Kashan. It has been worked in a small way for many years, the cobalt oxide being used for coloring pottery. Cobalt and nickel have been found in the Shehmriam Mountains, near Imam-radeh-David, and in the Sahend Mountains, near Tabiz.

Turquoise is the principal gem found in the country, and has been mined from an early date. Ancient mines are found near Maiden—the ancient Pashan. The mines have been worked for a very long time—perhaps even thousands of years—and still yield good stones. They are on the southern slope of the Alberus Range, in the province of Khorassan, and on the border of the Persian salt desert. The ridge where the gems are found is a decomposed porphyritic trachyte, tinged below the surface with iron oxide, and covered with strata of limestone and tuffs. In the trachyte are found disseminated short veins, composed of limonite, with occasional pockets of turquoise. At these mines there were recently no less than 266 pits, many of them abandoned. The deepest is 42 meters. The pits are not timbered and the methods of mining are primitive. The mines belong to the government, and the right to work them is leased only for a limited time; a system which prevents any permanent improvements. The gems obtained are sent chiefly to Teheran and to Russia. The yearly output is valued at about 200,000 francs. A few stones are found in the alluvial deposits at the foot of the mountains. Only the blue stones are valued, those of greenish tint being rejected.

There are also old mines at Kernan and Kavik: also at Mashiz, on the slope of the Chehelan Mountains. There the gems are found in fissure veins, and the same is the case at Tabaz in Khorassan. Recent discoveries have been made near Yezd and at Seistan. At the mines of Bar-i-Maden most of the stones are now obtained by working over the old dumps. It is said that the gems obtained from fissure veins do not change color like those found in the soft decomposed rock.

In Persia the commoner and more useful minerals are found in many places, but have been little developed or used. Limestone is found in many places, and there are beds of it which will take a polish and finish like marble. True marble is also found. Other building stones are abundant, and roofing slate is found in Masanderam.

Kaolin is found at Kerman-shah. Mineral paint is dug near Ispahan. Fuller's earth is found at Kum, and pottery clay in several places. A peculiar whitish clay, found near Kum also, is eaten by the people. This is a singular custom, and is not unknown in some parts of Europe and the United States.

Coal is found in the Alberus Range, running southward from the Caspian Sea. It is also found in the country drained by the Shahrud River, and along the Kevetch River. There are many outcrops in the districts mentioned and coal taken from them has proved to be of very good quality. Brown coal or lignite is found near Tabriz, outcropping in a seam 1-50 meters wide.

Petroleum is found in the Tertiary deposits on the southwest border of the Persian highlands. It is apparently abundant in the section bordering on the Persian Gulf. Along the gulf shore there are oil springs which were known at a very early date, and were described by Strabo in the second century. Oil springs are also found in the Bakhari Range in Southern Persia, near the Dalakhi River, on the road from Abushir to Shiraz. In the Darab Mountains there are springs where the crude oil has oozed out and gradually solidified into a sort of asphalt, or asphaltic bitumen. A deposit of asphalt is found at Zendjari.

Salt occurs very abundantly in Persia, both as rock salt and in saline lakes. The rock salts are found in embedded in the Tertiary miocene series. Rock salt is mined extensively at Sherifabad, on the slope of the Nishapur Range. In Southern Persia salt is mined at several points. It is found on several islands in the Persian Gulf. Over a large part of the country are found salt or bitter lakes. The largest and best known of these is the Urumiah Lake, in Azabiran, which contains brine of extraordinary strength, sometimes carrying as high as 18 per cent. of pure NaCl. The lake is 8 meters deep in places, but will not average over 4 meters. The shallow lake dries out partially in the summer, leaving its bed crested with white salt. The Bakhtegan Lake, in Taristan, is also large, and there are many smaller ones.

Borax is produced in many places, and is found most abundantly on the border of the Sirdjan salt desert.

Alum is found at Zadikan and several neighboring places. There is a yearly production of 550 to 600 metric tons. The value ranges from 50 to 235 francs a ton according to the purity of the salt. In the Sia-ruh salt desert, north of Teheran, alunite rock is mined. At Ravir, in Eastern Persia, alum is made, and an old chemical process, long forgotten in Europe, is still in use. In this 50 parts of alum are treated with 50 parts of saltpeter by distillation, yielding 12½ parts of nitric acid.

Saltpeter it found in some places as an effervescence on the surface of the ground, and at other points in caves. The country near Teheran abounds with ancient burial mounds, from which saltpeter is obtained by lixiviation. The quantity produced cannot be ascertained.

Persia has large mineral resources, which might be developed under better government, but the present production is very small.

THE MANCHINEEL OR MANZANILLA TREE.

On the seashores of most of the islands of the Caribbean Sea, especially abundant in Cuba, Puerto Rico, and their outlying islets, likewise indigenous to the more southern coasts of the Mexican Gulf and the Spanish Main, is found an evergreen tree, frequently fifty feet in height and yielding a somewhat tempting looking fruit, but apparently greatly avoided by living creatures. Birds are not found in its foliage, monkeys never ascend its branches, even lizards avoid its trunk. This is the *Hippomane mancinella* of botanists, but vulgarly known as the manchineel or manzanilla tree. The same species exists, though somewhat sparingly, along the extreme southern seacoast of Florida.

Belonging to the *Euphorbiaceæ*, a family noted for yielding acrid and toxic exudates, it obtains its generic title of *Hippomane* because it is supposed, when its foliage is taken into the equine stomach, to induce a

species of madness or insanity; but the evidence that any horse or mule ever sought to allay its hunger from this source is utterly lacking. Formerly all the tales accruing to this growth were of the most exaggerated nature. It was affirmed to be more deadly than the far-famed and greatly maligned upas of Java and Sumatra; that grass will not grow beneath or within the range of its shadows; that fatalities invariably overtake those who venture to avail themselves of its shade; that a drop of the sap from its woody fiber, the exudate from its leaves, and even the moisture obtaining to its smooth, brownish bark, falling upon the skin, induces effects precisely similar to those accruing to contact with molten metal; and finally, that any creature par-

A BRANCH AND FRUIT OF THE MANCHINEEL TREE.

taking of its leaves, flowers, or fruit is at once rendered hopelessly rabid.

That all the exudates of the manzanilla are pernicious, dangerous, in rare instances perhaps fatal, hardly admits of doubt. They, alike, whether from fruit, leaves, branches, or stem, are capable of inducing painful and persistent inflammatory disturbances upon the skin, disturbances greatly enhanced should any mucous surface be likewise involved. In this respect, the manzanilla greatly resembles the *Rhus* family, especially the *Rhus toxicodendron*, commonly known as "poison ivy," "poison oak," "poison sumac," "poison dogwood," etc.; but *Rhus* is more irritating to the skin, manzanilla most so to the mucous membrane. As with *Rhus*, poisonous effects are enhanced or limited, as the case may be, by individual susceptibility; and also, by repeated contacts, the untoward action is decreased.

The dark, green leaves of this growth are oval, pointed, dentate, from 3 to 3½ inches long and perhaps half as broad, with two glands at the junction between the blade and short footstalk, and from the latter, when bruised or broken, exudes the acrid, sticky, highly irritating juice that is generally the chief agent of mischief, though, as already remarked, all juices and exudates pertaining to the tree are poisonous.

The flowers grow in thick, short spikes at the end of the short, thick branches, those at the base being soli-

and mouth—no one has ever been able to reach the swallowing act; and these excoriations are sometimes most difficult to heal.

Presumably the juices, as well as the bark and wood, owe their untoward properties to the presence of some acrid, acid-like constituent similar to that yielded by the *Rhus toxicodendron* (toxicodendric acid), and, as toward the latter plant, it is probable there are individuals so sensitive to the poison as to be unable to closely approach the growth with safety; hence the belief its shadow may prove toxic. It has also been claimed that toxic effects have resulted from contact with raindrops that fell through the tree or rolled off its leaves—a claim open to some degree of suspicion. Seeman, the botanist, was terribly poisoned, and rendered blind for several days, after gathering specimens—doubtless touched or rubbed his eyes with fingers that had been brought in the closest possible relation with the leaves; and the boat's crew that accompanied him also were made blind by gathering some of the manzanilla branches to kindle a fire. Seeman seems doubtful whether it was handling the wood or some acrid material volatilized in the smoke that caused the sailors to suffer.

Despite the unpleasant character of the growth, its wood is in considerable request for cabinet work, inlaying, etc., and affords beautiful contrasts of brown and white when seasoned and polished. Before felling, the woodmen invariably surround the tree, or trees, with a cordon of fires, believing the heat neutralizes the poison, partly by driving off some volatile constituent, partly by drying and solidifying the sap and exudates. Those who work in the wood, also, fearing the irritating effects of sawdust and minute flying particles, are wont to protect their eyes, faces, and lungs by fine veils.

Within the last decade attempts have been made to introduce manzanilla leaves and their exudate into therapeutics, but with no definite results. The milky exudate has been claimed as a diuretic and emmenagogue, the dried leaves as diuretic and diaphoretic and a specific for enuresis—much the same as has been claimed for *Rhus*. Finally the wood has been heralded as an excellent substitute for guaiac. The tincture of the dried leaves seems to have much the same action, physiologically, when taken into the animal economy, as cantharides; it excites the same stranguary and excruciating suffering, and its use is likewise apt to be succeeded by evidences of paralysis of the cystic viscus, that fortunately appears to be but transient.

G. ARCHIE STOCKWELL.

VERONICA DIEFFENBACHII.*

We are indebted to Mr. Lindsay, of Kaimes Lodge, Murrayfield, for a specimen of this very rare *Veronica*. It is a hardy shrub, about 2 feet high, with thick, leathery, oblong-acute leaves. The flowers are in axillary spikes, and of a lilac color. It is a native of the Chatham Islands.—The Gardeners' Chronicle.

GREENHOUSE HEATING.

By THOMAS N. THOMSON.

FLOWERS are loved by all—in childhood, in youth, and in old age. We always welcome and adore the beautiful and fragrant blossoms, whether in the meadow, on the street, or in the sick chamber. Look at the little children as they merrily pick the buttercups and daisies from the neighboring fields or vacant lots

VERONICA DIEFFENBACHII—FLOWERS OF A LILAC COLOR.

tary and fertile, those at the apex staminate and in clusters, all obscure and without petals.

The fruit is generally of a pale yellowish, or yellowish green hue, except when dead ripe, when it is decidedly ocherous, presenting the form and general appearance of a small apple—hence the popular designation of manzanillo (little apple), a term that is by no means specific or generic, since it is carelessly bestowed by Hispano-Americans upon any similarly shaped fruit, just as any tree or growth possessed of leaves and flowers of apple-like odor is denominated manzanilla.

Of the acidity of the manchineel fruit, strange and frightful tales are in common vogue, fortunately, for the most part gratuitous. Death is said to be the common result when it is tasted, but the danger is really limited to badly excoriated and blistered lips, tongue,

and bring them home for "mamma" to put in water! The boys and girls at school are, of course, beyond the stage of buttercups and daisies, but watch them hunt for the trailing arbutus, the sweet scented honeysuckle, the delicately tinted laurel! Take notice of the rising generation in its teens and twenties—the beau with his boutonniere, the belle with her bouquet! And the benedict is just as susceptible as anybody else, for he cannot take a walk on Sunday without bringing home some beautiful floral trophy of the field with

* *Veronica dieffenbachii*, Benth., in D. C. Prod., 8, and in Hook. Fl. N. Zealand (1853 to 1855).—Fruticosa glaberrima; foliis lineari oblongis subobtusis, basi parum angustatis amplexicaulis; racemis axillaribus folio longioribus glabris; sepalis lanceolatis acutis, corollæ tubo brevioribus; capsula ovoidea sub-acuta, calyce sub-triplo longiore, Chatham Islands.

which to decorate the table. Yea, even the close, shrewd, business man—the man whose mind is full of dollars and cents from Monday morning to Saturday night—sometimes gives way to the temptation of the little florist's store on the corner, and goes in to order that some geraniums, fuchsias, and a few other pot plants be sent to his home at once.

Then there are the "old folks," who have been changing physically and mentally for sixty years or more, and have formed many likes and dislikes. They are, as we say, set in their ways; but their love of flowers has never changed. Nothing apparently pleases the aged—the most highly honored and respected people of our nation—more than to sow seeds, raise flowers, and enjoy their presence and the pleasure they give to the younger generation. Truly, we are a nation of flower lovers. Why should it be otherwise? A love of flowers betokens civilization. Go where you will, you will always find that the more refined and cultured families can be distinguished by the flowers in the windows, gardens, or conservatories. The only trouble is that there is not enough provision made for saving the beautiful plants that annually go to waste in the fall of the year.

Nearly every well-to-do mechanic in the country towns and villages, and in the suburbs of our great

FIG. 1.

cities, has a flower patch, which buds and blooms all summer long. The plants are carefully nursed, and grow more beautiful every day, until some blasting, bitter wind comes along—betokening the approach of winter—and cuts them off in their prime. They never looked better than they did the day before, and now they are ruined forever; the result of a summer's labor are destroyed. Why this constant sowing of seeds in the spring, coaxing and nursing of tender plants during the summer, and ultimate destruction of the full-grown beauties in the fall every year? Why are not these flowers lifted and removed to a place of shelter, and kept for winter decoration and pleasure? Simply because the average family has no place to keep them, except in the living rooms of the house, and we all know the objections to keeping them there. Doctors tell us that it is unhealthy to keep flowers in the house, and we ourselves know that they must be sprinkled periodically and watered regularly to keep them alive. The products of combustion from oil and gas flames, and sulphurous gases from the stove or furnace, tend to kill the house plants during winter. Then, again, they become infected with insects and small vermin, and require to be fumigated occasionally; while last, but not least, they cannot usually get enough sunshine, and so become almost useless for outdoor planting in the spring.

What is wanted, then, is a more general use of houses or apartments especially constructed for the purpose of horticulture; and they must be made of glass. True, there are many such houses dotted all over this vast country, but they belong to the wealthy or to such of the general public whose business or hobby is horticulture.

Now, there is no reason why the pleasures of winter

FIG. 2.

floral decorations should be confined to the wealthy; the industrious everyday mechanic can have the same thing, only on a smaller scale. The rich man can have his isolated greenhouses and conservatories, and no doubt can propagate and grow what he pleases, from mushrooms or forget-me-nots up to century plants or mammoth palms. He can have, and very often has, separate greenhouses for different purposes, such as carnation and chrysanthemum houses, vineries, palm

houses, roseries, propagating houses, etc., all of which, however, do him no more good than a small general greenhouse does the family of the business or working man.

The cheapest and perhaps the most desirable form of greenhouse is a simple "lean-to" glass building, connected to the house—something like that of which a floor plan is shown in Fig. 1. However, we shall not, in this article, go into the design of the greenhouse itself, but shall consider the heating arrangements for a greenhouse of this type. If the dwelling house is heated with stoves or a furnace in the ordinary manner, the best, simplest, safest, and most economical heating system that can be used is a low-pressure hot water system. Such a system is essentially composed of a boiler, or water heater, a series of pipes, called a coil, in the greenhouse, two pipes, called respectively the flow and the return pipe, to connect the coil to the

FIG. 3.

boiler, and an open tank or other vessel at the highest point of the system, called an expansion tank.

Fig. 2 shows the arrangement as it ought to be. A small cast-iron boiler, *a*, is set in the cellar near the chimney. A flow main, *b*, of 1½ inch black-iron pipe, is run from the top tapping of the boiler to the expansion tank, *c*. A coil of four 1½ inch pipe runs from the tank and under the flower pot benches. The lower end of the coil is continued full bore around the back of the greenhouse, and goes through the foundation wall into the cellar, and then connects to the bottom tapping of the heater, thus forming the return pipe, *d*, for the system. The floor pipe and all the other pipes must grade upward toward the tank with a pitch of not less than 1 inch in 10 feet, and all pipes must be supported, so that they will not sag, because if they are not properly graded, or if they sag, air bubbles will gather in the pipes and stop the circulation of the water. With the arrangement shown, all air bubbles will escape at the tank.

The reason why the tank is placed on the flow-pipe line, instead of on the return line, is to prevent the water from being blown out of the system if the heater should generate steam; also to allow a free escape of vapor, if necessary, by removing the loose cover of the tank during severely cold weather. This vapor will condense on the glass and freeze, thus forming a skin of ice, which not only closes the laps in the glass, but also forms a medium which helps the glass to prevent loss of heat by radiation and conduction.

Any man who is handy with tools can easily and very cheaply build a "lean-to" greenhouse for himself in the evenings, and if he has stocks and dies, he can readily install the heating system himself.

To determine the amount of pipe surface in square feet required to maintain any desired temperature in a greenhouse during zero weather, the following table should be referred to:

Temperature Desired in Greenhouse	Square feet of Glass and its Equivalent Proportioned to One Square Foot of Surface in Heating Pipes.			
40°	4.33	5.25	6.66	7.7
50°	3.07	3.93	4.76	5.7
60°	2.19	2.90	3.63	4.33
65°	1.86	2.53	3.22	3.84
70°	1.55	2.19	2.80	3.44
Temperature of Water in Heating-pipes.	140°	160°	180°	200°

About 4 or 5 square feet of exposed wall surface should be considered equivalent to 1 square foot of glass.

no case, however, should the grate area be less than ¾ of a square foot.

To determine the capacity of the expansion tank above the pipe connections, divide the entire capacity of the heating system by 20.

The pipes should always be large—never less than 1½ inches. In the best of greenhouses 4 inch pipes are used. Fig. 3 shows how 4 inch pipes are usually employed for heating a greenhouse. Five of them in all—two flow pipes, *a, a*, on top, and three return pipes, *b, b*, below—run the whole length of the benches, and are supported at intervals of about 8 or 10 feet, by brick piers, *d*. They are set in cast-iron chairs, *c*, and are staggered as shown, so that the air in flowing up between the pipes, *b, b*, must touch the upper pipes and thus become heated.

As the air near the glass is the coldest air in the house, it is advisable to keep the benches out from the wall a few inches, as at *g*. This allows the heated air from the pipes to flow freely up between the plants and the glass. If the benches are set close back to the wall, the plants next to the glass will surely freeze during very cold weather.

To prevent down draught at *g*, and, in fact, to compel the warm air to flow up *g*, in spite of the counteraction of a cold-air current at the glass, the face plate, or board, *f*, should hang about 4 or 6 inches below the bench planks.—For our engravings and the foregoing particulars we are indebted to Home Study Magazine, published at Scranton, Pa.

BABBITT METAL.

By C. VICKERS.

"GENUINE" babbitt is composed of a small quantity of copper added to tin and antimony. No lead is used, for the adjective "genuine" is applied especially to distinguish it from the cheaper grades containing lead.

There is considerable temptation to adulterate it with lead, owing to the difference in value of lead and tin; one pound of lead added to 100 of "genuine" makes a gain of about 18 cents. The character of the alloy would not be greatly altered, but when the purchaser pays for the best he certainly has a right to expect it. Fortunately, it is easy to detect such adulteration; take a piece and use it for a pencil, if it makes a mark, then it contains lead, as a small amount of lead added to tin causes the latter to mark paper. The following proportions may be used in making this alloy:

No. 1.	
Copper.....	4 pounds.
Tin.....	8 "
Antimony.....	8 "

This forms the hardening, as it is called. First melt the copper, add the tin and afterward the antimony; remove from the fire and let cool down to a dull red heat, then add 16 pounds more tin to increase the fusibility of the hardening. This makes 32 pounds hardening, add this to 64 pounds more tin—the proportions of tin to hardening thus being two to one. The additional tin should be melted separately in a kettle or suitable vessel, and the hardening added either in ingot form or direct from the furnace; in the latter case be sure the tin is all melted, otherwise an accident might occur by the hot metal from the furnace falling on the damp end of a projecting ingot.

To prevent loss by oxidation, the contents of the kettle should not be heated much above the melting point. In cases where a cheaper composition is desirable the following can be recommended:

No. 2.	
Genuine hardening.....	32 pounds.
Tin.....	64 "
Lead.....	93 "

This forms a good alloy. Another one is:

No. 3.	
Hardening.....	16 pounds.
Tin.....	50 "
Antimony.....	20 "
Lead.....	80 "

In mixing this alloy first melt a portion of the lead, say 40 pounds, in the kettle, or in a crucible in the furnace, bring to a dull red heat, add the antimony, in small pieces; when melted, add the balance of lead. Do not attempt to melt the antimony without the lead bath, as it is a volatile metal and there would be a loss from oxidation.

In making all alloys containing hardening, a furnace is necessary to melt the copper. The following mixtures contain no copper, and are fairly good compositions:

No. 4.

For hardening take:	
Lead.....	145 pounds.
Tin.....	40 "
Antimony.....	20 "

Melt 145 pounds lead and 40 pounds tin and add 52 pounds hardening.

No. 5.

For hardening:	
Lead.....	48 pounds.
Antimony.....	26 "

Add this amount to 152 pounds lead. The hardening is used in this merely to form a bath for the antimony, and any portion of 200 pounds lead may be taken. This is cheap and soft.

Another cheap composition is formed as follows, and is known as "hard lead":

No. 6.

Lead.....	80 pounds.
Antimony.....	20 "

Hard lead is better metal than No. 5. It is largely used for lining car journal bearings. It may be improved by the addition of tin, as in the following:

Hard lead.....	100 pounds.
Tin.....	100 "

This is given as an illustration. A great variety of alloys can be made by taking hard lead as a base and adding tin in varying quantities.—American Metal Worker.