IMPROVEMENT IN STEAM BOILERS.

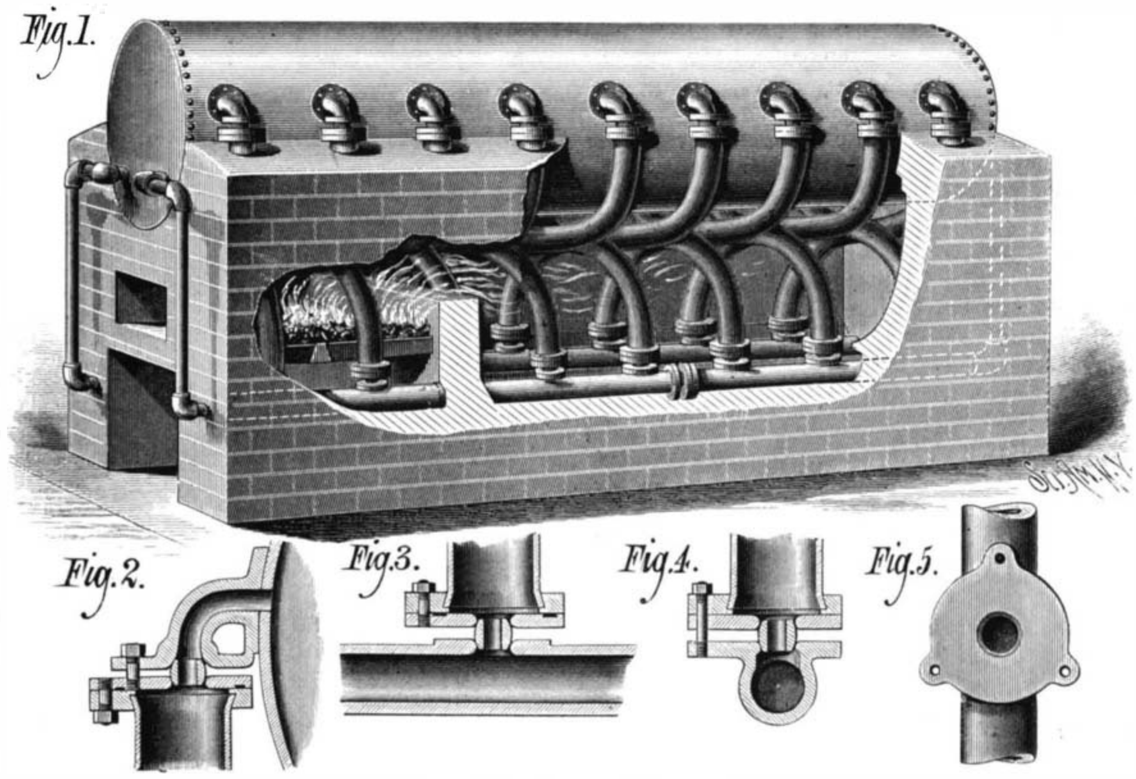
We give an engraving of an improvement in boilers lately patented by Mr. S. L. Hill, of 68 South Fourth St., Brooklyn, N. Y. In this boiler the inventor, by adding external water tubes, utilizes a great amount of heat that usually goes to waste, and thereby increases the capacity of the boiler without increasing the quantity of fuel consumed.

The boiler not only has this economical feature, but it is made safer and more durable by the addition of the water tubes. If the water contains any foreign matter likely to form sediment, it will be deposited in the horizontal pipe below the fire line.

Steam made in the tubes passes directly to the steam room of the boiler, and water is supplied to the water tubes by pipes leading from the water space of the boiler at each end. The curved tubes offer considerable protection to the fire sheets of the boiler, as they come between the fire and the boiler, and prevent the bottom of the boiler from being burned. This is especially advantageous where the feed water is very impure.

One of the principal advantages of this boiler is the facility with which it may be put together or taken apart. The ends of the water tubes are expanded into wrought iron flanges, to which cast iron reducers are secured by ordinary bolts, as shown in the sectional view. The joint is formed by two such reducers, connected by a double cone hollow plug, upon which the reducers are clamped by the coupling bolts. The peculiar form of the plug renders the joint similar to a ball and socket joint, and insures a tight joint, while allowing the pipes to expand and contract.

It will be noticed that none of the joints are exposed to the fire; they are consequently never corroded, and may be taken apart and put together whenever necessary without injury and without creating leaks. The great capacity of this boiler, its safety, and economy are points worthy of the notice of steam users.



HILL'S IMPROVED BOILER.

IMPROVED SPINNING FRAME.

The accompanying engraving represents a perspective view of a new spinning frame—double sided—built by Philip Townson, of Thompsonville, Conn., and tested one entire week in the spinning department of the Hartford Carpet Company, in Thompsonville. The view is taken from the "geared end," and presents the most important acting portions of the machine.

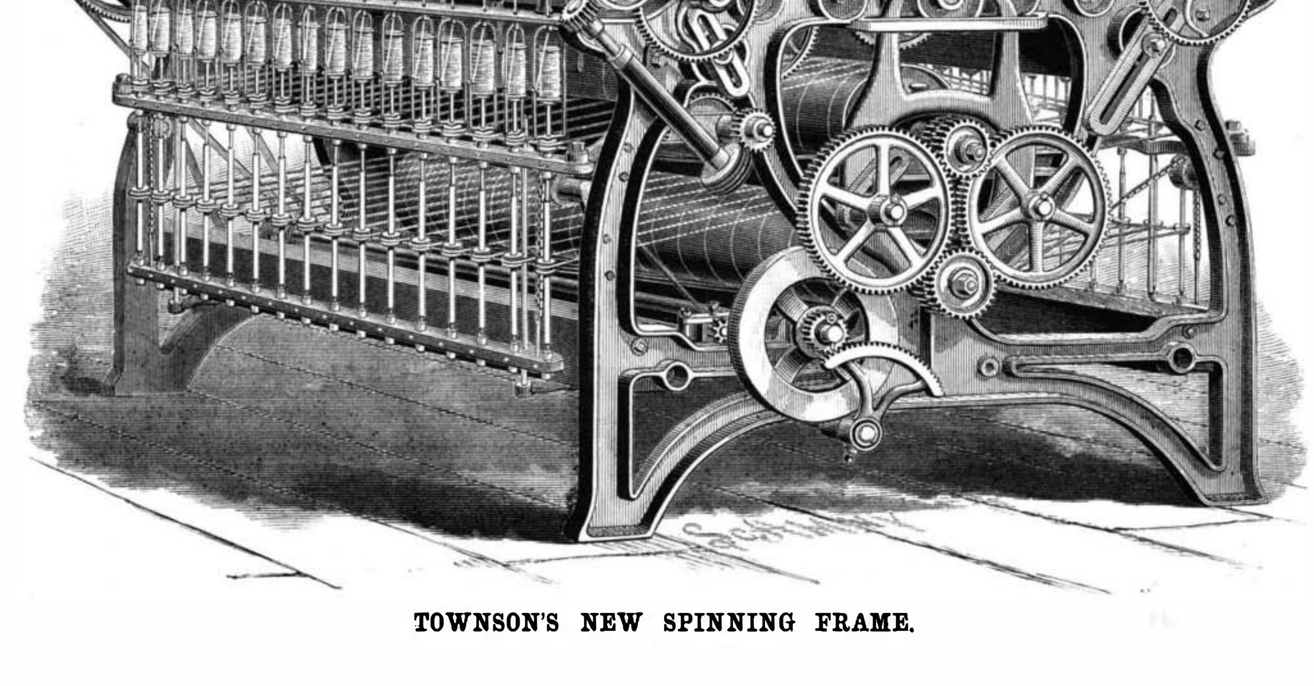
The design of this improved spinning frame is to allow the use of softer twisted yarn than is now possible by the usual spinner; to reduce the amount of waste by breakage of the "ends;" to allow of either filling or warp to be twisted on the same machine; to equalize the strain on the yarn, whether the bobbin be small or large, or "thin" or "full;" and to increase the production of yarn from roving, not only by saving, but by speed.

The Townson spinning frame does not depend at all for the revolution of its bobbins on the tension and centrifugal speed of the yarn and the flier; but the flier has its own independent whirr and cylinder, and the bobbin spindle has also its own independent whirr and cylinder.— both plainly seen in the engraving, the two cylinders, one over the other, in the center of the frame, and the two series of whirrs shown on the face or front view.

As the bobbins fill up and increase their diameters, a cam, shown plainly in the engraving on the front, that makes one complete revolution in once filling—or for once doffing—changes the feed gears, which are fixed on a rocking frame, disengaging a large or fast pinion, and engaging a smaller or slower pinion. This change is entirely automatic, and may be closely governed to suit differing sizes of bobbins, by changing the sizes of pinions on the oscillating frame, just as such changes are made on the ordinary drawing frame in the cotton factory to equalize and determine the weight of the yarn. In fact, this machine *can* be used in that way as a determinate measure of the size of the yarn.

The advantages of the new machine have been suggested by former items; but it may be stated that while a speed of feeding roller of 20 feet per minute is all that the ordinary spinning frame can deliver, this one delivers not less than 37 feet—a speed that may be extended to 45 feet. This increase will double, and more, the capacity of this spinning frame. The machine is an evident improvement on anything now in use for producing either filling or warp yarn of woolen for carpet or other purposes.

The inventor is Philip Townson, of Thompsonville, Conn.



TOWNSON'S NEW SPINNING FRAME.

Utilization of Smoke.

At Elk Rapids, Mich., is a blast furnace, in which are manufactured 50 tons of charcoal iron per day. There are 25 charcoal pits, constructed of brick. Each pit is filled with 100 cords of hard wood and then fired. The vast amount of smoke from these pits, which was formerly lost in the air, has now been utilized by Dr. Pierce. Chemical works have been erected, which are thus described by the Boston *Courier:*

First, they have a circular tube made of wood, with pine staves, 16 feet in length, bound together with heavy iron hoops. This tube is placed directly over the pits in a horizontal position, with an opening from each pit into the tube. At the end nearest the building there is a large drum containing a rotary fan propelled by machinery, the power of which is gas. That acts as a suction or draught for the smoke, which is conveyed into five stills filled with copper pipe, 2½ inches in diameter. The boxes in which the pipes are situated are 20 feet square, 8 feet deep, made of heavy pine, and filled with cold water; these are all connected by copper pipes; they are connected with the main still, 100 feet in length, 10 feet wide, 8 feet deep, filled with copper pipes, 2½ inches in diameter, in a horizontal position, surrounded with cold water; from this conveyed to a purifier, from which runs what is called pyroligneous acid, which is as clear as amber, with an unpleasant odor. From the acid is produced, first, acetate lime; second, alcohol; third, tar; the fourth part produces gas, which is consumed under the boilers. Each cord of wood contains 28,000 cubic feet of smoke; 2,800,000 feet of smoke handled every twenty-four hours, producing 12,000 pounds acetate of lime, 200 gallons alcohol, 25 pounds tar. These articles have a commercial value in the manufacturing of various articles. The alcohol has been contracted to a firm in Buffalo, N. Y., for five years, they furnishing the packages and receiving it at the works at 80 cents per gallon. The smoke from 40,000 cords of wood consumed per annum is thus made a source of much profit, as the works are nearly automatic.

A Cheap Railway.

There is now at work an interesting miniature railway—five miles in length—which unites the village of Westerstede in East Frisia with the station of Ocholt, on the Oldenburg and Seer line. It is solely due to the enterprise of the thinly-scattered population of the district, and carries their cattle and other produce to market, bringing them back their few requirements. The soil is marshy, so that a good deal of drainage work had to be done, and it was necessary to carry the line above the level of the frequent floods. In spite of this, the cost of construction was only £2,103 7s. 6d. per mile; and the cost of working (including wages, fuel, and every expense) amounts to the magnificent total of £1 7s. 6d. per diem. The buildings consist of a shed at each end of the line; the terminus is the courtyard of the principal inn at Westerstede, and the single station—half way along the line—is the house of a gentleman, who hospitably entertains the passengers while they are waiting for the train. The rolling stock comprises two small four-wheeled tank locomotives, weighing (when in working order) seven and a half tons each; three carriages of the American type, with a door at each end; two open goods trucks and two covered. A train consists of the engine and two vehicles, between which the guard sits. There are no turn-tables, so that the locomotive is at the hinder end of the train in returning. The fuel employed is turf, which is abundant in the district. The receipts of this tiny railway are steadily increasing.

THE best time ever made on the western division of the New York Central was accomplished September 4, in a run from Syracuse to Buffalo, 150 miles, in 3 h. and 4 m. It was an express train, late from Albany. Between Syracuse and Buffalo stops were made twice for water, and once at Rochester for passengers.

The Alligator Industry.

The business of killing and catching alligators gives occupation to many persons in the South. According to the St. Louis *Globe-Democrat* the hide of a large alligator is worth from one to two dollars. It is almost a day's task to skin a large one. Alligator oil has quite a reputation as a remedy for rheumatism. It has, however, a most unpleasant smell, unless properly treated. Many fishermen have been known to eat portions of the meat, that of the tail being said, when cooked, to have much the appearance of veal and to taste something like pork. Quite a lucrative business is that of capturing alligators alive to send away for exhibition. Colonel Williams, when Spanish Fort was made a summer resort, made a contract with a fisherman to fill the hole known as the alligator pond for him, and in the course of a couple of weeks he had it stocked with thirty or forty, ranging in length from 6 inches to 7 or 8 feet. The man who caught them showed no fear in handling the huge reptiles. With a companion he would capture and bring into camp an alligator 16 feet long.

The manner of accomplishing this feat was, as he explained, quite simple. The old are savage and will fight for their young, and this fact is taken advantage of. Some of the young are caught out of the spot in which the old one is lying, and a stout noosed rope is then placed where to emerge she must thrust her head through it. When all is ready the young are allowed to cry out, and the old one thrusts out her head to have her neck caught in the noose. She is dragged around in the water until pretty well choked, when another noose is secured to her tail, and she is firmly strapped, stomach downward, on a wide board, which she cannot break, as her powerful muscles in the tail act only in a lateral direction. Her head is then fastened to the boat, the noose about her neck is removed, and she is towed away after her young have been placed in the skiff.

Young ones are bought by dealers for from $2 to $4 a dozen, if not over a foot in length. When they sell them they get a much higher price, as they are hard to preserve alive. The large ones are sold differently, there being an increase in price of 50 cents to $1 for every additional foot over a certain length. Alligators 16 or 18 inches long are frequently found by the dozens in shallow water, and can be handled without trouble, providing the old one, who is generally near, does not take alarm. Most alligator fishers are usually turtle hunters also, and search along the shores of bayous and lagoons for the holes of the animals. When the hole is discovered it is explored with a long pole with a big hook set in the end, and if the unfortunate resident is at home he is promptly dragged out in spite of his struggles and quickly appears in market. The eye of a young alligator is a queer and pretty sight, having the fire and appearance of an opal of a similar size.

Embalming.

Experiments have been made at the New York morgue to test a process by which it is claimed dead bodies, though badly swollen and decomposed, can be restored to something like a natural appearance, and preserved so that it will be recognizable after months of burial. The subject operated upon was the corpse of an unknown woman who had died from erysipelas. It was soft, black and blue, and out of all human proportions. An incision was made in the right leg and an embalming fluid injected into the femoral artery. In less than half an hour the body assumed its natural size, became harder than in life, and as the degree of hardness increased the discoloration disappeared, leaving it of a marble whiteness. The body of a man, operated upon seven weeks before, had been kept unburied without decomposition. It retained a natural appearance, and was without odor.

A flywheel, said to be the largest in the United States, has been built by Watts & Campbell, of Newark, N. J., for Clark's Thread Works, of that city. It is twenty-five feet in diameter, with a face of seven feet six inches. It has three crowns for three belts, each twenty-four inches wide. It weighs 49 tons.

THE NATURAL REDDENING OF WATER.

In human societies the persons most in sight are rarely the most useful. The obscure workers, the humble and the ignorant, are in reality the ones who render the most service. It is the same in animate nature; among living beings it is the smallest, the least well known, that play the greatest role in the world. The formation of certain continents is the work of microscopic organisms which, for a long series of ages, have worked without relaxation at the bottom of the seas. In our brooks and our stagnant waters, in the air that we breathe, upon the earth that supports us, in the interior of our own bodies, and in that of the higher animals, magnifying apparatus reveal to us the presence of myriads of microbes which are accomplishing in silence gigantic operations. Invisible agents for reducing organic matter, they decompose the carcasses of animals, as well as dead plants, and cause their elements to serve for the elaboration of a new life. Like those ghosts that superstition has engendered, we are all born, in fact, as in a cemetery, partly formed from the *débris* of generations that have passed away. This circulation of matter, which renders us a portion of the past and connects us with the future, is effected through the innumerable legions of animalcules and microphytes that surround us. Of these, there are some, indeed, that enter our blood and our tissues, and bring about contagious and frightful diseases.

However infinitesimal are these little beings with respect to ourselves, they are worthy, then, of fixing our attention. To him who studies them they offer every day a new surprise. We find them, in fact, indefatigable actors in the drama of life, in a large number of natural scenes whose splendor and novelty excite our admiration. Such is the magnificent spectacle of the phosphorescence of the sea. I have had the good fortune to witness several times during the last two years a phenomenon none the less curious, in the tanks that serve for watering the Jardin des Plantes, at Paris. This was the conversion of the water into—I was about to say wine, so similar to the latter in its beautiful red color was the water that I had observed a few days before perfectly clear. Nothing could have allowed the extraordinary change that occurred to be foreseen. Great was my surprise, then, when I found that the entire liquid, from the lower part of the tank up to the surface, was strongly tinged with red. Drawn up by means of a pipette from different depths, it everywhere exhibited the same appearance. When poured into a glass it exhibited by either reflected or transmitted light almost the same aspect as a solution of fuchsine. And yet, far from being cloudy, far from holding the least visible particle in suspension, it was absolutely limpid. The microscope caused the prodigy to vanish; for, on examining a drop of the bloody fluid under a magnification of 500 diameters, although I found it as hyaline as normal water, I discovered in it clouds of red organisms in motion, as numerous as the stars in the heavens. Nothing can give to one who has not seen it any idea of so immense an overflow of life in so small a space. The restlessness of these animalcules was extreme; pressed one against another, they swam with wonderful rapidity in all directions in the liquid, some turning over and others moving in a spiral or describing fantastic sinuosities and endless gyrations. The apparent coloring that the water exhibited to the naked eye was due, then, to the multitude of living beings that it contained. Fig. 1 shows these curious little animals as I observed them in the water. They are very different from the algæ (*Hematococcus nivalis*) which, according to Ehrenberg, sometimes color mountain snow red. They approach, rather, the nudoflagellate infusoria, and I refer them, in fact, to the group of monads, although the organism, *Monas okenii*, Ehrbg., with which I identify them, has not offered me all the characters now attributed to that group. I have been enabled to cultivate them, follow their movements, and then to reproduce artificially in the laboratory the phenomena that they give rise to in nature. My object in making them known is to incite others to researches of the same kind; for I feel only too well the imperfection of my own, and the great interest it would prove to science to have them completed by more extended observations. It has doubtless happened that many persons have been struck with the singular coloration that the water of ponds in the country takes on at certain seasons of the year. Were the liquid submitted to microscopic examination there would probably be observed in it an infinity of animalcules analogous to those whose evolution I have endeavored to determine.

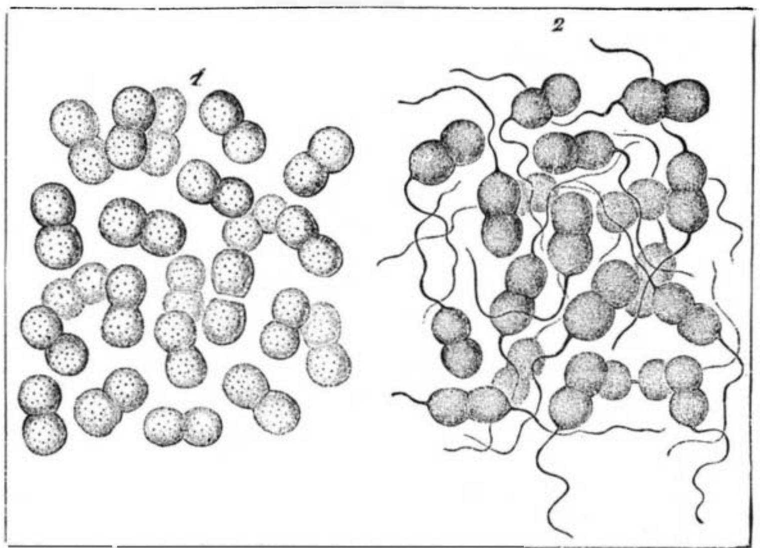


Fig. 1. *Monas Okenii* in the course of active division.—Fig. 2. The same colored by Paris violet. (Magnif. 530 diameters.)

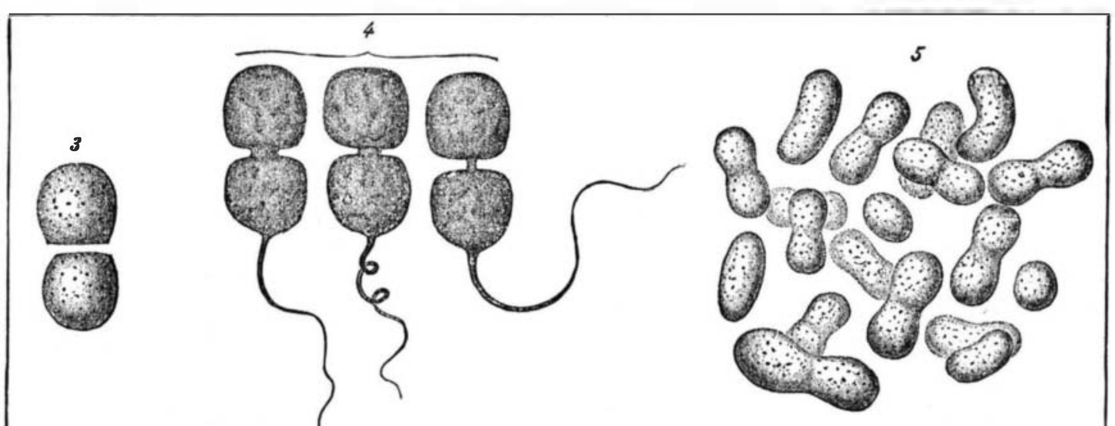


Fig. 3. *Monas Okenii*, not colored, and considerably magnified, so as to show the apparent interruption produced by transverse scission.—Fig. 4. The same colored by Paris violet, and considerably magnified to show transverse scission.—Fig. 5. *Monas Okenii* exhibiting a not very frequent division. Protoplasm colorless, containing extremely fine granulations. (Magnif. 530 diameters.)

It would prove very important for biology in general to gather precise facts as to the development, mode of nutrition, and reproduction of those beings that represent living matter naked, so to speak, and consequently life itself in its simplest state, in what it possesses of absolutely essential.

Unfortunately, when we wish to study these little organisms in all the phases of their existence, a great difficulty presents itself, for the liquid which contains them is soon invaded by a foreign population which disputes with them the empire of the water; infusoria, bacteria, micrococci, diatoms, and algæ of all kinds multiply therein, and, through their rapid and abundant development, exhaust the nutritive qualities of the medium. In this contest for existence the microscopic animalcules, whose modification it was proposed to detect, soon succumb, and it becomes impossible to continue the observation.

I have overcome such a drawback by doing the planting in liquids that have previously been deprived of germs by heat and afterward preserved from contact with the air in vessels inaccessible to atmospheric dust. Experience had taught me, in fact, that monads are great consumers of oxygen. It became necessary, then, to open the door to the outside air, and to close it against

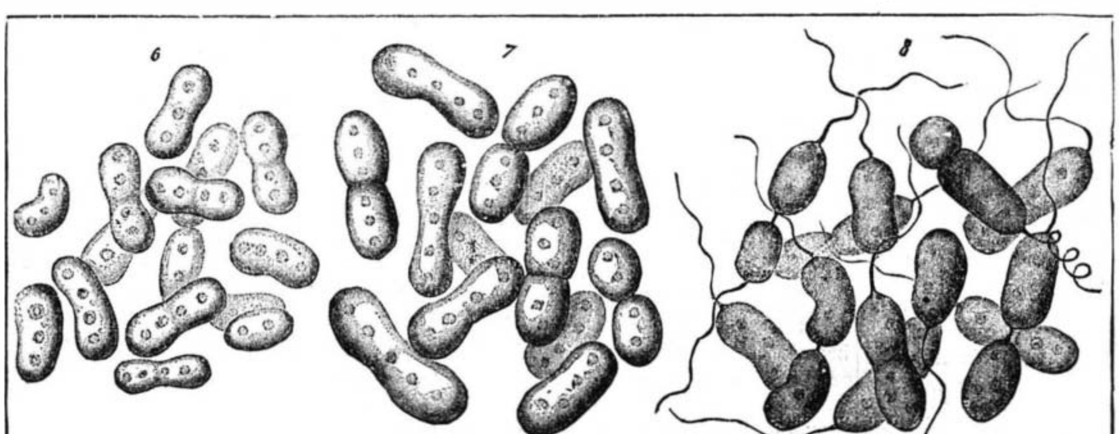


Fig. 6. *Monas Okenii*, showing a not very frequent mode of division. (Magnif. 530 diameters.)—Fig. 7. *Monas* dividing only after having acquired a large size.—Fig. 8. The same colored by Paris violet.