break off the wing of a duck the animal can actually breathe through the broken end of the bone though you hold its head under water. Some of the gigantic reptiles of the mesozoic epoch, which some scientists claim to have been the ancestors of man, had hollow bones similarly filled with air from the lungs, for the support of their bodies in the water while they browsed upon seaweeds near shore, their massive and solid leg bones serving them as anchors, at a depth about sufficient to cover their backs.

"People continually imagine that their bones are of solid mineral construction without any feeling in them. No one who has ever had a leg or an arm cut off is likely to indulge such a mistaken notion. Comparatively speaking, little pain is felt when the flesh is being cut through, but when the bone is attacked by the saw, oh my!

"You see, as a matter of fact, there are blood vessels and nerves inside the bones, just as there are outside. Anyone who has purchased a beefsteak at the market knows about the marrow in the bone. It is the same with other animals than the beef, including human beings. Through the marrow run the nerves and blood vessels, entering the bones from the flesh without by little holes, which you can see for yourself any time by examining a skeleton or part of one. When the disease called rheumatism, which no physician understands, affects the nerves within the bones no way has been discovered for treating it successfully. It does not do to smile when a person says that he feels a thing in his bones.

"Nature adapts the bony structure of various animals to their habits in a very interesting manner. Sluggish creatures like the sloth have solid bones, whereas the bones of the deer and the antelope are comparatively light, so that they may run fast, and the leg bones of the ostrich are hollow. You will find in the bones of any skeleton the application of mechanical principles which have only become known to man through the processes of laborious and long considered invention. In your own shoulder you have a most beautiful and perfect illustration of the 'ball-and-socket joint,' while at your elbow there is a combination of the hinge and ball and socket which in its way surpasses anything that human invention has been able to accomplish thus far. But these are simple things compared with the hand, the bones of which exhibit the most perfect and complete apparatus, in its adaptation to the purposes for which it is intended, that has ever been imagined. How is it possible for any one who has studied the structure of his own hand to say that there is no God?"—*World's Progress.*

WHAT KEEPS THE BICYCLE UPRIGHT.

Let us suppose a 'cyclist mounted on his wheel and riding, say toward the north. He finds himself beginning to tilt toward his right. He is now going not only north with his machine, but east also. He turns the wheel eastward. The point of support must of necessity travel in the plane of the wheel; hence it at once begins to go eastward, and as it moves much faster than the rider tilts, it quickly gets under him, and the machine is again upright. To one standing at a distance, in front or rear, the bottom of the wheel will be seen to move right and left.

I conclude, then, that the stability of the bicycle is due to turning the wheel to the right or left, whichever way the leaning is, and thus keeping the point of support under the rider, just as a boy keeps upright on his finger a broomstick standing on its smallest end.—*Popular Science Monthly* for April.

A "COUNTRY GENTLEMAN" INVENTS A ROTARY EXPANSIVE STEAM ENGINE.

As reported in the *Glasgow Herald*, a really economical rotary engine, combining the advantages of strength, durability, lightness, small bulk, and accurate workmanship, has just been produced by Mr. A. F. G. Brown, of Swindridgemuir, Dalry, Ayrshire. Mr. Brown is not an ordinary mechanic, or an engineer by trade, but a country gentleman, having a natural inventive turn of mind, and being impressed by the fact that the designs of Watt and the Earl of Dundonald were frustrated in a great measure by their inability to produce a machine of the above-mentioned qualities, due to the rough tools they had to work with and the then current abhorrence against high-pressure steam.

Mr. Brown's engine consists of a cylinder, truly bored and ground to gauge, in which revolves a piston of peculiar shape, keyed to a central shaft which protrudes through the cylinder cover stuffing boxes and glands at each end. On one outer end of this shaft is fixed the valve gearing, and on the other an overhanging fly-wheel, which may be coupled direct or through the intervention of belting to any machine which it is desired to drive. The valve gearing consists either of eccentric motion or of three toothed wheels, of which the central one is keyed to the central shaft, and it drives the two outside wheels, which are fixed to rotating valves placed respectively between the boiler steam pipe inlet, and oscillating doors. These doors form when closed, part of the inner circumferential surface of the cylinder. The two outside wheels may be so adjusted with respect to the central one that the steam can be cut off at any desired part of the piston's revolution, or they may be connected to a governor, so as to cause a constant speed to be maintained under widely different loads and steam pressures. The steam inlet doors to the cylinder always bear steam tight against the revolving piston, and are automatically opened by the pressure of steam acting behind them whenever the piston comes to the point where admission of steam should take place. They are also automatically closed during the time that exhaust takes place by the piston. It will thus be seen that there are very few working parts, and that those which exist are of such a nature as not likely to get out of order, or to become leaky owing to the clever device of spring-adjusted fitting strips proportioned to the pressure and space through which the moving parts have to work. The cylinder receives steam twice during each revolution of the piston, and the higher the speed the greater is the economy, as proved by a set of brake horse-power and indicator diagram trials. The size of the cylinder employed in this instance was 10½ inches diameter by 8§ inches long, with a piston occupying half the volume of the cylinder. The engine gave by indicator cards 29 indicated horse-power and a mean of 20.78 brake horse-power throughout five hours' run at 574.5 revolutions per minute, with an initial steam pressure in the cylinder of 80 lbs. per square inch. The economy of steam is greater than any recorded results of any other rotary steam engine, and quite equal to the best performances of William's famous engines of the simple, single-cylinder, non-condensing type, for the gross weight of feed-water used per indicated horse-power-hour was only 27.2 lbs. This consumption would have been still less had it not been for the type of boiler used, the right-angle bends in the steam pipes, and the neglect to have these pipes properly lagged and the cylinder jacketed; for, 30 per cent. of the weight of steam used passed into the cylinder as water held in suspension and form initial condensation.—*American Engineer.*