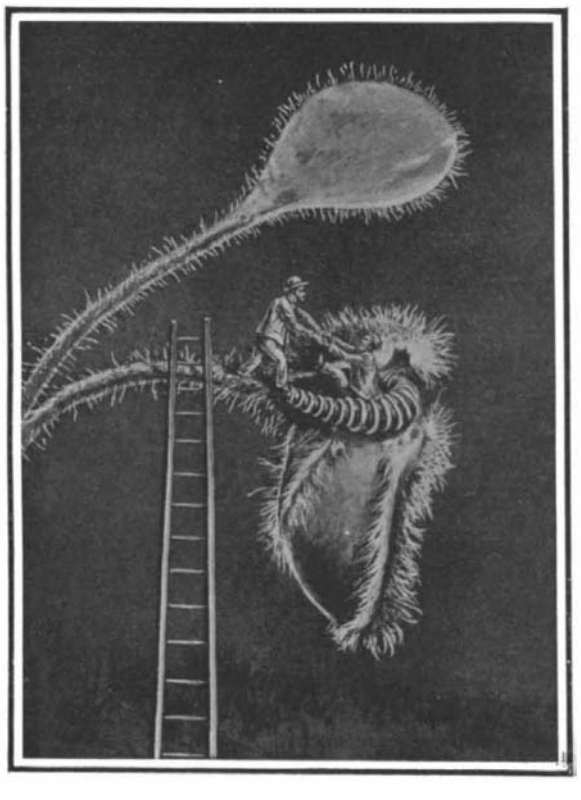


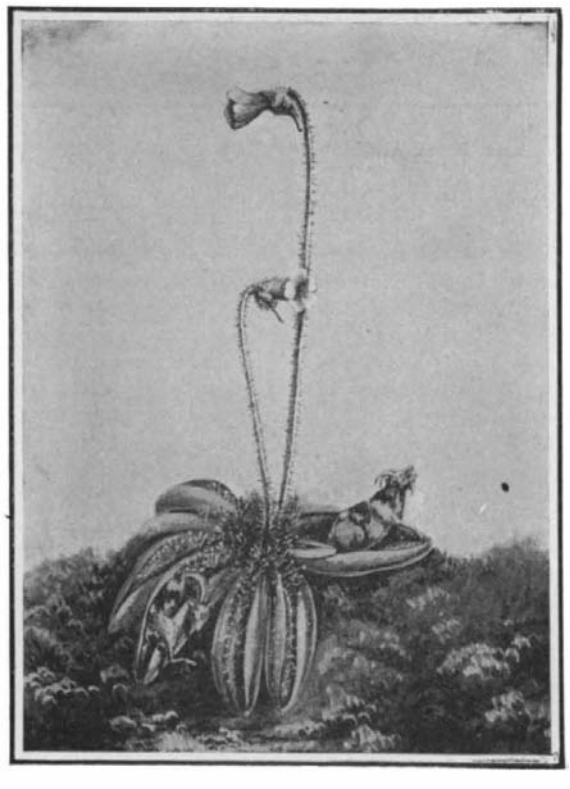
The great bladderwort swallowing a reptile.



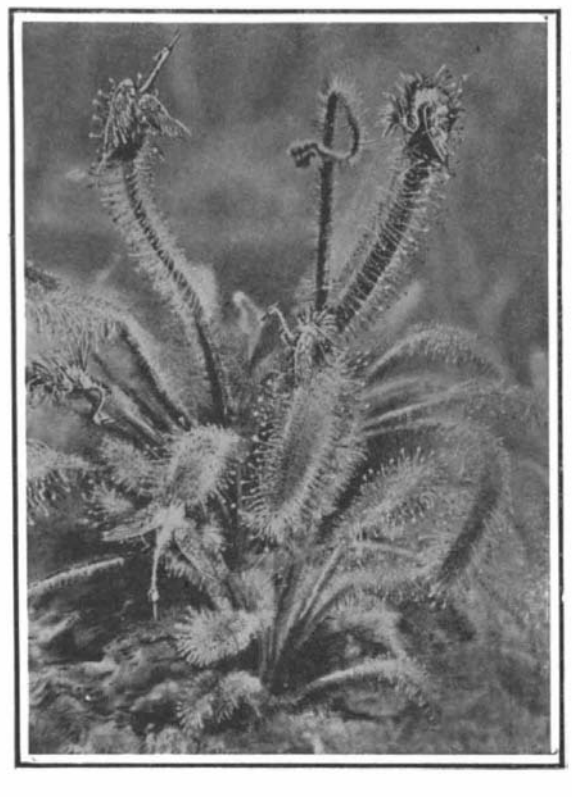
A man-eating Venus fly trap.



From a giant pitcher plant a man could escape only with the help of a friend.



A goat-eating butterwort of the future.



A great sundew, millions of years hence, catching a stork.

CARNIVOROUS PLANTS OF THE FUTURE.

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by much splashing and turbulent vortical motion resulting apparently from the streams that converge from all sides of the axis of the air tube at its upper end, . . . but (when) the turbulence has cleared away from the upper part, and from this stage onward the jet is well seen in all the figures, and it persists long after the segmentation of the air column has taken place. The reader must not suppose that this jet is a mere falling of the water under the action of gravity, for the rapidity with which it advances is far greater than could be accounted for in this way. . . . The great initial momentum of the sphere causes it to continue in rapid motion after the bubble has closed, thus the sphere acts as a sort of piston, which by increasing the length of the air tube diminishes the pressure in it and so sucks in the bubble, which is driven down by the greater atmospheric pressure above. The converging horizontal inflow near the mouth of the air tube cannot, of course, produce the downward-directed jet without an equal and opposite generation of momentum upward; but this is now expended, not in producing a similar upward jet, but in balancing the excess of atmospheric pressure. The reaction, in fact, to the projection of the jet downward is the force which holds up and slowly raises the roof of the long air shaft." The rising of the roof is well shown in some of the accompanying photographs.

Thus, as Prof. Worthington points out, the formation of a downward jet is not, in a sense, a new phenomenon, but one which, having existed unnoticed before, is now rendered visible by reason of its being produced in air instead of water. An increase in the height of fall to 22½ feet was found to produce but little change in the phenomena coincident to the resulting splash.

As an illustration of the possible application of knowledge gained from a study of splashes in an unexpected quarter, Prof. Worthington draws attention to the fact that photographs of the splash of a projectile on striking the steel armor plate of a battleship bear a close resemblance to photographs of splashes caused by a sphere falling into liquid. There is the same slight upheaval of the neighboring surface, the same crater, with the same curled lip, leading to the inference that under the immense and suddenly applied pressure the steel has behaved like a liquid. The professor suggests that from a study of the motions set up in a liquid in an analogous case, it may be possible to deduce information about the distribution of internal stress, which may apply also to a solid, and thus lead to improvements in the construction of a plate that is intended to resist penetration.

In conclusion it should be said that the number printed below each photograph here reproduced gives the time in decimal parts of a second which has elapsed since the first instant of contact.

CARNIVOROUS PLANTS OF THE FUTURE.

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edge of the leaf in certain species is seen to curl slowly inward. Now we can imagine that in the very far-away future with which we are dealing the Pinguicula will develop leaves which will hardly be less than five or six feet in length. These lying along the surface of the ground will make a special appeal to grazing animals. Perhaps as with the sundew the allurement will be in the form of some pleasant-tasting secretion which is peculiarly attractive to sheep and goats. We can imagine how these animals on first coming across the plants would start to regale themselves at the prepared feast. The strong sticky substances would take a firm hold of the hairs surrounding the mouth parts of the creatures, and in their endeavor to free themselves the animals would become more entangled. Gradually, too, the sides

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of the huge leaves would close inward, and the fate of the victim could not long be delayed. A pitiable spectacle indeed to see these animals done to death by a plant, but the same process on a smaller scale is repeated thousands of times during the summer in any place where the Pinguiculas abound.

We can hardly think in this advance of vegetable life that the many species of pitcher plants which catch their prey more by allurement than by force, would be behindhand in the forward movement. Even at the present time many of these species develop processes which are several feet in length, as exemplified in the case of the Sarracenias and Darlingtonias. In one of the accompanying illustrations is pictured one of the colossal pitchers which in the course of ages may be evolved from the comparatively small Cephalotus—a native of Australia. There is no knowing what inducements these plants might not be able to hold out for the capturing of even man himself. Perhaps the tissue inside the pitcher would be peculiarly succulent, and we know that where there is anything worth having, there will always be found men daring enough to take the risk of getting it. Once inside the pitcher of the Cephalotus, escape would be possible only with a friendly assistant at hand. From the bottom of the pitcher three barriers would confront the prisoner anxious to get out. First of all there is a circular ridge projecting in such a way that it is most difficult to surmount. Secondly a stretch of wall thickly covered with processes resembling the teeth of a comb and all pointing downward. Last of all, on the involute rim round the mouth of the pitcher is arranged a fringe of decurved spines which resemble a row of formidable bayonets. Indeed, it would be a far more simple matter to get out of the average well than to make one's escape from a giant Cephalotus pitcher.

Although the matter does not involve death, the giant Aristolochia flower brings about the imprisonment of flies for quite a long time. The system is in connection with the cross-fertilization of the blossom. The insects are induced to enter the cavernous mouth of the great bloom by an odor strongly suggestive of carrion, which is peculiarly attractive to flies. Once inside, the flies are held captive by an ingenious arrangement whereby they are lost in the tortuous passages at the rear of the flower. After blundering around for some time the winged creatures are able to emerge again, not, however, before they have become well dusted with pollen for transmission to another bloom. It is possible that the Aristolochia of years to come will assume much larger proportions, and we may imagine that the flower will be able to hold out some allurement which will tempt large animals to enter its gloomy depths. It is more likely that escape from the colossal blossom would not be such a simple matter, and there might be a danger of a creature's coming unpleasantly near to starvation before seeing daylight again.

Far more dreadful than any of the plants described above would be the Venus fly trap of the future. This plant would be a vegetable terror. As is well known, the leaves of this plant are designed in the form of a trap. On the upper surface of each half of the leaf are three hairs. To touch any of them is to cause the organ to shut up, inclosing the object which has given rise to the irritation. The bordering of the leaf is formed of sharp fringed hairs which when the trap is closed prevent escape. At the most the leaves of the Dionæa are not more than an inch in length, but we may get a little idea of what this plant may be in years to come if we imagine the foliage to be large enough to grapple with a man. It is the habit of this plant to grow with its leaves half concealed beneath the sphagnum moss in which it thrives. The leaves of the giant man trap partly hidden by the undergrowth would form the

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Sheet feeding machine, H. K. King..... 942,078
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Speedometer, W. R. Harris..... 942,497
Spike puller, W. F. Scott..... 942,415
Spinning and like machinery, thread guide for cotton, J. & E. Appleby..... 942,362
Spinning mules, reversing mechanism for the band cylinders of, J. H. Ryalls..... 942,752
Spinning spindle, J. V. Cunniff..... 942,777
Spring wheel, A. Moore..... 942,276
Stamp affixing machine, J. F. Monaghan... 942,454
Stamps, reversible ribbon feed for dating, B. B. Hill..... 942,827
Stanchion, F. G. & A. E. Harris..... 942,639
Stave jointing machine, N. M. Taylor..... 942,799
Steel holding and packing means, drill, D. S. Waugh..... 942,869
Stirrup, safety, W. V. Johnston..... 942,781
Stock releaser, Lemon & Stoops..... 942,875
Stoker, mechanical, T. V. Elliott..... 942,060
Storage battery, D. P. Perry..... 942,279
Stove, heating, H. F. Arenberg..... 942,805
Strainer, M. C. White..... 942,121
Strainer, liquid, F. L. Williams..... 942,428
Street and road construction, preparing mineral materials and the like for, J. H. Amies..... 942,235
Supplemental seat, A. Reineke..... 942,793
Support and insulator, E. F. Lindsay..... 942,086
Supports, adjusting device for, P. Colidge... 942,545
Switch signaling and operating mechanism, W. R. Oyler..... 942,099
Swivel hook, C. G. Theiling..... 942,681
Syringe, irrigating, W. S. Sawyer..... 942,523
Table. See Ironing table.
Table attachment, J. A. Chow..... 942,613
Tack, window shade, L. B. Girard..... 942,321
Talking machine sound box, A. Fischer..... 942,816
Target practice apparatus, H. H. Cummings 942,615
Telegraph, automatic, L. M. Potts..... 942,844
Telegraph, multiplex, S. D. Field..... 942,814
Telegraphic repeating apparatus, W. E. Athearn..... 942,807
Telegraphy, duplex cable, I. Kitsee..... 942,208
Telegraphy, electric, J. A. L. Dearlove..... 942,620
Telephone, portable, O. L. Mulot..... 942,401
Telephone systems, signaling apparatus for, R. C. Welty..... 942,703
Telescopic article, W. J. Dunn..... 942,490
Thermostat, J. F. Williams..... 942,870
Thread board, W. O. Aldrich..... 942,607
Threshing machine, garbanzon, F. Garver... 942,063
Tie and means for fastening rails thereon, I. C. Catton..... 942,438
Tie plate and rail anticreeper, combined, M. S. Clarke..... 942,307
Tilling machine, G. Spalding..... 942,469
Tire, B. F. Norcross..... 942,097
Tire, J. C. Taylor..... 942,149
Tire, W. R. & T. S. Stewart..... 942,418
Tire, J. G. Maxwell..... 942,654
Tire, automobile, I. B. Kempshall..... 942,567
Tire for vehicle wheels, cushion, J. H. Poole..... 942,842
Tire, pneumatic, P. G. Muenchinger..... 942,734
Tire protector, F. Vacher..... 942,682
Tire, vehicle wheel, J. A. Boyajean..... 942,364
Tires, metallic protector for pneumatic, E. A. Hultberg..... 942,500
Tobacco, aging and curing, S. G. Martin et al..... 942,838
Tobacco cutting machine, Beall & Parker... 942372
Tomatoes, treating, O. Schroen..... 942,287
Tongue switch, Strong & McPherson..... 942,295
Tool, D. C. Southworth..... 942,293
Tool handle, E. Kener, Jr..... 942,077
Tools, feed for pneumatic, M. Hardsocg.... 942,066
Towing device, C. W. Larson..... 942,450
Toy derrick, M. T. C. Wing..... 942,229
Toy, sounding, J. Berg..... 942,162
Toy, sounding, W. Bartholomae..... 942,610
Track sander, P. J Coady..... 942,377
Track sander, A. W. Ham..... 942,726
Traction coupling, M. Westra..... 942,764
Train stop, automatic, W. J. Soseene..... 942,189
Tramway, aerial, H. S. Robinson..... 942,518
Tramway switch, N. Schwarz..... 942,288
Transfer hanger, T. E. & E. Hudson..... 942,326
Transferring material from a high to a lower level, apparatus for, A. C. Johnston.... 942,449
Transportation system, W. C. Carr..... 942,437
Trap, G. W. Hess..... 942,069
Trolley wheel, H. L. Baylies..... 942,767
Trousers support, J. V. Backlund..... 942,126
Truck, C. J. Ingard..... 942,563
Truck, car, J. C. Barber.....942,048, 942,702
Truck elevator, inclined, W. Reno..... 942,352
Truck, railway car, C. F. Murray..... 942,096
Tube cleaner, rotary, P. J. Darlington..... 942,312
Turbine, S. T. Holly..... 942,829
Turbine regulator, S. T. Holly..... 942,828
Turpentine cup, E. A. McKoy.....942,210, 942,211
Turpentine gathering apparatus, E. A. McKoy..... 942,212
Type bar and typographic form, F. H. Richards..... 942,102
Type casting and composing machine, O. V. Sigurdsson..... 942,846
Typewriter, L. Hauerstein..... 942,825
Typewriting attachment, W. M. Deeter..... 942,366
Typewriting machine, A. G. Snyder..... 942,109
Typewriting machine, A. W. Steiger..... 942,113
Typewriting machine, J. Felbel..... 942,137
Typewriting machine, E. E. Barney..... 942,535
Typewriting machine, H. Crutchley..... 942,776
Typewriting machine, J. H. Barr..... 942,583
Typewriting machine clamp, E. E. Barney.. 942,049
Typewriting machine ribbon reversing mechanism, automatic, G. M. Kitzmiller..... 942,383
Universal joint, W. C. Lipe..... 942,087
Vacuum cleaning systems, handpiece for, C. R. Green..... 942,139
Valve, F. M. Ashley..... 942,045
Valve, F. N. Whitesell..... 942,122
Valve, C. F. Fernald..... 942,492
Valve, W. N. Long..... 942,576
Valve, T. P. Lavigne..... 942,834
Valve, dry, F. A. Phelps..... 942,100
Valve for engines, O. Pearson..... 942,587

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most terrible pitfall that the world has ever seen. Any unfortunate man who should chance to stumble into one of these leaves would be speedily crushed to death by the steady pressure of the inclosing sides. One can imagine that a country in which the man trap abounded would be avoided as much as a district inhabited by man-eating savages.

The aquatic plants such as the bladderworts (Utricularia) would scarcely be behindhand in this forward movement among the carnivorous species. These plants capture small water creatures by means of little bladders which are attached to their stems. The entrance to these receptacles is guarded by a little door, which can be opened easily from the exterior but may not be pushed aside from the interior. At the present time the bladders of the Utricularia are small, but there is no reason to suppose that they will always remain so. It is quite likely that they may increase in size so that they are able to grapple with good-sized fish and other water animals.

In these far-away days of which we have been speculating, plants will be divided into wild and tame sorts in the very real sense of the words. The botanical gardens of the time will be far more exciting than are the zoological collections of to-day. It is fortunate that all natural changes come about with great slowness, and it may be that the condition of man himself will have changed considerably by the time he is called upon to face these aggressive plants. It is to be hoped that this may be so, otherwise the outlook for the human race is distinctly disquieting.

A New Substitute for Cotton.

(Concluded from page 470.)

German East Africa, and the exports thence to Germany are steadily increasing. So far, little attention has been given to cocoanut fiber and the fiber of the many palms growing in the protectorates has been allowed to run to waste. With a view to becoming independent of foreign countries for her supplies of this fiber, Germany is also going to see what can be done with the product of her own colonies. The whole aim of the German is to become "independent" and, as far as possible, do without foreign goods and foreign labor. Other instances could be given of this, were they not quite outside the scope of the present article.

POWER-DRIVEN SCOOTER.

(Concluded from page 472.)

wheel clear of the ice when the engine is being started. This is accomplished by a lever of ⅜ x 1-inch iron placed and bent as shown in Fig. 1. When starting the motor the lever is pulled back and a small wedge of wood is slipped between it and the engine bed. After the motor has got going nicely it is slowed down and the lever gently relaxed, allowing the teeth to take a slight hold. As the craft gathers headway increase the power and also the pressure on the spikes until the lever is slack and the motor running at its maximum power. To stop, slow down and raise the wheel off the ice.

The construction of the rudder is simple. The stock is of ¾-inch iron 12 inches long. An 18-inch tiller of forged iron is pinned to the post with a ¼-inch pin. The stock is recessed and pinned to the iron yoke which carries the runner. This yoke is forged out of 1¼-inch iron and has a collar slipped over its shoulder to wear against another collar or flange fastened to the bottom to act as a bearing. A ½-inch pin secures the yoke to the runner. The runner blade is of ⅞-inch oak 1 foot 7 inches long and 2¼ inches high.

For the shoe use a piece of soft iron ¾ inch deep and ⅞ inch wide cut to a V edge at an angle of 45 degrees on each side. The shoe should have a rocker of about ⅛ inch for the 13½ inches it is supposed to bear on the ice. It should have 8 inches bearing forward of the rudder pin and 5½ aft. The shoe is held to the runner by three ⅜ through bolts riveted and smoothed off. A guard is placed under the boat to prevent the runner from catching in obstructions.

The engine can now be installed. For a foundation use two 1¼-inch oak stringers running along four frames and shaped and spaced as per requirements of engine used. The stringers should be through bolted from the outside of planking to top of the bed and drawn up tight and solid.

Now set the motor in its bed and fasten down with ½-inch lag screws 3 inches long. The exhaust is piped over the side and the water and gasoline tanks are situated on the forward deck. They each hold 3 gallons, and should be made out of 18-ounce copper. The piping is led down through the mast hole along the floor to the motor. It should be of copper tubing, ¾ inch for the gasoline and 1⅝ inch for the water.

The batteries and coil are placed just under the tanks. Six dry celis are sufficient. In order to have the scooter trim with one person on the seat it will be necessary to put about 60 pounds of lead up forward as shown. As the keels of these boats are rockered, attention must be paid to this or else the pressure on the rudder will be too great or it will be lifted clear.

A ½-inch heavy motor cycle roller chain should stand the strain with care; but as to the diameter of sprockets experiments would have to determine this, as it would vary for every type of motor. With the driving wheel turning up 700 revolutions per minute the scooter would be going about 33 miles per hour. If the motor could turn up to that or over, it would be better to let it run up and gear it down.

With a motor of six or seven horsepower and turning 700 to 800 per minute I would use for a starter an 8-inch sprocket on the driver and a 7-inch one on the engine.

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Valve for steam traps, B. L. & G. H. Clover 942,246
Valve for train brakes, engineer's, W. K. Rankin 942,280
Valve grinder, I. C. Smith 942,222
Valve, pressure retaining, R. W. Kelly 942,331
Valve, quick action triple, D. S. Gilbert 942,634
Valve, regulating, T. M. Wilkins 942,360
Valve, safety gas, Yockey & McLeod 942,158
Valve, silcock and other, F. W. Carlson 942,541
Valve, throttle, Z. Paul 942,345
Valves, making records for setting slide, J. B. Michael 942,453
Vault vestibule, J. G. Giesting 942,633
Vehicle, A. F. Rockwell 942,219
Vehicle seats, shifting rail for, A. E. Smith 942,292
Vending apparatus, coin controlled, M. J. Forth 942,253
Vending machine, F. M. Weber 942,117
Vending machine, cigar, L. A. Vandiver 942,527
Vending machine, stamp, J. R. Armington 942,766
Veneer tapping machine, Nystrom & Taxon. 942,277
Ventilator. See Car ventilator.
Vessels, controlling device for filling, G. Schollmeyer 942,755
Vessels, towing arrangement for canal and river, E. O. Nikel 942,510
Vibrator, A. J. Stecker 942,596
Waistband for garments, adjustable, M. S. Erlanger 942,628
Warning signal and stopping device for the safe movement of public conveyances, W. Whitmah 942,388
Warp balling machine, W. G. Denn 942,813
Warp carriage, H. D. Colman 942,247
Washboard, D. C. Juleson 942,076
Washing machine, Ramthun & Gutekunst 942,664
Washing machine, J. Szava 942,758
Water closet, H. S. Rumsey 942,464
Water gage, R. H. Buckner 942,365
Water gate, J. H. Phipps 942,460
Water tube boiler, J. P. Sneddon 942,797
Water wheel, J. L. Bell 942,811
Weed cutter and cultivator, M. Pruyn 942,744
Welding device, foot power, Garver & Bissell 942,444
Well tube cutter, J. F. Baker 942,701
Wells, trip wall packet for oil, W. Palm 942,739
Wheel, Foss & White 942,819
Wheel block, A. J. A. Bennett 942,161
Wheel, pulley, and the like, P. Montupet 942,400
Wheel scraper, C. W. Stark 942,471
Whiffletree hook, R. F. Bloom 942,431
Whip lock J. W. Robertson 942,285
Winding indicator, O. Ohlson 942,659
Window cleaning apparatus, C. E. Prickett. 942,743
Window grate, adjustable, S. Jablonovsky 942,502
Window lock and lift, R. T. Axe 942,851
Window, metallic, T. Lee 942,269
Wire bender, L. D. Danforth 942,440
Wire twister, I. N. Morford 942,732
Wire tying machine, automatic, O. L. Bowers 942,305
Wire wall pocket, T. V. Cromwell 942,714
Wire winding machines, notching means for, W. L. Wergin 942,118
Woods, treatment of coniferous, W. H. Rowley 942,106
Woodworking machines, pressure device for, C. G. Wilderson 942,804
Wrapping machine, A. M. Price 942,101
Wrapping machine, package, F. Girond 942,636
Wrought articles, making, J. H. Dods 942,489

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