page is a good representation of the various buildings in which these presses are made at Westerly, R. I. The most prominent building at the right in the picture is the main structure, to the left of which is the pattern shop, while in the rear are the foundry, blacksmith shop, engine room, etc. The buildings cover about two acres of ground, and the location is a most admirable one, on the Pancatuc river, about five miles above Stonington, where coal and iron can be brought direct to the firm's docks, and from whence their heavy machines may be shipped, at but a small cost for freight.

Messrs. Cottrell & Babcock have obtained nine different patents and two reissues, all but one of which were for inventions of Mr. Cottrell, who has devoted all his energy and ingenuity toward perfecting power presses.

The business offices of Cottrell & Babcock are at No. 8 Spruce street, New York, and 112 Monroe street, Chicago, Ill.

The Wire Age.

Whenever, in walking or riding through the streets of our great cities and towns, the eye is directed upward, a perfect network of wires is seen stretching from building to building and from chimney to gable. The appearance is as if some huge spider had been at work silently and covered in the compact city, holding it a prisoner in the meshes of its net. The view is bewildering, and it seems impossible that any practical or important use can be made of these iron wires, so numerous as almost to shut out the sunlight. It is but little more than thirty years since only a single one could be seen connecting some important building with another in a distant city, by which telegraphic communication was maintained; and forty years ago not even one was visible anywhere. We live in the *wire age* of the world's history, and a most interesting and wonderful epoch it is. We know that these iron filaments subserve the purpose of nerves of thought and sensation, and over them, or through them, the world's commerce is carried on. In the human organization we know that if any accident or event happens to the extremities, the fleshly nerves transmit instantly the news to the seat of sensation, the brain; and so it is with the iron nerves in the external world, which science has arranged; not an event of importance can transpire in any part of the globe which is not instantly "*wired*" to the great cities, and the news spreads everywhere with the rapidity of thought.

Until within the past four years, the wires were capable only of transmitting signals of a complex nature, but easily understood and interpreted by experts; now, human beings talk with each other over the iron, and it seems to make, as it were, a unit of the great family of man. Words, actual words, produced by the organs of speech, are ever winging their way, with the speed of lightning, over cities, across rivers and mountains and woods, and voices are recognized scores of miles away. The wires needed in cities for transmitting fire and burglar alarms, for police calls, time signals, and other municipal purposes, are many in number; and when to these are added the wires for telegraphic and telephonic purposes, the question of space or room for them becomes an important one. These wires must all be independent of each other; there must be no contact anywhere; else serious errors and complications occur. In this city the fire alarm system has been so often interfered with that the chief engineer has called the attention of the city government to the matter.

The time is not far distant when additional wires will become necessary for the purposes of electric lighting, and, perhaps, warming. In the years to come the whole country will be covered with them unless some plan is devised by which electrical currents can be conveyed in the earth by wires protected in tubes of clay or metal. It is certain that some method of this nature must be adopted, and that quite speedily.—*Boston Journal of Chemistry.*

Working Wire.

There are many jobs which require wire, in some one of its many sizes and in some form, as rings or springs, to complete them. Improperly treated, wire is a very obstinate material, if at all "springy" or possessing temper, either from condensation by drawing, or by hardening, it will not occupy the space or shape in which it is formed, and calculation or experiment is necessary to guide the workman to a satisfactory result. All wire of any stiffness, when coiled, will open or expand, making the coil larger in diameter and longer in stretch. In ignorance or neglect of this quality, a workman once tried to form a spiral spring of wire to play upon a flat rod one inch wide by three-eighths of an inch thick. He wound the wire on the flat rod, and when released the spiral was a sight to make his shop companions laugh. The coil was elegant, but scarcely useful; its short diameter and its long diameter alternated in a beautiful geometric spiral, instead of preserving a straight line. Sometimes it is necessary to make a spiral, or rather a coiled spring, of a certain diameter, to fit a hole, or to fit a rod acting as its core or support. It is impossible to give rules to determine the amount of expansion of the coil in diameter, as the nature of the material is so varying. This variation comes from the stiffness of the wire, the size of the wire, and the material—whether brass, iron, or steel.

In the case of desiring to produce a coiled spring of a certain diameter it is best to try a simple experiment with the specimen of wire to be employed. Wind one or two turns on a rod of the proper size for the core, and then, releasing it, measure the interior of the ring or spiral, and compare with the diameter of the core or rod. Reduce the size of the core or rod to an amount a little more than the difference between the size of the hole in which the spring is to work and the rod on which it was formed. If the wire is of a gauge that when wound on a half-inch rod it will fill loosely a hole three-quarters of an inch in diameter, but when allowed to expand the coil requires a hole seven-eighths of an inch, wind the wire on a rod three-sixteenths of an inch smaller than the half-inch rod. This example may not be definite enough to be made into a rule, but it is given as an illustration. A trial should be made, as before mentioned, by coiling the wire around a core of the estimated diameter, and thus determine the amount of opening or spring of the coil. It may be feasible, in some cases, to anneal the wire before forming it into springs. In this case the wire can be wound to the finish size at once. But with brass or iron wire, the springiness of which depends upon the condensation of the particles by the drawing dies, this plan is not practicable, as hardening and tempering by heat and water will not restore the stiffness of the wire. But with steel wire it is better to use the wire in an annealed form, making the spring just as it is to be in its finished state, and then tempering it, a process which is described further on.

It is a comparatively easy matter to make a close or expanding coiled wire spring in the lathe. The size of the core rod having been determined, all that is necessary is to keep the winding wire close to the previous coil, and this can be done by hand feeding and guiding. The rod on which the spring is wound is placed on the lathe centers, and one end of the wire secured in the dog end, when the lathe may be started on a slow speed, the wire being led to it by hand. This is a handy way also to form rings, the coil being cut apart either with a file or cold chisel.

But in forming open or compressing springs, there must be greater care employed. The stiffest open spring from a certain size of wire is that which has the interstices of the same space as the wire's diameter; so, such a spring—or rather two of them—may be formed by winding two wires at the same time, making a close spring, doubled. When completed, one is unscrewed from the other. A more open spring may be guided by means of a thin piece of iron with a hole large enough to receive the core on which the spring is wound, the hole being in one end of the piece and the other having a handle attached. A small hole should be made through the piece close to the large hole to receive the wire. In operation the guide is slipped on the core spindle up to the dog end, the wire passed through the small hole, and secured by the dog. Then start the lathe, holding the guide close against the rotating core, pulling toward the operator, and the wire, passing through the small hole in the guide from one side, winds against the guide on the other. It is evident that the thickness of the guide will determine the width between the coils. A still better way of forming an open spring is to use an engine lathe with screw cutting feed. With this the grade of the spring may be determined with great accuracy.

Sometimes it is necessary to close the ends of close coiled springs so as to make a central pull by means of hooks or loops. There is machinery to do this with rapidity, but for ordinary jobs hand work is sufficient. The closing is effected by a gradual reduction of the diameter of the coils at the ends of the spring. Unless the wire is very rigid and obstinate, repeated blows with a mallet, a lead hammer, or a copper hammer will do the work satisfactorily. The open end of the spring should be held at an angle on the bench block, and the hammer wielded, striking backward toward the held end of the spring, the spring being turned in the hand in the direction of the coiling. Before the end is closed, a looped piece of wire should be introduced to form a holder for the end of the spring, the projecting end of the looped wire to be formed into a hook or ring.

Large springs of large wire, which from its size and rigidity cannot be managed during winding by the hand, should be made on a contrivance similar in principle, build, and operation to the tire tenders in the blacksmith shop, or the pipe formers in a tin shop. These consists of two rolls to give a forward motion to the material and another to give the curvature. In spring forming the modifications consist in substituting narrow wheels with a V or segmental groove on their peripheries for the two rolls, which receive the wire, and a guide instead of the back roll to produce curvature. The two grooved wheels should be geared together, so as to turn in opposite directions, and the guide should be a curved piece, standing at an angle to the axial rotation of the rolls or wheels. And this guide should be capable of being set up to the rolls or moved back from them, to determine the diameter of the coil, and should also be capable of being inclined from a vertical position, more or less, to make a close or open spring. The guide should have a lip on its working edge to guide the wire. With such a contrivance, coiled springs of steel rod, a quarter of an inch and more in diameter, may be readily formed.

Sometimes a weak spring is required where a flat forged spring would be costly. In this case a piece of stiff wire of hard brass or unannealed iron may do the work when coiled two or three times around a core, the coiled portion forming the spring, leaving ends to be formed into loops or secured by screw, or left to act on the movable attachment it is to actuate, as a pawl. The principle of such a spring is seen in an extreme form in the U, or main spring, of a gun lock. In this spring the two long arms have little to do with its action, the spring or life being wholly in the curve between the two arms. The wire spring has its curve in one or more complete circles.

Coiled springs of steel wire are tempered by heating them in a box, or piece of gas pipe, in which they are packed with bone dust or animal charcoal, precisely as though they were to be heated for case hardening. If a piece of gas pipe is used, which is very handy in such work, one end should be closed by a screw plug or cap, and the open end luted with clay. When sufficiently heated—the box or pipe deep red—remove the spring, or plunge spring and its receptacle together into a bath of animal oil. Do not attempt water hardening or the use of crude petroleum. If common whale oil is not handy, melt lard and use it while it is liquid. The wire will be sufficiently hard to require drawing. This should be done by putting the spring in a shallow pan, with tallow or animal oil, over the forge fire, and agitate the pan and its contents until the oil takes fire. Take the springs out, and when the oil is burned off cool them in water.—*Boston Journal of Commerce.*

Correspondence.

Lighting Mines by Reflectors.

To the Editor of the Scientific American:

The proverb, "Necessity is the mother of invention," is so trite that its quotation calls for an apology, but its truth has been demonstrated recently in so valuable a way in the prosecution of an important and dangerous work here, that, for the benefit of other workers in like professions—mining engineers—who may meet with similar difficulties and dangers, I give you the result of an experiment in the use of sunlight as a means of illuminating underground workings.

An important part of my work during the past two years has been the construction of a deep adit level, to serve also as a base of development of the vein and a main channel of out-carry for ores extracted on higher levels of the mine, and it has been attended with serious difficulty and danger in consequence of the existence of inflammable gases in the rock through which it passes. Three serious explosions have occurred during the past six months, due to its ignition by workmen using open lights, and eleven persons were very badly burned. Workmen at last reached such a condition of fear of consequences that they could not be induced to take such chances of death, to earn a living, as work in the tunnel offered. Safety lamps would not furnish sufficient light. The question, then, was what safe means of illumination could be used. This question was decided, in a measure, in a peculiar way, and was the direct result of necessity, which compelled me to go into the header of the tunnel to look after a party of men that had just been burned by an explosion. I had recourse to a common looking-glass for a reflector of the sunlight. The result was marvelous. The whole tunnel was a flood of bright daylight—sides, roof, and floor, throughout its entire length of 2,500 feet, and all furnished by such a glass as can be bought in your city shops for a dime. Confidence was at once restored in my workmen, and now, while we can command the sun, we can command more labor than the work will employ.

The conditions of the tunnel and the philosophy of the light are these:

The tunnel is perfectly straight, 6½ x 5½ feet inside of timbers; its course south 36° 15′ west from the mouth; and is ventilated by a current of air forced in by a Burleigh compressor operated on the outside.

The philosophy of the light—its intensity and perfect diffusion—is thus accounted for: The air driven into the tunnel is saturated with moisture in the process of compression, and upon being released in the header, resolves itself into its natural volume, when the excess of water is liberated in the condition of a mist or fog, very light, of course, and millions of these atoms of water become direct reflectors at as many million angles. To convey an approximate idea of the intensity and brilliancy of the light it will, perhaps, be sufficient for me to say that the smallest type used in your publication is as clear at a point 3,000 feet from the looking-glass as in the open sunlight, and every item in your paper can be read at any point in the tunnel as rapidly and with as much ease as if out of doors.

It may be that some unfortunate may derive a benefit from having the use of this light suggested to him. If it will save one individual from being burned, as I have been, or as I have seen a number of my workmen, I shall be fully compensated for the time spent in preparing this communication, and you will be entitled to the thanks of the mining profession everywhere for publication.

The light may be used for many purposes underground, and many times diverted from the first mirror line.

JNO. W. C. MAXWELL.

New Idria, California, February 20, 1880.

A Fatal Italian Disease.

An Italian correspondent of the *Lancet* calls attention to an insidious and frightfully fatal disease called "pellaga," of which no less than 97,000 Italians are said to be dying, at the present time, the number of victims representing 3.62 per 1,000 of the whole population, and in the infected departments, especially in Lombardy and Venice, a higher proportion than ever occurred during the worst cholera epidemic in France. The disease usually runs a slow course, like consumption. Its cause is believed to be the exclusive consumption of maize in a deteriorated condition and the unhealthy state of the hovels in which the rustics live.