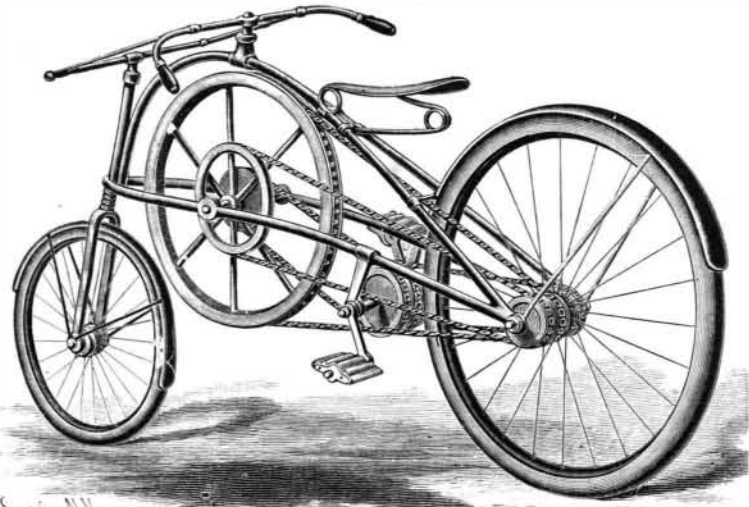


**AN IMPROVED BICYCLE.**

The system of differential gears provided in the wheel shown in the illustration is designed to enable it to be run very easily at an ordinary rate of speed, or to be run slowly and with great power, or very rapidly, as desired. The main frame has an upwardly curved backbone extending from front to rear, and the driving axle is journaled in hangers depending from opposite sides of the frame. On the axle is a double sprocket wheel of small diameter, a chain from which turns over a small wheel on the hub of the rear wheel,



JENKINS' BICYCLE.

while another chain extending forward from the same wheel drives a small wheel on the hub of a fly wheel. The periphery of the fly wheel also has a chain connecting with a small sprocket wheel on the hub of the rear wheel, and the latter wheel has likewise a sprocket chain connection with a sprocket wheel of intermediate size produced on the fly wheel. This gear arrangement allows for three changes of speed, one rate for slow driving over hilly and difficult roads, one for moderate work, and one for driving as fast as possible, in each case the main sprocket wheel serving as a fly wheel and assisting in keeping up a constant and steady motion.

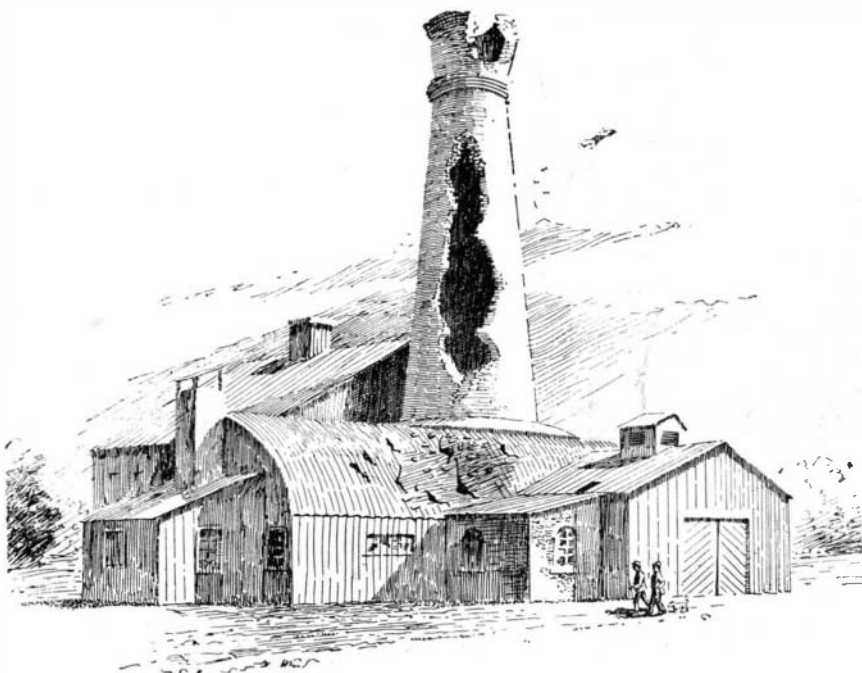
Further information relative to this improvement may be obtained of the patentee, Mr. Anthony D. Jenkins, in care of H. Bentley, East Walnut Lane, Germantown, Philadelphia, Pa.

**LIGHTNING DAMAGES A CHIMNEY.**

To the Editor of the Scientific American:

I send you a sketch of the chimney of the Flint Glass Co., of this city (Meriden, Conn.), which was struck by lightning several months ago, on a Sunday morning at 3 A. M. The chimney is the upper part of the furnace where the glass was melted and is about 100 feet high. The hole extends very near the entire length of the chimney. The chimney is considered unsafe, as the bricks are continually falling. You will notice that the bolt struck the top first, then skipped about 15 feet, tearing the bricks out to the base of the chimney, leaving a hole clear through one side of the chimney. There were no lightning rods on the chimney or building. There are no high buildings anywhere near the chimney, although there are a few small outbuildings not over one story high. The roof of the large building is heavy corrugated iron. The chimney is cracked very badly and appears to be very shaky. Coincident with the stroke, the local and long distance telephones were all burned out within a radius of one-fourth mile.

FRANK C. WHITE.



A CHIMNEY STRUCK BY LIGHTNING.

**Electricity in Surgery and Medicine.**

The enormous strides made by the new force in commerce and industries of late years have been, to a certain extent, paralleled by the application of electricity in medicine and surgery. The electric motor turns the drill of the dentist, bores out all the noses of mankind in the hands of the rhinologist, and may run the saw and the trephine of the surgeon. The electric light is made to illuminate all the cavities and interiors of the human body, so that "the pestilence that walketh in darkness" in the black recesses of our viscera is sought out and driven away by the electric search light. It is nothing now to put an endoscope into the stomach and scrutinize its walls from one end to the other, and in a dark room the very size of the stomach is determined by the transillumination of the abdominal walls when a light is turned on inside of that viscus.

Electricity furnishes heat for the cautery with which morbid surfaces may be healed, wounds stimulated, and tumors extirpated.

The electrolytic needle removes the hairs of the bearded women, eradicates birthmarks, decomposes tumors, coagulates aneurisms, and in its most romantic role manufactures those most desired ornaments of the feminine physiognomy, lovely dimples.

The electro-magnet pulls out the beam from our neighbor's eye, when the beam is in the shape of a piece of iron, and when the operation is intelligently directed by the ophthalmologist, it may hunt up and draw out wandering needles.

One of the new features of electric medication is the introduction of drugs into the human body through the skin. This is done by placing solutions of any drug upon a sponge, which is made the positive pole and placed against the skin. When the current is turned on, the drug is actually driven through the skin into the tissues. The application is not at all painful. Thus cocaine has been driven in over a painful nerve, and neuralgias have been relieved by it. Many other drugs have been used in this way. This property of electricity is known as cataphoresis. Operations have been performed after anesthetizing the skin and subjacent tissues cataphoretically.

The neurologist, perhaps, finds a large therapeutic field for electrical exploration. With the continuous current he soothes the pains of peripheral nerves, calms down an excited brain, stimulates healthy processes in a diseased spinal cord, exercises paralyzed muscles, rejuvenates overworked limbs, and aids in the rebuilding of tissues in members that have wasted away. Sometimes he calls in to his aid the interrupted and the alternating currents, and occasionally takes into service the static sparks evolved from his big glass wheels and Leyden jars. The method of the working of electricity in disorders of the nervous system is much more obscure than in the maladies mentioned above, where heat, light, electrolysis and cataphoresis produce effects at once apparent to the senses. Not able to demonstrate objectively the value of electricity in some of the chronic nervous diseases, a great deal has to be accepted on faith. There is dispute in some quarters as to its intrinsic value here, and many incline to the idea that suggestion has a good deal to do with improvement in patients of this kind treated in this way.

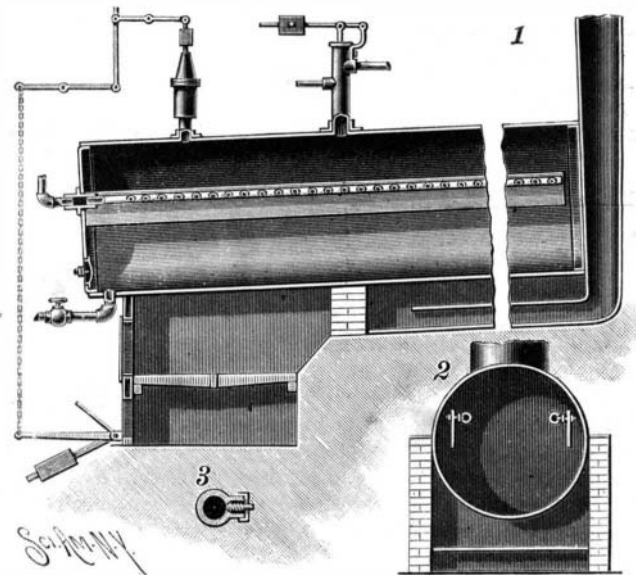
Besides its employment as a therapeutic agent, electricity has considerable value as a means of diagnosis in many neurological conditions. For instance, the resistance as measured by the rheostat is reduced in exophthalmic goitre and increased in hysteria. The muscular contractions produced in paralysis from injury to certain parts of the nervous system are so different from contractions produced by electricity in paralysis due to lesions in the brain, as an example, that their differentiation constitutes an important aid in distinguishing these affections one from another. Then, too, in the surgery of the brain and spinal cord, which has newly sprung into existence, electric stimulation of parts of the brain and of nerve roots is very valuable in localizing

the exact region to be operated upon. Indeed, much of our knowledge of the localization of functions in different parts of the surface of the brain is owing to electricity made use of by physiologists in their marvelous experimental researches in cerebral domains.

Altogether electricity occupies an extensive place in the armamentarium of the physician. All parts of the human economy are explored by its beneficent light, and there is no cell so secretly hidden that it may not be influenced by this wonderful force, which may be made to penetrate skin, muscle, bone, blood, nerves, and viscera. No one can yet place a limit upon its possibilities as a remedial agent, for each year new apparatus, new devices, new forms of current, and new methods are made available to the medical profession in its noble warfare against the diseases which assail mankind on every hand. It is not in vain that man has sometimes looked heavenward for aid in sore affliction, for has not the lightning been drawn from the clouds to become his friend and heaven-born ally? —N. Y. Sun.

**A NOVEL STEAM BOILER.**

In the boiler shown in the illustration the feed water is discharged upon heated plates arranged longitudinally within the shell of the boiler. The improvement has been patented by Messrs. Max and George Hise, of Grahamsport, Ky. Fig. 1 is a side sectional view and Fig. 2 a transverse section. The brick work is built around and nearly over the entire boiler shell, within which are longitudinal pipes connected with the feed pipe, and each provided with a series of nozzles for discharging water onto a plate held parallel to the supply pipe, and supported by arms or brackets projecting from such pipe. Each of the nozzles, as shown in detail in Fig. 3, has an inwardly closing valve to prevent the steam in the boiler shell from passing into the supply pipe. The dome of the boiler is preferably in the shape of a tube, from which lead steam pipes, and in the upper end of which is the usual safety valve, and on the boiler top is also a vertical cylinder in which works a piston whose rod is connected by levers and chains with a damper in front



M. AND G. HISE'S BOILER.

of the fire box. When the steam pressure forces the piston outward the damper is closed automatically, opening again as the pressure decreases.

**How to Keep Young.**

We find this circulating in the newspapers. The author is unknown to us. It contains much truth.

"Past grief, old angers, revenges, even past pleasures, constantly dwelt upon—all dead, decaying, or decayed thought—make a sepulcher of the soul, a cemetery of the body, and a weather-beaten monument of the face.

"This is age.

"The woman who never grow old are the student women—those who daily drink in new chyle through memorizing, thoroughly analyzing, and perfectly assimilating subjects apart from themselves.

"Study is development—is eternal youth.

"The student woman who makes wise use of her acquisitions has no time to corrugate her brow with dread thought of the beauty-destroyer leaping fast behind her.

"Not considered or invited, old age keeps his distance. Brain culture, based on noble motive, means sympathy, heart gentleness, charity, graciousness, enlargement of sense, feeling, power. Such a being cannot become a fossil."

THE captains of ships which carry bricks have to be very careful. An ordinary brick is capable of absorbing a pint of water. So with a cargo of brick in the hold serious leakage may quite well go on undetected, for the water that enters is sucked up as fast as it gets in. If this should be the case, the consequences are bound to be most serious.

## THE MARBLE CAVE OF MISSOURI.

(Continued from first page.)

not be called such by one familiar with the Alleghanies, the White Mountains, or even the Catskills. No railroad has yet touched the county, the forests of oak, with sycamore, elm and walnut in the valleys, are for the most part in their primeval condition, and thousands of acres of fertile land may still be taken up under the U. S. homestead laws. The forests are free from underbrush and much grass grows under the trees, giving the scenery a park-like aspect.

Mr. Truman S. Powell's claim occupies Echo Glade and the neighboring hills about a mile and a half from the mouth of the cave and about 300 feet below it, and is the best headquarters from which to visit the cavern. Mr. Powell is the editor of the *Stone County Oracle*, published at the county seat, Galena, 18 miles from his farm. He says that he has explored fifty caves in Stone County. He is a firm believer in the future of the county and is an ardent admirer of Marble Cave. His eldest son, William T. Powell, is the good-natured, efficient guide to the cave. He is strong and active and a keen observer whose judgment is very reliable.

Climbing this hill, which is known as Roark Mountain, we saw in its top a large sink hole about 200 feet long by 150 feet wide and 55 feet deep, the bottom of which had dropped out, leaving a yawning chasm opening into the chamber below. Descending a series of log steps in the side of the pit, we came to two short ladders which led through the opening to a platform, from which we descended a large, strong wooden ladder into what seems to be a bottomless pit. This part of the journey is fraught with many imaginary dangers to those unaccustomed to ladders, but our party had received considerable training in entering mines in different parts of the State, and consequently we hastened down without fear, anxious to see what was in store for us. The bottom of the ladder rests upon the top of a mound of debris, about 45 or 50 feet below the platform above mentioned. Climbing down this cone of earth and slabs of limestone, we reached the bottom of the vast room which is called the "Grand Amphitheater."

Some light comes through the great rift in the roof, which is the bottom of the sink hole, and as soon as our eyes became accustomed to the semi-darkness we could see something of the really grand dimensions of the immense dome in which we stood; but when the room was illuminated by red fire, its full grandeur was revealed. The dimensions as given in the newspaper accounts are greatly exaggerated, but the truth is sufficiently grand. The room is about 150 feet wide by 200 feet long, and the roof rises in a magnificent arch to a height of 165 feet from the floor. Some stalactites were seen on this broad expanse of roof, but the beauty of the scene lay chiefly in the symmetry of the arch and the variations produced by the differences in the limestone strata.

Two beautiful examples of drip formations occur in this great amphitheater. One is the "Great White Throne," a magnificent stalagmitic mass of pure white onyx about 50 feet high, 50 feet in extreme width and 12 or 15 feet in thickness, showing all the beautiful forms which one might imagine to be caused by the freezing of a fountain. It is hollow and one can climb more than half way to the top inside.

A few yards from the Great White Throne rises the "Spring Room Sentinel," a beautiful fluted column of combined stalactite and stalagmite about 20 feet high and from 2 to 3 feet in diameter with swelled base which stands near the opening leading from the Grand Amphitheater to the Spring Room and to the Animal Room. This passage is a long, straight, gradually converging one following a "joint" in the limestone, which leads to a large low room of unknown dimensions which contains the mummified remains of hundreds, even thousands, of animals, mainly, if not entirely, of carnivorous species. Admittance to this room is positively forbidden by the owner of the cave, but the assistants in the Smithsonian Institution at Washington have had access to material from it and are now at work upon their identifications. A specimen from this room which was shown to me consisted of the skull and jaw bones of a cat-like animal to which portions of dried skin and fur still clung. It had a very ancient appearance. The continuation beyond the Animal Room of the joint leading to it seems to emerge in the side of a ravine outside the cave. What was once apparently an opening here is now filled with earth and debris.

Mr. Will Powell thinks that this is the place where the much desired horizontal entrance to the

cave can be made with comparatively little trouble and expense.

Opening out from the passageway to the Animal Room is the Spring Room and beyond this lies the "Shower Bath Room," the latter being a perfect example of a conical dome some 30 feet high, down the roof of which the water trickles and flows over a low precipice into the Spring Room. This water showed the remarkably low temperature of 48° F.

Behind the Great White Throne, in the Grand Amphitheater, is a passageway which leads to the waterfall and to other portions of the cave, which will be described as we go on. The first room to which this passage leads is called "The Registry Room," because the walls are covered in places with firm, damp, red clay, in which numerous visitors have inscribed their names with finger or staff—an unstable method of gaining celebrity. Here our guide called our attention to the fact that the atmosphere had become much warmer than it was in the first great chamber. There is, in fact, a difference of six or eight degrees. Then pointing to a great black hole in the floor of the room, he said, "Listen!" and taking a huge rock cast it into the abyss. After some seconds we heard the sound of the rock as it fell into water below us. The abyss is called the "Gulf of Doom." Actual measurement proved this precipice to be 88 feet in height!

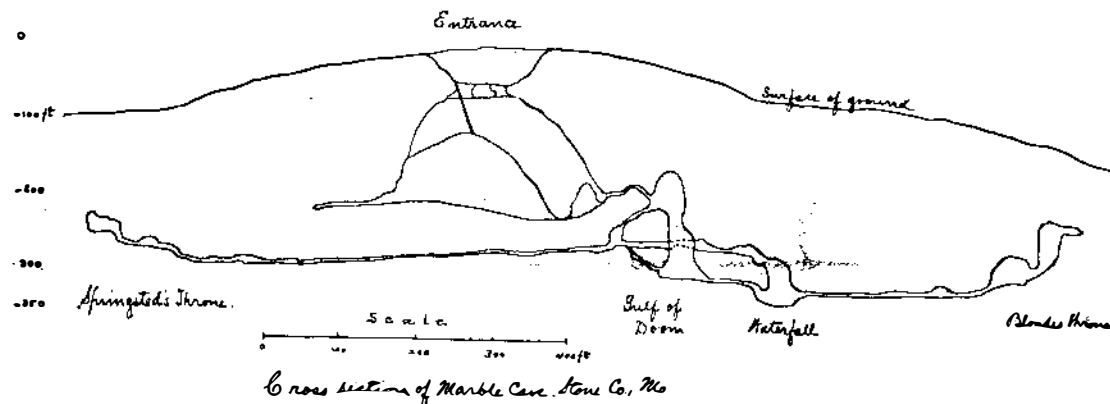
Turning to the left and descending a slippery clay bank and a narrow ladder, we reached a point at which the cave divides, one arm going past a great slab of limestone standing on end, known as "The Lost River Sentinel," in a direction S. 30° W. to "The Lost River Canyon," a journey which we reserved for another day. Taking the other arm, leading in a directly opposite direction, and clambering through two passages like the "Corkscrew" in Mammoth Cave, we soon reached the top of the waterfall. The edge of this fall is about 20 feet across, and the water passes through a series of beautiful little pools with projecting rims of calcite crystals before it takes its final

to our destination. Further progress on the level on which we had come was stopped by a pool of water of unknown extent, known as "Mystic River," spanned at the beginning by a low symmetrical arch of limestone.

A short, steep ascent led us to a great narrow cleft in the rocks about 100 feet high. Following this a short distance, we came to a steep incline of wet, slippery limestone, up which we climbed 25 or 30 feet, then pushing our way through a hole in the wall, barely large enough for our bodies, we were in Blonde's Throne. This is a small room, only about 15 feet in diameter, but it is a gem. It is almost completely filled with beautiful and curious stalactites and stalagmites. Some of the stalactites were in sheet-like folds, and a sufficient number of them give forth musical sounds when struck to enable a skillful musician to play simple tunes. The stalactites here are in all stages of growth, from narrow, hollow tubes, like pipestems, to solid pillars several inches in thickness. A small opening in the side of the room revealed the existence of a room which has never been explored. Rockets fired into it show that it must be a room of large dimensions.

Returning from Blonde's Throne, and slipping and sliding down by the aid of the slimy rope which had helped us up the steep ascent, we reached the bottom of the incline all too soon for some of our party. Lighting up the cleft by magnesium ribbon, we could see weird drip formations filling the crevices and projecting from the walls far above our heads. The return journey to the bottom of the waterfall was made much more expeditiously than the advance, because, being thoroughly wet, muddy, and cold, we did not stop for scenery or surveyor's measurements.

Another day was spent in exploring the windings of the "Lost River Canyon," which, as stated above, lies out to the southwest from the Registry Room. Climbing over huge blocks of limestone which had fallen from the roof, or threading our way between slabs standing on edge, we soon came to the beginning of a much longer but drier crawl than the one just described. After worming our way along for some 200 yards, we came to a beautiful stream of water flowing swiftly through the underground channel which it had carved for itself in the limestone. This was the "Lost River." In several places tortuous passages led out from this canyon, which are barren of interest, and serve merely to confuse the traveler and add to the length of the cavern. Somewhat less than a quarter of a mile from



MAP OF THE MARBLE CAVE, MISSOURI.

plunge of 50 feet into the darkness. The top of this waterfall is about 285 feet below the top of the hill at the entrance of the cave.

Retracing our steps for some distance from the top of the waterfall and turning on our track again at a lower level, we reached the bottom of the pit (8) into which we had cast the stone from the Registry Room above, and then passed on down a narrow defile by the aid of ladders and over slippery clay banks until we stood at the foot of the beautiful waterfall. Half way down the precipice a projection has caught the spray from the water, and the deposits of ages have formed there a beautiful bowl of carbonate of lime. Pointing to a 25 foot slope of miry clay and water, which lay just beyond us, Mr. Powell said: "That's the way to 'Blonde's Throne,' the prettiest thing in the cave." We looked at the prospect in dismay, and anxiously inquired whether there were no other way to get there; being answered in the negative, we left him behind, as he said there was no need of a guide, and plowed our way through that miry mass, which came to our knees. After toiling up this slope and through a narrow cleft in the rock, we reached the beginning of what they called "The Dry Crawl." We wondered what the wet one was going to be. Down we went on our hands and knees and began the toilsome journey. One hundred and fifty feet of this, most of which was too low even for this method of locomotion, brought us to the "Midway Rest," a small room, out of which a passage leads upward to several small chambers, in which were phantastically carved shapes in the limestone. We suggest the name of "The Temple" for one of these chambers, which contains fine Doric capitals. But Blonde's Throne did not lie in that direction. As soon as we had gotten our breath and adjusted our surveying instruments we started on the "Wet Crawl," and wet it surely was! We were pretty careful about the first pool, and tried to keep out of the water as much as possible, but when we reached the second pool we saw there was nothing to do but to plunge in and work our way across. After thirty or forty yards of this kind of travel on hands and knees in the water, or worming our way through comparatively dry holes in the rocks, we reached a room at the base of the ascent

the Registry Room we ascended a steep slope and arrived at "Springsted's Throne." This is a room about as large as Blonde's Throne, but with a smaller amount of drip formation in it. The special feature of the room is a small recess, which is separated from the main portion by a lattice of stalactites. The cave has been explored for about a fourth of a mile beyond this room, but nothing of interest has been discovered in that direction.

The explorations thus far described have been along galleries opening out from only two places in the grand entrance dome. On the north side of the Grand Amphitheater another series of chambers opens out, most of which are comparatively small and devoid of drip formations. The first of these is the Mother Hubbard Room, in which an isolated waterworn pillar of limestone stands which has received the name "She" from its suggestion of Rider Haggard's weird descriptions. A dry crawl of 70 feet from this room takes one to the "Battery," a dome which is 60 feet in greatest diameter and 50 or 60 feet high. Here the bats congregate in vast numbers, whence its name. From one side of the battery a series of rooms, one of which is known as the Dungeon, and low dangerous passages extend to the Grand Amphitheater again.

A low narrow passage leads from the Mother Hubbard Room to the northwest to a series of barren rooms two of which are said to rival the Grand Amphitheater in size. This part of the cave is dry. The second room reached contains considerable amounts of epsomite,  $MgSO_4 \cdot 7H_2O$ , and therefore is called the Epsom Salts Room. The passage to these rooms is called the Windy Passage on account of the strong current of air which sweeps through it.

As there were no means at hand of exploring this passage and the dangerous route beyond, we did not undertake to visit it.

In addition to bats the living animals to be found in the cave consist of crickets, newts, and eyeless fish. Plant life is represented by a peculiar white fungus which grows on the rocks in the Grand Amphitheater. Vast numbers of bats make their home in the cave, especially during the winter season, and the floor is covered to a depth of many inches with bat guano. Mr.