Scientific American.

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

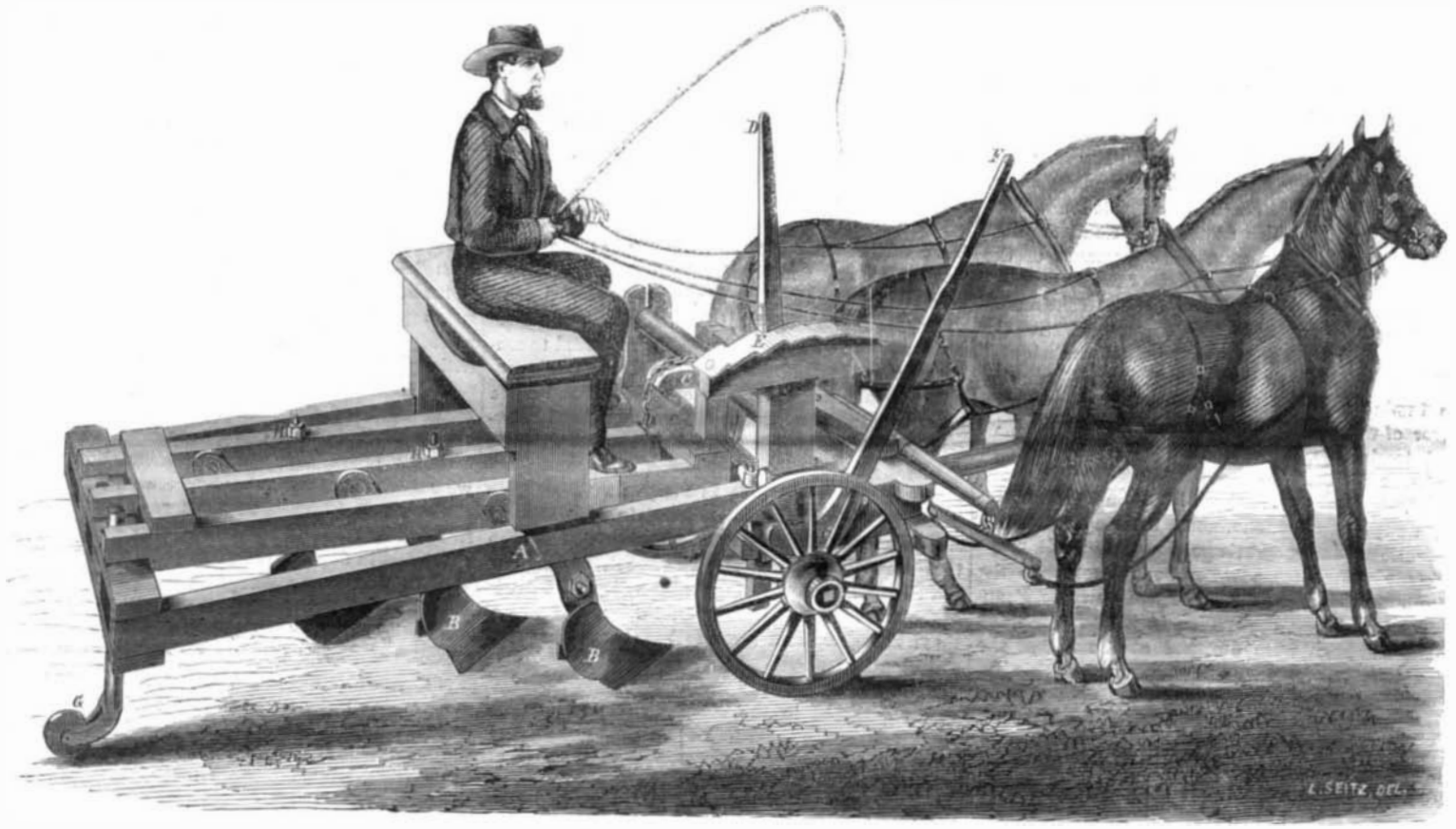
Vol. XV.---No. 22. [NEW SERIES.]

NEW YORK, NOVEMBER 24, 1866.

$3 per Annum, [IN ADVANCE.]

Improved Gang Plow.

Gang or combination plows are now frequently used, usurping the place of the single plow in large fields, and where the labor of horses can be more easily obtained than that of men. Of course, they require more power, but then the work is done much more rapidly, and where neither stumps nor stones present obstacles, there is a great advantage in their use over that of the single plow. The engraving herewith presented shows, in perspective, an arrangement of gang plows which, while they thoroughly turn up the soil, yet enable the driver to ride and turn three furrows, where the user of the single plow does one, and gives him the control of the plows by the devices which enable the driver to elevate one or more of the shares, or all, to accommodate the "lay of the land," or to use the contrivance as a vehicle.



HUTCHINSON'S PATENT GANG PLOW.

As seen in the engraving, the device is a rectangular frame, A, having two wheels in front, the axle of which is secured rigidly by forked bars extending down on each side the axle. To the frame, A, the driver's seat is fastened at any point most convenient. A frame, consisting of three longitudinal bars, secured in position by cross-bars, carries the plows, B. At the rear end this frame rests upon the cross piece of the main structure, and at the other is held by a chain passing over and secured to a roller furnished with a lifting cam, C. By means of the lever, D, the plow frame can be raised and held at any hight by the toothed segment, E. The lever, F, is employed to raise the main frame in a diagonal position, which will elevate the plows so they can be adapted to ground which is sloping instead of level. The turning of the vehicle is readily effected by the broad wheel, G, which acts as a common furniture truck or caster, turning freely in all directions.

The depth of the plowing can also be determined by means of bolts with nuts, seen at H, by which the nose of the share can be elevated or depressed. These bolts have a check-nut under the bars as well as a lifting nut on the top, so that the plowshares can be held rigidly in any required position. The engraving represents three horses abreast. In this case the "off" horse walks in the furrow last made, but by a peculiar arrangement of the whiffletrees—not clearly shown in the engraving—it is claimed there can be no side draft, each horse exerting an equal amount of power.

The plowshares are made of sheet steel, and can be readily removed and replaced by others, so that the machine may be called a "universal gang plow." Two, three or four horses may be used, as desired. It was patented through the Scientific American Patent Agency by Samuel Hutchinson, Aug. 7, 1866. For further particulars address Augustus Winchester, 706 Chestnut street, Philadelphia.

WATER-SPOUTS IN THE MOUNTAINS.

According to the writers on the subject, moisture exists in the atmosphere, in an invisible state, at all temperatures. It sustains itself there in the intervals that exist between the particles of air. These intervals are either partially or wholly filled with vapor, constantly arising from the earth. When they are wholly filled with vapor, the atmosphere is said to be saturated. An increase of temperature, by dilating the air, increases its capacity for moisture; while a diminution of temperature is followed by contrary effects. But the capacity increases at a faster rate than the temperature, so that the air, at thirty-two deg. Fah., can contain only the one-hundred-and-sixtieth part of its own weight of vapor; at one hundred and thirteen degrees it can contain the twentieth part of its weight. Thus it appears, that while the temperature advances in an arithmetical series, the capacity is accelerated in a geometrical progression. A considerable increase of temperature, therefore, will enable even a saturated atmosphere to receive a greatly augmented amount of vapor, and, as it were, to swallow the clouds that may pass into it, without any diminution of its own transparency. On the contrary, when the temperature is diminished by the rapid union of two currents of air, saturated with vapor, the one being warm and the other cool, the average temperature is so reduced that an excess of vapor exists, which is incapable of sustaining itself in the diminished capacity of the air, and is necessarily precipitated in the form of rain. But when two currents of air, not fully saturated with vapor, are brought into contact, the precipitation of moisture is slight, and mists, only, are produced. When the mists, thus precipitated are near the earth, they are called *fogs*, but when they are high in the air they take the name of *clouds*.

Another fact must be noted. The temperature of the air diminishes with the altitude, but the law of decrease is very irregular, being affected by latitude, hours of the day, and a diversity of local circumstances. It may, however, be assumed as a general rule, that a loss of heat occurs to the extent of one degree, Fah., for every three hundred and forty-three feet of elevation. But this is an average result, for the rate of decrease is very rapid near the earth, after which it proceeds more slowly, and at the loftiest hights is again accelerated.

From this brief statement of the general principles governing the production of fogs and clouds, it will be apparent that the higher portions of mountains must be refreshed by frequent rains. At present we refer only to those of the western section of North Carolina. The more elevated portions of

these mountains, ever clad in mantles of cool air, stand, as so many custom-house officers, to exact tribute from all the currents of air laden with vapor, from the warmer regions below, which attempt to sail over their summits. These currents of air cannot but pause, when richly freighted, to divide their treasures with the thirsty soils and mountain-springs. And even when they are lightly burdened with vapor, and no rain can be condensed from them, these passing currents often yield copious clouds of fog, covering the vegetation, by contact, with moisture, and promoting its more vigorous growth. Nor are the mountain summits alone in the exactions they make upon the moving atmosphere for its vapors. The mountain bases, all along the rivers and larger creeks, cool the surrounding atmosphere during the night, while the waters of the streams, retaining their warmth, send up a plentiful evaporation. The vapor which is thus formed, rising into contact with the over-hanging colder air, is condensed into fog, and floats above the streams till the morning sun sets it in motion, or dissipates it by increasing the temperature of the air along the mountain sides.

But fog and rain are not the only meteorological phenomena occurring in mountain regions. Others of a less peaceful nature, and terrific in the extreme, have been witnessed.

Once in a generation or two, perhaps, a *water-spout*, so called, bursts upon some elevated portion of a mountain. Previously to its descent, the clouds are seen moving to and fro, and commingling in a confused manner, somewhat as the circling eddies of a vast whirlpool. When concentrated above or around the mountain's summit, the cloud acquires such a density as to wear the appearance of the blackness of darkness. The roll of the accompanying thunder is deafening, and almost continuous, shaking the eternal hills to their base; while the flashes of lightning, following each other in quick succession, afford a glare of glimmering light nearly as luminous as that of the sun. Then comes a river of waters, dashing down the mountain-side, and tearing up, in its resistless progress, earth, rocks, and trees, so as to create, in its course, a deep canal. The amount of water at times discharged from such clouds is enormous, swelling inconsiderable streams into great rivers.

Many years since, a water-spout burst upon the North Mountain, to the westward of Newville, Pennsylvania, carrying destruction in its course. Many cattle and hogs were drowned at the foot of the mountain, where they were confined within inclosures, preventing escape. The largest rocks were torn from their beds, and a deep chasm excavated from the top of the mountain to the valley. Its course can now be traced by the difference in the trees within the channel from those on either side —a growth of pines occupying it, instead of the oaks and hickories of the surrounding forest.

Another water-spout fell upon the western end of the Chilhowee Mountain, where it faces the Little Tennessee River, about the date of the first settlement of the country. Its course is marked, like the one at Newville, by a large growth of evergreen trees. Again, on the west side of the same mountain, not far from Tuckalechee Cove, and near Little River, a water-spout fell, not many years since, carrying away a distillery, around which, the day previous, being the Sabbath, the young men of the vicinity had met, in a frolic, and perpetrated some enormous blasphemies—in their drunken revelries undertaking to make a mock of religion, by the administration of its sacraments. Monday was ushered in by as clear a sun as ever shone. In the course of the day, however, the thunder pealed forth a signal, startling the neighborhood into fixed attention: there they beheld, gathering upon the mountain's brow, the ominous cloud, that soon burst out into one vast deluge of water, which, descending down the mountain side, laid desolate the very spot where the profanation of Heaven's ordinances had occurred. The terror created by this celestial phenomenon was such as to produce a religious revival, accompanied by the conversion of many of the thoughtless fellows who had taken part in the iniquities of the preceding Sabbath.

Having seen the traces of all the water-spouts noticed, and having heard the descriptions of eye witnesses to the accumulation of the cloud which produced the rain-fall, in one case so furious in its descent, I concluded, as usual, that there had been a concentration, to one point, of nearly all the water yielded by the cloud, through the agency, probably, of a whirlwind motion of the air controlling it; but this theory had to be abandoned, as soon as I had completed, for myself, the investigation of the facts connected with the great fall of water-spouts upon Tusquitta Mountain, on July 8, 1847.

An intelligent professional gentleman, who visited the locality soon after the storm, described to me the effects produced. The chasm excavated in the earth, he said, had a depth of several feet, with its sides cut out as vertical as if dug with a spade. The roots of the trees and plants beneath the surface, were cut off as squarely as if done with the knife. At the surface, close up to the sides of the chasm, nothing seemed to be disturbed. The shrubs and grass, and even the fallen leaves upon the soil, remained unmoved, as though no running water had come into contact with them. This was the condition of things where the water-spout first struck the ground; and as the excavation, at the point of origin, had a width of but a few yards, the whole volume of the descending water, he concluded, must have been concentrated within that space, and continued thus contracted till the contents of the cloud were exhausted. In descending the mountain, along the line of the widening chasm, evidences existed that the torrent produced had attained, in places, a depth of sixty feet, uprooting in its course the largest trees, and removing immense rocks from the gulch created in its descent to the valley below.

In all the descriptions given, I had inferred that but a single water-spout had fallen, at the same time, from any one cloud. Such seemed to have been the case in the old ones, grown up with evergreens. But very different indeed had been the result on Tusquitta Mountain, as I was forced to conclude, when I examined the facts for myself, in relation to the fearful character of the elemental strife accompanying the descent of its hundreds of water-spouts, which had fallen at the same moment.

In the month of May, 1859, I called upon Robert Martin, Esq., who resides in Tusquitta valley, near the spurs of the Tusquitta Mountain. He had resided there in 1847, when the water-spouts fell upon that mountain. From his statement, and that of Mr. Pierce, his neighbor, who also noticed the whole of the movements of the clouds, during the space of three hours, or from first to last, I make up my statement.

The clouds were some two hours in forming. One group gathered in the southeast, another in the southwest, and a third in the south. The unusual commotion among them, as they were forming, attracted the attention of these gentlemen, and riveted them to the spot, where each one stood, near their own doors, a half mile apart.

When nearly fully formed—a process which will be described in another article—the clouds commenced moving rapidly, in eddies of many whirls, toward Tusquitta Ball. Salutations of thunder, from the first, passed between them, as though cloud called to cloud, in organizing for the coming conflict. The play of the lightning, at first occasional, became almost continuous, as the constantly accumulating masses began to move swiftly toward a common center; while the thunder, increasing in equal frequency, soon became terrific. In addition to the thunder, and just before the rain began to fall, there came a succession of sharp, keen, cracking sounds, lasting for ten or fifteen minutes, which resembled a sharp crack of the electrical spark, and then came a crash as if ten thousand pieces of artillery had been discharged. The earth fairly trembled with the concussion. There was also a loud roaring sound, independent of all other sounds, for some minutes before the clouds came into contact; and when they did meet, they shot instantly upward, with great velocity, like an arrow shot from a bow—the forests, a few rods distant, becoming so dark that nothing could be seen.

The rain now began to fall in torrents. In a few minutes the small spring branch, at Mr. Martin's, having its rise a mile or so further up the mountain, was swollen into a river.

In an hour the rain was over, and the sun again appeared as bright as ever. The gentlemen named then commenced an examination of results. About three hundred feet above the head of the spring branch, a water-spout had fallen, which excavated a canal ten feet deep, and seventy-five feet wide at its head. The side-walls, at this point, were perpendicular, while further down, it varied both as to depth and width; the vast body of water, of course, obeying the general laws controlling the descent of that fluid down a steep inclination. This torrent, in rushing down toward the spring branch, at an angle with the line of that stream, could not make a sudden turn, but dashed across, rising on the opposite side to the top of a spur of the hill, thirty feet high, when, from the further side, it naturally fell into the channel of the branch, swelling it into the proportions of a river.

Upon more extensive examination, the water-spouts were found to have been very numerous, nearly a hundred canals existing within an irregular area, not exceeding three miles in extent. The largest one was eighty feet in width, and others not more than eight or ten feet.

But these excavations were not the only effects produced during this hour of awful sublimity. Many forest trees had been struck by the lightning, and explosions of electricity, from the earth, had thrown out large masses of clay and rock, in several places producing rounded excavations of sufficient depth and width, often, to bury a common hogshead; the vegetation all round these spots being scorched and withered by the electrical fluid.

The seat of these water-spouts lay about four miles from the summit of Tusquitta Mountain. Two gentlemen were upon its summit when the cloud reached that point. One of them—Mr. William M. Martin—described the rain-fall as so dense as to almost suffocate him. The sensation was such as is experienced when under water; and the only remedy was to lean the body over, so as to have a little space of air to breathe from, beneath the breast.

On the 23d of May, 1859, I commenced a personal examination of the area upon which the water-spouts had fallen; being accompanied by Dr. McCoy, of Fort Hembre. In ascending the mountain we could see, at one time, more than a dozen of the excavations. The first one measured about twenty-five feet in width at its head, and was from six to eight feet in depth. It was only twenty yards from the top of the mountain-spur, upon which the water had fallen. There was only a slight concavity where the spout first fell, and wholly insufficient to accumulate sufficient water to cut such a canal, within the space of twenty yards. Then, as there had been no washing away of the surface rubbish above the point of excavation, it would appear that the agency which produced the cutting must have begun its work at that spot.

The next excavation examined was where two spouts had fallen, close to each other, being separated, at the head, by about three rods of unbroken ground. Each of these canals measured forty feet in width, and when united, a few rods below, the channel was sixty feet in width. These two are not in a trough, or concave portion of the mountain, but naturally fall into one some distance below their junction. The heads of both are only twenty yards from the top of the mountain spur, and could only have been cut out by the force of a descending sheet of water.

The same general features were presented in the other excavations, and additional descriptions are, therefore, not necessary.

One remark only need be ventured, in relation to the agency which cut out these channels. That it was water, none can doubt. But that the water was concentrated to one point, by a whirlwind-like action of the cloud, compressing its falling rain-drops into one compact sheet, capable of cutting away all the mere clays and fragmentary rocks upon which it might fall, is disproved by the multiplicity of excavations upon Tusquitta Mountain. The only remaining solution of the mystery, then, in relation to the manner in which the rain becomes condensed, in what are called water-spouts, on land, is to be found in the statement of philosophical principles upon a preceding column. When two clouds meet, of different temperatures, the result is a more copious discharge of rain than either, separately, s

capable of yielding. The clouds at Tusquitta, upon meeting, were observed, at once, to ascend swiftly, as if doubling upon each other. This of course, brought more cloud surface into contact than would have been the case had the clouds, on meeting, blended together at once. May I not suggest, therefore, that this sudden folding of the clouds upon each other, by their upward motion, might have produced an almost solid sheet of water, at the main points of contact, which, upon descending to the earth, would be capable of cutting its way down through any extent of clays and decomposed rocks, so as to bear them away, and leave an open canal as the result? That the descending water sheet remained stationary for a few moments, so as to limit the excavations to the spot first struck, is supposable from the fact that the motion of the clouds may have been momentarily arrested by their collision with each other. But I must leave this whole question to the philosophers. D. C.

THE NEEDLE GUN.

The merits and defects of this celebrated breech-loader were detailed by Mr. Norman Wiard, before the Polytechnic Association, recently, in an interesting comparison between this weapon and those of this class more familiar to us.

The Prussian needle gun is not to be commended as a finished piece of mechanism, but, in the opinion of the speaker, it combined advantages that render it in many respects far superior to any weapon of like character heretofore constructed. The most noticeable peculiarities of this gun are its length and weight toward the muzzle. According to our received ideas, these features should be looked upon as disadvantages, but in reality great accuracy and steadiness of aim are thereby attained, and when pointed, the weight and length make it easier to hold, and the end of the muzzle is not deviated by the recoil.

The peculiarity of placing the charge nearer the muzzle of the gun than has been customary, is an advantage which the speaker believed might be still more improved upon, for the further forward the powder is placed the less force is wasted in overcoming the friction resulting from contact of the ball with the barrel, and by igniting the cartridge at the front end the whole power is employed simply in propelling the ball. In this gun all the expansive force of the powder, and also of the fulminating gases, are utilized, but in the Sharps rifle, the propulsive power that might have been obtained from this latter force is lost, and a portion of the other force escapes through the nipple orifice.

The breech of the Prussian gun is nearly on a line with the muzzle, while in the ordinary musket a considerable angle is formed, and, in consequence, a muscular effort is required to bring the gun into position for taking aim, and the force of the recoil is not so easily resisted. The certainty of becoming foul, after a number of charges have been fired, limits the capacity of the Springfield rifle to twenty rounds, hence the superiority of breech-loaders in this respect, for every ball acts as a swab in cleansing the barrel of the solid residue from the powder.

In conclusion, Mr. Wiard presented some curious statements furnished in an official report on the battle of Gettysburg, stating that 27,574 guns were picked up on the field after the engagement, 24,000 of which were loaded. Of this number one-half had two loads each remaining unfired, one-quarter had three loads, and the remaining six thousand contained over ten loads apiece. Many were found having from two to six bullets over one charge, in others the powder was placed above the ball, one gun had six cartridges with the paper untorn, in one Springfield rifle twenty-three separate charges were found, while one smooth-bore musket contained twenty-two bullets and sixty buckshot rammed in promiscuously.

Japan.

Dr. McGowan recently delivered a lecture in San Francisco, upon "Japan and the Japanese," in which he said: The geological formation of the mountains is generally igneous in character, with the superimposition of limestone, sandstone, and coal measures. Gold is found in abundance, and when the speaker went there it could be obtained for its weight in silver. The Japanese, however, soon saw that the gold was leaving their country in large quantities so rapidly that they increased its value. Japan is preeminently a copper country. So plentiful is it that the traveler will find their boats, inside and out, lined with it, as also the shutters and roofs of their houses. They have spades and cooking utensils made of it. There is one of these islands which contains nothing else but copper ore. Conversely iron is met with in only limited quantity. You will see the Japanese washing it out of the sand in the beds of rivers, after the fashion of the placer miners of California, who pan out their gold. Coal is found all over the country, though the mines are not much worked, nor is there a great deal of demand for it, as the people dress very warmly and use chafing dishes in their houses to keep them warm. But when one line of steamers gets established this will come in very conveniently, and the supply will be quite equal to the demand.

New Safe Lock.

The London *Engineer* gives the following account of a new lock which seems to be constructed upon new principles:—"It is composed of neither more nor less than steel wires—call them needles if you like—strung together on two stumps, attached to the running bolt upon which they revolve, and they require to be lifted by the key to a position to admit of their being passed through certain holes in a plate of brass, and thus passing, carry the running bolt with them, which carries the real bolt. The needles move obliquely, perpendicularly, laterally, and, indeed, in any direction; hence the difficulty in raising all the needles with an instrument, simultaneously, to their required positions to run through their own apertures, and escape the many traps set for them in the shape of a number of holes, pierced nearly half way through the fence plate, of the exact size to fit the needles. In the more expensive latches, as we have only been describing the cheapest ones, there are protectors and detectors."

Statistics of Photography.

The rapid growth of new and special industries, says the *British Quarterly Review*, is a fact so characteristic of the present day, that the statistics of photography can scarcely be regarded as wonderful, viewed merely as a question of economies. Nevertheless, some of the facts are sufficiently startling. Twenty years ago one person claimed the sole right to practice photography professionally in England. According to the census of 1861, the number of persons who entered their names as photographers was 2,534. There is reason, however, to believe that these figures fall short of the real number; since then it is probable the number has been doubled or trebled, and that including those collaterally associated with the art, it is even four or five times that number. But these figures fall far short of the number interested in photography as amateurs. We are informed that eight years ago, in establishing a periodical which has since become the leading photographic journal, a large publishing firm sent out twenty-five thousand circulars—not sown broadcast, but specially addressed to persons known to be interested in the new art-science. The number of professional photographers in the United States is said to be over fifteen thousand, and a proportionate number may with propriety be estimated as spread over continental Europe and other parts of the civilized globe.

But a more curious estimate of the ramifications of this industry may be formed by a glance at the consumption of some of the materials employed. A single firm in London consumes, on an average, the whites of two thousand eggs daily in the manufacture of albumenized paper for photographic printing, amounting to six hundred thousand annually. As it may be fairly assumed that this is but a tenth of the total amount consumed in this country, we obtain an average of six millions of inchoate fowls sacrificed annually in this new worship of the sun in the United Kingdom alone. When to this is added the far larger consumption of Europe and America, which we do not attempt to put in figures, the imagination is startled by the enormous total inevitably presented for its realization.

In the absence of exact data we hesitate to estimate the consumption of the precious metals, the mountains of silver and monuments of gold which follow as matters of necessity. A calculation based on facts enables us to state, however, that for every twenty thousand eggs employed, nearly one hundred weight of nitrate of silver is consumed. We arrive thus at an estimate of three hundred cwt. of nitrate of silver annually used in this country alone in the production of photographs. To descend to individual facts more easily grasped, we learn that the consumption of materials in the photographs of the International Exhibition of 1862, produced by Mr. England for the London Stereoscopic Company, amounted to twenty-four ounces of nitrate of silver, nearly fifty-four ounces of terchloride of gold, two hundred gallons of albumen, amounting to the whites of thirty-two thousand eggs, and seventy reams of paper; the issue of pictures approaching to nearly a million, the number of stereoscopic prints amounting to nearly eight hundred thousand copies.

The Breweries of Chicago.

The Chicago *Republican* has an article upon this subject, describing the process of brewing, and giving the history and statistics of the business in that city. Beer, porter, stout, and the numerous kinds of ale, are manufactured in nearly the same way, the difference lying in the malting and fermenting. The most approved grain is barley, of the species called "Rath." The grain must be full, and must contain a large proportion of starch. In malting, the first process is to steep the barley. This occupies about forty-eight hours. When taken out, the grain has increased in weight about forty-seven per cent. It is next dried, and "conched." This process is simply piling the grain upon the malt floor, in rectangular heaps, from twelve to sixteen feet in hight. After a short time the grain becomes moist and hot, and germination begins. This is checked as soon as the stem begins to grow, and the grain is spread on the floor and turned two or three times a day. In this process it becomes white and crumbly. It is then placed in the kiln, and is gradually heated, first to 90 deg., and then to 140 deg. This takes from two to three weeks. It is at this point the character of the liquor is determined, ale being made from the palest, and porter from the brownest malt.

The malt is next ground and thrown into water at 160 deg., where it is thoroughly soaked. At the end of half an hour more water is added, increasing the temperature to 167 deg. After a few hours the "sweet wort" is run off into the "undertack." This wort is a clear, sweet liquor, of the same color as the malt from which it was made. The same process is repeated, the second solution being mixed with the first. The third solution becomes small beer. The liquor is boiled in copper vessels, at 212 deg., strained through the "hop-buck," and cooled as rapidly as possible to prevent souring. Lager-beer is cooled by the application of ice water. The liquor is then let into the fermenting vats, cleansed by isinglass, and barreled for use.

Dundas Cultivator Reissue.

We publish on another page an important decision of the Examiners-in-Chief in the above case, which is one of great public interest. A petition, with some eleven thousand signatures, was presented to Congress last winter desiring it to prevent the grant of the reissue; and a resolution passed that body requesting the Commissioner of Patents to suspend action until the matter could be investigated. The application was consequently suspended, but as Congress adjourned without making the investigation, the Commissioner allowed the case to proceed. The Secretary of the Interior has received many letters since from Members of Congress, and others, asking that action be delayed until Congress meets again, but after mature deliberation, he decided to let the case go on. The report, therefore, is one of unusual interest.

ERRATA.—On page 320, article "Porcelain," fourth paragraph, for "oxide too" read oxide of tin. On page 335, article "Inclosing Electricity," thirteenth line from top, for "glue bottle" read glass bottle. These typographical errors provoke the editor much more than they do the reader. The poor printer often has a narrow escape of well-merited chastisement.