

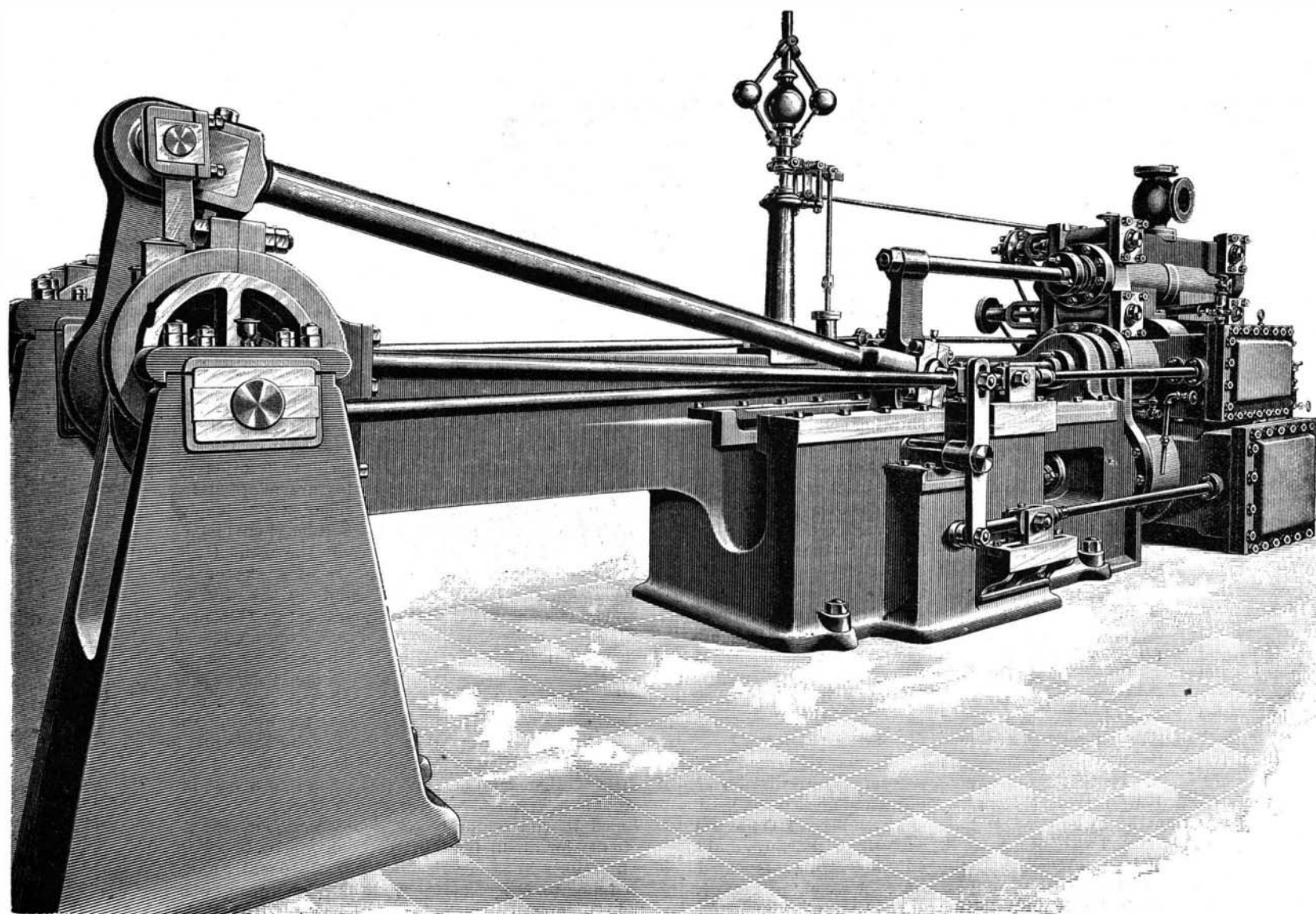
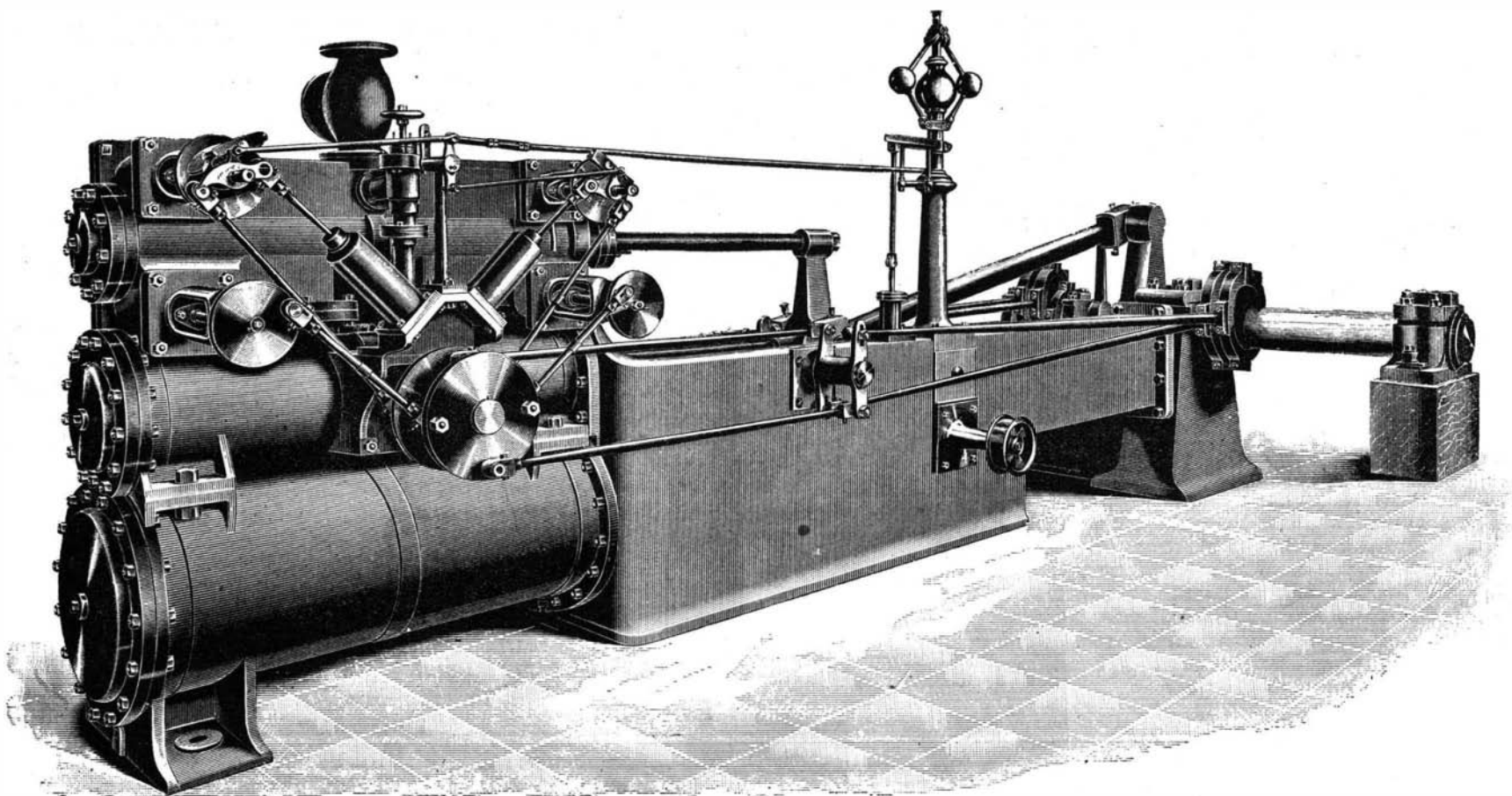
## TRIPLE EXPANSION ENGINE.

We illustrate a novel construction of a triple expansion engine constructed by Cole, Marchant & Co., of Bradford, to the designs of Rhodes & Critchley, of Bradford, and given in a recent number of *Engineering*. The three cylinders are placed one above the other, and all the piston rods are connected to one and the same crosshead. This arrangement was adopted on account of the limited space at the disposal of the designers, the engine house being only 30 feet in length

back bonnets. The disks on which are mounted the tripping arrangements are made of wrought iron forged plates. The pawl is of steel, and is fitted with a steel pin 1 in. in diameter; on the same axis is also fitted the cam and lever for tripping the pawl, which is of steel casehardened. The wrist plates are of cast iron bushed with steel liners and fitted with  $1\frac{3}{8}$  in. steel casehardened pins. The details of construction of this trip gear, which is the designers' special pattern, are clearly shown by the engravings.

high pressure cylinder,  $3\frac{1}{4}$  in. for the intermediate pressure cylinder, and  $3\frac{1}{2}$  in. for the low pressure cylinder.

The crosshead is fitted with a steel gudgeon  $5\frac{1}{2}$  in. in diameter in the body and  $4\frac{3}{4}$  in. in diameter in the necks, with outer necks  $2\frac{1}{2}$  in. in diameter by  $2\frac{1}{2}$  in. long, for the air pump links. The connecting rod is 10 ft. long,  $4\frac{1}{2}$  in. in diameter at the crosshead end,  $4\frac{3}{4}$  in. in diameter at butt end, and  $5\frac{1}{2}$  in. in diameter in the center, forked at the crosshead end and solid at



## IMPROVED TRIPLE EXPANSION ENGINES, WITH CORLISS VALVE GEAR.

by 8 ft. 9 in. in width. The cylinders are  $8\frac{1}{4}$  in.,  $13\frac{1}{4}$  in., and 21 in. in diameter respectively, with a stroke of 4 ft. The crosshead has been made very strong, of cast steel, and has slide blocks  $2\frac{1}{2}$  in. in thickness, and of a length equal to the distance from the center of the high pressure piston to the center of the low pressure piston.

The valves of the high pressure cylinder are of the Corliss type, the steam boxes being 10 in. long by  $4\frac{1}{2}$  in. in diameter, and the exhaust boxes 5 in. in diameter. The valves are made to draw out through the

The intermediate cylinder is fitted with two slides and cut-off plates, worked directly by eccentrics  $2\frac{1}{2}$  in. wide on the drag shaft. These valves can be regulated to cut off earlier or later as required to equalize the amount of work done by the respective cylinders. In order to facilitate the adjustment of the valves the cut-off spindle has a screw index and wheel.

The low pressure cylinder is fitted with an ordinary slide valve worked also by an eccentric on the drag shaft. The pistons are all on Buckley's principle. The steel piston rods are 3 in. in diameter for the

the butt end. The fork end is fitted with a wrought iron cap and four  $1\frac{1}{4}$  in. bolts and lock nuts. The butt end is fitted with a steel block, die, and brasses, with  $1\frac{1}{4}$  in. steel adjustment screw.

The crank is 6 in. broad, turned and polished all over, and fitted with a steel pin  $4\frac{3}{4}$  in. in diameter by 6 in. long, with an outer neck for the drag crank. The crankshaft is 9 in. in diameter in the body and  $8\frac{1}{2}$  in. in diameter by 14 in. long in the bearing for the crank pedestal, and 10 in. in diameter for flywheel.

The eccentric rod which drives the low pressure



valve is coupled to a lever mounted on a rocking shaft fixed in adjustable phosphor bronze bearings. The eccentric rods for driving the Corliss wrist plates are hung on two two-armed rocking levers mounted on a 4 in. cast iron stud pin, which is bolted to the bed plate.

The air pump already in the engine house was used again. A cast iron liner was put in, 15½ in. in diameter. This pump is not shown in the engravings, but is of the vertical type, and is worked from links connected to the crosshead. The stroke is 18 in.

#### THE VENOMOUS SERPENTS OR TOXICOPHIDIA OF THE UNITED STATES.

The rattlesnakes, family *Crotalidae*: In genus *Crotalus*, the true rattlesnakes, the head above is covered with small scales. (See Fig. 1.) The species are: 1. Eastern or mountain rattlesnake, *Crotalus horridus*. It is found from Maine to Arkansas and Texas. It varies greatly in color, being found dark brown, nearly black, to pale sulphur yellow with ashy gray bands. 2. The diamond or Southern swamp rattlesnake, *Crotalus adamanteus*. It inhabits North Carolina to Florida. There are several varieties of this repulsive serpent, which from time to time have been described as new species; variety *atrox* is found from Texas to California; variety *scutulatus* in Arizona. 3. Western rattlesnake, *Crotalus confluentus*, habitat Nebraska to Oregon, south to Texas and New Mexico. The red rattlesnake, *C. pyrrhus*, of Arizona, seems to be a local variety. 4. The bull-dog rattlesnake, *Crotalus molossus*, of which the U. S. Museum, at Washington, contains only three specimens, one each from Arizona, Texas, and Mexico, is nearly related to the harsh rattlesnake, *C. durissus*, of Mexico and South America, and may be a variety of the latter. 5. The horned rattlesnake, *Crotalus cerastes*, found from Colorado to California and south to Mexico. 6. The tiger rattlesnake, *Crotalus tigris*, found in New Mexico and Arizona. The St. Lucas rattlesnake, *C. enyo*, bears a close relationship to *molossus* and *durissus*, and it is doubtful if it may be called a distinct species. Four specimens from Lower California are in the United States Museum. 7. The lucifer rattlesnake, *Crotalus lucifer*, bears a near resemblance to the diamond rattlesnake variety *atrox*. It is possible that the Oregon rattlesnake, *C. oregonus*, described by Dr. Holbrook, is the young of this species. His faded type specimen in the collection of Academy of Natural Sciences, Philadelphia, measures about a foot in length, and the tail has but one button, which proves it to be quite immature. *C. lucifer* has been found in Oregon, California, and Arizona. Mitchell's rattlesnake, *C. Mitchellii*, is founded on one individual from Lower California. It is a doubtful species, resembling *lucifer* and *atrox*. 8. Kennicott's asp or rattlesnake, *Aploaspis lepidota*, from the Rio Grande, Texas, has been described from two alcoholic specimens of heads only, and requires further study.

The second group of rattlesnakes belongs to the genus *Crotalophorus* of Gray, 1825. Linnaeus in 1735 first gave the name *Caudisona* to all the known rattlesnakes; but subsequently rejected it, and in 1749 adopted *Crotalophorus*. In 1754, and subsequently, he placed all the rattlesnakes in the genus *Crotalus*. Laurenti in 1768 adopted the genus *Caudisona* for the rattlesnakes. Gray in 1825 placed the rattlers with large plates on the head in the genus *Crotalophorus*; one year later, 1826, Fitzinger proposed *Caudisona* for the same group; therefore, Gray's genus *Crotalophorus* (a rattle bearer) should be retained. This family of rattlesnakes have the upper surface of the head covered with nine

large plates, as seen in many non-venomous serpents. (See Fig. 2.) 9. Massasauga or prairie rattlesnake, *Crotalophorus tergeminus*. In 1854, Prof. Baird collected several specimens in a white cedar swamp at Byron, Genesee Co., N. Y. "Nessmuk," in *Forest and Stream*, says he observed it in a tamarack swamp, fourteen miles south of Brockport, N. Y. From New York its range extends westward to Utah and Montana, and from Ontario, Canada, south to Georgia. Edwards' rattlesnake, *C. Edwardsii*, although described as a native of Texas and Mexico, has lately been found in company with the massasauga in Bruce Co., Ontario. It seems to be only a variety between the prairie rattler and the following. 10. Southern ground rattlesnake, *Crotalophorus miliarius*, is found

opportunity to identify his specimen. I can find no records of it occurring north of the State of North Carolina. The mountain moccasin, variety *atrofuscus*, is found in the mountains of North Carolina and Tennessee. The Texan moccasin, variety *pugnax*, occurs in Texas only.

In the harlequin snakes, *Elaps*, the neck is not contracted as in the foregoing genera, but in most cases is continuous with the head and body. (See Fig. 4.) The upper jaw on each side is furnished with a small erect grooved fang. They are small snakes, not generally much over two feet in length, and are beautifully annulated with carmine red, black, and yellow rings. Although belonging to the same family as the dreaded cobra of India, they are generally considered harmless, and it is said they never attempt to bite, even though handled. Audubon says that formerly it was the fashion for Indian girls of Florida to decorate their hair with these brilliant little serpents; and in many places they are known as "bead snakes."

13. The common harlequin snake, *Elaps fulvius*, is found from South Carolina to Florida and Texas. Variety *tener*, of Baird and Girard, occurs in Texas, Mexico, and Florida. 14. Kennicott's harlequin snake, *Elaps euryxanthus*, inhabits Arizona and Mexico. *E. distans* has been found in Mexico and Florida; it appears to be merely a variety of *fulvius*, and not a distinct species.

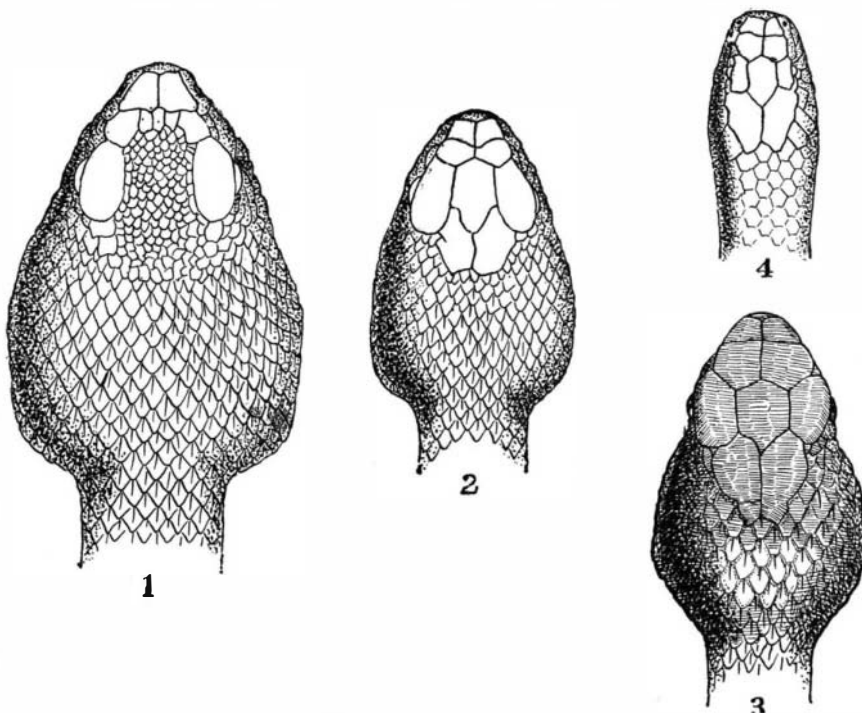
The above list includes all the well-founded species of venomous serpents found in the United States; and it is not probable that many more names will be added in the future, as all the States and Territories have been well ransacked with the hope of finding "new species."

In nearly every section of country the natives will point out snakes which they "know for certain are awful poisonous," but which are, in reality, as harmless as a duckling. Take the hog-nosed snake or "blowing viper," *Heterodon platyrhinus*, for example; in one part of the country the rustic will declare to you that "that wiper am fearful venomous," while in another section you will be informed that it is "a hog snake and ain't poisonous." By the way, this snake varies greatly in color, being found uniform black to pale yellowish brown with brown blotches. It can always be distinguished by its turned-up, hog-like snout and the manner in which it can flatten or spread itself and blow when approached. By some it is called "the spreading adder."

It is often a very repulsive and formidable-looking snake, and the additional fact that the posterior teeth in the upper jaw are long and fang-like has caused even educated persons to consider it venomous. Sometimes it has a curious habit of feigning death when pushed about with a stick or your foot—a habit which

I have not observed in any other snake. At such times it throws itself over, assumes a *rigor mortis*, dislocates the lower jaw, becomes motionless, and to all outward appearances seeming as though the last spark of life had vanished. The unknowing person would imagine that a very tender spot had been touched which caused instant death. But when it sees the intruder at a safe distance—a snake always sleeps and dies with its eyes open—it quickly glides away to a place of safety. I know one instance where one of them permitted itself to be completely buried in sand without showing the least sign of life, but after a few minutes, when it supposed the unwelcome visitor had left, slowly pushed its head out of the sand, and not seeing the hidden yet observing enemy, slowly crawled out and began moving off.

The common garter or ribbon snake is rightly considered harmless, and yet the following clipping from a South-



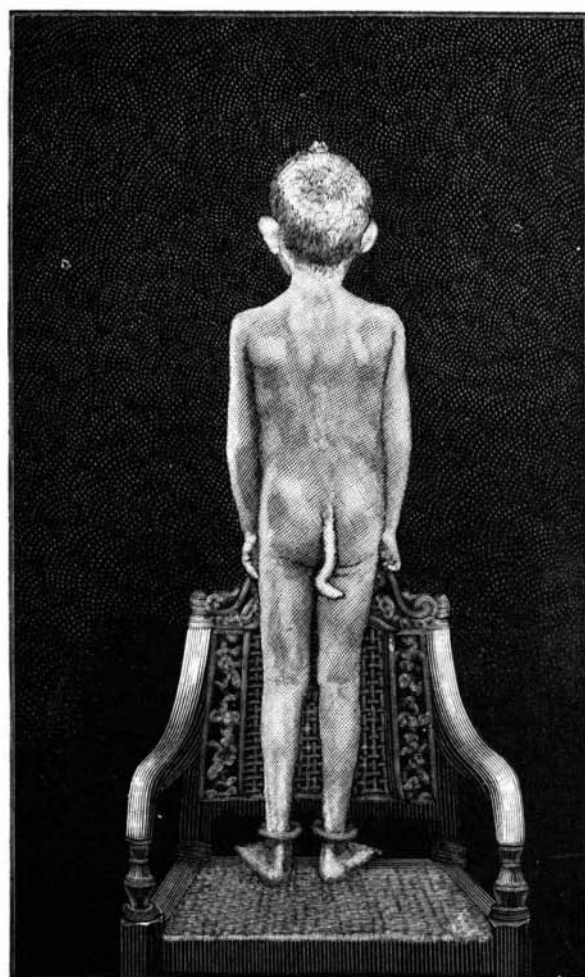
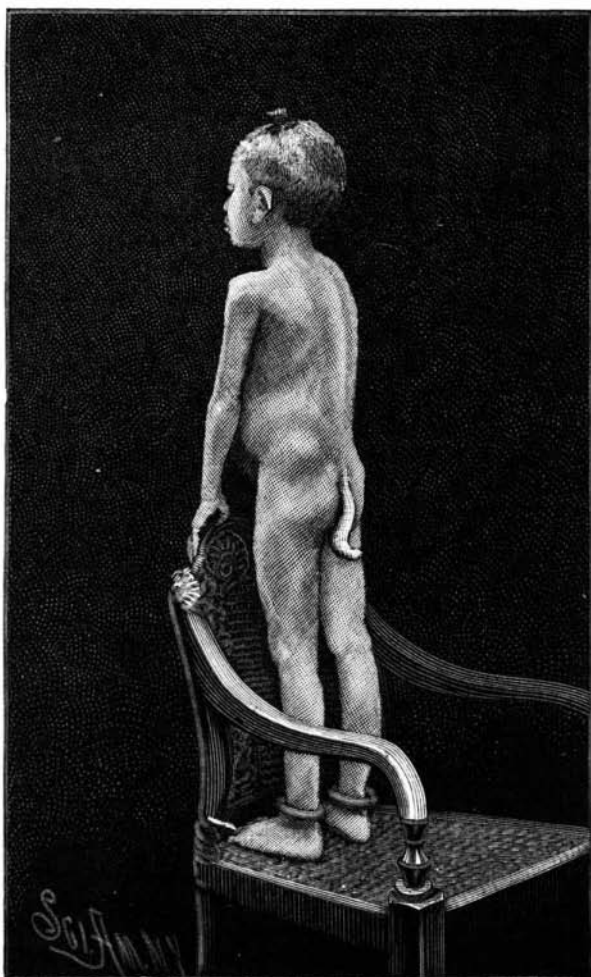
1. Eastern rattlesnake. 2. Massasauga. 3. Water moccasin. 4. Harlequin snake.

#### POISONOUS SERPENTS OF THE UNITED STATES.

from North Carolina to New Mexico, and southward. *C. consors* is an accidental variety from Texas.

To *Ancistrodon* belong the pit vipers without the rattle—the copperhead and moccasins. (See Fig. 3.)

11. The copperhead, *Ancistrodon contortrix*, has been found from Vermont to Florida, and westward to Kansas. 12. The water moccasin, *A. piscivorus*, is said to be found from North Carolina to the Gulf, and westward to Texas and Arkansas. Two years ago an ornithologist captured what he declared to be a true moccasin in a swamp in southern New Jersey. He sold the specimen to a dealer in objects of natural history. When I called to examine it, I found it had been bought by some unknown person, and all trace of it was lost. Mr. G. was a member of the Philadelphia Academy of Natural Sciences, and had ample



A MOI BOY WITH TAIL NINE INCHES LONG.—(Engraved from a photograph.)

(FOR DESCRIPTION SEE PAGE 296.)