of them, are coincident with the operation of the lymphatics. We have here two separate systems, the lacteal and lymphatic, which ramify from the intestines all over the body, and of which the anatomical and physiological actions and relations are at present an important subject of investigation for modern biologists, and not yet fully understood.

It is evident from the preceding that the blood vessels, which have received the material from the digestive apparatus, contain two distinct liquids, the original venous blood and the chyle; this mixture makes its way through the portal vein to the liver, which is a double structure, of which one function is to cause this mixture to undergo an enormous change, consisting in the formation of young blood cells, and the other is the economizing of the mineral ingredients of the disintegrated blood cells, which are also eliminated by the liver and of which iron is the principal ingredient.

The above outline may serve to give the general reader an idea of the highly elaborate complexity of the diverse operations belonging to the mysterious process by which foreign organisms are changed into the living tissues of our bodies, which tissues, by interstitional repair, take the place of the old ones; they do this so thoroughly that we may safely assert that, in the course of only a few years not a single material atom is left of those of which the body originally was made up. In order to comprehend the truth of this, we have only to consider that the average amount of solid food required for each human being is 800 lbs. per year, of drink 1,500 lbs. and of oxygen, consumed from the air, 800 lbs., a total of 3,100 lbs., surpassing the weight of the body more than 20 times. The most wonderful fact to contemplate is that, with all this continual change of the material of which our bodies consist, we do not lose our identity.

MORDANTS FOR ANILINE COLORS.

While aniline dyes are remarkable for the ease with which they attach themselves to animal fiber, whether silk or wool, they are difficult to fix upon cottons and vegetable fiber in general. For this purpose albumen, the bichromates and other mordants have been used or recommended. The number of such mordants is not a small one; but the important question at present is which can be employed to the greatest advantage, and which will produce the most beautiful and cheapest colors. This cannot be answered by a series of experiments conducted on a small scale, but only by operating upon large quantities and in a practical workshop. The dyer in fine colors will not usually have an opportunity to decide which is the most suitable mordant for cottons. In this question, the value of the bath after the operation and its capability of being turned to account must be considered, and in all calculations, its value must be deducted from the total cost of the materials employed.

To discuss at this time all the different methods employed in fixing aniline colors would lead us too far; almost all have been superseded by the methods in which tannin is employed. This is especially adapted to fuchsin and iodine green. Both of these dyes produce, with tannin, brilliant colored compounds which are totally insoluble, so that tannin most completely fulfils the ends required of a mordant. Tannin is, however, quite expensive, and hence we must seek some substitute which either renders the use of tannin entirely unnecessary or at least makes a saving in its use. The substances previously suggested, such as oleic acid or stearic acid, do not sufficiently fulfil the requirements, and it seems probable that a substitute for tannin, which shall entirely replace it, will be difficult to find. A long series of experiments on a large scale have lead to the conviction that tannin, either pure or in sumach, is, in the mean time, still indispensable.

A German, named Austerlitz, has recently observed that a considerable saving of tannin can be effected by combining it with glue before using it, so as to employ both glue and tannin smultaneously as mordant. Under these circumstances, much less tannin is required to produce a given shade with fuchsin, iodine green or any other aniline color; in fact, the same results may be obtained with half the quantity of tannin required when no glue is used. Austerlitz says: "I have established this by a series of experiments on a small scale using weighed quantities of tannin with varying quantities of glue. A piece of cotton goods was first mordanted in a bath of tannic acid, and then cut in two, one half being drawn through a weak solution of glue or gelatin, the other immersed directly in a dye bath of known concentration at a given temperature. The half which had been through the glue bath was then dyed in a bath of precisely the same sort, and the two samples compared. The cotton on which glue had been employed was far more thoroughly dyed and of a deeper shade. It was also proved that the tannic acid bath might be much weaker, if followed by a glue bath, than when used alone. The amount of tannin saved in this way is not small.

By gradually diluting one of the tannin solutions and continuing the series of parallel experiments with tannin and glue and with tannin alone, a point is finally reached where both methods produce the same shade. When this point is arrived at, a comparison of the concentration of the two tannin baths will show how much is saved. This quantity, of course, depends greatly upon the quality of the tannin, so that many experiments have not given a result which can be expressed in figures. Samples from different sources gave different results, so that in some cases more was saved by the glue bath, in others, less."

The cause of these phenomena have not yet been ascertained but it is probable that a compound of tannin and glue is formed, which has an action upon aniline different from that of tannin alone.

FISH CULTURE BY FARMERS.

Why should not farmers and others raise fish for the market and for their domestic uses, as well as cattle, fowls or any other living stock? For so staple and healthy an article of food, it seems as absurd to be dependent upon chance capture in a wild state as it would be to rely for our poultry upon the fortune of the hunter or for our vegetable supply upon the finding of suitable esculents in localities in which a knowledge of botany may tell us they ought to grow. The efforts of the fish commissioners in this and other parts of the country, in stocking the waters with the spawn of valuable species of fish, will undoubtedly largely increase the numbers of the finny denizens of our rivers and streams; but the labor of securing an abundant and readily obtainable supply is thus only begun, and it seems to us that it may be continued by every dweller in the rural districts having the simple facilities requisite for the construction and maintenance of suitable fish receptacles.

Artificial incubation and the stocking of private ponds are of course no novel idea. History tells us of the vast sums expended for such purposes during the decline of the Roman empire; and pisciculture, especially in the monasteries, seems to have flourished through the middle ages. The success which has attended all modern efforts in a similar direction, even in the propagation of the trout and other delicate species, leaves little doubt but that, at a very moderate outlay of time and money, every farmer could provide himself with a well stocked pond, which he would find a constant source of valuable remuneration.

Dr. J. H. Slack, the New Jersey Commissioner of Fisheries, writes to the *Tribune* a letter containing many useful hints relating to this subject. Referring to the preparation of the ponds, he says that two points must not be overlooked: proper proportions of the banks and freedom from surface water. For the former, with ordinary loam, the following proportions will be found correct: Let the base of the tank equal three times its hight, and let the width of the top equal the hight. Thus, if the tank be 10 feet high the base should be 30 feet and the width at the top 10 feet. The sluices and overflow should be made of stone laid in cement. Wood, it is stated, will rot very rapidly and prove of no value. The services of a competent engineer may be employed to advantage, and the money expended for such supervision will save much trouble and vexation. Surface water is a fertile source of trouble, as it carries with it brush and leaves, which clog the screens, allowing the contents to overflow and permitting the escape of the fishes. In most cases, a series of ditches, entirely surrounding the ponds, will carry off the surface water, a gate being placed at the head of the ponds with an opening only allowing as much water to enter as can be readily conducted away. At the sluice gates screens of wire gauze must be placed to prevent the egress of the fish. These should be made of galvanized wire if of large mesh, and of copper if fine. A screen of coarser mesh, placed a few inches up stream from the fish screen, will arrest much of the floating trash and prevent clogging. This second screen, called the leaf screen, should be placed at an angle of about 60° that a greater surface may be exposed to the water.

As regards stocking the tanks, it can hardly be expected that every farmer can enter into the careful operations of trout culture, but there are plenty of other varieties of fish suitable for food which may be easily and profitably reared. The ordinary cat fish (*pimelodus*) will thrive and breed in almost stagnant water, and is hardy and enduring. The female takes care of her young, which, for some weeks after they are hatched, follow her about as chickens do a hen. For large ponds, through which a gentle current can be made to flow, the best fish for the south is the southern bass (*grystes salmoides.*) It has a variety of names and is known also as the yellow and black bass, trout, chub, and growler. The adult fish is of a greenish brown color with a bluish black spot upon the gill, the young having in place of the spot from two to four longitudinal bars; the back fin is spinous and high, and the tail is similar to that of the trout. Besides the above two varieties mentioned as examples, there are scores equally valuable as food, some indigenous to northern, others to southern waters, which will probably suggest themselves to our readers interested in the subject.

The temperature of the water in the tank is an important matter, as fishes respire not water but air mingled with water. At the temperature of 50°, six cubic inches of air are contained in each gallon of aerated water, while at 212° none is present. With a supply of 1,000 gallons per minute at a temperature of 50°, fish could be maintained in a tank of about 8,000 cubic feet sufficient for a small village.

If the pond be well supplied with aquatic insects and plants, the fishes will need no food; but generally overstocking is the case and hence a certain quantity is required. Any kind of animal food, cooked or uncooked, is suitable; the entrails of fowls, lights of beef, oxen and hogs, if thrown in in small pieces, will be eaten with avidity. Curd or "smear kase" should only be given with animal food, being apt to cause disease. For the small fry of trout, the larvæ of the common mosquito are stated to form excellent nutriment, a better utilization, by the way, of that tormenting insect than the Yankee project of capturing them in large quantities and using their bodies as manure. It is estimated that about two barrels of rain water will be required for each thousand fry, the insects being strained out from time to time as fast as they are developed, and thrown into the trout pond.

A SHOWER of frogs, which darkened the air and covered the ground for a long distance, is the reported result of a recent rain storm at Kansas city, Mo.

THE RECENT ARCTIC EXPEDITION.

Secretary Robeson's report of the official investigation regarding the Polaris expedition, based upon the testimony of the survivors rescued from the ice floe, has at length been given to the public. As far as the record of the voyage extends, the account is substantially the same as that already published in detail in our columns. Considerable information, however, has been elicited regarding incidental topics and that bearing upon the mysterious portion of the recital, notably the death of Captain Hall; while that relating to the separation of ship and crew is of especial importance and interest.

The circumstances attending the decease of the commander are fully detailed, and as far as possible the statements of the witnesses reconciled and carefully compared. From all the testimony, the examining officials are inclined to reject the poisoning theory, so eagerly grasped by sensational journals, and arrive at the unanimous opinion that the death was due to natural causes. This view is qualified by the statement that none of the survivors are capable of giving an accurate account of Captain Hall's symptoms, nor of his last illness, and consequently the true state of the case must remain indefinite until the return of the Polaris. There seems little doubt but that the breaking adrift of the ship was purely the result of accident. The vessel was suddenly beset by a tremendous pressure of ice, which was driven against her from the southward, throwing her on her beam ends. To ease her, the provisions, stores, etc., were being removed when, during the darkness of the night and in a fierce gale, she parted her hawsers and disappeared. The sighting of the Polaris on the next day and her non-response to the signals of the abandoned crew, even when, from the distance intervening, they must have been clearly seen, are carefully considered. It is believed that, from a dispassionate point of view, the apparent indifference of those aboard must be ascribed to both inability and caution. The vessel had been so roughly handled the night before that both captain and crew might readily believe she would be lost; hence the removal of articles to the floe was attempted. Then when she broke adrift, her steam pipes, valves and connection were solid; and she was for hours without steam, unmanageable amid the floating ice. Moreover she was leaking badly and totally destitute of boats, so that it appears to have been the duty of the commander, Buddington, to get her in a place of safety, such as was the shelter of Northumberland Island, as speedily as possible. Furthermore, he knew that the ice party had boats and consequently could have believed their safety assured; and at all events, whatever his doubts might have been, a severe gale decided the question, driving the ice floe out of sight of ship and land. From this array of considerations, the final judgment is reached that the entire circumstances of the separation were accidental and unavoidable.

The Polaris, it is stated, had a broken stem and was leaky. She had plenty of provisions but not much coal, and probably remained in winter quarters at Northumberland Island. There is a difference of opinion as to whether she will be able to reach Upernavik or Disco under sail if she gets free this season, and it is believed that she will need assistance to escape from the ice.

The scientific results of the expedition are better than first imagined. The records of the astronomical, meteorological, magnetical, tidal and other departments are extremely full, and extensive collections of objects of natural history have been made. Specimens of drift wood were picked up near the shores of Newman's Bay, in which walnut, ash, and pine were recognized. The dip of the needle amounted to 45° and its duration to 96°, being less than at Port Foulke and Rensselaer Harbor, as given by Drs. Kane and Hayes. Auroras were frequent but not brilliant, consisting sometimes of one arch and sometimes of several. Streamers were quite rare and shooting stars almost constantly visible. The average of the rise and fall of the tide was about 5½ feet, and the greatest depth of water noted 100 fathoms. The existence of a constant current southward was also noted, its rapidity varying with the season and locality. The winter temperature was found much milder than was anticipated, the minimum being 58° below zero in January, though March proved to be the coldest month.

The open polar sea of Kane and Hayes was found to be a sound of considerable extent, and, it is believed, communicates with Francis Joseph Sound, and thus defines the northern limit of Greenland. Its length was not ascertained.

Pursuant to the recommendations of the investigating committee, the Secretary of the Navy has completed the purchase of the sealing steamer Tigress, the vessel which rescued the party on the ice field, and has ordered her prompt fitting out for a voyage in search of the Polaris. The Tigress is constructed especially for encountering the heavy ice of the arctic regions, and will be equipped in the most thorough manner so as to be ready for sea by the early part of July. She will be commanded by Commander James A. Greer, a well known officer of the navy. The Juniata, another naval vessel, has been got in readiness with the greatest rapidity and has sailed for Disco to carry supplies of coal and provisions for the Tigress, and also to seek information regarding the Polaris. The ship was fitted out at the navy yard in Brooklyn, and is heavily sheathed with iron. It is expected that she will return during the autumn, bringing the latest news and leaving the Tigress to penetrate to Northumberland Island.

"THE PIG IRONISTS IN COUNCIL" is the heading of a report, in the New York *Herald*, of the proceedings of a convention of gentlemen engaged in the iron trade, lately assembled at Cleveland, O. Rather a scaly sort of irony, that.

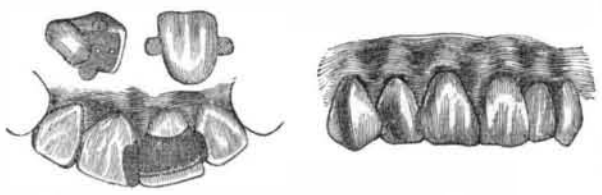
[Dental Cosmos.]

A Device in Dentistry.

The insertion of a porcelain tooth without a plate or clasps, and where no root remains, and where the remaining teeth are firm in their sockets, may be considered permanent when inserted as here illustrated. About two years ago an operation somewhat of this character was described in the *Dental Cosmos* by Dr. B. J. Bing, then practicing in Paris, now in London.

A patient who disliked the wearing of a plate, and desired something different, presented, when the operation now to be described was decided upon and performed. After forming appropriate cavities in the proximate surfaces of the teeth next the space left from the loss of the natural tooth, an impression was taken and a plain porcelain tooth selected, fitted to the parts and backed with gold, a portion of the backing extending from each side about one and a half lines, for insertion into the cavities prepared for them in the adjoining teeth. A small gold plate was then formed to fit upon the gum, covering as much of it as would embrace the neck of the natural tooth were it in position. The backing when riveted to the porcelain was then adapted to the position in which it was to be placed; and while the whole rested on the small plate upon the gum, the backing and plate were so secured by a cement that they could be removed intact, and, after the usual preparation, soldered. The surface of the extended sides of the backing was roughened, so that the gold would better secure them when filled into every part.

This being done, a thin piece of rubber coffer dam was placed on the adjoining teeth and over the gum upon which the porcelain, with the gold attachments, was to rest. The rubber occupies but little space, and, when ligated to the teeth adjoining, so presses up the gum that its thickness is more than compensated for. The porcelain, with its attachments, was then placed in position, and secured firmly by the solid impactation of small pieces of light cohesive gold foil around that portion of the plate extending into the cavities.



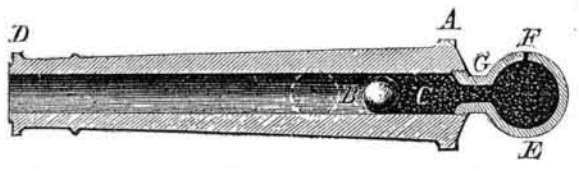
The parts when in position appear as here illustrated, the gold backing and fillings showing plainly on the palatine surface, while on the labial no gold is exposed to view, excepting a small portion of the filling in the lateral incisor. The porcelain and gold attachments as prepared for insertion are also shown. It will be seen that the cavity in the central incisor was formed to the cutting edge of the tooth. This was done to gain access to both sides of the plate extended into the cavity, which could not otherwise be done unless a portion of the labial surface were cut away, which would have been objectionable in consequence of the exposure of gold. In the lateral incisor this was deemed necessary, because, being smaller than the other, it was thought best not to cut it away in the same manner. It was so arranged, however, that though the filling can be seen, it is not conspicuous.

A Curiosity of Old Times.

In the *Mechanic's Magazine* of January, 1824, we find the following curious communication:

PROPOSAL FOR INCREASING THE STRENGTH OF GUNPOWDER.

A D is a longitudinal section of a great gun; C, the cartridge; B, the ball; E, a hollow metal sphere, similar to a



bombshell or hand grenade, with a hollow neck or tube, G, which screws into the breech of the gun: F, the touch hole.

The design is that the ignited powder in the shell shall throw a quantity of flame suddenly into the gun, and explode every grain of the cartridge powder. It is not, however, meant that preventing any of the powder from being blown out unignited is to give the additional force; on the contrary, it is certain that the expansive power of explosive mixtures is as the quantity of flame suddenly formed by them, particularly in confined situations, where the flame is supplied with matter from the combustible substance itself only. In proof of this, let flame be communicated to the powder of a charged gun, by firing a pistol containing powder only into its touch hole, and the result will be found to be, that the momentum of the ball from the gun will be much greater than if the same quantity of powder as that fired from the pistol had been added to the cartridge in the gun, and the whole exploded in the customary manner. This I ascertained by experiment nearly ten years since. The thing is now put beyond all manner of doubt, from the discharge of guns being effected by detonating copper caps. Sportsmen, using the same, declare that a less quantity of powder produces an equal effect to a greater quantity without these caps. It may be necessary to add, that trials are indispensable to ascertain the maximum of the size of the shell, E, and of the quantity of powder it should contain to be safe and most efficient.

Query.—Might not the guns of forts be constructed so as to slide backwards and forwards on *fixed* but *centered* carriages, by which much fatigue would be avoided by the men?

Chatham. J. H. PASLEY.

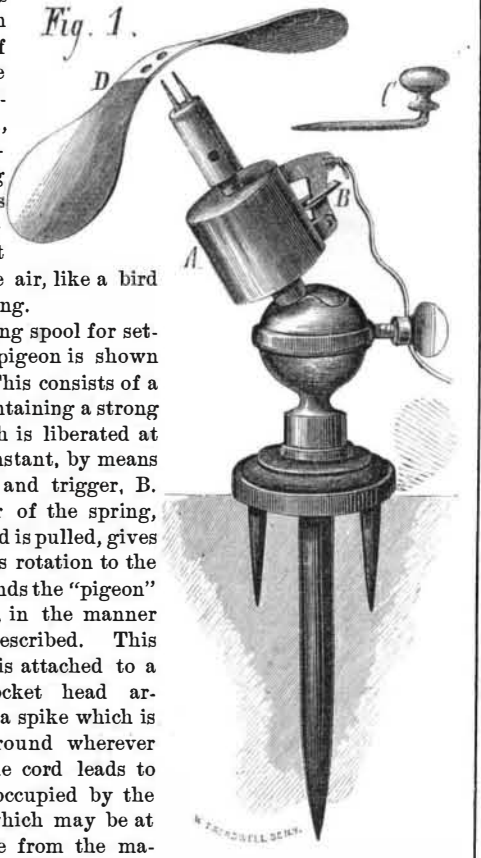
THE MECHANICAL PIGEON.

To attain dexterity in the shooting of birds upon the wing, it has been the practice of sportsmen to make use of live pigeons, which are placed in suitable cages, from which, by a string, they are liberated at the desired moment, to be needlessly shot down by the gunner. The great cruelty of this sport has led to the invention of what is termed the mechanical pigeon, the construction and operation of which is illustrated in the accompanying engravings.

The mechanical pigeon consists of a thin strip of sheet iron, six inches or more in length, having wings bent somewhat like the blades of a screw propeller, as shown at D, Fig. 1. When rapid rotation is given to this propeller, it rises high in the air, the wings are seen to flicker or vibrate, and its whole appearance resembles a flying bird.

To effect the aërial flight of the mechanical pigeon, two methods are employed. One of these, shown in Fig. 2, consists of a spool, A, mounted on a handle, thei spool being turned with great rapidity by the application of force to the cord, as shown. Upon the forks of the spool the pigeon is centered, and, when a proper rotating velocity is communicated, away it sails into the air, like a bird upon the wing.

Fig. 1.

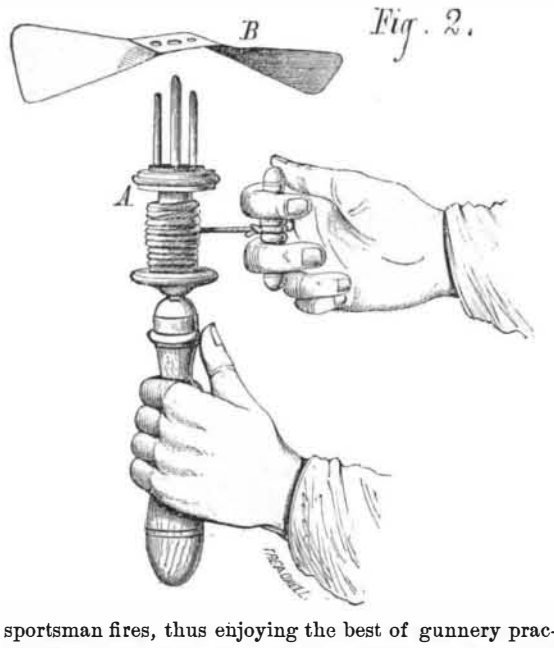


A self-acting spool for setting off the pigeon is shown in Fig. 1. This consists of a barrel, A, containing a strong spring, which is liberated at the proper instant, by means of the cord and trigger, B.

The power of the spring, when the cord is pulled, gives instantaneous rotation to the forks, and sends the "pigeon" into the air, in the manner previously described. This spring spool is attached to a ball and socket head arranged upon a spike which is set in the ground wherever desired. The cord leads to the position occupied by the sportsmen, which may be at some distance from the machine, as shown in Fig. 3.

When the trigger is pulled, the mechanical pigeon flies and

Fig. 2.



the sportsman fires, thus enjoying the best of gunnery practice without cruelty to innocent birds. If a shot strikes the mechanical pigeon, its direction is changed, and it falls to the ground. This contrivance has become an extensive article of sporting merchandize.—*Science Record for* 1873.

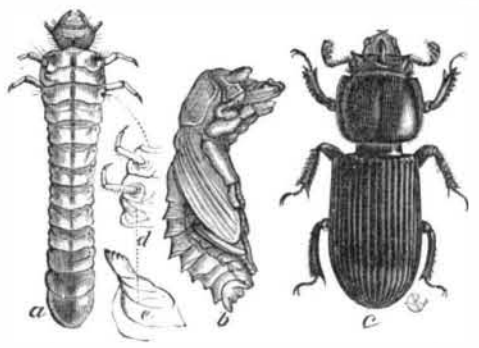
[From the Fourth Annual Report of Charles V. Riley, State Entomologist of Missouri.]

THE COMMON BEETLE.

Many an one will doubtless recognize, in the insect illustrated herewith, the bug with which he or she, as a child, was wont to play at "oxen," the curved horn on the head forming such an inviting projection on which to hitch, by means of a thread, small chips and other diminutive objects, to be dragged by the rather awkward beast of burden. Every pioneer in this Western country, as he rolled over huge decayed logs, in the work of clearing his land to make it ready for the plow, must have become familiar with this highly polished coal-black beetle. Every woodsman who has split or grubbed an old stump will be likely to recognize in this horned bug an old acquaintance. Every entomologist who has dug into or pulled to pieces old rotting stumps, in search for other treasures, must time and again have seen this lazy, clumsy *passalus* tumbling down with the loose and crumbling dust and excreta of its own making, and expressing its disapproval of such summary disturbance, in the plainest manner, by emitting a peculiar half hissing, half creaking noise. And though met with at almost every step in his forest rambles,

Where wild birds sing beneath the leafy bowers,

the inquisitive student has no doubt found himself repeatedly examining specimens, not only to admire the elegance and beauty of form, but to ascertain the means by which the peculiar noise is produced. A sufficiently careful examination



The Horned Passalus—*Passalus cornutus*, Fabr. (Coleoptera, Lucanidæ.)

will end in the knowledge that it is caused by the rubbing of the rather horny terminal joints of the abdomen, known as the *pygidium*, against the inside of the hard wing covers.

This insect cannot be considered injurious in any sense of the word, and might with propriety be introduced in the section of "Beneficial Insects." It is never found in sound or green wood, but invariably in that which is decaying, and it very materially assists and hastens the reduction of stumps which might otherwise remain treble the length of time, to occupy valuable ground and serve as an eye sore to the careful farmer in wooded countries. Unseen and unheard it carries on incessantly the good work of converting useless timber into mold which enriches the soil; and this has been its office in all the past ages of its existence. A decaying, moist condition of the wood is necessary to its development, and it will be found most common on low moist ground, and in oak, hickory, and sweet gum logs or stumps.

Common as is this beetle, its larva and pupa are rarely seen, and seem to be unknown even to most entomobgists, while no good figures of them have been published.

The larva, *a*, is of a very exceptional character, being the only one in this country which possesses but four well developed legs, for though many butterflies in the imago state have the front pair functionally impotent, no other insect than our *passalus* exhibits a similar feature in the larva state. Indeed the only other larvæ in the whole class of insects which are similarly characterized are those belonging to the same genus in other parts of the world. The third pair of legs really exists, however, in a rudimentary state, as shown at *a*. This larva is of a bluish white color with the anterior joints broader and flatter than the rest. It transforms in the fall of the year, within the wood it inhabits, to a whitish pupa, *b*, in which the front pair of legs is thrown forward under the head, and the horns of the future beetle show plainly on its top. The pupa lasts but about a fortnight, when, throwing off the pupa garb, it becomes a perfect beetle. At first the parts are all beautifully white and delicate; then the head, thorax, and limbs gradually become amber brown, and lastly the wing covers assume this color. The whole body then deepens very gradually so that many days elapse before the coal black color is acquired; and in the month of August the beetle is as often found brown as black. As larvæ only half grown are found in company with those that are full grown, they require at least two years to mature.

Progress of Plated Ware Manufacture.

By many the plated goods are preferred, not only on account of the difference in cost, but because the design and appearance of the goods are nearly identical with the solid ware. The Meriden Britannia Company confine their attention mainly to the manufacture of nickel silver and white metal silver plated goods. The company was established in 1852, at West Meriden, Conn., where they now occupy five acres of ground, and have eight factories, the largest of which is seven hundred feet long, presenting an imposing appearance. The capital invested is more than $2,00,000 and the capacity of the works about $4,000,000 yearly. The company employ 700 men.