Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, DECEMBER 13, 1884.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 467,

For the Week ending December 13, 1884.

Price 10 cents. For sale by all newsdealers.

BELT MATERIAL.

The first idea of a belt for machine purposes is a leather band, but other materials have been used for many years; the writer remembers seeing a six inch or an eight inch belt that had run for more than a year in a wood working establishment, which was made of cotton cloth—sail duck. The belt connected two pulleys of three feet and two feet diameter respectively, the shafts of which were on the same level. To compensate for the shortening and lengthening of the belt by the changes in humidity of the atmosphere, a pivoted idler was used. This change of length appeared to be the only serious drawback to the employment of cotton as belt material; for the adhesion of the material to the face of the pulley was excellent.

Rubber belting is simply cloth and rubber united by being pressed between heavy rollers; its strength depends on the fibrous portion—the cloth. There has recently been another cloth belt put upon the market, that depends for its adhesiveness to the pulley face on cotton. This a woven belt, the woof or warp of which is of a series of continuous steel wires, the filling being coarse cotton yarn or twine. No preparation is given the cotton, either before or after the weaving, and the "shed" in weaving is so arranged that the steel wires, on which the strength of the belt depends, are entirely covered. One of these belts has been noticed by the writer for more than two years—a twelve inch belt leading from the fly wheel of an engine—and it shows no sign of destructive wear yet, and has absolutely no stretch. From these examples it would appear that under some circumstances (those of a dry atmosphere, equable temperature, and an unshipable belt), cotton might prove to be an excellent substitute for leather for belting purposes.

There appears to be only one sort of leather that is properly applicable to belt making—that from the skin of the ox or *Bos* tribe. During a residence of several years in one of the British American provinces, the writer was compelled by circumstances to make his own belts, of such material as could be obtained. Moose hide leather was tried, but it had a quality of indefinite stretch; to obtain a six inch wide belt, strips not less than ten inches wide were required, and these were wetted and stretched by powerful winches for several days before they were fit to cut to width. The leather was very thin for the width of belt, but it was wonderfully tenacious and adhesive. Raw hide (untanned skin) will do fairly well as a belt if kept soft by oil, but it lacks the hug of leather, and has little elasticity.

Ox leather belts stand at the head of those of all other materials for the satisfaction of all demands on belts. No other belts will stand the wear of the shipper; cotton belts are weakened when wet; rubber belts are rotted when oiled, but leather will stand wet and dryness, cold and heat, and lasts a long time even when oil saturated.

GOLD LEAF.

If a sheet of gold leaf is held up against the light, it appears to be of a vivid dark green color; this means that the light is transmitted through the leaf. When it is considered that this leaf is a piece of solid metal, a better idea of the extreme tenuity of thickness of the leaf can be comprehended than by any comparison by figures; nothing made by the hand of man equals it in thinness. This extreme thinness is produced by patient hammering, the hammers weighing from seven to twenty pounds, the lighter hammers being first used. When the true method of this beating is understood, the wonder expressed sometimes that gold leaf beating should not be relegated to machinery ceases; the art belongs to the highest department of human skill and judgment. Apprentices have served a term, and have been compelled to abandon the business, because they never could acquire the requisite skill and judgment combined necessary to become successful workmen.

The only pure gold leaf is that used by dentists for filling carious teeth, and it is called foil. It is left much thicker than the gold leaf for gilding—indeed, it could not be beaten so thin; for thin or leaf gold an alloy of silver and copper is required to impart the requisite tenacity. Dentist's foil weighs six grains, five, four, and three grains per sheet, or leaf, according to its thickness. The last operation on the leaf is annealing. This is done over a charcoal fire, the leaf being laid singly in a sort of corn popper—a square receptacle with wire bottom at the end of a handle—over which is held a similar cover to prevent the flame from carrying the leaf away. An instant's exposure to the flame induces a red heat, when the leaf is laid on a sheet of a book.

The material for gold leaf and dentist's foil is coin gold. The gold is precipitated by muriatic and nitric acids over a fire to separate the gold and silver, the copper of the alloy passing off in the heat. The silver from gold coin amounts to about seven pennyweights to $800 worth of coin—the amount usually treated at a time. This reduction and separation of the metals is the usual method, and does not require special description.

The pure gold is then melted in sand crucibles with the proper proportions of silver and copper to produce the color of leaf desired, very fine ornamental effects being produced in gilding with leaf of differing shades. The fluid metal is poured into iron moulds, making bars seven inches long, one and an eighth inches wide, and one-fourth of an inch thick. These bars are forged, like iron, between anvil and hammer, to even the edges, and then rolled in powerfully geared rolls to a ribbon not thicker than writing paper and one inch wide. Of course, in the rolling as in all the processes, there must be occasional annealings.

Now comes the first of the beating processes. These squares of gold (one inch square) are placed in a pile alternating with larger squares (four inches or more) of "kutch" paper, a material made from a pulp of animal membrane—raw hide, intestines, etc.—and the outside of the pile receives a square of parchment. The hammering then begins with a seven pound hammer on a block of marble that rests on a solid foundation. After one hour's beating the pile is warmed at a fire to anneal the gold, a process requiring care, so that the kutch paper be not burned. Four hours of beating suffices for this preliminary process, 180 squares of gold being treated in one pile. The final process requires great skill. The partially beaten squares are packed as before, but with alternates of gold beater's skin, until the pile contains 900 sheets. The beating is continued with increasingly heavier hammers until the final finish with the twenty pound hammer. The gold beater's skin comes from England, and the best of it—and the most of it—is made by one family—Frederick Perkins. The skin is so thin as to be almost transparent, and yet it is double, two thicknesses. It is prepared from the larger intestine of the ox. Each sheet of the skin is rubbed on each side, before the pack is made and whenever the pack is rearranged (placing the outer gold in the center and *vice versa*), with a powder made from calcined gypsum of a very pure sort, imported from Germany. This is to prevent the gold from sticking to the skin.

In beating, the work of spreading the gold is from the center of each square of gold out toward the edges, and the finished squares are thicker at the edges than in the center. A contrary spreading would split the edges and ruin the squares. In rearranging the squares in the process of beating they are sometimes torn, but another piece laid on as a patch, lapping over the torn place, will be firmly welded in the after beating.

The finished squares are cut to a size of three and three-eighths inches, and packed in a "book" holding twenty-five sheets, the paper leaves being rubbed with red ocher to prevent sticking. These books of twenty-five sheets are sold at from thirty to forty cents each. The cutting of the leaf is done by knives, which are simply slips of the outer shiny shell or skin of the Malacca cane such as is used for walking sticks. The outer rind contains silex or flint in minute, invisible particles, forming a peculiar edge. Steel will not answer the purpose.

CRIMINAL IGNORANCE.

The October number of *The Locomotive* has an editorial article on the foolish carelessness of engineers of stationary engines that ought to be generally read, because it tells the truth where subterfuge and pretense has sometimes blinded judgment. Engineers are not, as a class, pretenders and cheats; but there are many who pretend to know their business who are simply and only swindlers; who do not know the manual of their business even, and never thought of knowing its chemical and mechanical reality.

The Locomotive says:

The carelessness sometimes displayed by engineers (?) who have charge of boilers is simply criminal, and deserves the severest penalties. A recent occurrence will illustrate this. Visiting an establishment where we had boilers insured, our attention was attracted by the suspicious actions of the engineer. Watching for what he supposed was a favorable opportunity, he climbed up on top of the boilers and headed toward the safety valve, always keeping as nearly between it and us as he could, but not, however, succeeding in always keeping from view. Reaching the valve he busied himself a few moments about it, and then returned with a nonchalant air to where we were. The following conversation then occurred:

Inspector: "Tired of living, are you?"
Engineer: "No; what do you mean?"
Inspector: "I thought perhaps you were."
Engineer: "What makes you think so?"
Inspector: "Why, from the use you make of that wedge you now have in your overalls pocket. I see that you had the safety valve fastened down with it. Now, if you want to die, why don't you go out and jump into the river, and drown yourself; then nobody's life but your own would be endangered?"
Engineer: "Those boilers are all right. I don't believe a boiler can blow up so long as there is plenty of water in it. I have been running boilers twenty years." And so on to the end of the chapter.

This fellow had actually made an iron wedge, and driven it into the forked guide above the lever, so that it was impossible for the valve to lift, in order to "bottle up the steam," as he expressed it. And this in spite of the fact that the pressure was all that could be safely allowed; and he had also moved the weight out on the lever fifteen pounds beyond the limit allowed. This is an actual occurrence.

PULLEYS AND GEARS.

In American practice, pulleys have led gears for more than thirty years. There was a time when no large establishment driven by power could be arranged to run except by gearing; all the main shafting was geared to the prime mover, and if that was a steam engine a jack wheel instead of a belt imparted motion from the fly wheel or crank shaft. The writer remembers a set of cards in a cotton mill; the cylinders, licker-ins, doffers, and even the doffer combs, were all connected by gear wheels. Years after the grinding, wearing, noisy main gears were superseded here by the smoothly running pulleys and belts, the English adhered to the toothed wheel system. It had its value; it has its advantages, and the gear wheel is taking its place as a valuable adjunct to machinery of all kinds. One of these advantages is its absolute security; "give a tooth take a tooth" is an old adage in mechanics, and is an absolute law in gearing; there is no slipping and no failure of transmission of power.

But there were objections to the gear, and although some have been removed, others remain. One of the great objections to the gear, as it was formerly made, was its tendency to crowd apart—the two gears working against each other rather than with one another. But with the recent improvements in gear teeth cutting that objection is entirely removed; gears properly cut run together with no inclination whatever to come apart, except with a speed that develops centrifugal force. Some recent experiments seem to prove that the forcing apart tendency of well cut gears is reduced to *nil;* while on the other hand the connection of pulleys by belts necessitates a very strong pulling together, proportioned to the diameter of pulleys, width of belts, distances apart of the pulleys, and their relative positions.

Another objection to the use of gears is where the reach is considerable between the shafts; in which case the only connection feasible is by means of one or two intermediates, as the direction of revolution may demand. If the two connected shafts are to revolve in the same direction, a single intermediate may be used; but it is evident that the diameter of this wheel must be sufficient to reach between the peripheries of the two other wheels, else three intermediates must be employed. Sometimes these transmitters—or otherwise idlers—are unhandy, and then the advantage of pulleys and belts is apparent. The belt and pulley have a reach that is impossible without a train of gearing or a belt connection of links of machine chain. Except for this lack of reach it is evident that the gear connection is superior in itself to the pulleys and belt, which at its best must be considered a makeshift for an absolute transmitter.

A BASIC METAL.

The title of "the iron age," which has been applied by some writers to the present period, seems to demand some modification or addition; copper has become fashionable in our houses, in our public buildings, and in our monuments. It appears pure, or in alloys forming bronzes and brasses of a variety of color and a number of degrees of tenacity, obduracy, and durability. This is a revival of the fashions of several generations ago. It is a good one, however, for there is a limit to the tractability of iron and steel, and the eye tires of non-colored metal as it would of neutral tinted clothing.

The capacity of copper for combining with others forming different alloys is not possessed so fully by any other metal; with zinc the brasses that may be made vary from the deep red of the copper itself to the gray white of the zinc, and in tenacity from that of the toughest, purest copper to the hard brittleness of spelter. In combination with tin its products are still more varied in color and perfect in beauty.

Not one of the alloys of copper is subject to destructive oxidation when exposed to air, water, or steam; but by weather exposure the beauty of the bronzes is enhanced and their durability insured. There is more brass used in the machine shop than formerly; the work of the machinist of to-day is not limited to iron and steel; he must know the qualities of the "composition" he is working and how to work it well. Brass finishing can hardly be called a distinct trade nowadays. Recently there was noticed in a large machine manufacturing establishment one of its products that consisted of three-fourths by weight of copper and its compounds and only one-fourth of iron and steel. The work was of such a character as required the skill and tools of the machinist and the conveniences of the machine shop. Said the superintendent, a machinist of more than thirty years' experience:

"I can tackle any job now. Time was when I would have sent copper and brass work to the coppersmith and the brass finisher, but we must do these mixed jobs if we would do any work. So I compelled myself to learn the working of these metals, and then I taught my men. A machinist who can't work copper, bronze, and brass is not a competent workman."

The value of copper compositions in machinery is very great; a casting of bronze or of brass is wholly unlike one of iron in its tenacity, and it may combine this sometimes necessary quality with a hardness (durability under wear) that no iron casting can possess. These combined qualities cannot be imitated by any other metal. The writer once successfully proved this advantage. A small pinion made first of cast iron, then of cast steel, and lastly of forged Lowmoor iron, broke, or stretched beyond usefulness, when one of tough bronze was tested with satisfactory results.

To Foretell Weather.

Weather wise prognosticators seem to be on the increase. In last week's issue we quoted from a Cincinnati observer his method of foretelling the changes in the weather, from watching the habits of animals; and there now comes from the South a weather prophet who adds a long list of the signs which he has observed to precede changes in the weather.

Few intelligent persons, says the *Southern Planter,* can have any sympathy with the so-called prophets who oracularly announce phenomena, giving dates, occasionally making lucky hits, but as often firing their random shots altogether wide of the mark. That there is, however, something in weather philosophy, intelligent persons will be quite ready to concede, and they will be in accord with the view of the writer when he recommends the observation of natural phenomena, which has been long practiced. He says:

If one could read the signs, each day foretells the next; to-day is the progenitor of to-morrow. When the atmosphere is telescopic, and distant objects stand out unusually clear and distinct, a storm is near. We are on the crest of the wave, and the depression follows quick. It sometimes happens that clouds are not so indicative of a storm as their total absence. In this state of the atmosphere the stars are unusually numerous and bright at night, which is also a bad omen. It appears that the transparency of the air is prodigiously increased when a certain quantity of water is uniformly diffused through it. Mountaineers predict a change of weather when, the air being calm, the Alps covered with perpetual snow seem on a sudden to be near the observer, and their outlines are marked with great distinctness on the azure sky. This same condition of the atmosphere renders distant sounds more audible.

There is one redness of the east in the morning that means storm; another that indicates wind. The first is broad, deep, and angry; the clouds look like an immense bed of burning coals; the second is soft and more vapory. At the point where the sun is going to rise, and a few minutes in advance of his coming, there rises straight upward a rosy column, like a shaft of dyed vapor, blending with and yet partly separated from the clouds, and the base of which presently comes to glow like the sun himself. The day that follows is pretty sure to be windy.

It is uncertain to what extent birds and animals can foretell the weather. When swallows are seen hawking very high, it is a good indication, because the insects upon which they feed venture up there only in the most auspicious weather.

People live in the country all their lives without making one accurate observation about nature. The good observer of nature holds his eye long and firmly to the point, and finally gets the facts, not only because he has patience, but because his eye is sharp and his inference swift. There are many assertions, the result of hasty and incomplete observation, such as, for instance, that the way the Milky Way points at night indicates the direction of the wind the next day; also, that every new moon indicates either a dry or a wet month. There are many other stories about the moon too numerous to mention. Again, when a farmer kills his hogs in the fall, if the pork be very hard and solid he predicts a severe winter; if soft and loose, the opposite; overlooking the fact that the kind of food and the temperature of the fall make the pork hard or soft. Numerous other instances could be cited to prove that the would-be shrewd farmer does not interpret nature in the right way, and that his conclusions, being hasty and incomplete, are wrong; and until he studies nature understandingly, using a little common sense, so long will he be more or less under the ban of superstition and ignorance.

The Bell Telephone Patents Sustained.

The great telephone suit has been decided by Judge Wallace in favor of the Bell Telephone Company. The People's Company will, it is said, take an appeal to the United States Supreme Court, but they are in the mean time enjoined from putting up and operating any telephones under the Drawbaugh inventions. The suit of which the present opinion is the result was commenced in 1880, and the principal points relating thereto have already been referred to in these columns. Judge Wallace in his opinion says:

"The issues made by the pleadings are practically resolved into the single question—to which the proofs and arguments of counsel are mainly addressed—whether the patentee, Bell, or Daniel Drawbaugh, of Milltown, in Cumberland County, Pennsylvania, was the first inventor of the electric speaking telephone."

The theory of the defendants, according to the opinion of Judge Wallace, is that some of Drawbaugh's instruments were made in 1867, and others at various times before 1874.

"It is in proof that thirty-three patents were granted for improvements in telephones in 1878, sixty-four in 1879, more than one hundred in 1880, and ninety-four in the first six months of 1881. According to the theory of the defendants, therefore, as early as February, 1875, Drawbaugh had not only distanced Bell in the race of invention, but also Gray and Edison, and had accomplished practically all that has since been done by a host of other inventors."

The testimony on both sides is reviewed at length, and the Judge concludes:

"Succinctly stated most favorably for the defendants, the case is this: One hundred witnesses, more or less, testified that one or more occasions, which took place from five to ten years before, they think they saw this or that device used as a talking machine. They are ignorant of the principles and of the mechanical construction of the instruments. But they heard speech through them perfectly well, and through one set of instruments as well as the other. This case is met on the part of the complainants by proof that the instruments which most of the witnesses think they saw and heard through were incapable of being heard through in the manner described by them; and further, that the man who knew all about the capacity of his instruments never attempted to use them in a manner which would demonstrate their efficiency and commercial value, but on the contrary, for ten years after he could have patented them, and for five years after they were mechanically perfect, knowing all the time that a fortune awaited the patentee, and with no obstacles in his way, did not move, but calmly saw another obtain a patent and reap the fame and profit of the invention. Without regard to other features of the case, it is sufficient to say that the defense is not established so as to remove a fair doubt of its truth; and such doubt is fatal. . . . A decree is ordered for complainant."

Congress and the Patent Office.

The Hon. Benjamin Butterworth, Commissioner of Patents, labored earnestly during the last session of Congress to obtain from that body the relief which the Patent Office so sorely needs, in the way of increased appropriations for the employment of additional examining and clerical force, and urging the necessity for enlarged departments for the transaction of the steadily growing business of the office. Mr. Butterworth is now himself a member-elect of the next Congress. This body, however, does not meet, except it be called together in extra session, until December, 1885, and unless the present Congress takes some favorable action before its dissolution in March next, the Patent Office will continue to go on in its present crippled condition for a year, and perhaps a year and a half, to come. Mr. Butterworth succeeded last spring in getting a slight increase on the former appropriation, but his present position is such as to give added force to any effort he may now make in behalf of the inventors of the country to obtain from the Government what has only thus far been withheld by the grossest injustice.

In the mean time we trust that inventors themselves will not be entirely idle. There are enough of them in each Congressional district who have been greatly annoyed or injured by former delays in the Patent Office to exercise a potent influence on the action of their representatives. Let all such inventors, as well as those who are expecting in future to have business relations with the Patent Office, write direct to their representatives, urging prompt action on this hitherto greatly neglected matter. The present session is a short one, lasting only till March, but the appropriations now made must govern the business of the office for the year commencing next July. It is evident, therefore, that there is no time to lose, and interested parties should strongly urge that this appropriation should be one of the first considered, and not to be left to the hurry and accidents of the closing days of the session.

Madagascar.

Madagascar consists of a central plateau or highland rising from 4,000 feet to 5,000 feet above the lowlands of the coast, and from this plateau rise occasional volcanic cones, the highest, Ankaratra, being 8,950 feet above the sea. These volcanoes extend from the northern extremity of the island to the 20th parallel of south latitude. South of this appear granitic rocks, at least as far as 22° south latitude. At higher latitudes than this the rocks of the interior are practically unknown to Europeans. According to a recent paper by Mr. F. W. Rudler, F.G.S., several crater lakes and mineral springs abound; and to the north of the volcanic district of Ankaratra there is a tract of country containing silver, lead, zinc, and copper ores. As regards building stones, besides the granite which is so general, there are vast beds of sandstone and slate between the district of Ankaratra and the fossil regions in the southwest of the central plateau. These fossils, according to M. Grandidier, the recent French traveler in the interior, are referable to the Jurassic system, and comprise remains of hippopotami, gigantic tortoises, and an extinct bird of the ostrich species. The coasts of the country are rich in timber, and it would also appear that the interior is a good mineral field.

More Time for American Inventors.

For the purpose of allowing American inventors every possible facility for participating in the London "Inventions" Exhibition the time during which applications will be received has again been extended, the limit being now fixed at Jan. 31. As the exhibition opens in May next, it is hardly to be expected that there will be any further postponement, so intending applicants for space should take this as a last notice. The Hon. Pierrepont Edwards, British Consul in New York city, who will furnish the necessary printed forms for applicants, reports that the number of applications thus far from this country have been quite large, and the interest shown by our people in respect to the exhibition is quite encouraging.

Mr. Edwards is untiring in his efforts to interest American inventors in the exhibition, and he is encouraged to believe that the display of their works will be most creditable to the nation.

The Slaughtering of Cattle.

The process of killing and dressing beef at the stock yards, says a contemporary, is not as expeditious and wonderful in character as is that of killing and dressing hogs. The features most noticeable are the two methods used in killing the animal at the start. One of these methods is through the use of the rifle, and the other the lance. In both the animals are driven singly from the yard into a narrow box stall open at the top. A dozen of these stalls are in a row, and over their tops are laid some loose planks on which the slayer walks with rifle or lance in hand. In the case of the rifle the executioner puts a ball into the animal's brain at short range, which kills instantly. Not a groan is heard, not a muscle moves. The animal falls like a lump of lead, and is at once dragged from the stall into the slaughter-house, where the throat is cut and the process of dressing is completed.