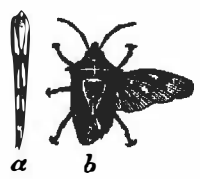
class of beetle it belongs to, with its proper name. It seems to be a new discovery. I have not had time to watch it very much, but have seen it kill two bugs in ten minutes. Seems to destroy the most from three o'clock P. M. until dark. Would be pleased to have an answer through your paper.

Sandusky, Iowa. F. A. WHITNEY.

The rust-gray, angular, and somewhat flattened animal referred to in the above letter is not a beetle, but a genuine bug(order, *heteroptera;* family, *scutellerida*), popularly known by the name of the spined soldier-bug (*arma spinosa dallas*). It is an old acquaintance, and every reading farmer protects it as far as possible in his warfare with the potato beetle.

The specimen sent by Mr. Whitney was a female, and had just laid 22 eggs by the way. These eggs are pretty little cauldron-shaped objects, with a convex lid, around which ciliate from 15 to 20 delicate white spines. The color of the egg is at first pale bluish gray, but the shell being translucent, the black and red colors of the embryo within soon show through it, and give the egg a bronze hue. Carefully examined, the surface is seen to be studded, especially on the convex lid, with what, under the microscope, appear like blunt spines, and which give the egg a slightly specked appearance to the naked eye. The convex lid opens with a spring of marvelous delicacy, when the hatching period arrives.

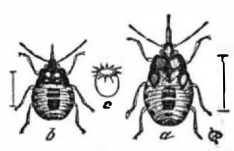


SPINED SOLDIER-BUG—*a*, enlarged beak; *b*, bug with right wings expanded.

These eggs are neatly placed side by side, in clusters of a dozen or more, upon leaves and other objects, and are so much subject to the attacks of a minute hymenopterous parasite, that those who undertake to hatch such as are found out-doors will more often get flies than bugs.

The newly hatched bugs are broadly ovoid and swollen-backed creatures, which congregate together, and look quite unlike the parent. The color is polished black, except the abdomen, which is crimson, with transverse black bars on the middle of the back and at the sides.

In the full-grown larva, the black still predominates on the thorax, but some four yellowish spots appear, and the abdomen becomes more yellowish, though still tinted with red. In the pupa, which is readily distinguished by the little wing-pads, the ochreous-yellow extends still more, and finally, with the last molt, the black disappears entirely in the perfect insect. Throughout the immature stages the shoulders are rounded, and not pointed, and the antennæ, or feelers, have but four joints, instead of five as in the mature bug, while there are but two visible joints to the feet, or tarsi, instead of three.



SPINED SOLDIER-BUG.—*c*, egg; *b*, larva; *u*, pupa.

The writer thus speaks of this gallant little fellow in his work on "Potato Pests":

"This is one of the most common and efficient of doryphora's enemies, occurring in all parts of the country, and seeming to have a decided fondness for our potato-destroyer, especially for the soft larva. . . . Thrusting forward his long and stout beak, he sticks it into his victim, and in a short time pumps out all the juices of its body and throws away the empty skin.

"We have been taught to admire the muscular power of the lion, which is enabled to grip and toss an animal larger than itself with its powerful neck and jaws; but feats performed by these young soldier-bugs throw the lion's strength completely into the shade, for they may be often seen running nimbly with a doryphora larva, four or five times their own size, held high in air upon their outstretched beak.

"The spined soldier-bug by no means confines himself to potato-beetle larvæ, but attacks a great number of other insects."

Water Pipe Pressures.

A series of important experiments, having for their object the settlement of several important questions in connection with the extinction of fires, were carried out at Grays on behalf of the Metropolitan Board of Works by Sir Joseph Bazalgette and Messrs. Branwell and Easton, C.E. The experiments were classed under three heads, the first being to test the effect produced by a pressure of 40 feet (that being the greatest height above road level to which the East London Waterworks Company are required to deliver water under their Act), using various lengths of hose and sizes of jets. The second was to test the effect of varying pressures under differing conditions of hose and jets. The third was to experiment with jets of great height. The basis from which the experiments started was the assumption that the value of a jet for extinguishing fires will be according to the height to which it can be thrown and to the quantity of water delivered, both of which depend on the elevation or head of reservoir, the lengths and sizes of the mains and pipes, and the dimensions of the hose and jet. Thus three things had to be considered—namely, the pipe friction, the hose friction, and the ratio between the height of the jet and the pressure immediately producing it. The results of the experiments proved that in overcoming the friction due to driving 600 gallons of water per minute through one-eighth of a mile of 4-inch pipe, 225 feet of pressure would be exhausted. If these 600 gallons were separated into the four jets of 150 gallons, each with their 200 feet of hose, there must be added to the 225 feet the loss of 55 feet in delivering 150 gallons per minute; and to throw that quantity to a height of 50 feet by jet would exhaust a further 80 feet of pressure. The inevitable conclusion, therefore, is that to deliver these quantities through the stated lengths of pipe and hose, and to throw it to a height of 50 feet, would exhaust a pressure of 360 feet. It may be as well here to observe that one-eighth of a mile of 4-inch pipe appears to be a very long length for the delivery of so large a quantity of water, and, as shown by the second experiment, the reduction of the quantity of water to one-half reduced the pressure from 250 feet to 63 feet, 6 inches. A proportionate enlargement of the pipes to deliver the larger quantity of water would effect an equivalent reduction of pressure, so that with high pressures it is clear that at the same time there must be pipes of sufficient size not only for the delivery of water extinguishing fires, but also, at the same time, for supplying the domestic requirements of the surrounding district. It must also be borne in mind that if these high pressures are introduced into the metropolitan district, the whole of the house pipes and fittings must be strengthened so as to be able to withstand them. The cost of that alone has been estimated by Mr. Muir, of the New River Water Company, at £40 per house. As there are about 400,000 houses to be dealt with, that means an expenditure of somewhere about four millions of money.—*London Building News.*

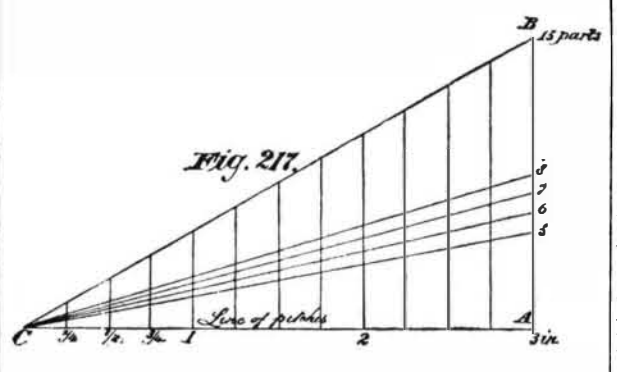
PRACTICAL MECHANISM.

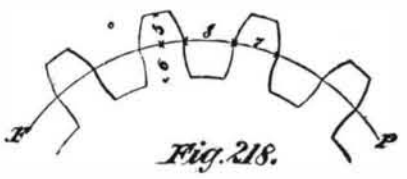
BY JOSHUA ROSE.

NEW SERIES—No. XXX.

PATTERN-MAKING.—WHEEL SCALE.

The accompanying illustration (Fig. 217) represents a very serviceable article for those who may be called upon to lay out gearing. It is not new to the mechanical world, but as the author never happened to meet with but one man who actually had made himself a scale of this kind, he considers it will prove a novelty to a large class of the readers of THE SCIENTIFIC AMERICAN.





Draw the lines AB and AC at right angles to each other. Make AB equal to three inches; the line AC may be any convenient length, say six inches, as by observing this proportion the scale will be in addition a very useful set square with the angles at B and C 60° and 30° respectively. Join BC; divide AB into 15 parts; from C draw lines to the fifth, sixth, seventh and eighth part, as in the figure. Divide AC into as many parts as there are inches in AB, number the divisions, and erect perpendiculars to AC. These are for the even inch pitches. To make the scale serviceable for the fractional parts, divide and subdivide again, and erect a perpendicular at each division. This process in our figure is carried out to quarter inches. It may, however, be further extended, if desired; but inasmuch as it is so little trouble to draw a perpendicular at any time for any fractional pitch required, it may be preferred by some that the scale should not be overcrowded with lines.

Brass is probably the most suitable material, as it takes the lines readily, does not oxidize, and is sufficiently hard to stand considerable wear.

The method of using this scale will be clear from the following example. Let O, Fig. 2, be the center of a tooth wheel or pinion, and PP the pitch circle, which we will suppose already divided off, and that the pitch is one inch; on the perpendicular marked take with the compasses the distance up to line 5, and set this off outside the pitch for the tops of the teeth; on the same perpendicular take the distance up to line 6, and mark this inside the pitch circle for the roots of the teeth. With center, O, and the points so found as distances, describe circles.

Make the thickness of the tooth equal to the distance on the scale up to line 7; the width of the space will then be equal to the distance up to line 8—all of course measured from the base line, AC.

Scales upon this principle may be made to accommodate any preferred proportions of the teeth of wheels.

Naphtha Explosions.

At noon, May 28th, an explosion and fire occurred on a barge which was discharging naphtha in front of the pier of the Metropolitan Gas Company, on the North River, near New York city. There had been about 95 barrels in the cargo, of which about one-half was pumped into a receiving tank, and the accident occurred just as the engineer, who was on the pier, was about starting the donkey pumps for work, after the dinner hour. The captain of the barge and two men were killed, and the engineer seriously injured. The barge and pier were damaged to an amount of about $3,000, but the receiving tank, which was not far off, most fortunately escaped. It was unusual to receive the naphtha in barrels—it generally having been sent in bulk, and pumped to this same receiving tank. Possibly a pipe or match used by one of the men killed ignited the inflammable gas evolved from the naphtha, or a spark may have originated from the iron implement used to remove the bungs, striking a nail.

June 2d, an explosion took place at the residence of C. B. Shoemaker, 1504 Swain street, Philadelphia. Mr. S. had procured five gallons of "benzine" to use as a moth preventive, and, with a watering-pot, had sprinkled the carpet and furniture of the parlor with the fluid. At 8·45 A.M., Mrs. Shoemaker and Mary Hall being in the parlor, a violent explosion occurred in the lower rooms, setting fire to the clothing of the two ladies, and causing the death of Miss Hall at noon of the same day, and of Mrs. Shoemaker about midnight of June 3d. The benzine in the can held by Mr. Shoemaker, in the second story at the time, did not ignite. There was no fire either in the parlor or dining room, and the only theory which seems possible is, that the volatile gas extending through the dining room to the kitchen—a distance of about 40 feet—and forming an explosive mixture with the air, ignited at the range in the kitchen.

At the coroner's inquest it was shown that Mr. Shoemaker had for four years past used benzine in a similiar way without accident. The can in the present case was labeled "Parlor Oil, Non explosive." The portion remaining in the can, upon being analyzed by Shippen Wallace, chemist, was found to be "a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha." The specific gravity was only 75° Baumé. In his testimony, Mr. Wallace said:

"It is extremely volatile, giving off inflammable vapors at the ordinary temperature, and can be ignited when a flame is held within half an inch of it. By submitting the fluid to distillation, I succeeded in obtaining 64 per cent below the temperature of 170° F., and the balance between that and 205°. In the process of refining petroleum, the oil coming over from the still at a temperature below 170° F. is termed gasoline, and has a specific gravity from 80° to 90° B.; I would therefore call the fluid a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha. By the name 'naphtha' is, at the present time, by chemical writers, embraced most of the inflammable liquids produced by the dry distillation of organic substances; commercially, as applied to the products of petroleum coming from the still, between 150° and 278°, and having a specific gravity of 71°–76° B., while the liquid obtained below 150°, and which generally has a specific gravity of 80° to 90°, is termed gasoline."—*American Exchange and Review.*

Priming.

Never prime a piece of wood, especially hard wood, unless certain there is no moisture in it. Run all wheels out in the sun, or dry by artificial heat before priming, and if painted as described in hurried work, they will not scale, crack, nor blister. Use more or less oil, according to the time required for finishing; on slow work oil will take the place of varnish. Do not put on one coat and let it stand a long time without sanding, and never put a thick coat on bone dry work. A job painted in this way, with an extra coat of rubbing varnish, allowed to stand a week or more, then rubbed out and well varnished, and kept away from mud and water for one month, will hold its gloss equal to oil work, and will not crack nor have the small-pox, and come off generally. If necessary to hurry it still more, use more japan and varnish and less oil, thinning well with turpentine.

Do not put a dry flat coat on glossy oil, nor *vice versa.* Be sure your job is free from moisture, so that it will drink in the priming. Make your priming thin enough with turpentine, so that it is drink and not victuals. Make each coat as near like the last as possible, put them on as soon as dry, and they will form one solid coating; then if you have time, let them thoroughly dry before varnishing. For wood work to keep in stock a long time, prime with best pail lead, boiled oil and a little turpentine.—*Carriage Monthly.*

A Steel-Clad Bullet-Proof Car.

A car of this sort has recently been constructed at York, Pa., for the Spanish Government, for use in Cuba. The steel slides, which are pierced with loopholes for musketry, and which take the place of windows, have been so cunningly planned by the painter's skill to resemble the decorated ground-glass sometimes used in cars, as to deceive the unwary at a little distance. The car is 31 feet long, 8 feet wide, of the usual height, and is mounted on the Pennsylvania Railroad standard passenger car truck. Its weight is about 24,000 lbs. No finer work of the kind has ever been made.