VIVARIUM & AQUARIUM KEEPING FOR AMATEURS

A. E. HODGE

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A YOUNG ALLIGATOR BEING FED

By permission of "The Daily Mirror." *(Frontispiece.)*

VIVARIUM AND AQUARIUM KEEPING FOR AMATEURS

A PRACTICAL GUIDE TO THE HOBBY

BY

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PREFACE

It was nearly thirty years ago that I made my first attempt at the keeping of Vivaria and Aquaria, and as I still maintain a small menagerie of reptiles and batrachians in addition to a collection of live fish, this I think, is practical testimony as to the interest and pleasure to be derived from the hobby.

In those days, Nature-study was the exception rather than the rule, and the ridiculous superstitions and beliefs attaching to the creatures with which I am about to deal—that the forked tongue of a snake was its fangs, that toads spat fire, and newts had the power of the " evil eye," that Salamanders were incombustible and that Slowworms were blind —were not confined to the uneducated.

To-day, the long despised and much maligned reptile is winning its way to popularity as a pet, so much so indeed, that, apart from those dealers who trade exclusively in livestock, many of the large West End emporiums find it advantageous to stock them in their " Zoo " Departments.

The interest displayed by the rising generation

in wild-life generally is a hopeful sign, and, though many a " Tiddler " may meet an untimely end from suffocation in an ill-aerated bottle of water, the intentions on the part of the captor were no doubt good and not in the same category as the " sportsman " who catches to kill.

Fish, I can assure you, are much more interesting in an aquarium than a frying-pan, and, though reptiles and batrachians are likely to escape the latter, they are, likewise, more edifying as living occupants of a vivarium than as preserved specimens in a museum.

It is in the hope of encouraging interest in the habits of these lower orders of the Vertebrata, to which we ourselves belong, that this guide is written.

In it will be found such advice—the result of many failures as well as successes—which I consider of primary importance to the amateur herpetologist and aquarist.

With regard to those reptiles, batrachians and fish which are dangerous or more or less delicate, I have said nothing, for the simple reason that, as will be seen, there are sufficient hardy species to gratify the ambitions of an enthusiast with the average amount of time and accommodation at his disposal without undertaking the care of troublesome specimens likely to prove disappointing.

Facts which may be gleaned from an ordinary

work on natural history have, too, been excluded to a great extent for want of space, but I have to acknowledge the assistance which I have derived from the writings of Mr. E. G. Boulenger (Curator of Lower Vertebrates in the Gardens of the London Zoological Society) and the Rev. G. C. Bateman, particularly in regard to the technical descriptions of the various species.

A. E. H.

September, 1923.

CONTENTS

LIST OF ILLUSTRATIONS

PART I

CHAPTER I

TYPES OF VIVARIA

THERE is really no need for detailed descriptions of the various vivaria required, provided due consideration is given to such essential matters as ventilation, sun and shade, moisture and drainage.

In fact, by taking the trouble to find out the habits of any particular creature, it should be an easy matter to provide an ideal case for it, with a little common sense and ingenuity.

The point to be remembered is to endeavour to imitate, so far as is possible, the natural habitat of the species—more than that you cannot do.

Let me say at the outset, to avoid unnecessary repetition later, that IN THE CASE OF ALL REPTILES AND BATRACHIANS (EXCEPT THOSE OF THE LATTER WHICH, BEING AQUATIC, REQUIRE SPECIAL CONDITIONS), A PAN OF WATER SUITED TO THEIR REQUIREMENTS AND SOME HOLLOW BARK OR ROCK-WORK, TO ACT AS A SHELTER, SHOULD ALWAYS BE PROVIDED.

It can be taken as a general rule that batrachians require plenty of shade, lizards, terrapins and tortoises a maximum amount of sun, while the requirements of snakes lie somewhere between the two.

As regards moisture, this is more or less

necessary for all batrachians, while, with the exception of Slowworms, lizards delight in a dry situation.

Snakes which feed upon batrachians require, as one might reasonably deduce, somewhat similar conditions to those suited to their prey, and the same remark applies to those which subsist upon lizards, so that a case adapted to Grass and other water-snakes living chiefly on frogs would not be the sort of vivarium in which a Dark Green Snake (which subsists upon lizards and mice) would feel at home.

As Terrapins, being amphibious, must be provided with a pond, pool or tank, the question of moisture need not be considered, but land tortoises, except for drinking purposes, spurn water, and their vivarium should, therefore, be kept as dry as any growing vegetation will allow.

In order to maintain a permanently moist atmosphere, such as is necessary for batrachians, it is advisable to restrict ventilation to the top of the case, but reptiles not being dependent upon moisture for their welfare should have some portion of the sides or back of their vivarium ventilated as well—the more the better, in fact, especially if the case is to stand in the sun.

The habits of the future occupants are, of course, an important consideration when fitting up a case.

Terrapins and lizards require rockwork or something of the kind for climbing facilities, Tree Frogs and Snakes branches for a similar purpose, water-loving creatures such as Grass, Dice and Garter Snakes a "swimming bath" of some

PLATE 1. A REPTILIAN CORNER OF THE GARDEN

kind, while Salamanders and Toads will be satisfied with a pan of shallow water.

Ordinary frogs I do not recommend as pets for a vivarium—unless it be a very large one—as they are apt to leap blindly against the glass and injure their noses.

Claw-footed Frogs—a purely aquatic species of which I shall have something to say later—need, like Axolotl and Newts, an aquarium, wherein they may be viewed to the best advantage.

If you pay regard to the above instructions and take care that the doors (or lids) are arranged so as, when opened, to preclude the escape of the occupants, there is no reason why you should not start right away and construct, or order, vivaria to your own design.

There are, however, one or two important points which I had better touch upon before leaving you to your own devices.

Outdoor Vivaria

In the first place, you must decide whether you are going in for outdoor vivaria. Hitherto, so far as I know, no published work has dealt with this subject, yet, from my own experience, I am inclined to pin my faith on them.

The temperature of an outdoor cage is frequently higher than that of an indoor vivarium, but, unfortunately, we are apt to get spells of dull or chilly weather, when reptiles " go off " their food, and one has to remember, that unless they take sufficient nourishment during the warmer months they are not likely to survive hibernation in Winter.

Every opportunity should, therefore, be taken of

a warm period to give outdoor specimens all the food that they will take, and, if this be done, you will find your pets all the better for hardy treatment.

With one exception—the Alligator, which I could not refrain from including as it has a sort of individuality of its own—none of the species herein referred to requires artificial heating apparatus. But it would be well to give the less hardy species the choice of sheltered positions, if kept in the garden in Summer, or, in the event of an abnormally dull season, adopt the practice of putting them out during the day and taking them in on cold nights. An ordinary box, securely fastened and well ventilated, containing hay or moss, as the case may be, will answer the purpose for night-quarters.

Outdoor treatment has many advantages, such as a maximum amount of light and fresh air, natural moisture and drainage, apart from chance "food" in the form of small life which may enter the cages. As an example of this, let me state that, contrary to expert advice, I decided to leave out, to weather the winter in their own fashion, my terrapins, tortoises, Grass Snakes, Tree Frogs, Salamanders, Slowworms and Wall Lizards (because I could not catch these) but brought in my Green Lizards. The latter, with the exception of one Grass Snake, which had not been feeding well the previous Autumn, were the only specimens to succumb!

I should have mentioned, to be more precise, that one Green Lizard having refused to budge from its retreat in some permanent rockwork in its

cage, was left out, yet, after withstanding a very severe spell of frost—the only real wintry weather we had in London during the 1920-1921 season—put in an appearance on the unusually warm Christmas Day which was characteristic of that period.

It was then quite lively, but I unwisely captured it and placed it with its companions in a box of dry moss—with fatal results, as already recorded.

What happened, no doubt, was that, on some warm day in early Spring, my lizards awakened from their hibernation intent on taking exercise and refreshment—water, or some insect which would have emerged for similar reasons—but, unable to forage for themselves, suffered in consequence.

Now, in the garden (as will be seen from Plate 2) their cage is covered with wire netting of $\frac{3}{8}$ in. mesh, so that insects and other small creatures, apart from worms, are able to enter, innocent of the fact that they are thus providing the lizards with food.

Terrapins may be kept in a cage of wide-meshed netting, but it should be covered by the same material for I have found them able to climb such netting, clumsy as is the procedure. (See Plate 3.)

Of course, wire netting will not answer the purpose for small lizards, or snakes, whose cases must be ventilated by means of perforated zinc and fitted with one or more glass sides, but even then numerous small creatures come up out of the soil, which, by the way, is a natural deodorizer—another argument for outdoor vivaria. Land

Tortoises are safe enough if surrounded by a foot or so of galvanized iron railings (see Plate 2), such as are usually sold for garden borders, and though this will not exclude cats I have never found my specimens suffer from feline interference.

The framework of all outdoor cases should, of course, be bottomless with a long spike at each corner which can be pressed well into the ground.

With the object of preventing the escape of the occupants by burrowing, the lower portion of the framework should be six or more inches deep so that it, too, can be sunk into the soil.

This is particularly necessary for cases in which toads, salamanders and slowworms are confined.

All wood which is to lie beneath the surface of the earth must be well tarred, the remainder receiving two coats of good oil paint.

A primitive but effective form of outdoor cage can be constructed having grooves or ledges in which glass can slide or rest, thus dispensing with doors, but care should be taken to leave sufficient space for swelling of the wood in damp weather.

When mealworms are introduced into outdoor cages, they should be placed in little tins (such as 2 oz. circular tobacco tins) perforated with small holes at the bottom and painted with Brunswick Black, these being sunk in the ground level with the surface of the soil.

The object of the holes is to prevent the larvæ (which should be taken in after a reasonable time, if not eaten, and replaced by others) being drowned during rainy weather.

By surrounding each tin with a circular " holder " formed of Portland cement and sand

the tins may be removed for cleaning or replenishing purposes without disturbing the adjacent earth, which, otherwise, is apt to fall into the cavity.

Reptiles and batrachians soon get to recognize these receptacles as feeding-troughs and take a lively interest in one's attentions thereto.

Gentles may be merely thrown, sparingly, on the floor of the case, and those not disposed of at the time will duly pupate and provide a variety in the menu in the form of Blow Flies.

There is just one other point in connection with the housing of reptiles in the open air, and that is vegetation.

Here again common sense is all that is necessary in making a selection, shade and moisture-loving plants such as ferns, Tradescantia and mosses being naturally suitable for batrachians (with the addition of—say, a small laurel bush for Tree Frogs), Irises, Bamboo or some stout grass for water-loving snakes, Sphagnum or some other sun-bearing moss for Slowworms, Sedums for sunny rockwork, with, in the case of lizards, a root or two of heather or heath.

When fixing upon sites for vivaria in the garden, care must be taken as to selection of sunny and shady positions, or failure will result. If there is any difficulty in affording sufficient shade this may be easily overcome by planting tall shrubs in the vicinity.

In Plate 1 it will be noticed that one side of the garden gets full sunshine, and that is where the reptiles are housed. The Batrachian cases are on the right, hidden from the camera by herbage.

Conspicuous in the foreground on the left is the small lizard-case with glazed front and hinged lids covered with perforated zinc. Midway between this and the large lizard-cage at the end of the row, a portion of the Terrapin enclosure can be seen, while " in the shadows " at the bottom of the path the dim outlines of the snake-case is recognizable. Later in the day this gets a fair amount of sunshine.

In Plate 2, a nearer view is obtained of the Terrapin Enclosure and large lizard-cage with its rockwork and wire netting, and, in this photograph, the circular rails of the tortoise enclosure may be observed joining up the two cages.

The Terrapin Enclosure, as will be seen from Plate 3, is but roughly constructed, with network flaps for roofing, one of which, in the picture, is turned back so as not to obstruct the view of the basking reptiles.

There is, as will be seen, no need for outdoor vivaria to be at all conspicuous, if sombrely coloured and judiciously disposed amid the plants, which thus provide a natural and beautiful setting.

An hour or two spent in such a garden is as entertaining as it is interesting. There is always " something doing."

I pass a good deal of my leisure time thus, watching the lizards as they bask and scamper intermittently on the rockwork, listening to the Tree Frogs' shrill croaking, or the occasional " plomp " of a Terrapin as it dives into its pool, or admiring the symmetry of the sinuous snakes as they glide amid the branches of their vivarium.

If you have the opportunity, it is certainly worth

PLATE 2. OUTDOOR TERRAPIN, TORTOISE AND LIZARD ENCLOSURES.

while to try your hand at outdoor vivaria, leaving the aquaria—which are unsuited to such conditions owing to frost—for indoors.

Though the reptiles and batrachians will, in such circumstances, hibernate during Winter, this, at any rate, is natural and avoids the trouble of finding food which is sometimes difficult to obtain at this season. Moreover, it gives one a chance of overhauling the aquaria—cleaning and re-stocking them—at one's leisure.

Facilities must, of course, be provided for your pets retiring out of reach of frost.

The tortoises and toads will bury themselves in the mould, and the terrapins remain dormant at the bottom of their pond, but the snakes should have a pile of hay and stable refuse to creep under, whilst the lizards and other creatures should have opportunities of stowing themselves snugly away under rockwork.

In severe weather, cover the cases with sacking, as you would protect your plants.

If you do not care to take the risk of " hardening off " your pets, pack them away for the Winter in well ventilated boxes containing hay or moss (damp for batrachians), keeping these in a coal cellar, or similar spot, secure from frost.

So soon as the first warm day of Spring arrives, give them an airing, taking them in o' nights at first until used to the change.

The first thing they will probably do is to have a long drink! See that there is something more nourishing handy.

Indoor Vivaria

Of course, apart from the less hardy species, some creatures, such as Newts and specimens of small size which could not be conveniently observed in a large garden case, are better suited to indoor conditions.

The foregoing recommendations for outdoor vivaria should, nevertheless, be considered when constructing and selecting positions for indoor cages. In addition to the drawback of restricted sunlight for those reptiles which require it, there is the question of drainage in the case of moist vivaria while the lack of any natural supply of small-life as food has to be taken into account.

Dry vivaria—for those creatures requiring merely sand or gravel on the floor of their vivarium—may be made on the lines of those already suggested but plus a wooden bottom.

A moist vivarium—which needs mould—on the other hand should have the bottom either lined with zinc inside or coated with pitch. Small holes should be bored for drainage purposes, which will necessitate a tray beneath to catch the superfluous water.

Before putting in the soil, a layer of small gravel should be strewn over the bottom of the case to prevent the mould being washed through the drainage-holes.

For Axolotl and Claw-footed Frogs, as already stated, an aquarium is necessary, but for newts, which are more or less terrestrial during a portion

of the year, a sort of aqua-terrarium should, if possible, be provided.

After many experiments in this direction, I have come to the conclusion that one or other of the two following suggestions is eminently satisfactory for the purpose:

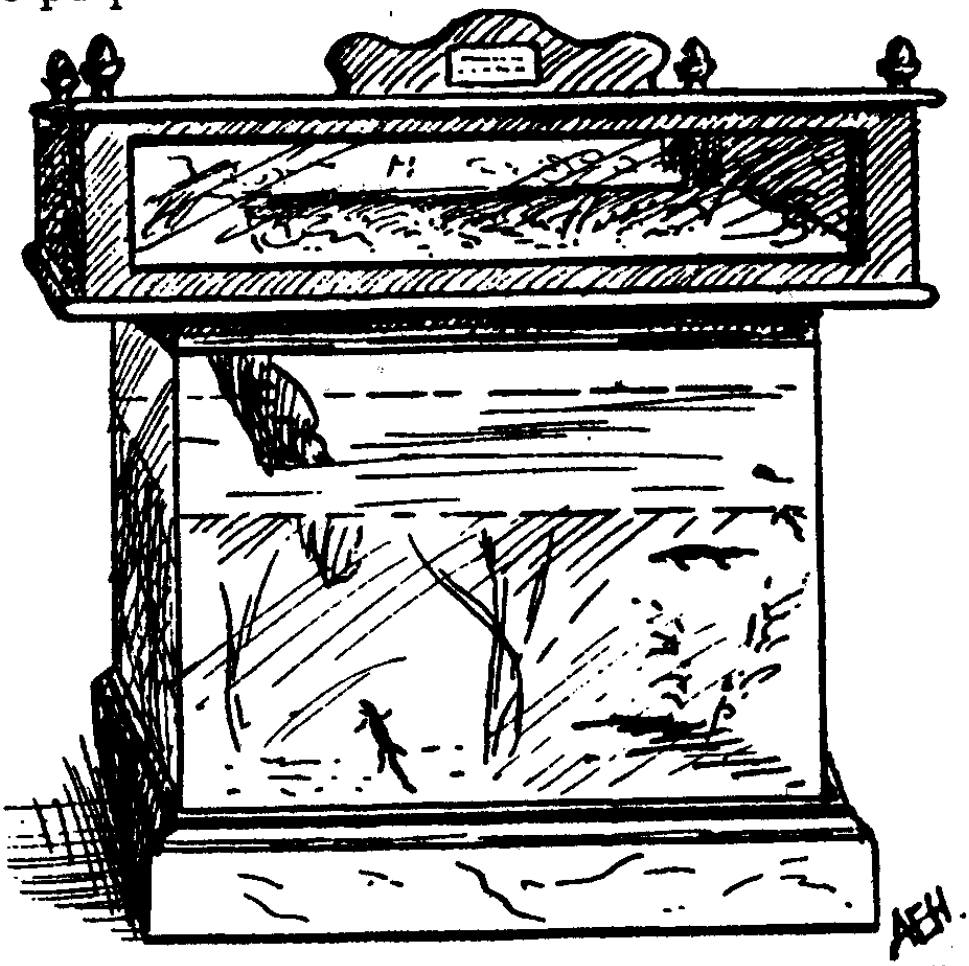

DIAGRAM 2, which is a sketch of my own "Newtarium," shows clearly the above arrangement.

1. An ordinary all-glass aquarium with a corridor running around the top communicating with the water by means of a sloping piece of cork—on the lines of a swimming-bath.

The front and back of the corridor, which should be made to fit tightly into the top of the aquarium by means of a ledge, should be of glass. The sides should be of perforated

zinc, and the whole structure covered with a removable glass lid.

If four shallow zinc trays, painted with Brunswick Black, are constructed to fit around the bottom of the corridor, partially filled with peat and kept replete with water, various miniature marsh-plants—obtainable from any bog—will thrive therein without any drainage, provided that they receive plenty of sunshine.

It is, perhaps, better to keep one of them merely moist, with a few pieces of rugged pumice stone here and there, so that, when the newts leave the water, they may find suitable retreats. This, too, can then be periodically stocked with worms, for which the newts will hunt around at night.

2. A similar aquarium with, instead of a corridor, a zinc "hanger." This, if perforated at the bottom, painted with Brunswick Black or Bath enamel and filled with earth on the top of a layer of gravel, can be made very decorative by planting suitable dwarf ferns and other plants therein.

The "hanger" can be suspended from the sides of the aquarium by stout copper wire, taking care that, for drainage purposes, the bottom is above the surface of the water.

Of course, if Marsh Plants are grown in it, this precaution is unnecessary.

Some pieces of cork bark can be hooked on to the front of the "hanger," one or two of which should be allowed to be partially submerged so that the newts, when in the mood, can gain an easy footing and take a spell "ashore."

Newts, as a matter of fact, are such skilful climbers that they can ascend the glass sides of their vivarium. This, therefore, should be securely covered.

For a vivarium in which an alligator is confined artificial heating, as already mentioned, is necessary, but this is not so difficult to provide as might be thought.

A small lamp, or a night-light (those burning for twelve hours are the most convenient), standing beneath its tank will suffice. The tank—a large baking-tin will do for a small specimen—should be sunk level with the floor of the case and the light stood on a bracket beneath it.

Later on, I will describe more fully how such a case should be arranged.

Ventilation will need to be kept under proper control and there must be an absence of draughts.

As regards the temperature of the water and the air in an Alligator-case, the former should average 80 degrees during the year and the latter 70 degrees.

This, of course, does not mean that the animal should be kept at the same temperature all the year round—an unnatural state of affairs—but, if possible, the temperature should not vary more than 10 degrees, i.e., a maximum of 85 degrees (water) and 75 degrees (air) in Summer and a minimum of 75 degrees and 65 degrees, respectively, in Winter.

CHAPTER II

BRITISH REPTILES AND BATRACHIANS

THERE are thirteen reptiles and batrachians indigenous to this country, so that, though the scope is not great, there is an opportunity of capturing, yourself, some of the specimens for your collection.

This not only adds greatly to their interest, but provides an incentive to "active service in the field."

Of British species, only one—the thirteenth it would be imagined, if there is any truth in unlucky numbers—is venomous, and that is the VIPER (or Adder).

Though its bite is seldom fatal to human beings, it is often followed by more or less serious consequences, especially in hot weather, so it is advisable to be thoroughly familiar with the appearance of this undesirable before indulging in a snake-hunt.

Once seen, there is really no difficulty about recognizing the Viper, for it is quite unlike the Grass Snake and easily distinguishable from the Smooth Snake—the only two other species inhabiting Britain.

Vipers vary in colour so much that you cannot

rely on this feature for identification, while a V-shaped marking (suggestive of the initial of the reptile's name), though usually present on the back of the head, is not always constant.

COMMON VIPER (*Vipera berus*).

Range.—Europe (including England and Scotland) and Asia.

Maximum Size.—About 2 ft.

Coloration.—Very variable, being sometimes red, olive, olive-brown and even black or white. British specimens characterized by dark zig-zag band running along centre of back, with, usually, an inverted V-shaped marking on the back of head.

If, however, you see a sturdily built snake less than 2 ft. long with zig-zag band or chain of markings along the centre of the back, do not handle it. You may take it that it is a Viper, and you can confirm the fact by looking at the pupil of its eye, which, in the Adder, is a vertical slit, and, in the case of the other two British species, circular.

You have, in fact, only to look your "man" straight in the eye to discover his character.

SMOOTH SNAKE (*Coronella austriaca*).

Range.—Europe, including English counties of Hampshire, Dorsetshire and Surrey.

Maximum Size.—About 2 ft.

Coloration.—Grey or reddish brown above, with usually four series of spots along the body; a dark streak on each side of the head, passing through the eye, and sometimes a dark marking on the back of the head somewhat similar to the inverted V on that of the Adder. Underparts, brown, red or orange, speckled with black and white.

The SMOOTH SNAKE, as will be seen from its description, is readily distinguishable from the

Viper by its four series of spots (one pair on the back and one on each side), apart from the optical " hall mark " of the latter reptile, while the GRASS SNAKE, a much larger species, is adorned with two black patches behind the nape, and usually a white, yellow or orange collar in front of them.

GRASS SNAKE (*Tropidonotus natrix*).

Range.—Europe (including England), Algeria, West and Central Asia.

Maximum Size.—English specimens, 4 ft. (rarely over); Continental, 6 ft.

Coloration.—Very variable. Typical European form is grey, olive or brown above with black spots or narrow cross-bands; a white, yellow or orange collar, sometimes interrupted, bordered behind by two black patches of more or less triangular form. Underparts, checkered black and white, or grey.

When setting out on a snake-hunt, it is wise to take with you a hooked stick and a small " Y " such as is sold for butterfly nets, the two smaller holes of which should be plugged with corks.

Upon coming across a snake of doubtful species, you have then only to ram the " Y " on to the ferrule-end of the stick, hook the snake out on to an open spot, and pin it down between the prongs of the " Y " for a closer scrutiny.

If not a Viper, it can be safely picked up (for the bite of even a large Grass Snake may be ignored) and placed in a canvas bag, the mouth of which should be securely tied with cord.

Should further specimens be needed, a second piece of cord tied around the centre of the bag will prevent the escape of the occupant beneath it when the bag is again opened.

After tying up the mouth once more the central

cord can be released, the fresh captive shaken down, and the operation repeated as before.

Lizard hunting is quite good sport—so long as one has patience and perseverance, for these reptiles are as nimble as they are alert.

On such an expedition I usually carry a flat biscuit-tin having a hole at one end, about the size of a penny, stopped with a cork, and a small but deep triangular net on a stout frame.

The net, of course, can be carried in the pocket and attached to a walking-stick when arriving on the scene of operations.

My usual method is to seek out, on some sandy common where heather abounds, a sunny slope more or less clear of vegetation. Here I "outspan" and await developments.

The chances are that, if I keep perfectly still, a lizard will soon put in an appearance, peering around in characteristic, bird-like fashion before venturing out into the open to bask in the sun.

With little spasmodic darts it will, perhaps, leave its retreat. That is my opportunity for making use of the net, with which I hitch it towards me so that I can secure it with the hand. If unable to effect its capture in this way, I endeavour to net the reptile right away.

Care must be taken not to seize a lizard by the tail, as this is apt to snap off in your hand—and the reptile scuttles off to grow a new one.

A running noose of horse-hair on a long and slender stick is, in the hands of an expert collector, very effective, I am told, but I, personally, have never experimented in this direction.

You simply slip the noose over the lizard's head,

give the stick a flick, and there you are! It certainly should beat fishing hollow!

Apart from the Slowworm (which is a legless lizard) there are only two species of lizards in this country—the SAND LIZARD, a very local creature, and the common VIVIPAROUS LIZARD.

SAND LIZARD (*Lacerta agilis*).
Range.—North and Central Europe, including England.
Maximum Size.—English specimens, 8 in., which size is, however, exceeded by Continental specimens.
Coloration.—Female: brown with numerous conspicuous black and white eye-spots on the back and sides. Male: more or less emerald green on sides and belly.

The Sand Lizard is more heavily built than the Viviparous Lizard, which has usually dark lines upon its brown or bronze-coloured body instead of eye-spots.

COMMON LIZARD (*Lacerta vivipara*).
Range.—North and Central Europe, including Great Britain and Ireland.
Maximum Size.—About 6 in.
Coloration.—Light brown with, frequently, a dark line down middle of back, and another edged with yellow on the sides. Young are blackish.

The verdant adornment of the male Sand Lizard has, no doubt, resulted in its being frequently mistaken for the more beautiful Green Lizard.

As the latter is not included in the British fauna, I shall defer my remarks about it until dealing with foreign species.

Everyone, of course, knows the SLOWWORM when he sees it glistening in the sunshine like a polished stick. But it is not everyone who knows that it is

a perfectly harmless lizard, except from the point of view of the Slug, its natural prey.

SLOWWORM (*Anguis fragilis*).

Range.—Europe (including England and Scotland) and Western Asia.

Maximum Size.—About 18 in.

Coloration.—Adults : brownish grey. Young : silvery white above with black streaks along middle of head and back; black underneath.

How the Slowworm earned its popular name it is difficult to imagine, for it can move very rapidly when alarmed, slithering among the herbage like a tiny stream of flowing water.

At such times the novice is apt to make a grab at the disappearing reptile, and it is then that he appreciates the appropriateness of its specific name, *fragilis*, for the little creature will part company with its tail—a useful protective action common to many lizards, for the discarded, twitching member distracts the attention of a pursuer—with even less provocation than in the case of the Sand and Viviparous Lizards.

In captivity, however, a Slowworm, if carefully handled at first, will not indulge in this instinctive habit of self-mutilation, though, should it do so, an " apology " for the missing tail will develop in course of time.

It will be noticed that the Slowworm, unlike a snake, has eyelids. As these, of course, close when the creature is asleep, this fact, no doubt, has given rise to its other appellation, " Blindworm."

So much for the British reptiles. Now we will turn our attention to the batrachians.

Of these there are two species of toads and two

of frogs, each easily distinguishable from its nearer relative.

COMMON TOAD (*Bufo vulgaris*).

Range.—Europe, North West Africa and (temperate) Asia.

Maximum Size.—English specimens about 3 in., but Continental specimens attain 5 in.

Coloration.—Brown, olive, greenish or reddish above, uniform or blotched with brown or black.

The NATTERJACK TOAD can at once be recognized by its yellow vertebral line, absent in the COMMON TOAD except in a variety from Eastern Asia, while the COMMON FROG may be distinguished from its more local cousin—the Edible Frog—by the dark coloured patch on the temples, which accounts for its specific name "*temporaria*."

NATTERJACK TOAD (*Bufo calamita*).

Range.—Northern and Western Europe.

Maximum Size.—3 in.

Coloration.—Greyish or greenish brown, marked with darker shades, the warts being often of a reddish hue. Yellow vertebral line.

Damp situations are where frogs and toads usually abound, and dusk the best time to look for them, unless one indulges in a special expedition after dark armed with a lamp of some kind.

COMMON FROG (*Rana temporaria*).

Range.—Northern and Central Europe and Northern Asia.

Maximum Size.—About 2½ in.

Coloration.—Very variable; ground colour usually either grey, brown, yellow or red, with spots or marblings. Limbs usually transversely banded, with a distinctive dark mark on the temples.

In the case of the Natterjack Toad, however, its favourite habitat is, curiously enough, dry, sandy districts, in the porous soil of which it burrows deeply.

EDIBLE FROG (*Rana esculenta*).
Range.—Europe, Western Asia and North West Africa.
Maximum Size.—About 3 in.
Coloration.—Upper parts usually a rich green, but occasionally brown, uniform or spotted with dark olive or black. Frequently there is a light yellow, green, or blue vertebral stripe. Hind limbs with black stripes or marblings.

Three species of Newts complete the list of batrachians. They are:

The GREAT WARTY NEWT, which is distinguishable from the others by its tuberculated skin.

GREAT WARTY NEWT (*Molge cristata*).
Range.—Central and South East Europe (including Great Britain).
Maximum Size.—6 in.
Coloration.—Brown, blackish or olive above, with, usually, distinct black spots, and the sides speckled with white. Breeding male has black and white marblings on the head and a silvery white band along side of tail. Underparts, bright yellow or orange, spotted or marbled with black. Lower edge of female's tail is uniform orange. Female has sometimes yellow vertebral line, which is almost always constant in the Continental variety *karelinii*, frequently imported and distinguishable by its larger head, shorter body, and larger spots on belly.

The COMMON NEWT, characterized by its perfectly smooth skin and spots on throat.

COMMON NEWT (*Molge Vulgaris*).
Range.—Europe (including British Isles) and (temperate) Asia.

Maximum Size.—4 in.

Coloration.—Variable. Upper parts olive-brown, with darker spots, large and rounded in the male, but, in the female, merely a series of dots, sometimes confluent and forming a little band. Underparts, yellowish shading into orange medially, with black spots disposed, in each sex, similarly to those on the back. Throat, white or yellow, spotted with black. Lower edge of tail orange in female and red bordered above with blue, barred with black in the male. Festoons of dorsal crest, of male, usually tipped with red.

The PALMATED NEWT (the smallest of the trio) which, though having a smooth skin like the Common Newt, has no spots on the throat.

PALMATED NEWT (*Molge palmata*).

Range.—Central Europe and Great Britain.

Maximum Size.—3 in.

Coloration.—Brown or olive above, with small dark spots, numerous on the head. Underparts uncoloured except for the median zone of the belly, which is orange. There are a few spots on the belly but none on the throat. Lower edge of tail, bluish grey in the male, and yellow or orange in the female.

During Spring, when newts resort to ponds and pools for breeding purposes, they may be easily caught with a hand-net, as they are forced to rise periodically to the surface of the water to gulp down supplies of air, thus revealing their presence.

When the breeding season is over—about the end of June—newts, as a rule, leave the water (though some exotic species are much more aquatic) and forage for food upon land.

Their usual retreats are holes in the ground or beneath stones in the vicinity of water, to which they will return the following April.

PLATE 3. EUROPEAN TERRAPINS LEAVING THEIR SWIMMING-POOLS TO BASK

CHAPTER III

TORTOISES AND TERRAPINS

It should be explained that a Tortoise is, now, usually understood to be a Chelonian which is essentially terrestrial in habits and a Terrapin amphibious, while a Turtle is purely aquatic. The last-mentioned, however, does not come within the scope of this book.

Both Tortoises and Terrapins are particularly adapted to confinement in the garden for, unless very small, they always seem peculiarly out of place in an ordinary vivarium—and babies of this kind seldom thrive under captive conditions in this country.

Numbers of tortoises of the commoner species are, or were, purchased by zealous but misinformed persons under the impression that they would rid their gardens of slugs and undesirable insects. Such an idea is, of course, erroneous, as it would soon be found if one has lettuces, cauliflowers or cabbages growing in the garden, for these tortoises are, to all intents and purposes, vegetarians, and a single specimen will quickly dispose of such appetizing morsels.

Unless, therefore, you are prepared to put up with their depredations upon greenstuff you had

better fix up an enclosure of some kind, as already suggested.

To provide a regular supply of food it would be as well to plant a few roots of Dandelion, together with grass, which will provide a stand-by at all times. Delicacies such as gooseberries, strawberries, currants and peas, may be given to the occupants now and again by way of a special treat, but lettuces and cauliflowers should form the chief items in their menu.

An inverted box, minus one side, will answer the purpose of a shelter, and if covered with cork bark, it will not look at all unsightly. My specimens have a "little wooden hut" of this sort, to which they frequently retire not only from rain, but curiously enough, when the sun-temperature is particularly high.

As Winter approaches, the tortoises will bury themselves in the earth to hibernate until the Spring, but, if preferred, they may be stowed away in a ventilated box, packed with moss or hay, and kept in a coal-cellar or cupboard out of the reach of frost.

Of course, like other reptiles, a tortoise can, by the provision of artificial heat, be kept more or less active throughout the year, but as this is an unnatural condition of affairs, I do not recommend it.

Tortoises are not nearly so thick-headed as they look. They soon learn to recognize their keeper, and make very tractable pets.

Seeing that, apart from Giant Tortoises known to have existed for over two hundred years, Gilbert White's famous tortoise (of the common

species *T. ibera*) lived nearly sixty years, while another belonging to a Miss Jenkins, of Trewergie, in Cornwall, is recorded as having been kept in the family for ninety-six years, there is the additional attraction of being able to leave one's pet as a sort of family heirloom!

IBERIAN TORTOISE (*Testudo ibera*).
Range.—North Africa, Southern Spain, Turkey, Roumania and South West Asia.
Maximum Size.—About 9 in.
Coloration.—Carapace (upper shell) brownish yellow, bearing a number of black blotches.

In addition to the IBERIAN TORTOISE, distinguishable by the presence of a large conical tubercle on the back of the thigh, there are two other species of similar habits and equally hardy—the GREEK TORTOISE and the MARGINED TORTOISE.

GREEK TORTOISE (*Testudo græca*).
Range.—Balearic Islands, Sicily, Corsica, Sardinia, Balkan Peninsula, Greek Archipelago and Syria.
Maximum Size.—About 9 in.
Coloration.—Similar to *T. ibera*, but more conspicuously marked.

The latter may be recognized by the strongly expanded and more or less serrated posterior margin of its shell and the former by the absence of this characteristic and the tubercle peculiar to the Iberian Tortoise.

MARGINED TORTOISE (*Testudo marginata*).
Range.—Greece and Sardinia.
Maximum Size.—About 11 in.
Coloration.—Carapace black or dark brown with yellow spot on each shield. Shell elongated.

Strange as it may seem, I once got into trouble through having a tortoise as a bedmate.

It was years ago, while serving with the forces during the South African campaign which ushered in the present century.

Perhaps I cannot do better than quote from an article of mine which appeared in the " Boy's Own Paper " of the 25th April, 1908.

" I had had a pretty hard day," I pointed out, " and, being tired out, turned in early.

" How long I slept I cannot say, but I was suddenly awakened by a peculiar rapping sound which seemed to come from the very earth itself.

" Thoughts of subterranean mines and other terrors filled my mind, and I sat up and rubbed my eyes to make sure that I was awake.

" All was now quiet save for the sound of muffled snoring from within the tent.

" I groped behind me for my tunic, which I used as a pillow, in the hopes of finding a match. In doing so, however, I clumsily stuck my fist in the face of a comrade sleeping nearby. His remarks, perhaps, had better here be omitted.

" All the inmates of the tent were now aroused and there was quite a babel of voices inquiring what the row was about and why, in particular, they had been awakened.

" Suddenly, the truth dawned upon me and I burst out laughing. Hastily striking a match I dived down amongst the motley collection of articles in my kit-bag and drew out an old biscuit-tin. Pulling off the lid I revealed to the curious gaze of my companions a little tortoise!

" I had captured him the previous day crawling aimlessly about on a kopje near the camp, and for want of something better, had confined him in the article referred to.

" Here, in his efforts to escape, he had been the innocent cause of all the commotion."

But—to return to my theme—while tortoises are herbivorous, Terrapins, or, at any rate those to which I shall refer, are carnivorous and should be fed upon worms, tadpoles, fish and raw meat.

Terrapins usually only feed whilst in the water, but the common European Terrapin will frequently take its meals ashore.

It may be found that, if their pond is devoid of aquatic vegetation and the water clear, terrapins will hesitate to enter it. They may be tempted to do so by introducing a lily or some floating weed; such as Duckweed.

A lily is, perhaps, the best adapted, provided it be securely planted in some loam, covered by a layer of shingle, and the pool be deep enough for the particular variety chosen.

Canadian water-weed, though excellent for the purpose of aerating the water and keeping it wholesome is rather unsatisfactory as the terrapins get entangled in it, and when climbing out of the pool, cart portions of it away with them.

It is best to have a separate shallow pool in which the terrapins can be fed on raw meat. If the latter be placed in the swimming-pool the water will soon become contaminated, necessitating a general clean-out. This, of course, is quite easily done with a mop in the case of the feeding-tank.

In the absence of a feeding-pool in the garden, a good idea is to take the terrapins out of their enclosure, when feeding them on meat, and place them in a large bowl or tank of tepid water. When the meal is over, the terrapins can then be returned to their home and the dirty water and refuse thrown away.

Terrapins are very nervous creatures, and until thoroughly domesticated, seldom will partake of food if aware that one is watching them.

They will frequently plunge into the water, immediately one approaches their enclosure. I have even noticed them adopt such tactics whenever my dog barked in the garden.

After a while, however, they soon become tame and, instead of taking such precipitate action, they will show an apparently intelligent interest in all that goes on around them, training their heads, like so many miniature howitzers, in the direction of their keeper, whenever he favours them with a visit.

On cold nights, Terrapins usually prefer to remain at the bottom of their pool rather than seek shelter ashore.

The EUROPEAN TERRAPIN is the species most commonly imported into this country—where, ages ago, it was indigenous.

EUROPEAN TERRAPIN (*Emys orbicularis*).

Range.—Southern Europe, Algeria, Tunisia and South West Asia.

Maximum Size.—10 in.

Coloration.—Variable. Carapace (which is oval in the adult and round in the young) usually dark brown or black with yellow radiating lines on shields. Head black with yellow or pale brown dots.

These creatures are, indeed, shipped from the Continent packed together "like sardines in a tin," with the result that, in their struggles for freedom, many are blinded by the claws of their companions.

It is, therefore, advisable, before purchasing a specimen, to inspect it thoroughly, while, at the same time, touching its head or a protruding limb with the finger. If it withdraws the member quickly it may be taken that the Terrapin is in good condition, but, if not, try another.

IBERIAN TERRAPIN (*Clemmys leprosa*).
Range.—Spanish Peninsula, Morocco, Algeria and Tunisia.
Maximum Size.—About 6 in.
Coloration.—Carapace, dark olive. Head, olive with yellow streaks on sides and an orange spot between the orbit and the ear.

The IBERIAN TERRAPIN—which has earned its specific name because of a fungoid growth, of leprous appearance, which is apt to develop upon its shell—and the CASPIAN TERRAPIN, a rather handsome species, are, though more aquatic in habits, equally suitable.

CASPIAN TERRAPIN (*Clemmys caspica*).
Range.—South East Europe and Asia.
Maximum Size.—About 12 in.
Coloration.—Carapace beautifully marked with wavy black-edged yellow markings.

Of several more or less hardy North American species, the PAINTED TERRAPIN takes the palm in point of attractiveness—at least, those specimens

which still retain the striking coloration of their youth.

PAINTED TERRAPIN (*Chrysemys picta*).
Range.—North and Central America.
Maximum Size.—6 in.
Coloration.—Carapace, dark olive or blackish with, frequently, a yellow vertebral line. Marginal shields scarlet: yellow bands on neck, generally forming three forks, the centre one having its base on the chin.

As it is occasionally imported into this country and lives well in confinement, one should make a point of adding it to the collection, but, except in warm weather, it should be kept indoors.

CHAPTER IV

MISSISSIPPI ALLIGATOR

THERE is something in the very word " Alligator " which impresses one. You have only to tell a friend that you have a pet of this sort and he immediately visualizes a monstrous creature ready to attack all and sundry.

My own experience with pet Alligators had been confined to specimens of the hardiest species—A. MISSISSIPPIENSIS—from 10 in. to 3 ft. or so in length, and these I have found particularly interesting and amusing.

Though a baby alligator does not indulge in such undignified antics as boxing its shadow or chasing its tail, as a kitten will do, it can be very lively at times.

COMMON ALLIGATOR (*Alligator mississippiensis*).
Range.—South East United States of America.
Maximum Size.—15 ft.
Coloration.—Adult: dark green or blackish above.
Young: of a yellowish hue with black cross-bands.

My latest acquisition in this line, for instance—a 10 in. youngster (see Frontispiece), can make the sand fly when travelling " full speed ahead," grunt like a little pig with the nightmare and give what appears to be a feeble imitation of a steam-blast house-cleaning apparatus in action, while his broadside smile at feeding times is worth seeing.

I had some little difficulty in rearing him at the

outset, owing to his stubborn refusal to take food, for some reason best known to himself, so, for the sake of those who may find themselves in a similar dilemma, I will explain how I dealt with the situation.

Briefly, the procedure was forcible-feeding with a penholder!

At first, this proved no easy matter for, despite the alligator's insignificant dimensions, my strength proved inadequate to pull his jaws asunder—and I naturally hesitated at employing a tin-opener or a jemmy for the purpose.

However, by dint of a little coaxing, the reptile compromised by opening his mouth half-way.

This was my opportunity and I seized it. A saucer of shredded meat steeped in milk stood handy, and holding the " patient's " jaws firmly apart by a finger and thumb thrust between them, I deposited a tiny ball of meat on the tongue and gently rammed it home with the penholder dipped in milk, returning him to his tank to soliloquize on this first course.

The animal seemed to at once think better of his self-imposed fast, for, after operating his three eyelids as though in a reverie of delight, he consented to have the operation repeated several times, at intervals, without resistance.

This proved the turning point in my pet's career, for, three days later, he willingly partook of a similar repast and, instead of sprawling in his tank with his head beneath the cork " bank " as though ashamed of captivity, he stood stiffly in the centre, with upraised head—always a good sign of health.

One day I tempted him with a small Lob Worm,

which I threw into the water near him. He rose to the occasion, and with a little rush and a side-long snap, he seized the wriggling annelid, which he quickly disposed of by a series of progressive gulps.

My difficulties were henceforth over, and the next step, after a short course of worm diet, was

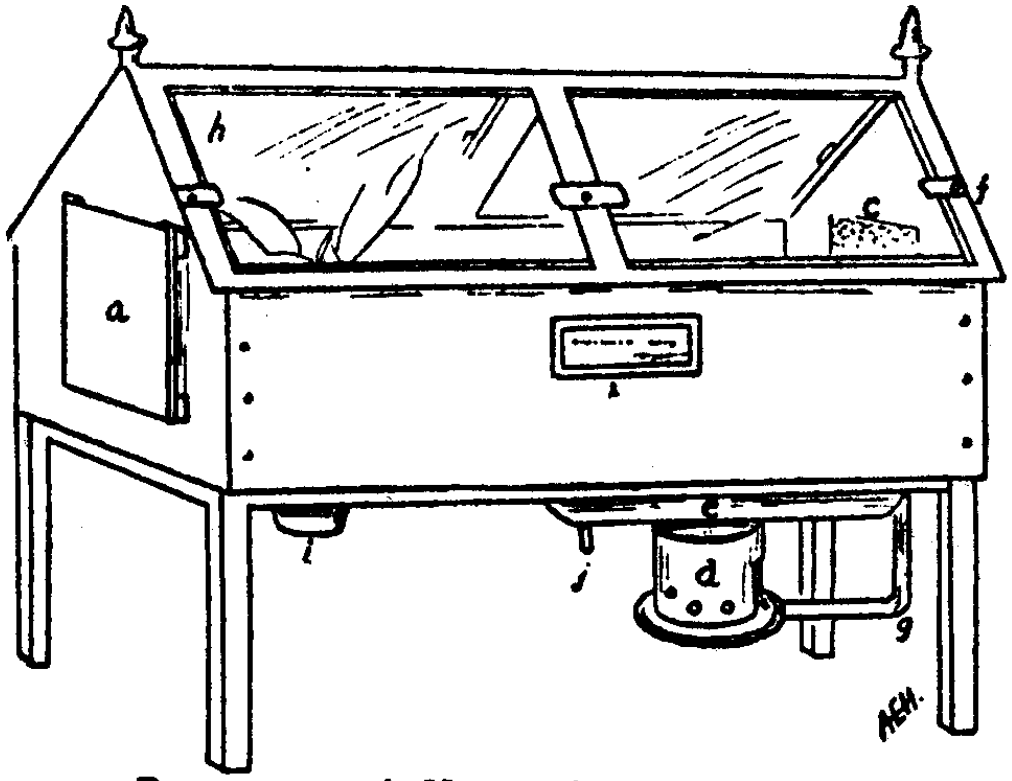

DIAGRAM 3.—A HANDY ALLIGATOR CASE.

a. Shutter over perforated zinc.
b. Label.
c. Perforated zinc ventilator.
d. Can, with holes, to slide over night-light.
e. Bottom of tank.
f. Revolving glass-holder.
g. Bracket to hold night-light.
h. Glass (removable).
i. Bottom of pot holding palm.
j. End of exhaust pipe.

to change the menu to small minnows, then strips of meat, and finally, a varying diet of all three items with, now and again, a snack of raw fish when minnows were unavailable.

This treatment was eminently successful and the reptile soon commenced to put on weight appreciably, growing nearly an inch a month.

Well, that is how I managed to bring up an inconveniently small alligator.

Another specimen, about 2 ft. in length—gave no trouble whatever, except to cope with his insatiable appetite for fish. Dead or alive he would eat them, twisting them round in his jaws by manipulative jerks until their heads pointed towards his gullet when, of course, their fins gave a minimum of obstruction.

I have already explained how an alligator-case may be heated. So far as its design is concerned, this may be elaborate or primitive so long as there is ample room for the reptile to flounder about in the tank and climb around ashore.

My first was made out of a large packing-case, artfully camouflaged with cork and fern pockets so that it looked quite imposing.

At one end was the sunken tank; at the other a platform covered with gravel, with a circular hole in which a palm-pot could be placed (see diagram) and, between, a sloping bank formed of virgin bark, under which the occupant could retire when so disposed. (A portion of the bark should be allowed to overhang the tank as an alligator sometimes likes to remain in water more or less concealed from observation. At night, you will find that it leaves the water and roams about "on land.")

Beneath the tank, of course, was the bracket on which the necessary lamp or night-light was constantly kept burning.

The roof was composed of four sloping pieces of glass resting in ledges either or all of which could be propped open at the top to increase ventilation.

A large hole at each end, covered with perforated zinc, was the chief means of providing the latter, and to prevent a direct draught, a shutter was fitted over the ventilation-holes, fixed by corner pieces so that it stood out about half an inch or so and thus caused the air to enter indirectly all round.

Though I have at present a more elaborate "Alligatorium," it has no practical advantages over the primitive case described above, which will be found to answer the purpose admirably.

Cleanliness is, of course, essential, and to facilitate the changing of the water the tank should be provided with a small outlet-pipe and plug.

When replenishing the water, see that it is, approximately, of the same temperature as that taken out, for sudden changes of this kind are good for neither man nor beast.

In pre-war days, one could purchase a suitably-sized alligator (1½-2 ft.) for about ten shillings, but those days have gone and the price is now more likely to work out at, roughly, four shillings per inch.

If provided with ample accommodation and well fed, an alligator should grow about a foot a year, but, in a small case, I am told, growth is considerably retarded without, apparently, any ill effects.

Once when making inquiries on this point I was told of a small alligator which was a veritable "Peter Pan," as, for years, it had never grown at all and was still in the best of "spirits." I found that my informant was quite correct—for the specimen was preserved in a bottle.

CHAPTER V

LIZARDS

LIZARDS—or, at least, those that I shall mention which are not legless—will be found exceedingly entertaining owing to their restless and inquisitive habits.

At one moment, basking lazily in the sunshine, as though they had not an ounce of energy left, the next, seemingly inspired by a bright idea, they are full of movement, darting around their cage, or climbing the rockwork like "a cat on hot bricks."

Talking about cats reminds me that the lizards in my outdoor cages are a source of great wonderment to local felines.

Daily they sit for hours on end, with staring eyes and twitching tails, wondering, apparently, whether the lively little reptiles, so near and yet so far, are something new in the mouse line.

One of these uninvited spectators actually succeeded in gaining possession of a Green Lizard's tail which the owner had indiscreetly allowed to protrude through the netting. But as the lizard grew another in course of time it could afford to laugh at the incident.

The EYED LIZARD is an extremely handsome

creature, but, unfortunately, it is a "doubtful starter" from the feeding point of view and one has to chance to luck in this respect when purchasing a specimen.

Those most commonly imported into this country are of a variety known as *pater* in which there is a tendency for the characteristic eye-spots to disappear, and as this form seldom thrives in captivity one should endeavour to procure the hardier variety from South West Europe.

EYED LIZARD (*Lacerta ocellata*).

Range.—South France, North West Italy, Spain and North West Africa.

Maximum Size.—About 20 in.

Coloration.—Green, with black and yellowish network on back; large dark-blue eye-spots on sides.

In any case, certain individuals are apt to go on "hunger strike" and unless forcible feeding is resorted to the best thing to do with such a specimen is to exchange it at the first opportunity.

It should be given a fair trial, however, with such delicacies as small mice, Lob Worms, cockroaches and mealworms, for some specimens feed readily enough when they become accustomed to their new surroundings.

In an outdoor cage of wire-netting, provision, of course, will have to be made to prevent the escape of mice, if these, its favourite food, are given to the lizard. A lining of glass, around the lower portion of the cage, will answer the purpose.

If an EYED LIZARD has been feeding well during the Summer months it should hibernate quite safely if kept out of the reach of frost.

Of all the hardy lizards, the GREEN LIZARD is undoubtedly the most popular, for apart from its beauty it is a ready feeder and easily tamed.

Green Lizards are great climbers, so should be provided with plenty of rockwork.

If they are confined in a cage of wire-netting (not more than ⅜ in. mesh), they will spend much of their time climbing this, at first diligently poking their nose into every portion of it in the vain hope of finding an avenue of escape.

It is fortunate that they desist in this after a time for they are apt to rub their noses raw in the procedure.

GREEN LIZARD (*Lacerta viridis*).

Range.—Central and Southern Europe (including Channel Islands).

Maximum Size.—About 1 ft.

Coloration.—Entirely green above, with blue throat in typical adult male. (There are several ocellated and striated varieties.)

I have found that Green Lizards are remarkably intelligent—or, perhaps, " cunning " would be the better word—for, though timid at first, and inclined to scuttle off to some retreat as soon as one approaches their cage, they afterwards learn to associate one's appearance with the introduction of food and " line up for duff," as it were, when one proceeds to replenish their feeding-tins.

Like Wall, Sand and Viviparous lizards, they feed voraciously on mealworms, which they shake like a dog does a rat, afterwards licking their lips appreciatively, and will also subsist on gentles, worms, wood-lice and, in fact, any small creature so long as it moves, glad of a variation in their menu.

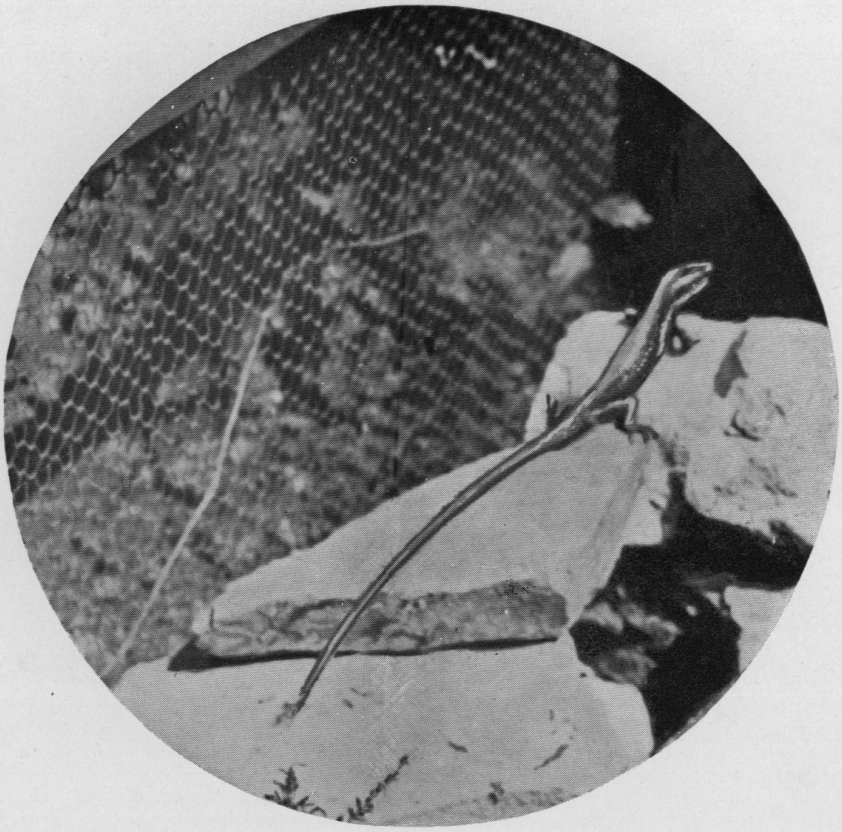

PLATE 4. THE GREEN LIZARD

Green Lizards from the Channel Islands are, naturally, more hardy than those from Southern Europe, though they are not quite so large. The latter can withstand our climate quite well, however, and, as one has to take the dealer's word for the source of his supplies, I do not think this point is worth while troubling about.

When purchasing a lizard, hold it firmly by the shoulders and give it a shake. If the head waggles as though the reptile had lost control of it, this is a sure sign that it is, at least, out of condition.

One never knows what hardships a reptile has had to endure before it is offered for sale in this country and, therefore, there are, at first, almost certain to be casualties.

For this reason, always purchase one or two extra specimens in anticipation of losses, and " natural selection "—or " natural elimination " as I should prefer to call it—will leave you a residue of healthy lizards which, if well fed and properly attended to, are not likely to give you further trouble.

Make sure of getting your specimens as early in the year as possible, not only for the reason that you will then be able to feed them up before they have become too weak to retain sustenance but because you will not be disappointed. There is usually a rush of importations in the Spring, after which they are liable to drop off until it is too late.

WALL LIZARDS, owing to their smaller size, cannot be confined in a cage of wire-netting or they would be certain to escape, but they are well worthy of a special case to themselves.

WALL LIZARD (*Lacerta muralis*).

Range.—Greater portion of Europe, Mediterranean Islands, North West Africa and South West Asia.

Maximum Size.—9 in.

Coloration.—(Numerous varieties.) Typical form of grey or brown colour with darker markings, but specimens of a green ground colour similarly marked and sometimes embellished by sapphire blue are frequently imported.

One which I have found particularly suitable for them is that which figures in the foreground on the left in Plate 1. It has a wooden back entirely covered with cork bark, with pockets here and there in which small pots of Sedum or other rock plants may be hidden.

This arrangement provides ample climbing facilities for these active little reptiles and also such retreats as they delight in.

The case has a glass front (facing the sun) and the upper portion of each side is also of glass, the lower, and the hinged lids, being covered with perforated zinc.

To prevent the lizards darting up the cork and escaping when the case is opened I have arranged a sort of shelf of smooth wood, about 9 in. wide, projecting from the back over the top of the cork. I find that they are unable to negotiate this and the idea is worth adopting.

A small hole in the cover, plugged by a cork, will be found useful for introducing as food, odd insects one comes across, without opening the lid.

So far as my experience goes, Wall Lizards are not so easily tamed as the Green Lizard, though individuals differ greatly in this respect. For instance, a few of my Wall Lizards are not in the

least timid and remain in the open regardless of my presence, while others seem unable to overcome their nervousness, and at my approach always make a dash for some nook or other from which one can see, afterwards, a little head poking out, and an eye cocked at an angle so as to watch every movement.

Some, too, make a practice of taking to the branches of the heather growing in their case while others have never shown this arboreal tendency.

Whether it is they are more suspicious than the Green Lizard or more stupid, I do not know, but they seem to regard the little feeding tins in which, as already referred to, I put the mealworms, as possible traps, and it is some time before they make use of them.

The GLASS "SNAKE," which in shape somewhat resembles a gigantic Slowworm or, superficially, a clumsily built snake, is quite hardy though it cannot, despite its glossy appearance, be considered handsome.

Like the Slowworm, it has eyelids, and these, apart from many other anatomical differences, distinguish it from a snake.

Moreover, it has two little flap-like appendages which are the rudiments of hind limbs.

GLASS SNAKE (*Ophisaurus apus*).

Range.—South East Europe.

Maximum Size.—4 ft.

Coloration.—Adults: chestnut or dark-brown; lighter beneath. Young: olive grey, with transverse dark brown bands on upper surface of body, and brown streaks on head and neck: greyish white beneath.

Though it will not bite, it should be handled with caution as it is very brittle—hence its popular name—and a specimen minus its tail is about as elegant as a rope's end, looking more fit for a sanatorium than a vivarium.

It will feed on live mice, snails, slugs and worms, as well as, it is said, raw meat and even hard-boiled eggs. I cannot confirm the latter statement —for the simple reason that I have never tried my specimens with dead food.

During Winter, the Glass Snake may be stowed away in a box of moss, where, if it has been feeding well during the Summer months and is secure from frost, it should hibernate safely.

SLOWWORMS make admirable little pets for, unlike their relatives with legs, they are unable to make a sudden dash for liberty just when you are showing how wonderfully tame they are, even though, as before mentioned, they can travel fast enough when in the humour.

If one has a garden, there is no difficulty in providing them with food, for they subsist chiefly upon slugs, and these are generally to be found only too plentifully hidden away beneath some stone, board, or dead leaves during the day or wandering abroad at night.

By distributing a few spare lettuce or cabbage leaves around the garden just before dusk one can usually secure, by examining their under-surfaces the next morning, sufficient slugs to replenish the larder for some time. The smaller ones I usually put into a stoppered jar and let them " carry on " with some lettuce until required.

During a dry spell, when slugs are difficult to

find, you have then only to "call up the reserves."

Earthworms, too, will be eaten, but they are not nearly so tasty as slugs—at least, so it would seem, from the Slowworms' behaviour.

Though these reptiles prefer plenty of moisture, care should be taken that their case is well ventilated or, as their case needs to stand in the sunshine, the occupants will meet an untimely end.

I have reason to remember this fact for I once lost a particularly fine Slowworm through making a mistake of this kind.

An ordinary frame-light, as used by gardeners, makes a useful outdoor case for Slowworms, provided that the ends are covered with perforated zinc so as to secure ample ventilation and protection is taken against the reptiles escaping by burrowing, to which they are much addicted.

The glass should be made to fit securely, for a Slowworm can work its way up the perpendicular side of a case until almost on the tip of its tail, and thus effect an exit through a hole which might have been thought beyond its reach.

Sphagnum moss, if well watered, grows well in such a case and suits the inmates admirably.

CHAPTER VI

SNAKES

No reptile is, probably, more reviled than the snake, of whatever species it may be, despite the fact that only a small minority of them are venomous.

Of course, a large constricting snake such as a Python cannot be considered harmless even though it be not poisonous.

A snake, to my mind, is a beautiful creature, quite apart from its coloration, and I do not see how it can be considered otherwise, once one's instinctive aversion is overcome—if there is any beauty in symmetry and grace of movement.

At any rate, a creature which, devoid of arms, hands, legs, feet or fins, can "out-climb the monkey and out-swim the fish," as Sir Richard Owen once said, while having the ability to travel over the ground at an astonishing rate, as does a snake, is, to say the least, particularly interesting.

How a snake accomplishes such feats will be best understood by studying a reliable natural history, and it is sufficient here to explain that a snake has a wonderfully adaptable "cup and ball" arrangement of the vertebræ, and being minus a breastbone is able to progress aboreally and terrestrially on the ends of its ribs, each pair of which is attached to a ventral plate.

The edges of the anterior plates having, as it were, "got a hold of the ground," or bark, the posterior ones are drawn forward, by an alternate closing-up process, and upon the latter hitching on to some other excrescence, the front are pushed forward to repeat the operation, the continued action being so rhythmical that the eye cannot detect the process.

Hence it is that a snake on a polished surface is in much the same quandary as a pig on skates.

By keeping snakes in captivity you will be able to study this vastly interesting subject under favourable conditions, and also their remarkable method of swallowing prey out of all proportion to the size of their jaws.

The reason for this is that the latter are united, in front and behind, merely by ligament, enabling them to stretch, horizontally and vertically, to such an extent that when some creature is engulfed by them the snake's head is almost unrecognizably distended. The expanding ribs and elastic skin are equally accommodating.

But, as I have said, all this and much more may be gleaned from some scientific work on the subject, and as this guide is not intended as such, I must confine my remarks to the subject with which I am dealing.

As snakes generally refuse to touch dead food, one has either to give them living animals or resort to forcible feeding—with a glass tube, chopped meat and a ram-rod—a process which I do not recommend for snakes, as it is apt to injure their teeth.

Whatever views one may hold on this question

to feed a snake naturally one has to give it the prey upon which it usually subsists and, if you do not, you are cruel to the snake.

Occasionally, one comes across a specimen which will refuse to feed at all, refusing the most attractive prey that can be provided, and in such a case I should suggest exchanging it, if possible, rather than " cramming " it.

Snakes of the genus *Zamesis*, such as the Dark Green (or Angry) Snake, are very prone to this suicidal habit in captivity, and for that reason, I do not recommend them as pets.

The members of this genus, moreover, are all, more or less, inclined to bite, and though this may not be a serious matter, I, personally, prefer a pet which adopts less objectionable methods of showing its appreciation of one's efforts for its welfare.

The GRASS SNAKE will live quite well in an outdoor cage and there hibernate safely if provided, during the Winter months, with a heap of litter (protected from the weather by—say, an inverted box), under which it can burrow.

Its case should contain a large pool of water (a sunken bread-pan will answer for the purpose) and climbing facilities in the form of stout branches.

As the snakes will, in moving about, beat down most of the vegetation in their case it is not worth while going to much expense or trouble in obtaining a choice selection of plants.

Grass Snakes, as a rule, will feed readily enough on frogs, newts or small fish.

As an instance of this I may mention that a

specimen, not more than 3 ft. long, devoured four full grown frogs while I was conveying it home in a fish can.

Though small frogs are probably preferred to large ones, a 3 ft. snake can swallow a full-sized frog, and I was told by a keeper of the reptile house at the "Zoo" that he saw a Grass Snake of similar dimensions in the act of demolishing a sparrow, though this is quite an unusual incident.

A Grass Snake, however much it is pulled about, almost invariably refrains from biting, but, when freshly caught, it occasionally ejects an evil-smelling fluid. After it has overcome its natural timidity it desists from this objectionable habit.

The more a snake is handled the sooner it becomes tame. It, as a cold-blooded reptile dependent upon external heat, soon learns to appreciate the warmth of human hands which do it no harm, and will then allow itself to be picked up and fondled without struggling in any way.

There are many varieties of Grass Snakes to choose from, and as specimens of over 4 ft. long may occasionally be obtained, apart from occasional "giants," these are sufficiently impressive for show purposes.

The DICE SNAKE, a smaller and more sombrely coloured species, is very similar in habits to the Grass Snake, with which it will live on good terms.

DICE SNAKE (*Tropidonotus tesselatus*).

Range.—Central and South Europe and South West Asia.

Maximum Size.—About 3 ft.

Coloration.—Olive-grey chequered with dark spots: a dark band, somewhat like the inverted "V"

on the Adder, is present on the back of the neck. Underparts: yellow or red, spotted or marbled with black—sometimes almost entirely black.

Minnows are an especial favourite of the Dice Snake and I had one specimen which would dispose of several at a time while held in the hand over a bowl of water containing the fish.

The VIPERINE SNAKE is another water-loving species, feeding, likewise, on frogs and fish.

VIPERINE SNAKE (*Tropidonotus viperinus*).
Range.—South West Europe and Barbary.
Maximum Size.—3 ft.
Coloration.—Brown or reddish above, with, usually, a dark brown or black zig-zag dorsal band, suggestive of the Viper, which it also resembles in the V-shaped marking on the back of the head and neck. A series of black eye-spots, with yellow centres, adorn the sides.

Despite its undoubted unprepossessing appearance, it is quite docile, and as it is, moreover, hardy, it may well share the abode of Grass and Dice Snakes.

Another snake which may be associated with the foregoing species, if room permits, is the GARTER SNAKE, as it subsists on similar food and frequents swamps and meadows.

GARTER SNAKE (*Tropidonotus ordinatus*).
Range.—North and Central America.
Maximum Size.—About 3 ft.
Coloration.—Variable. Typical form, olive or green above, uniform or with black spots. Variety *sirtalis*, which is sometimes imported, is marked with three yellow, red or pale green stripes.

I have at present a very beautiful form of this snake, with an orange vertebral stripe and black collar.

The BANDED SNAKE, commonly known as the Moccasin Snake, will make another companion for the water snakes mentioned.

BANDED SNAKE (*Tropidonotus fasciatus*).
Range.—North and Central America.
Maximum Size.—About 4 ft.
Coloration.—Variable. Typical form usually dark brown with irregular oblong or triangular reddish spots on the sides—less conspicuous in old specimens.

Its proneness to bite and sinister expression, however, does not add to its popularity.

The little SMOOTH SNAKE, an allusion to which was made when referring to British species, is a constrictor.

It is, naturally, quite hardy, but as its food consists of lizards, it is, for this reason, a rather troublesome and expensive pet, unless one has sufficient leisure to go lizard hunting.

The ÆSCULAPIAN SNAKE is one of the larger European snakes suitable for captivity, though the majority of specimens generally turn out to be bad feeders.

Care should be taken when purchasing an Æsculapian Snake to see that it is genuine, as a variety of the Angry Snake is frequently sold as such.

When accustomed to confinement, the Æsculapian Snake becomes quite docile. It is a constrictor, its food consisting of small mammals, birds and lizards.

ÆSCULAPIAN SNAKE (*Coluber longissimus*).
Range.—Italy and South East Europe, and, locally, in Central and Northern Europe.

Maximum Size.—About 6 ft.

Coloration.—Yellowish or dark olive above, with whitish spots or lines on some of the scales, occasionally forming a net-work. The young have dark brown spots on the back in longitudinal rows, with a yellow collar like the Grass Snake.

Mice may form the chief item of its menu and these should be of the tame variety, if the cage is a wooden one, for wild mice are apt to gnaw through the sides and not only escape themselves but provide egress for the snakes.

If not devoured within twenty-four hours, mice which have been introduced into the cage should be removed to their own quarters, where, pending their return to the snake-cage, they should be properly fed and tended.

Corn, bran and canary seed should be given them regularly with an occasional slice of carrot, and every other day or so, a pan of stale bread crumbs which have been steeped in boiling milk.

As the mice are not for exhibition purposes, they may be kept, quite hygienically, in an enamelled biscuit-tin having a perforated zinc lid, and if the bottom be covered with 3 or 4 in. of dry mould, this will act as a deodorizer.

With the addition of one or two pieces of cork bark, under which they can hide, and some hay or moss, the mice will live quite healthfully—more so, in fact, than in an ordinary wire cage covered with bran.

Needless to say, the milk-pan must be kept scrupulously clean, while the bark should be taken out and scrubbed occasionally, drying the same thoroughly before returning it to the cage.

The hay, or moss, should be renewed weekly (unless there be a litter of young ones, when it should not be interfered with) and the mould changed when necessary—say once a month.

A similar tin may be used for the accommodation of those frogs which are not needed for food at the moment. In this case, however, some small holes should be made in the bottom to allow of drainage, as the mould in the tin needs to be kept moist. A saucer of water, some damp moss and a few worms now and then will keep them content until needed.

It seems rather a bother to have to "feed the food," but this, of course, cannot be avoided as one is not able to send out for a supply of mice or frogs as one would for matches, just when required.

With this diversion on the question of food, let me continue with my selection of species.

Though the following are more or less expensive, compared with those hitherto mentioned, they are well worthy of the investment.

The FOUR-LINED SNAKE is the largest of all European snakes, but quite docile.

Like the Æsculapian Snake, it feeds on birds and small mammals, such as mice, and is an expert climber.

FOUR-LINED SNAKE (*Coluber quatorlineatus*).

Range.—South Italy, Dalmatia, Greece, Hungary and Southern Russia.

Maximum Size.—About 8 ft.

Coloration.—Adult, brown, with four black longitudinal bands. The young are of a pale fawn colour with black spots, which are subsequently replaced by the bands.

As it is easily tamed and does well in captivity—"better, in fact, than any other European snake," says Mr. E. G. Boulenger, a specimen should certainly be purchased when the opportunity occurs.

The KING SNAKE may be said to be one of the most, if not *the* most, popular of snakes, due, no doubt, to its extraordinary intelligence, hardiness and beauty.

It is said to recognize its master—an appreciable quality—and to feed from the hand.

KING SNAKE (*Coronella getula*).
Range.—North America.
Maximum Size.—About 6 ft.
Coloration.—Black, marked with round yellow spots or with longitudinal or transverse yellow or white bands.

Not because of its royal title but because of its cannibalistic habits, it should be given a case to itself.

It may be fed on mammals, birds and lizards, though snakes smaller than itself would be more to the liking of the reptile.

Mr. Boulenger states that, at the Belle Vue Gardens, Manchester, King Snakes have been fed regularly on eels, a fact which he describes as "of considerable interest as no other reptile-eating snake will make a meal off fish." He suggests that possibly the snakes are unable to discriminate between the eels and members of its own order, owing to their similarly elongate form—which, I am afraid, rather discounts their reputation as to intelligence.

The King Snake seldom takes to water, so it

need not be supplied with a large bath, or with many branches, as it prefers terra firma.

A shady situation, and a fairly high average temperature is to its advantage. Its case should contain moist earth, with growing grass and moss.

The North American CORN SNAKE is another hardy and handsome species, of medium size.

CORN SNAKE (*Coluber guttatus*).
Range.—U.S.A. and North Mexico.
Maximum Size.—3½ ft.
Coloration.—Yellowish, or pale brown above, with red, black-edged spots along the centre of back, and similar spots along the sides. Underparts: yellowish, with large squarish black blotches.

It, like the Four-lined Snake, may be associated with the Æsculapian, its food consisting of small rodents.

When purchasing a snake, you should, if possible, watch it glide along the floor, for specimens are apt to be injured while being captured, and such will be detected by an impediment in their movements.

A snake with arboreal habits, such as the Four-lined Snake, should have a case at least as high as the specimen is long, and proportionately large.

As regards those which spend the greater part of their time on the ground (as the King Snake), the length of the case is of primary importance.

Vivaria for the larger snakes should be fitted with plate glass and the fastenings need to be exceptionally strong, as such specimens have considerable strength.

A snake looks at its best after it has shed its outer cuticle, a periodical process known as

"sloughing," or "shedding its skin." It is, of course, merely the epidermis which is thus discarded, and not the true skin. The reptile peels this off from the nose downwards by rubbing its body against rough surfaces, and if the specimen be not a very large one, and healthy, the cuticle comes off entirely—inside out, except, perhaps, for a portion near the tip of the tail.

While preparing for desquamation, a snake looks, and is, in fact, ill. It refuses food and is listless in its habits, while the bluish opaque appearance which its eyes assume give the impression that it is blind.

Upon ridding itself of its old covering, it recovers its spirits and at once looks around for food and water.

If the slough comes off entire, it is worthy of preservation.

As time goes on, all sorts of interesting objects of this kind will turn up—such as eggs, which freshly-imported snakes and tortoises sometimes lay upon arrival—and these, together with shells of terrapins and tortoises which have died, will make instructive specimens for a parlour museum.

If you know anything of taxidermy or spirit-preserving, you may, also, make good use of the bodies of any creatures which should chance to succumb.

PART II

CHAPTER VII

BATRACHIANS (TAIL-LESS)

BATRACHIANS occupy an intermediate position between reptiles and fish, breathing by means of gills during a portion of their existence, yet minus rayed fins.

Generally speaking, they are exceptionally easy to cater for, as they will devour worms, beetles, cockroaches, wood-lice, caterpillars and flies—in fact, any moving creature small enough to swallow.

Both the COMMON and EDIBLE FROG will live healthily enough in captivity, provided that they have plenty of moisture and bathing facilities, but, as already stated, they are not, I think, suitable occupants of a small vivarium, owing to their leaping proclivities.

The same comment applies (in a greater degree) to the AGILE FROG, a close and hardy relative of the Common Frog, for it is able to leap a distance of fully 6 ft., and needless to say, it is bound to suffer if kept in an ordinary case.

Likewise, I do not recommend the AMERICAN BULL FROG—a large and noisy species measuring sometimes 8 in. in length and capable of making a meal of sparrows and mice, apart from other frogs smaller than itself.

The Rev. J. G. Wood has said that " an Indian

was not able to overtake an irritated Bull Frog after it had sprung three leaps in advance," and it is also said to skim over water (in which it spends most of its time) with great speed.

It will live without artificial heating in Summer, and it is for this reason that I have included it and the Agile Frog in my remarks.

Toads are in many ways preferable to frogs for, being less active, they do not come to grief with the glass.

They take quite an intelligent interest in what is going on outside their case, and their characteristic serious expression is very comical.

The pantomimic exhibition which a toad indulges in when feeding is enough to raise a smile on the saddest of faces. On catching sight of a worm, for instance, it approaches very cautiously to within striking distance with its rear-hinged tongue and then hesitates in meditation as to which end it shall take, first peering at one and then the other.

When, at length, it has solved this apparently important problem, perhaps the worm wriggles on to its toes. Starting back with a look of amazement at such impudence it again settles down to consider the fresh situation, but generally gives it up as hopeless and seizes the worm in the middle.

So quickly is this done, however, that the action is scarcely visible.

Then follows an extraordinary series of convulsions on the part of the batrachian, which proceeds to stamp, kick and blink, while, all the time, greedily tucking the ends of the worm into its capacious mouth.

An extraordinarily large variety of the COMMON TOAD is frequently imported into this country from the Continent and sold by the dealers as " Giant Toads." Though they are certainly giants in their way, the description is somewhat misleading as the Giant Toad is a distinct species (*Bufo marinus*) from Southern America and the West Indies.

When purchasing toads, or other batrachians, examine them carefully, for many frequently suffer from gangrenous sores which are very contagious, difficult to heal, and generally prove fatal.

This disease is generally caused by overcrowding or an excess of moisture in the cases in which the batrachians are confined.

But, to return to the " Giant Toads." These have been known to " turn the tables " on the Grass Snake by devouring its young, so, needless to say, no small batrachians should be allowed to occupy their vivarium.

I once lost a pair of Alpine Salamanders owing to the insatiable appetite of a pair of these toads, which kept me busy replenishing their " larder."

The Natterjack Toad—a particularly clever climber by the way—whose manner of progression, due to its short hind legs, has been likened to the slow running of a mouse, does exceedingly well in captivity.

This toad, to which I have already referred, is an exception to the general rule regarding batrachians in that it should be kept in a comparatively dry situation, with plenty of sandy mould in which to burrow.

The GREEN TOAD is more handsomely marked

than its relative, the Common Toad, with which it will live happily.

GREEN TOAD (*Bufo viridis*).

Range.—Central and Southern Europe, the Mediterranean Islands, North Africa and South Western and Central Asia.

Maximum Size.—About 4 in.

Coloration.—Variable. Greyish, greenish, yellowish or even pinkish above, with large irregular-shaped blotches, ranging from bright green to olive, sometimes margined with black. Occasionally adorned with a fine yellow vertebral line.

The above-mentioned frogs and toads will do best in the garden, in as large a case as possible, though you will not see much of them in the daytime.

It is a good plan, therefore, to provide yourself with an electric flash-lamp, when you can stroll out at any time of the night and "switch on." You will then catch them unawares and get a far better idea as to their natural habits than if the specimens are kept in an indoor vivarium.

TREE FROGS are, in my opinion, undoubtedly the most charming of all batrachian pets.

One can get as much amusement out of a few of these little creatures as the funniest of kittens—which is saying a good deal.

By possessing a case full of Tree Frogs one has, in fact, always at hand a troupe of comedians possessing gymnastic skill which cannot be equalled by any human performer. They also provide their own orchestra!

The music, it should be explained, is produced by means of large vocal sacs possessed by the

males, which, when distended, remind one uncommonly of a bagpipe.

On the advent of rain, the noise which these little frogs create is, at times, somewhat embarrassing, for they are quite likely to continue the " concert " into the small hours of the morning.

These entertaining batrachians are, moreover, veritable quick-change artists, as you will probably discover before you have kept them long.

I remember once, after accompanying a young friend to purchase some Tree Frogs, how I laughed at the surprise which awaited him on arriving home. He had selected several brightly-hued froglets—of a brilliant apple-green—from amongst a motley crowd in the dealer's shop, but a journey in a brown-paper bag resulted in their assuming the sombre colour of the receptacle so closely that it was thought at first they had escaped.

This power of assimilative coloration, which extends from vivid green to deep sepia, enables Tree Frogs in their natural haunts to frequently avoid detection by their numerous enemies.

As regards their gymnastic feats, the frogs can always be relied upon to give an exhibition of these if a few flies are introduced into their case.

Perhaps one sleeping-looking individual, squatting in characteristic compact manner on some leaf or branch, apparently fondly dreaming of its far-off Southern home, will espy a too-venturesome fly. This will cut short its soliloquy.

Immediately the little dreamer will be aroused to activity, and with a reckless leap, will launch itself forth into space in an endeavour to catch the alluring insect.

It misses its object, possibly, but does not fall, for deftly grasping some twig or other in its descent it sways backwards and forwards as composedly as the most highly trained trapezist.

Another froglet, more fortunate perhaps, alights with unerring aim on the coveted fly, which is caught by the adhesive tongue of the batrachian and swallowed, with much gulping and blinking of eyelids.

Other Tree Frogs, urged to essay similar feats, will soon be clambering, sailor-fashion, and leaping in every direction—even scaling the glass sides of their case—providing no end of fun to spectators.

COMMON TREE FROG (*Hyla arborea*).

Range.—Europe, North West Africa, Canary Islands and temperate Asia.

Maximum Size.—2 in.

Coloration.—Normally bright green above, but has the power of changing to various shades of green or brown and even exhibiting temporary light or dark spots.

A small laurel, in addition to some perches fashioned from branches should be provided, on which the frogs can rest "between the acts," while, if the back of the interior of the vivarium be covered with hollow bark this will afford suitable retreats.

By making a small hole in the perforated zinc lid (with a cork as stopper), one can, without opening the case, drop in tempting morsels such as flies, earwigs, earthworms and gentles, which one comes across in the garden.

The gentles will, of course, turn into pupæ, if

not eaten, and, in due course, appear as "blue-bottles," thus providing a change in the dietary.

Easy exit from the water-bowl in the Tree Frogs' Vivarium should be afforded by means of rockwork or partially submerged cork-bark.

FIRE-BELLIED and YELLOW-BELLIED Toads, and Midwife Toads, are, owing to their small size, hardly suited to ordinary outdoor vivaria, where they are likely to be lost sight of.

Small cases, which may be hung on some shady fence, are, however, admirably adapted to them.

The occupants can then have the benefit of fresh air and rain, while drainage may be ample without fear of damage to carpets or tablecloths.

Both the Fire-bellied Toad and its cousin, the Yellow-bellied Toad which used to be considered a variety of the same species, do exceedingly well in captivity.

FIRE-BELLIED TOAD (*Bombinator igneus*).
Range.—Northern Europe.
Maximum Size.—2 in.
Coloration.—Dark olive or blackish above. Lower parts, marbled with orange or vermilion and black.

A curious habit of these little batrachians is said to be that, when alarmed, they turn up their head and hinder portion of their bodies and limbs, exposing to view the vermilion or yellow marblings on their underparts. Thus, it is stated, they will remain motionless for some time as though shamming dead.

This is an interesting instance of warning coloration and protective action, but, although I have kept these toads for many years, they have

never favoured me with an exhibition of their powers in this direction.

YELLOW-BELLIED TOAD (*Bombinator pachypus*).
Range.—Central and Southern Europe.
Maximum Size.—2 in.
Coloration.—Similar to *B. igneus*, but underparts marbled with yellow and black.

Like larger batrachians, they will devour almost any moving creature which they are able to swallow.

These quaint little toads are very aquatic in their habits, so they should have a proportionately large though shallow bowl of water.

The MIDWIFE TOAD has received its popular name from the fact that, during the breeding season, the male takes charge of the eggs after being deposited by the female, winding them round his legs and carrying them about on land until they are due to hatch, when he repairs to the water and the young make their appearance as advanced tadpoles.

MIDWIFE TOAD (*Alytes obstetricans*).
Range.—Central Europe.
Maximum Size.—2 in.
Coloration.—Olive or pale brown; underparts white.

This little creature, which affords a unique example of parental solicitude amongst batrachians, may be associated with the foregoing species.

Found sometimes at an altitude of 7,000 ft. where, during the greater part of the year, the ground is covered with snow, the Midwife Toad will hibernate safely in the open, if given an

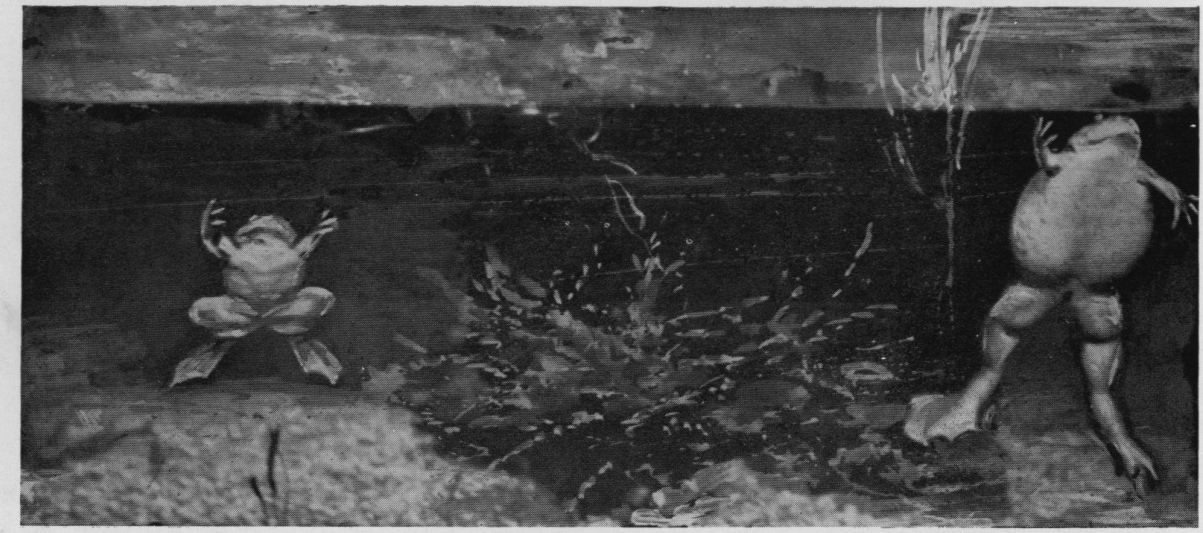

PLATE 5. AFRICAN CLAWED FROGS AS SEEN IN THEIR TANK

opportunity of retiring to some underground retreat.

For a living example of what one might imagine an aquatic " bogie " to be like, the CLAWED FROG cannot be surpassed.

CLAWED FROG (*Xenopus lævis*).
Range.—South Africa.
Maximum Size.—About 4 in.
Coloration.—Greyish brown, with or without spots; underparts whitish.

Though a breather of atmospheric air, it never leaves the water, in which it is able to move with great celerity by propelling itself forward by means of its expansive umbrella-like webbed hind-feet.

Assuming the most extraordinary attitudes in the water—generally in a more or less upright position—these grotesque creatures will remain as motionless as bronze statues for lengthy periods, sometimes resting on the bed of their tank, sometimes with their periscopic eyes above water, and sometimes poised midway.

During the breeding season I have regularly heard the male uttering, beneath the water, a call—it cannot be described as a croak—which resembles more than anything else I can think of the muffled notes of a toy trumpet.

They are as voracious as they are hardy, and an adult specimen will dispose of several full-sized lob-worms, and then go hunting around for more.

Using their clawed " fingers " like the proverbial schoolboy on a surreptitious visit to a jam-jar they ram their food into their capacious mouths in vulgar though comical fashion.

My own specimens, which I feed by hand, appear to show striking intelligence, for sometimes when I go near their tank and do not give them any food they come to the front and go through the antics of feeding themselves, stopping every now and then with an appealing " What-about-it " expression. If this is not asking to be fed, then I have been shamefully deceived.

It is when you see a Clawed Frog peering through the vegetation of its tank, after the manner of the lower figure in Fig. 17, that you appreciate its bogie-like appearance.

Clawed Frogs will feed upon tadpoles, small fish, and aquatic insects, in addition to worms and raw meat.

Their tank, which should be set up according to the directions given later with regard to aquaria, should contain some rockwork behind which they can retire when so disposed.

If raw meat is given them, small strips should be dropped just in front of their noses, when they will probably be immediately grabbed and devoured. If not, a fresh effort in this direction should be made. In the event of the batrachians refusing the proffered meat it should in no case be allowed to remain in the water or putrefaction will be set up.

In 1920 a consignment of Clawed Frogs sold for fifteen shillings each, so it is well worth while endeavouring to induce them to breed.

The best way to do this, it is said, is to supply them with plenty of vegetation and food, giving them an imitation rain-storm every evening in warm weather, by removing some of the water in

the tank and replacing it with fresh, of a cooler temperature, poured through the rose of a watering-can. Personally, though I have treated my specimens to mimic storms varying from an

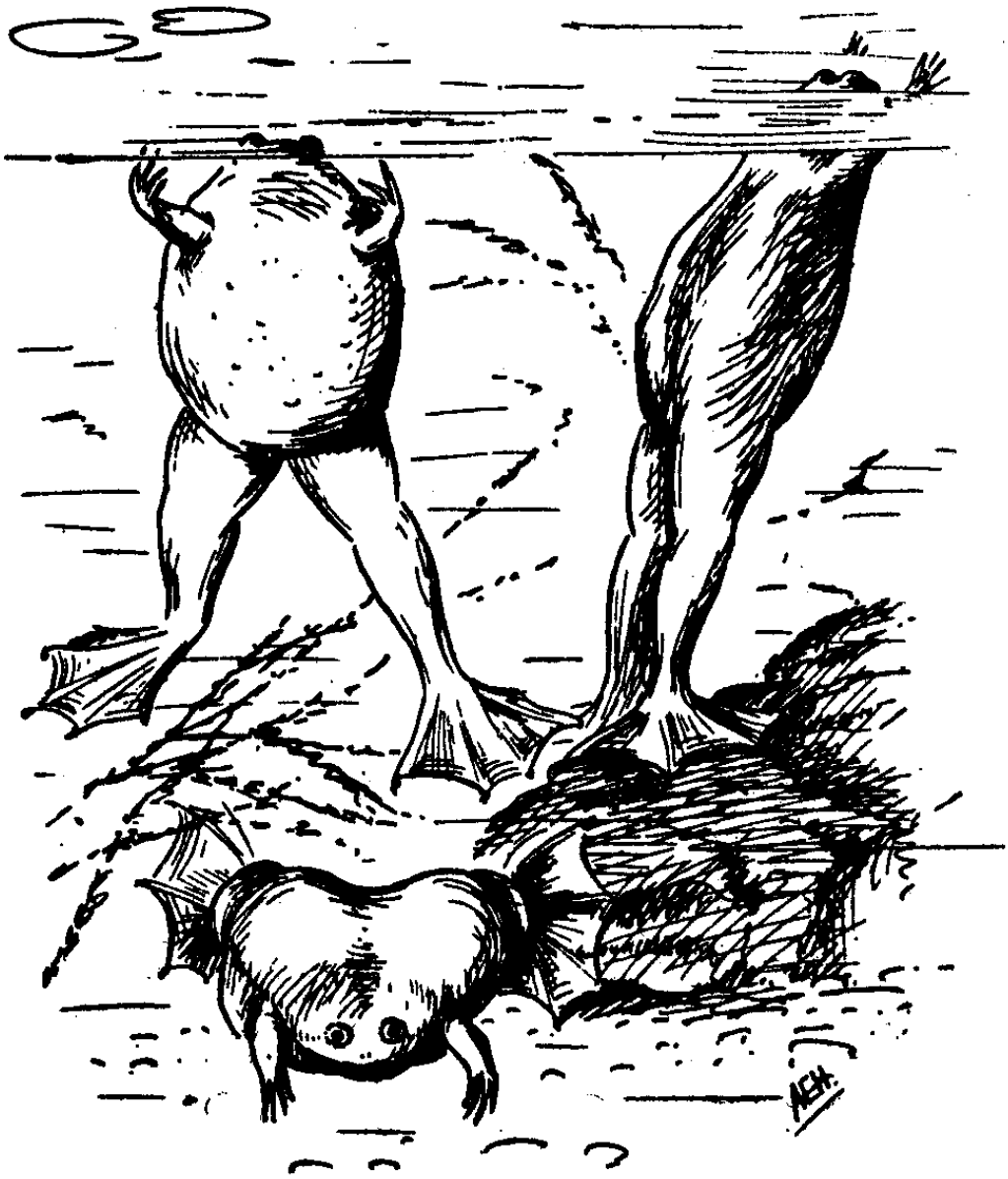

DIAGRAM 17.—CHARACTERISTIC ATTITUDES OF CLAWED FROGS.

" April shower " to a torrential downpour, I have never met with success.

Eggs to the number of 100 are sometimes laid, attached singly to the aquatic plants. A

peculiarity of the tadpoles is that they come into the world without external gills and develop long tentacles on each side of the head which eventually attain a length equalling that of the head and body.

As soon as deposited, the eggs should be removed to a separate tank containing water of the same temperature as that from which they were taken, and when the tadpoles put in an appearance, they should be fed in the manner suggested for baby axolotl.

CHAPTER VIII

BATRACHIANS (TAILED)

BOTH the COMMON (OR SPOTTED) and the BLACK (OR ALPINE) Salamanders do well out of doors, where they will hibernate quite safely in Winter if given reasonable facilities for doing so.

SPOTTED SALAMANDER (*Salamandra maculosa*).
Range.—Central and Southern Europe.
Maximum Size.—6 in.
Coloration.—Black with variable yellow or orange markings.

As they seldom leave their retreats except at night one has, if they are kept in the garden, to have recourse to the aforesaid flash-light to see them on the prowl.

Of course, if wanted for exhibition purposes during the day, they can always be routed out from their retreats, which are generally beneath the moss, rocks or bark which should be provided for them as a shelter.

The Spotted Salamander with its livery of yellow and black is conspicuous enough, but the Black Salamander, a smaller species, is sometimes difficult to find in a large outdoor case. A vivarium similar to that suggested for small toads is, therefore, better suited to this species, as it can

then be taken down and inspected with ease when desired.

BLACK SALAMANDER (*Salamandra atra*).
Range.—The Alps.
Maximum Size.—4 in.
Coloration.—Entirely black.

I have already described at some length a suitable aquavivarium for Newts, and, as regards the setting up of the tank itself, this is dealt with adequately later on.

Of the three British species only the CRESTED NEWT is really satisfactory in confinement, owing to the habit of the other two to leave the water during the greater part of the year, when little will be seen of them, and the difficulties of catering for them will be hardly found worth while.

The Continental variety (*karelinii*) of the Crested Newt, often upon the market, is even more aquatic than its British representative, and, for this reason, it should be chosen if procurable.

Newts of all kinds will feed greedily on small aquatic insects and crustaceans, bloodworms, small earthworms and tiny tadpoles.

The introduction of a few earthworms into the tank will have a similar effect to putting a coin into an automatic working-model.

Newts which had hitherto been peacefully floating beneath the weeds in the tank will be immediately roused to activity.

They appear to be the very embodiment of greediness, for when one secures the end of a worm the others will chase the possessor though there may be plenty of other worms about, and, if they

cannot capture the coveted morsel they will endeavour to make a meal of one of the captor's toes, or take a bite out of its tail.

As a result, specimens frequently lose some leg, foot or toe during the scramble, but there is no need to worry about "trifles" of this sort as the member will grow again in due course and the "casualty" does not appear to be in the least inconvenienced.

In addition to the Crested Newt, one should lose no opportunity of securing specimens of the following species, all of which are highly satisfactory in captivity.

JAP NEWT.
MARBLED NEWT.
COMMON AMERICAN NEWT.
CALIFORNIAN NEWT.

JAPANESE NEWT (*Molge pyrrhogastra*).
Range.—Japan and (locally) China.
Maximum Size.—4 in.
Coloration.—Under surfaces bright carmine. Sometimes adorned with black spots. (Vertebral ridge takes the place of a dorsal crest, and is present in both sexes.)

MARBLED NEWT (*Molge marmorata*).
Range.—South West Europe.
Maximum Size.—6 in.
Coloration.—Bright or dark green above, marbled with brown or black. The straight edged crests on back and upper portion of tail of breeding male are barred with black and white. Yellow, or orange, streak always present along the back of female. Lower surfaces: brown or greyish, with darker spots, and speckled with white.

COMMON AMERICAN NEWT (*Molge viridescens*).
Range.—North America.

Maximum Size.—3½ in.

Coloration.—Upper parts olive-brown with black spots. Underparts: red or orange, dotted with black. (No dorsal crest but long tail is crested above and below.)

CALIFORNIAN NEWT (*Molge Torosa*).

Range.—North West America.

Maximum Size.—7 in.

Coloration.—Upper parts, uniform brown. Underparts, orange or yellow. (Without dorsal crest but with upper and lower crests on tail.)

The AXOLOTL, which may be said to have been domesticated in Europe for over half a century, has a history which is as remarkable as its appearance—and this is saying a good deal.

With a huge blunt head, like the toecap of a boot, small eyes and a capacious mouth, it rivals the Clawed Frog for sheer ugliness. Its cylindrical body surmounted by a straight-edged fin extending along and beneath the compressed tail, however, is not ungraceful, save for its helpless-looking legs, while its three pairs of feathery external gills (which it possesses as well as lungs) are quite an attractive adornment.

AMBLYSTOME (*Amblystoma tigrinum*).

Range.—North America and Mexico.

Maximum Size.—10 in.

Coloration.—Upper parts: black spotted, or blotched, with yellow. Underparts: slate grey sparsely dotted with white. (Axolotl is larval form of above and attains similar length.)

The typical form is blackish, but a striking albino variety, bred from captive specimens—like a ghost of the other—has long been on the market.

Efforts to produce piebald specimens by crossing have so far proved unsuccessful.

No batrachian has probably received greater attention from scientists than the Axolotl.

It leapt into fame in the " sixties " when, among a number of specimens imported into Europe from the Mexican lakes, certain individuals astonished their owners by absorbing their gills and fins, developing eyelids and yellow spots on the skin, and taking to land. In fact, transforming into the North American Amblystome, a salamander already well known, in the mature form, to naturalists.

As Mexican Axolotl had not previously been known to go through this metamorphosis or leave the water, the fact that they were merely undeveloped Amblystomes had hitherto been unsuspected.

The discovery was considered the more remarkable as Axolotl, both in Mexico and in confinement, had bred regularly, and, of course, it is exceptional for creatures to bring forth offspring while in the larval stage.

Scientists at once began to experiment with a view to forcing other Axolotl to make a similar change, with more or less success.

Various theories were put forward to account for this, but, from the records, it would appear that the primary factor was depletion of water in the tanks in which Axolotl were confined.

Mr. E. G. Boulenger, who has succeeded in obtaining the transformation of numerous specimens, says that " Axolotl will, with few exceptions, transform into the Amblystome stage if placed when about 5 in. in length, under conditions which force it to make free use of its lungs."

Mlle. de Chauvin, while at Freiburg University, was the first to experiment in this direction. She placed her Axolotl in tanks so arranged that only at one spot could the batrachians become entirely submerged.

By gradually reducing the water, a change took place within a few days, and in from four to fourteen days, the animals left the water, the complete metamorphosis being effected about ten days later.

A more modern method, which recently created quite a stir, is to feed the Axolotl on Thyroid, the effect of which is, apparently, to cause the Axolotl to " get a hustle on," their development by this means being expedited.

Further experiments of the kind are at present being tried not only upon Axolotl but even more lowly batrachians of strictly aquatic habits, which may lead, if successful, to surprising results. There appear to be some drawbacks to the use of Thyroid, however, though it is too early to make any definite comment on the subject.

At the time of writing, the London Zoological Gardens possess Amblystomes which have been reared by both methods referred to.

As Axolotl are quite easily kept in captivity, living for many years and breeding regularly, while partaking of such commonplace diet as newts, tadpoles, small fish, worms and even raw meat, it is certainly worth while to procure a pair and experiment on your own account.

If your efforts at breeding are successful, the venture should prove profitable as well as interesting, for as many as two hundred eggs are some-

times laid at a time and the price of full-grown black Axolotl is now in the region of £1 each, while that for albinos is about half as much more.

Assuming that you have a pair of adult Axolotl, they should be accommodated in an aquarium set up and stocked as hereinafter described, with the addition of a few pieces of rock behind which they can retire.

If they have plenty of vegetation and have been feeding well, they are almost certain to deposit their eggs in early Winter or Spring.

These will hatch in from ten to twenty days, according to the temperature of the water, and the young, directly they are observed, should be removed to a shallow vessel containing water of the same temperature.

It is wise, apart from the danger of overcrowding, to employ several rearing-tanks, when, should fungus unfortunately make its appearance in one of them, the occupants of the other recepticles will not be infected.

At first, the tadpoles should be fed on the tiny freshwater crustaceans known as Daphnia (Water Fleas), Cyclops, etc., which may be obtained from almost any pond either by means of a net of fine muslin or by replenishing a jar with water from the pond and straining it off by means of a syphon until the recepticle contains a reasonable quantity of the little creatures.

Later on, the young Axolotl, which grow rapidly, may be fed on bloodworms, small earthworms and scraps of raw meat.

They are sexually mature when about a year old.

My own specimens will feed readily from the

fingers, but, otherwise, when feeding with raw meat, the best plan is to drop a thin strip so as to fall somewhere between the nose and eyes. They are then not likely to miss it, but if it falls in front of them they are apt not to notice it, stupid as this may seem.

If snails are present in the tank, they should be of the kind known as Freshwater Winkles (see Fig. 27). Otherwise, a close watch should be kept upon them for Axolotl have a habit of snapping at their bodies, resulting in casualties and probable contamination of the water. The operculum with which Freshwater Winkles are provided proves some protection against such attacks.

Axolotl are so interesting and, incidentally, expensive that it is well worth while to take every precaution to keep the water in their aquarium clean and wholesome.

In the chapter on Aquaria, it will be noted that I particularly recommend Vallisneria and Anacharis as aquatic weeds, but as Axolotl in their movements are apt to uproot the former and break the latter (unless allowed to float in a bunch), a root of Willow Moss or a few pots containing one or other of the sub-aquatics hereinafter mentioned are more suitable. Floating vegetation such as Riccia, Duckweed, Frogbits and, perhaps, a Water Soldier, may be added with advantage.

As axolotl are not solely dependent upon the oxygen in the water, the question of aquatic vegetation is not so important as where fish are concerned.

CHAPTER IX

FISH

SOMETHING like thirty years ago, when I commenced the study of aquatic life, I asked an expert for his advice as to "How to Keep an Aquarium?" Jokingly, he replied "Don't get rid of it."

Now, there is a great deal more wisdom in this remark than would appear at first sight, for though, when an aquarium is maintained in good condition, there is very little likelihood of one voluntarily disposing of it, there are times when, owing to some neglect, the water becomes opaque with confervoid growth, or worse, the weeds uprooted or, perhaps, fungus makes its appearance upon the fish.

It is then that the owner, who alone is responsible for the state of affairs, is prompted to "get rid of it," but it is just on such an occasion that he should remember that the road to success is beset with difficulties such as these, and that if he takes the trouble to clean out the tank and set it up afresh he will have gained rather than lost by the experience derived.

There is really no need to give more than a few minutes' daily attention to an aquarium, and it will

come as a surprise, no doubt, to those who are not experienced aquarists to learn that though my tanks are only cleaned out once a year the water in them is always quite clear.

This happy state of affairs is brought about by providing a sufficient quantity of growing vegetation, a judicious amount of light, by calling in the services of a number of suitable water-snails as "window cleaners" and a mussel or two to act as scavengers, and by using a certain amount of restraint in the matter of feeding and avoidance of overcrowding.

Here you have, "boiled down," the secret of successful aquarium-keeping—but I will explain more fully.

In the first place, it should be understood that the carbonic acid gas expired by the fish is, under the influence of light, consumed by the aquatic plants and that these, after extracting the carbon for their own use, liberate the oxygen, which is necessary for the respiration of the fish and the maintenance of the water's purity.

A considerable amount of oxygen, however, is absorbed by the water from the atmosphere which comes in contact with its surface, and for this reason, the proportions of an aquarium are an important matter.

It is a fact that, of a number of aquaria each holding the same quantity of water, the one which is the shallowest will support the greatest number of fish or other gill-breathing animals.

Of course, it is necessary that the water should be of sufficient depth to provide ample facilities for swimming, apart from observation purposes,

and it may be taken as a general rule, so far as pond fish are concerned, that if the breadth of the tank is greater than its depth the proportions are satisfactory.

In nature, of course, the light only enters the water from the surface, but, to derive the full benefits of keeping an aquarium, one, at least, of the sides must be of glass.

This should not be placed facing the sun or the water will, in time, become thick with the growth of Confervæ (freshwater Algæ). If possible, the aquarium should be placed in such a position that while it gets plenty of light it is, nevertheless, protected from the sun's direct rays.

If it be desired to stand it by a window, a site facing the North should be chosen, but, in the event of this being impracticable, cardboard screens may be arranged so as to cover one or more sides. One does not need to be an artist to paint upon the inside of such a cardboard screen a representation of weeds upon a dark background with, perhaps, the suggestion of a rock here and there. If merely crudely done this will enhance the appearance of the tank, when seen through the water.

Plants will not grow without an adequate supply of light, so one has to use a certain amount of judgment in the effort to strike a "happy medium."

One frequently sees, even in these days of enlightenment, some unfortunate fish imprisoned in a glass globe, without weed, subjected to the full glare of the sun and probably kept without food under the impression that it can obtain

sufficient, in some mysterious way, from tap-water.

Though the water may be changed regularly—as, of course, it would need to be, in the circumstances—such treatment is sheer cruelty, for, not only is the temperature of the water rendered abnormally high by magnification of the sun's rays, but the starving fish, devoid of eyelids as it is, has neither shade nor shelter. Little wonder that its domestic life is a brief one!

Now there is no need to go to unnecessary expense in purchasing an aquarium, for very large tanks have their drawbacks. They are not only more apt to leak than less pretentious aquaria but much more difficult to move.

An aquarium of about 2 ft. long is a handy size, and, personally, I prefer the rectangular all-glass tanks used by electricians for storage purposes, though the glass is not so clear as that in metal framed aquaria.

Apart from the fact that they are considerably cheaper, they cannot leak, unless broken, and, as no cement is used in their construction, the chance of poisonous properties being absorbed by the water is absent. (An aquarium in which cement of any kind has been used should be soaked for a week or two, at least, before use.)

To protect all-glass aquaria from breakage, a good plan is to bind the top edges with zinc. Having cut four strips of the required lengths, bend them so that they will fit loosely on to the edges of the glass. Then fill them in with putty and press them well "home."

When neatened-off and enamelled, they will

enhance rather than detract from the appearance of the aquarium. An all-glass tank should be stood on a soft mat of some kind or the bottom may get scratched with grit and result in serious damage.

A glass cover is also advisable, in order to keep dust from falling on the water. This should have a wooden frame and be supported about half an inch above the tank by means of notched corks at the corners.

Though not essential, a stout stand with—say, four little cubes for legs, is an advantage, especially when one wants to move an aquarium. (A framed aquaria, however, should never be shifted while full.)

Emerald Green is a suitable colour with which to paint the " protectors " and frame of cover as it is not too " heavy."

As regards the stand, this looks well if marbled with black and white.

Give it a good coat of white enamel first and then, before it has had time to dry, pencil some wavy markings, in imitation of marble, with a feather lightly dipped in black enamel.

A second coat—thin, so as not to entirely obliterate the original markings—should be given and a few more marblings added, which will, of course, be more conspicuous than the others and add to the realistic appearance of the " marble."

Though this external business is a matter of taste, the setting up of the tank is quite another matter.

First of all, procure sufficient coarse sand to cover the bottom to a depth of a couple of inches or so, according to the size of the tank.

This will need to be scalded and well washed by placing it in a pail under a running tap and continually stirring the sand until the water is no longer cloudy.

Some aquarists prefer gravel, but after trying this and a combination of both, I vote for sand alone, for the debris which in course of time accumulates at the bottom can then the more easily be removed, as it remains on the surface of the sand.

For this purpose a dip-tube should be used. This is merely a length of glass tubing with a rubber bulb at one end. By squeezing the bulb before submerging the tube, and releasing it gradually when the tube is in position, the debris will be sucked up until the bulb and tube are full. Then withdraw, empty and repeat the operation. You simply have to run the end of the tube over the sand, like a carpet-cleaner on the floor.

Another advantage in having sand is that those plants which require root-hold will flourish therein, thus dispensing with pots, which take up much valuable space in an aquarium.

VALLISNERIA (*Vallisneria spiralis*) is one of these, and, generally speaking, there is no aquatic plant to equal it either for oxygenizing purposes or decorative value.

If the tank in which it is grown is favourably situated, Vallisneria will thrive well, sending out runners and throwing up fresh plants here and there until the tank is full of its graceful wavy grass-like leaves.

The longer it is kept, the more sturdy and beautiful do the latter become, so that one must

not be disappointed if freshly-planted wild specimens prove somewhat straggly.

Vallisneria is most easily planted when water to a depth of only a few inches has been poured into the aquarium. The roots can then easily be spread out and pushed into the sand, after which the plant should be given a slight pull upwards so that its crown is above the surface of the sand.

To avoid disturbing the latter, when filling the tank, a watering-can with a fine rose should be used. Otherwise, a bowl should be stood on the bed of the aquarium and the water poured into this so that it flows evenly over the rim.

DIAGRAM 20.
A ROOT OF VALLISNERIA.

Almost equal to Vallisneria as an oxygenizer is the CANADIAN WATER WEED (*Anacharis alsinastrum*), now abundant in almost every pond throughout this country.

All one has to do is to arrange several little bunches of healthy sprays, tie each to a stone and drop them in the tank wherever desired. Even with this primitive treatment they will

grow so rapidly that pruning will occasionally be necessary.

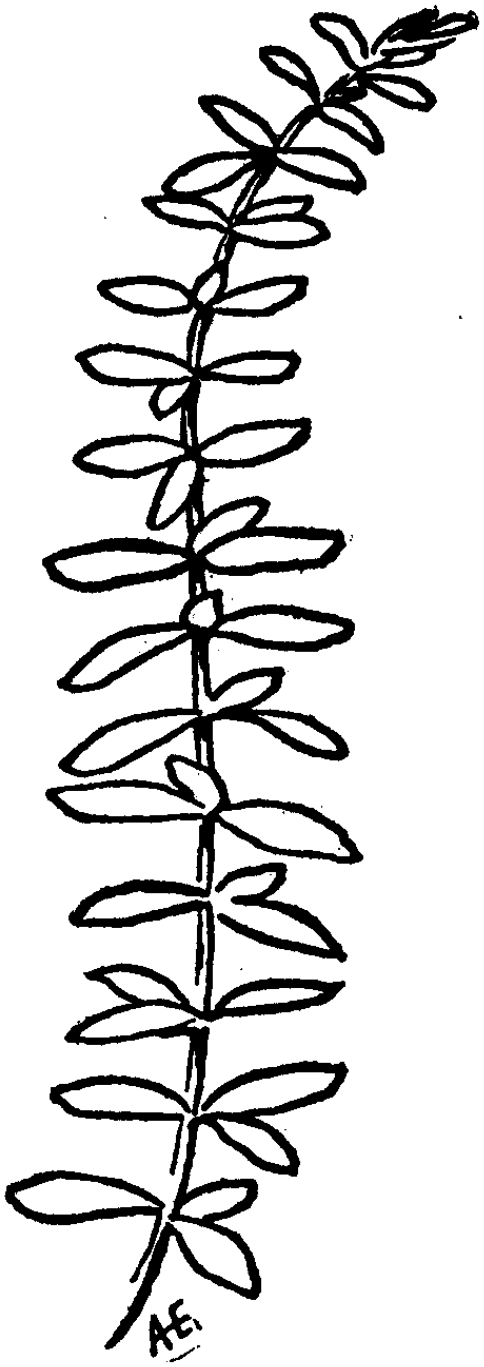

DIAGRAM 21.— A SPRIG OF CANADIAN WATER WEED.

If, on the other hand, the fish strip off the little oval-oblong leaves (which grow in whorls of three or four), as they are prone to do in course of time, there is no difficulty in replenishing the stock.

Canadian Water Weed, like VERNAL STARWORT (*Callistriche verna*) another common aquatic plant, is particularly adapted to an aquarium containing newts, for the females make use of the leaves for depositing their eggs.

Starwort, however, should be treated differently or it will not thrive. Simply break off a few inches of each stem and allow the bright green star-like whorls, on the top, to float on the surface of the water with the rest of the plant submerged.

FROGBITS (*Hydrocharis morsus-ranæ*) and WATER SOLDIERS (*Stratiotes aloides*) are also suit-

able as floating plants, the beautiful kidney-shaped leaves of the former, and the serrated, curling blades of the latter proving a welcome contrast in the vegetation of the tank.

The lower leaves of the Water Soldier are prone to decay so that a "trim up" now and then should be given it.

Riccia, and Duckweed, will, if introduced, cover the whole surface of the water.

Though this habit provides shade for the fish, and ideal hiding places for newts, it is rather a nuisance when one is attending to the tank, for the tiny plants cling to the net or whatever appliance is put into the water and have to be removed piecemeal, or wasted.

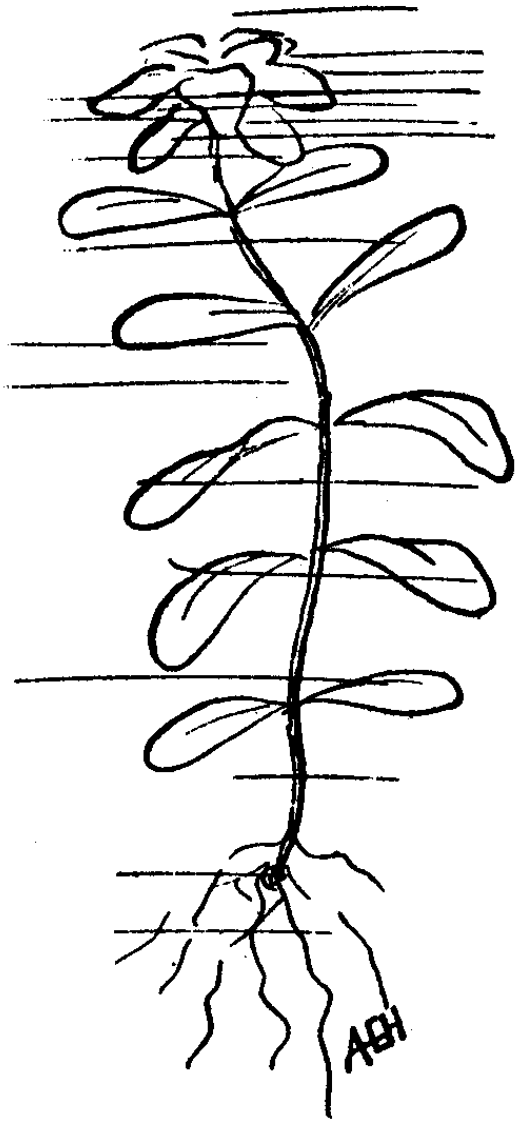

DIAGRAM 23.—A FLOATING SPRIG OF VERNAL WATER STARWORT.

Some of the Water Lilies stocked by aquarium dealers do fairly well if sunk in the sand, but, where only gravel is present, these should be planted in a small pot of loam, with an upper stratum of sand.

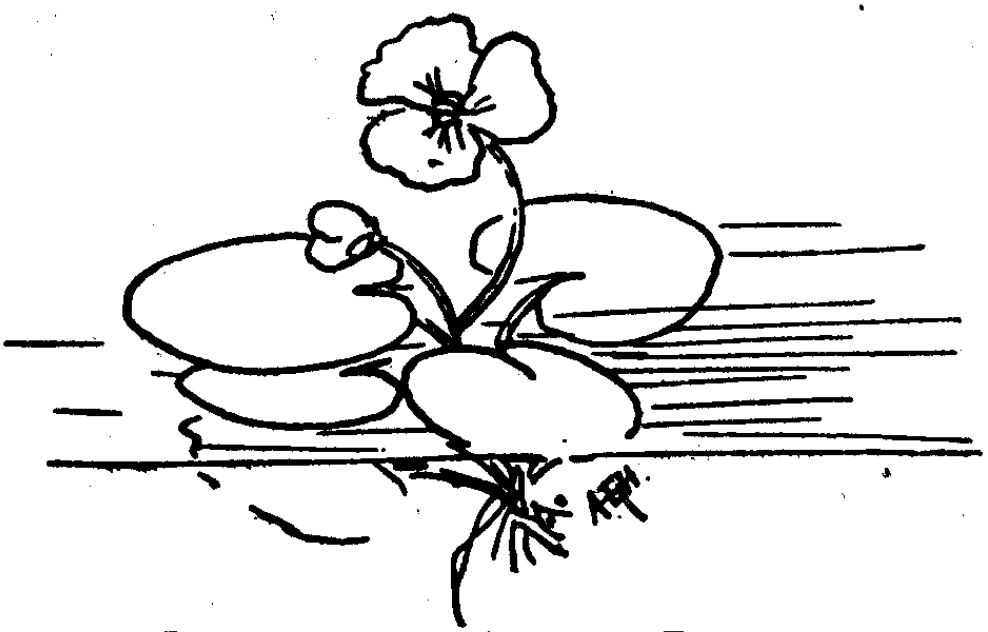

DIAGRAM 24.—A FLOATING FROGBIT.

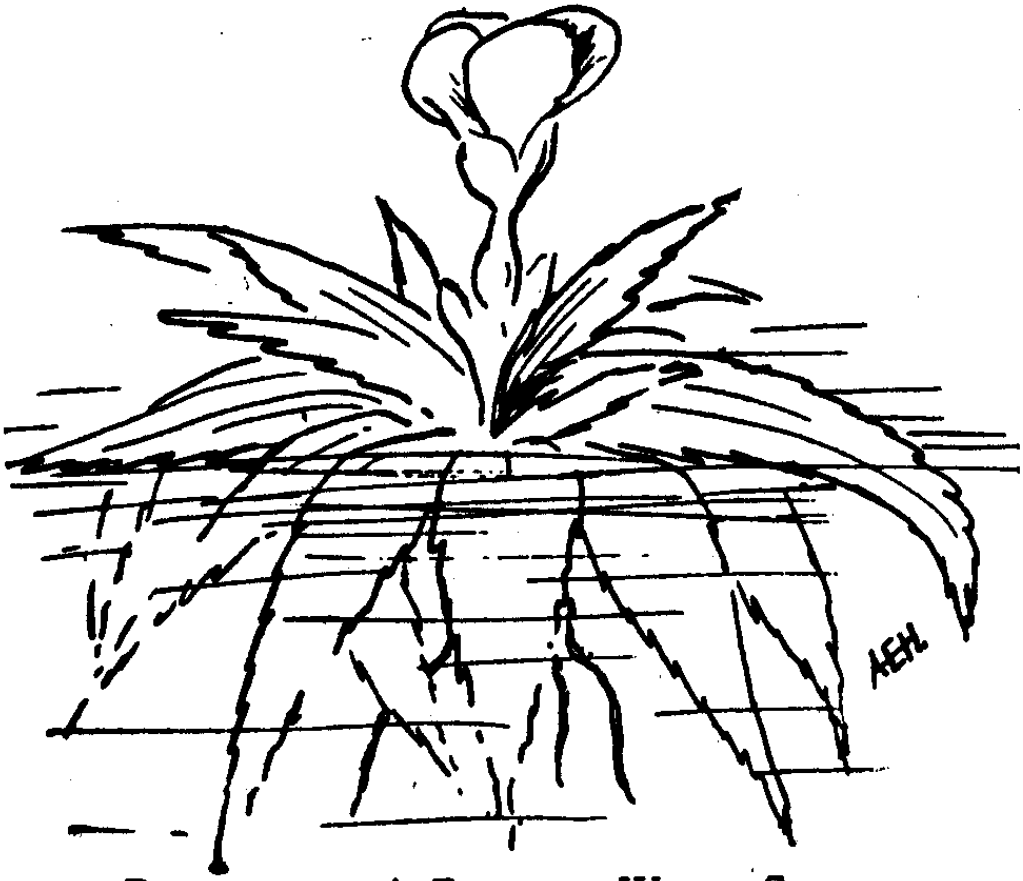

DIAGRAM 25.—A FLOATING WATER SOLDIER.

Those which survive the Winter in a small aquarium appear to adapt themselves during the following season to their new environment, I have found, throwing up smaller and less extensive leaves more suited to the dimensions of the tank.

I have never been successful in getting mine to flower, for the simple reason that, to do so, a Lily requires plenty of sunshine, and this, in consideration for my aquaria, I did not allow them to have.

WILLOW MOSS (*Fontinalis antipyretica*), so long as it is rooted to a small piece of rock, will grow, though slowly, and is also useful in providing a shady retreat for the occupants of the tank.

DIAGRAM 22.—A SPRIG OF WILLOW MOSS.

It will be found that, after a time, it becomes encrusted with sediment. This is rather an advantage to the aquarist for by simply taking out the plant, rinsing it in water, he can expeditiously get rid of so much undesirable matter.

LUDWIGIA is essentially a Marsh plant, but, like the common Creeping Jenny, it thrives in a submerged condition, doing best in full light, when the underparts of its leaves become a beautiful red colour.

For tanks which have no cover, there are quite a number of hardy sub-aquatics, such as the

common Arrow-head, Flowering Rush and Branched Bur-reed, whose bold upstanding foliage and flower spikes, rising several inches above the surface of the water, look extremely ornamental.

They need to be planted in suitably-sized pots, in similar fashion to that suggested for a water lily.

Such pots may be camouflaged by covering the outside with imitation rockwork composed of Portland cement, sand and rugged chips of stone, though it is necessary to soak them for a week or two before use.

Of course there are many other aquatic plants, more or less suitable, but those mentioned are, in my opinion, some of the more satisfactory. They are sufficient for all purposes—oxygenization, shade, shelter, contrast and general ornamentation.

Unless you have an unusually large aquarium, always choose fish of moderate size, for not only can more specimens be kept but these will obviously be more at ease.

One has to use a considerable amount of restraint in stocking a tank, for, to keep fish in health—without which they no longer afford pleasure—there must be no approach to over-crowding.

To be on the safe side, you should calculate upon a gallon of water to every inch of fish. That is to say, a six-gallon aquarium will only comfortably support two three-inch, or three two-inch fish, and so on.

The higher the temperature of the water—which should average about 50 degrees—the fewer fish will it support, and just as in a crowded room the

suffocating occupants will seek an open window for air, so will the fish instinctively rise to the surface in the effort to obtain an adequate supply of oxygen.

This is a sure sign that either the water is lacking in oxygen, or that the fish are ailing.

If you consider that it is merely the high temperature, remove a quantity of the water and replenish from the rose of a watering can.

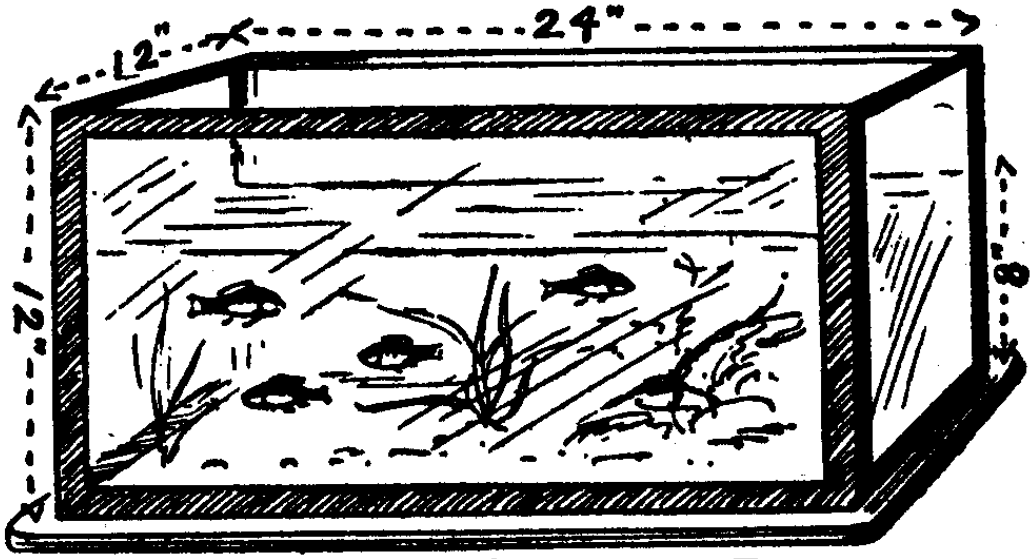

DIAGRAM 35.—TEN-GALLON STILL-WATER TANK, WITH FULL COMPLEMENT OF FISH (*Four 2½" Specimens, or equivalent*).

A long spell of hot weather, especially when there is thunder about, is very trying to fish, and to avoid casualties, it is a good plan to have handy a temporary fountain or, better still, an aerator.

As these are quite easily and inexpensively made, and are sometimes as useful to the fish as a life-buoy to man, a brief explanation of how to construct them will not, I think, be waste of space.

We will take the fountain, which is the more decorative idea though the least effective for the purpose, first.

Procure a length of narrow lead piping and bend

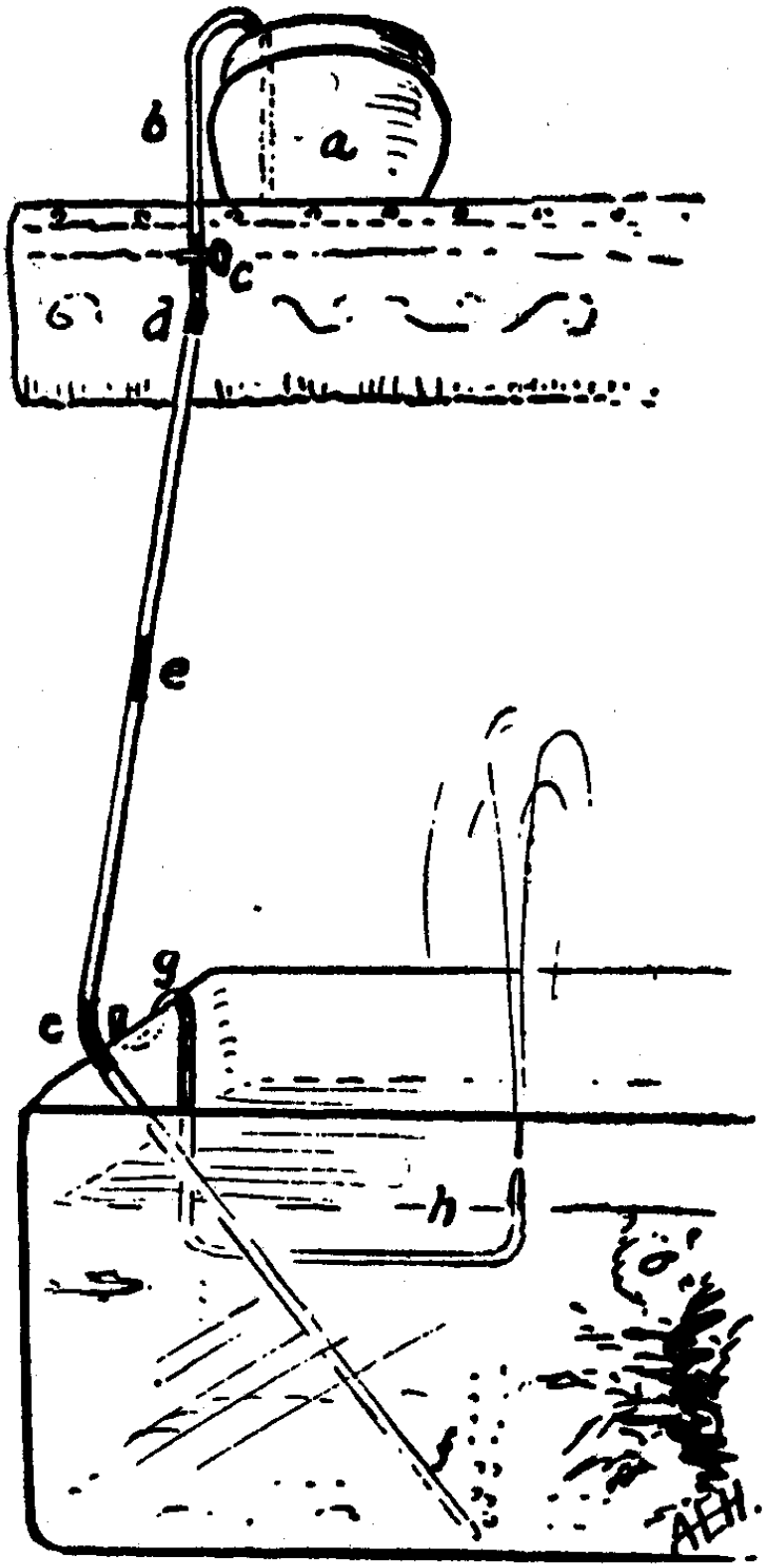

DIAGRAM 19.—AERATING APPLIANCE
(showing Temporary Fountain Attachment).

a. Reservoir.
b. Syphon.
c. Regulator.
d. Rubber connection, with hole.
e. Rubber connections.
f. Air-bubbles rising from tube.
g. Detachable fountain.
h. Surface of water.

the last few inches of one end into the form of a horizontal S (see diagram). Then twist the piping so that, when the S-curve is fitted on to the top of the tank with the short end of it sticking up in the air the other runs down the side of the tank, under and parallel with the surface of the water, and projects upwards an inch or so above it, at right angles, in the centre of the tank.

Now, nip this end with a pair of tweezers and make a small hole through the top with a pin: the smaller the hole the higher the spray which will result when the fountain is working.

All that remains to be done is to stand a large fancy flower bowl or other receptacle on a shelf above the aquarium, and bending another section of lead piping into the form of a long hook so that one end will reach to the bottom of the bowl and the outer portion descend below it, join this up with the piping below by two or more lengths of narrow glass tubing connected by small sections of rubber tubing.

To start the fountain, fill the bowl with water and give the jet a draw with the mouth so as to start the syphon running.

With a bowl of average size the fountain should play for an hour or two, and on a hot Summer afternoon, it has a very cooling effect upon spectators as well as the fish.

The aerating appliance is much on the same lines, as will be seen from the illustration. The bowl and syphon is similarly employed and also the glass tubing, with this difference. In the top rubber connection a small hole is made, about $\frac{1}{8}$th in. in diameter, and above it is screwed on

a regulator, similar to those used for babies' feeding bottles.

Instead of having lead tubing at the bottom, the last section of glass tubing is allowed to rest on the floor of the aquarium and, if brought to a fairly fine point so much the better.

The syphon is started as in the case of the fountain, except that one has to place a finger over the hole in the rubber section meanwhile.

As the water passes the hole at the top, when the finger is lifted, globules of air are continually carried down to the bottom of the tank, and rising uninterruptedly to the surface, the water absorbs oxygen from them.

When working properly, there will be a regular chain of bubbles visible along the whole of the glass tubing, and so small is the quantity of water carried down between them that a half-gallon jar should be sufficient to keep the appliance working for nearly twenty-four hours!

So effective is this contrivance that if one cared to keep it in operation continuously there is no reason why " running-water " fish, which will not thrive in an ordinary still-water aquarium, should not live healthfully.

By the way, tap-water (generally used for filling an aquarium) being more or less lacking in mineral elements, a tip worth remembering is to occasionally throw into the tank—say, once every week or so—a pinch of Epsom Salts.

As one cannot draw a hard and fast line between herbivorous, insectivorous and carnivorous fish, I will suggest two menus, and to avoid needless repetition later, I shall refer to them by number.

No. 1.

Earthworms.
Flies.
"Ants' eggs" (really the pupæ of ants).
Bloodworms (larvæ of water-fly *C. plumosus*).
Fresh-water lice.
Fresh-water shrimps.

No. 2.

Finely crushed vermicelli.
Finely crushed dog-biscuit.
Baked and finely crushed shrimps (Marine).

Items in No. 2 should be very sparingly given or uneaten food will contaminate the water. Such a quantity as can be heaped on a threepenny piece, for instance, is quite sufficient to provide a meal for the occupants of a 2 ft. aquarium.

If you can obtain them, there is nothing to surpass those minute crustaceans, Daphnia and Cyclops, as food for fish, especially for the smaller specimens. These have already been referred to.

During Winter, when Daphnia are unobtainable alive, dried specimens may be obtained from the dealers—generally imported from Germany—but these are but poor substitutes, and being a highly concentrated form of food which will quickly putrefy, it should be used in very small quantities.

Presuming that you have, by this time, set up your aquaria, give the plants a chance to "get going" before introducing the fish.

Golden Carp or Goldfish (*Carassius auratus*)

Goldfish are undoubtedly the most attractive fish for an aquarium, and as they vary in colour from a smoky drab (known as silver) to metallic red

(called gold), yellow, white (pearl) and more or less black, there is plenty of choice.

Colours in goldfish, however, are liable to change, and it is interesting and useful to take accurate notes of these. As a rule, the variation is towards a lighter colour, e.g., black to red, or red to white.

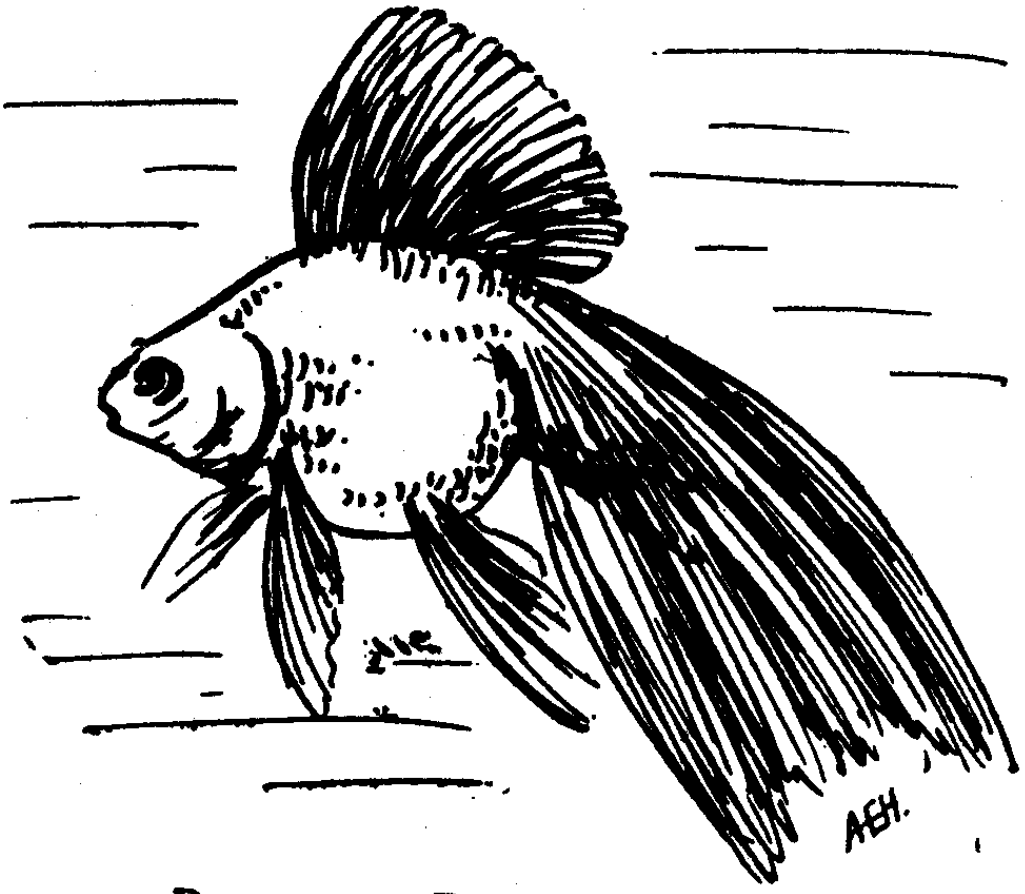

DIAGRAM 30.—FRINGE-TAIL GOLDFISH.

In addition to the familiar variety, there are many fancy forms, the result of patient experiments extending over many generations by clever Oriental breeders.

Some are as beautiful as they are expensive, such as the Fan-tails and Fringe-tails, with their large sail-like dorsal fin, pendant lower ones, and an elegant trailing lace-like tail. Their chunky

bodies, however, which form one of the chief points aimed at by fancies, are anything but graceful, while those varieties known as "Telescopes," Egg-fish, "Tumblers," "Lionheads" and "Celestials" are as unnatural as they are grotesque.

The "Tumbler," for instance, owing to its abnormal development, is in the habit of turning somersaults in the water, providing an exhibition which is more pitiable than edifying.

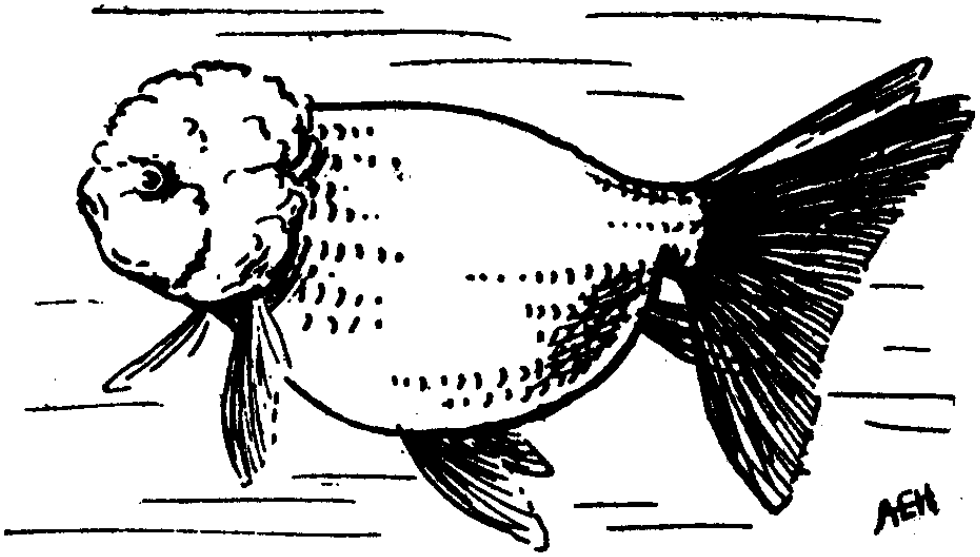

DIAGRAM 32.—THE LIONHEAD.
(An extreme example of variety-breeding.)

As can be seen from the illustration, the "Lionhead" has a thick growth over the head which gives it the appearance of a gigantic raspberry, whilst the "Celestial" has earned its name on account of its eyes always being directed heavenward!

There is something to be said in support of the Comet Fish, whose unusually long body and fins, with a particularly free-flowing tail, is really handsome, for its movements in the water are accelerated rather than impeded by its peculiar features. Yet,

curiously enough, this variety is not highly prized by experts.

Nevertheless, being perfectly hardy and not

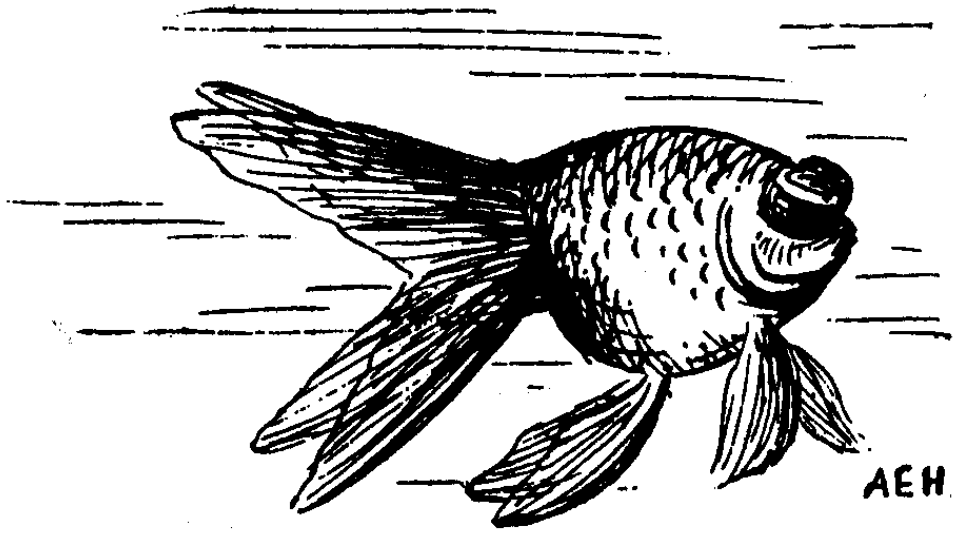

DIAGRAM 33.—THE CELESTIAL GOLDFISH.

prone to swimming-bladder trouble as is the case with those with globular bodies, Comet Fish are worthy of a tank to themselves.

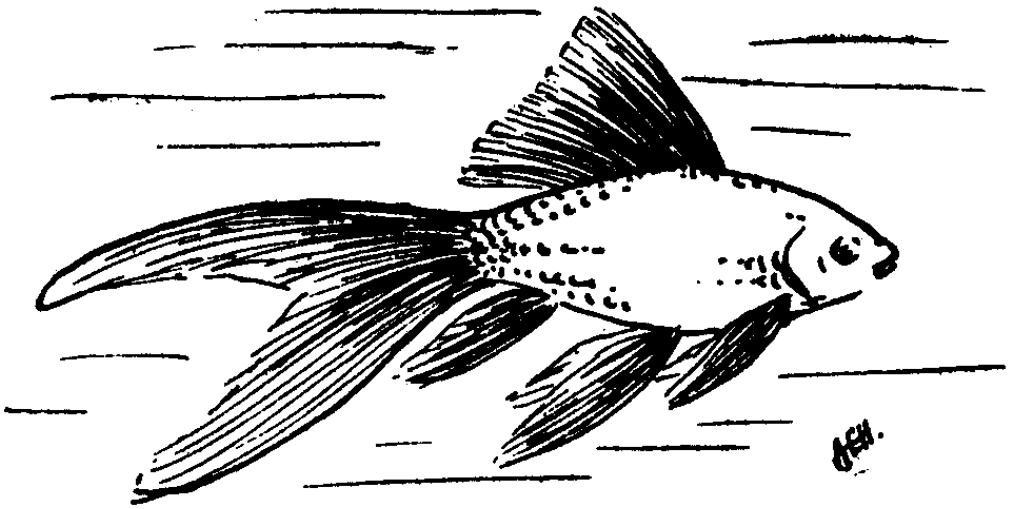

DIAGRAM 31.—COMET GOLDFISH.

There are three other species of Carp almost equally suitable for an aquarium, and generally obtainable from the dealers.

Common Carp (*Cyprinus carpio*)

Of these, the Common Carp is distinguishable from the other two by the presence of barbels on the sides of the mouth.

It is to be found in most old-established ponds in England.

A variety of this species, known as the Speigel, or Leather, Carp, has the greater part of the body devoid of scales, which are merely scattered here and there—generally in rows along the central line, but sometimes along the back, when it is known as the Saddle Carp.

Prussian Carp (*Carassius gibelio*)

The Prussian Carp, whose fins are red, will make quite a handsome addition to the tank, as will also the Crucian Carp.

Crucian Carp (*Carassius vulgaris*)

The body of the latter is more curved above and below than the Common or the Prussian Carp. Its scales are of a light golden hue.

All three species of Carp should be fed, like Goldfish, mainly on Menu No. 2.

Tench are quite as hardy as Carp, with which they may be associated. They are, however, apt to keep out of sight during the daytime, which is rather a drawback—from the aquarist's point of view.

Common Tench (*Tinca vulgaris*)

The Common Tench, being of a greenish hue, provides a welcome contrast, while the Golden

Tench—a handsome variety frequently offered for sale—is quite distinctive.

Golden Tench (*Tinca auratus*)

Though the Golden Tench lacks the metallic lustre of the goldfish, its gill-plates are beautifully iridescent.

Specimens are sometimes whitish, or pink, and, like the yellow form, not infrequently spotted with black.

Menu No. 1 will be most appreciated by Tench, with an occasional variation of diet from No. 2.

Bitterling (*Rodeus amarus*)

Bitterling make very desirable occupants of an aquarium. They are naturally small, not growing to more than 3 in., while the male, which is the larger of the sexes, assumes, during the breeding season, such beautiful coloration that the species is sometimes referred to as " Rainbow Fish."

I have noticed, however, that, when confined in an ordinary tank, the male, after the first year or two, does not put on these attractive hues.

A varied diet of items from Menus 1 and 2 suits Bitterling best.

Dog Fish (*Umbra krameri*)

Dog Fish are so interesting that they deserve a tank to themselves, where, barring accidents, they will live healthfully. I say " barring accidents " advisedly, for these fish are great jumpers, and unless the aquarium be covered, you will assuredly find, some time or other, one of their shrivelled bodies on the floor.

Though insectivorous by nature, my specimens, which have lived for several years in an ordinary tank, eventually partook of Vermicelli as it sank in the water. At first I had some difficulty in getting them to take even " Ants' eggs."

Dog Fish are great fly-catchers, and I encourage them in this by smearing a little treacle on the underside of the glass cover, in order to attract the insects. The fish, rising to the occasion—in more senses than one—will leap out of the water and dexterously capture the flies innocently partaking of the sweet syrup.

These fish are prone to bully smaller ones, though I doubt whether they could do them much harm.

The appearance of their head—especially when looking around for food, is very dog-like. This, coupled with the fact that they use their pectoral fins alternately, like the fore-legs of a swimming dog, no doubt accounts for their popular name.

They poise themselves in the water in the most unusual attitudes, like veritable submarines.

It is because of these eccentricities, as well as their hardiness, that I recommend them, for they cannot be considered beautiful.

SUNFISH (*Eupomotis gibossus*)

The Sunfish, with its iridescent hues of green, brown and pale blue, is one of the handsomest of aquarium fish, but, owing to its pugnacious disposition, it should be given a tank to itself, or share it with another fish of similar size and armament.

A wild specimen, which I obtained from an

English breeder of these fish, at first charged the sides of its tank like a bull at a gate, and, when not thus actively engaged it would sulk somewhere out of sight amid the weeds and rockwork.

Two young Bass, smaller than itself, which were put into its aquarium by way of companions, were chased so relentlessly that they had to be removed.

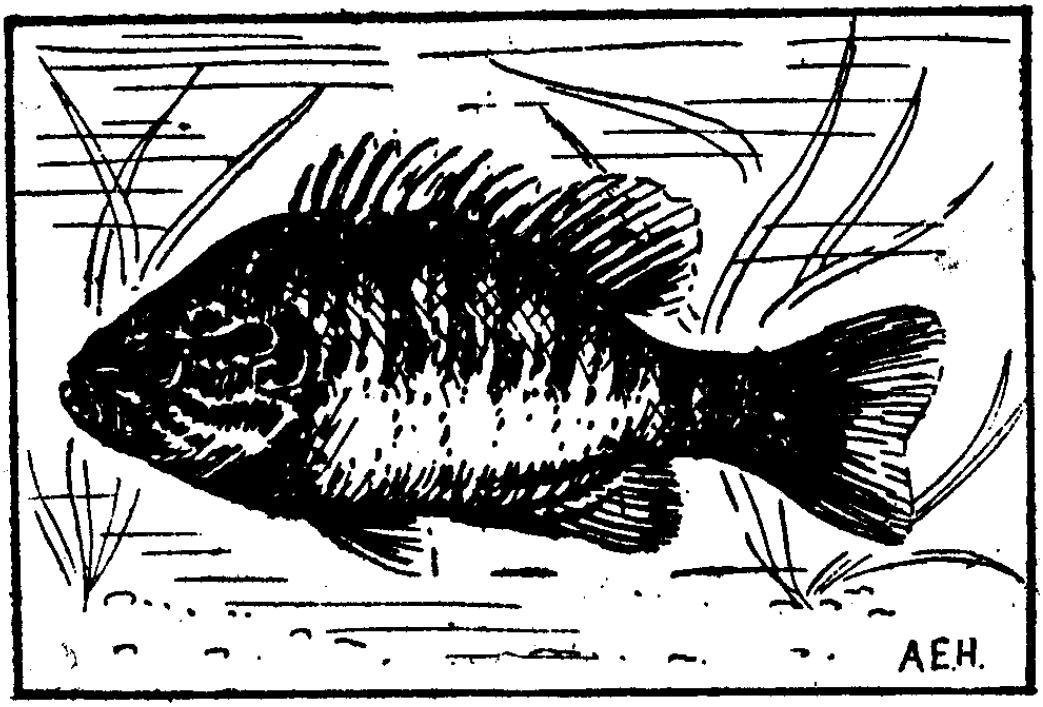

DIAGRAM 34.—THE COMMON SUNFISH.

Later on, however, it grew resigned to captivity and became as docile as a goldfish.

It even lived peacefully with a Perch until the latter died—as Perch will, in warm weather—though this was probably accounted for by the fact that the Perch was of its own size and well able to take its own part.

Unlike some Rock Bass which I possess, my Sunfish ignores such usually tempting morsels as Freshwater Shrimps and Water-lice, but feeds

greedily on worms and flies, and even "ants' eggs" and dried shrimp.

Rock Bass (*Ambliopsis rupestris*)

Rock Bass are somewhat similar to Sunfish, but brownish and with bright red eyes. If of similar size, a specimen may well be associated with a Sunfish.

Cat-fish (*Amiurus nebulosus*)

Cat-fish are curious-looking creatures, with their bull-heads, long, conspicuous barbels and scaleless bodies.

They are, unfortunately, nocturnal in their habits, so that little will be seen of them during the daytime if there is much rockwork or vegetation in their tank.

In the earlier editions of this book I referred to the fact that most of the Cat-fishes which had come into my possession developed fungus. I wish to qualify the suggestion that the Cat-fish is particularly liable to this disease, for, during the five years which have elapsed since the above statement was written, I have had no further trouble of the kind amongst the numerous Cat-fishes I have kept.

Cat-fish should be fed on a selection from Menu 1.

Golden Orfe (*Leuciscus orfus*)

Small Gold Orfe will live well in a well aerated aquarium, where their active and graceful movements are very pleasing to watch. They are really more pink than golden, shading off, on the sides, into silver, with white beneath.

Golden Orfe will partake of items in both of the

Menus given, though they seem to prefer small worms.

MINNOW (*Leuciscus phoxinus*)

For liveliness and tameness, minnows cannot be beaten. They soon appear to recognize the person who looks after them, and it is very amusing to see a small shoal of them flocking to the side of the tank at which he appears.

My own feed quite readily from the fingers.

During the Springtime the male minnow is a beautiful fish, being tinged with red and green.

Minnows will greedily devour small aquatic insects, flies and the various items mentioned in Menu 2.

ROACH (*Leuciscus rutilus*)
RUDD (*Leuciscus erythrophthalmus*)

Roach and Rudd are less hardy than those species already mentioned, but I include them here as, when young, they will live well enough provided their aquarium be comparatively shallow and well stocked with growing vegetation.

The latter species is the more easily kept in health, and the more handsome of the two.

Give them a varied diet from Menus 1 and 2.

THREE-SPINED STICKLEBACK (*Gasterosteus aculeatus*)

Sticklebacks are apt to be despised owing to that contempt which is bred by familiarity.

In the aquarium they cannot be excelled, in point of interest, except by tropical fish, whose

striking hues the male, in Springtime, very closely resembles.

They should be given a tank to themselves, owing to their ability to injure defenceless fish with their spines, and, if this be a large one well stocked with growing weeds and provided with such small aquatic life as entomostraca, they will probably breed there and bring up their young in their own peculiar fashion.

In such an event, the male will be observed building its little muff-shaped nest and, subsequently, guarding and fanning with its fins, the spawn within.

When the young " Tiddlers " hatch, the father zealously protects them from the cannibalistic tendencies of his companions by using every effort, forcible and otherwise, to keep them within the " nursery " which he has so cleverly constructed.

The reason for not associating other fish with Sticklebacks will be apparent after one has witnessed the fights which ensue amongst themselves and the way in which they can use their comparatively formidable spines.

Sticklebacks prefer items in Menu 1.

Common Eel (*Anguilla vulgaris*)

A small eel will give very little trouble in an aquarium where its sinuous movements are always very attractive.

One which, when about 4 in. long, I casually dropped into my " Newtarium " throve so well on bloodworms and small earthworms that I had to remove it to a separate tank, on account of its size.

It is said that Eels are able to ascend the sides of an aquarium and that this should, therefore, be securely covered, but I have never known any specimen of mine to indulge in this feat.

Perhaps they were quite comfortable where they were!

Though there are many kinds of freshwater snails available it would be wise, unless specializing in this direction, to use considerable discrimination in making a selection, for while some prove extremely useful in removing confervæ from the sides of the tank and disposing of

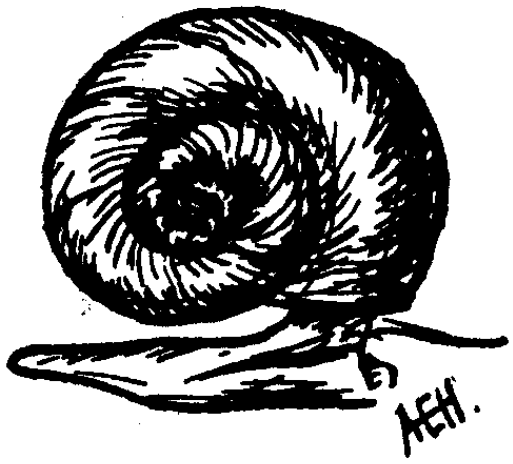

DIAGRAM 26.—RAMSHORN FRESHWATER SNAIL.

decaying animal and vegetable matter, others will speedily demolish the choicer weeds.

If you follow my advice you will restrict your attention to the following, which are varied in form and equally suitable:—

1. THE RAMSHORN SNAIL (*Planorbis corneus*) which has a flat-coiled shell. A handsome red variety known as var. Rubra is sometimes procurable from the dealers, and is a worthy addition to the tank.

2. THE FRESHWATER WINKLE (*Paludina*

vivipara), whose popular name suggests its shape.

3. THE FRESHWATER WHELK (*Limnæ a stagnalis*), whose popular name is, likewise, sufficiently descriptive.

The last named species is occasionally apt to be destructive among the weeds but not to any large extent, and, when born in the aquarium, the young snails appear to be quite content with a diet of confervæ.

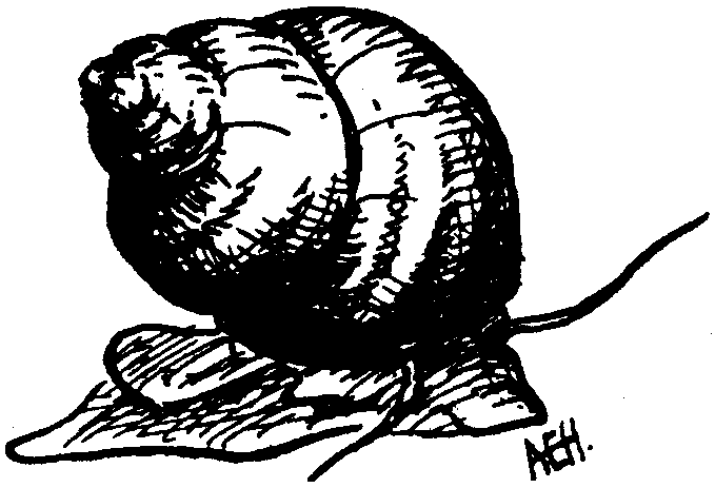

DIAGRAM 27.—FRESHWATER WINKLE.

As, for many years, I had been told to regard the Freshwater Whelk with suspicion, I excluded it from my tanks. One day, however, I found a tiny specimen therein, having apparently been introduced with some weed. I decided to give it a chance, and watched it closely as time went on. Hardly ever did I see it otherwise engaged than removing the confervæ from the glass, although, when it eventually died, it was fully grown.

The three species of Freshwater snails mentioned

are the largest and handsomest of British species. Being very prolific, they form a valuable source of food supply for the fish.

In the case of 1 and 3, the eggs, contained in orbicular capsules, are deposited on the weeds, stones and sides of the tank, hatching in about three weeks, according to the temperature of the water.

DIAGRAM 28.—FRESHWATER WHELK.

The Freshwater Winkle, as its specific name implies, brings forth its young alive.

It is well worth while to keep a few of the red variety of the Ramshorn Snails separately for breeding purposes. The tank should contain plenty of aquatic vegetation, a little—a very little—dried shrimp, or a dead worm, being introduced as food occasionally.

When snails are present in an aquarium you should take the precaution of making a periodical inspection to see if any of them have died, for the dead bodies of the molluscs unless removed at once will contaminate the water and necessitate a cleaning out of the tank.

Mussels are particularly apt to die in an aquarium and, therefore, it is wise to choose com-

paratively large specimens which are not likely to be overlooked.

If you notice a specimen lying on its side with the valves of its shell partially open, touch it with something or other and, if it be alive, these will at once close. If they do not, take it out of the water and examine it more thoroughly. Should the valves not shut tightly then you may be sure that it is dead.

As mussels extract particles of animal and vegetable matter from the water, one or two are useful in an aquarium.

The DUCK MUSSEL (*Unio tumidus*) and the SWAN MUSSEL (*Anodonta cygnea*) are the species most usually stocked by dealers.

As the former attains a length of over two inches and the latter, sometimes, three or four times that size, full-grown specimens should not be chosen unless the tank be of large dimensions.

SICK FISH

Too much care cannot be taken to avoid the introduction of disease into the tank, and therefore, if possible, a newly purchased fish should be kept in quarantine until you are satisfied that it is in good condition. (If a fish which usually carries the dorsal—back—fin erect droops it, this is a sign that something is wrong with it.)

Likewise, it is a wise precautionary measure to sterilize all weeds by immersing them for about an hour or so in water containing permanganate of potassium in the proportion of three grains (by weight) to a gallon.

A similar solution is useful for disinfecting an

aquarium, or net, which has become contaminated, but in this case the period should be extended to several hours.

Fish, like all other creatures, are naturally subject to various diseases, so a little medical treatment may be found necessary now and again.

A special tank, of shallow proportions, should be kept handy for use as an aquatic hospital, it being vitally necessary that an ailing fish be at once removed from its fellows, in case it be suffering from some contagious disease.

Various treatments have been suggested for the ailments of fish, but, speaking generally, the most satisfactory one is probably as follows: Pour into the hospital tank a solution composed of two heaped teaspoonfuls of Sea Salt to each gallon of water and place the "patient" in this, replenishing the water every other day with a fresh mixture of the same temperature.

If the sick fish shows no sign of improvement after a few days, gradually increase the proportion of salt to double the quantity suggested and then, after a couple of days, diminish, daily, the salt proportion until a minimum is reached.

Fungus, which appears as a white scum and is extremely contagious, and fin-congestion, recognizable by blood-red streaks, are two of the commoner diseases of aquarium fish, but, if dealt with in time, they should prove amenable to the treatment suggested above.

Sometimes all that is necessary is to place the fish in green water taken from some stagnant but wholesome pond, or place the hospital tank under dripping water.

Appliances

The following are some easily constructed, or procurable, appliances which, in addition to such as have already been mentioned, will be found useful:

1. A pair of wooden forceps made of two lengthy strips of pliant wood screwed on to a small block at one end. (For removing snails, mussels, worms, etc., from the tank, and also for feeding creatures—such as a small Alligator—which are liable to nip the fingers.)

2. A hand-net consisting of a frame of stout galvanized iron wire with a bag of Brussels netting (which is not likely to damage the scales of a fish). If the frame is angular, it will be more convenient for poking into the corners of an aquarium, where fish have a provoking habit of getting when wanted.

3. A long-handled wire brush. (These are sold by some dealers for cleaning the glass sides of the tank.) A piece of chamois leather tied to the end of a stick, in mop-like fashion, will also answer the purpose, using a little sand, if necessary.

4. A syphon composed of a length of lead tubing bent nearly double, so that it will hang over the edge of the tank (the inner portion reaching to within an inch of the sand) with a length of rubber tubing attached to the outer, of sufficient length to connect with a bucket below. This, of

course, is necessary whenever it is required to empty the aquarium. To prevent small aquatic life from being drawn off with the water, the inner mouth of the tube may be covered with some netting of small mesh.

5. A couple of planting-sticks. These consist merely of two long thin strips of wood each having a semi-circular notch at one end. (These are used, after the manner of a spoon and fork, for pressing the roots of plants into the sand when specimens have become displaced, or when introducing fresh ones after the tank has been filled.)

6. A Bloodworm carrier. This is a receptacle formed of perforated zinc, made to hang from the top of the tank so that the bottom descends just beneath the surface of the water. When the bloodworms, which are generally obtained mixed with a quantity of dead leaves, are placed in the carrier, the larvæ obligingly wriggle through the holes into the water, when the debris—and any dead " worms " left in the carrier—may be removed without difficulty.

7. A small floating bath-thermometer.

To remove scum which is apt to form on the top of the water, owing to accumulation of dust, a few sheets of newspaper are all that is required. Cut them to the width of the tank and, placing one flat on the water, draw it along the surface, repeating the operation with another piece in the opposite direction.

This will be found to answer the purpose admirably and not interfere with any floating weed such as Riccia or Duckweed.

A Warning. Do not use the brightly-banded worms known as " Brandlings " for feeding either reptiles, batrachians or fish, while those river-worms known as *Tubifex rivulorum* are, too, best avoided, for there is reason to believe they prove parasitic (internally), upon fish.

In conclusion, let me urge the amateur herpetologist and aquarist not only to endeavour to understand thoroughly his pets by reading up all he can about them, but to keep accurate records of his own observations so that not only himself but others may benefit from his experience.

He will also find it to his interest to join The British Aquarists' Association, which, having several London and Provincial Branches, enables aquarists to get into touch with one another for their mutual benefit. For an annual subscription of 4s. 4d. members receive, in addition to special privileges, four quarterly issues of *The Aquarist*, a beautifully illustrated magazine, of which I have the honour to be editor. The Headquarters of the Association are at 14 Astonville Street, Southfields, London, S.W., from which address full particulars and advice may be obtained.

In America, such societies have flourished for many years, and prizes for fancy fish are keenly competed for at annual exhibitions. It is up to the British aquarist to likewise get full enjoyment and instruction out of his hobby.

INDEX

INDEX