Windmills are easily and cheaply constructed, and, if it would not require cumbersome or expensive apparatus to compress the air and transmit its power to the various machines, I do not see why it should not almost entirely supersede animal power on the farm.

Wind is a variable power, and some may object to its use on this account; but there are rarely more than two consecutive days in which the wind would not produce the requisite force; and if sufficient power could be stored up to run the machinery of the farm during these days, this objection would wholly disappear. SAMUEL GRAY.

Homer, Ill.

Motive Powers--The Expansion of Gases, versus that of Fluids.

MESSRS. EDITORS:—Heretofore gases have been chiefly employed to utilize the expansive force of heat. Gases are elastic and compressible; fluids are—water, at least, is—nearly incompressible. Gases expand with a force in proportion to the increment of heat; water, with a force equal to its power of resisting compression—*i.e.*, the same increment of heat that would expand a volume of water in the open air, would expand it under any pressure, and doing any amount of work. Apply heat to water, and it will burst the strongest vessel you can put it into. Why will it not move the most heavily loaded piston you can apply it to? It will: but it is objected that the motion is too slow, and not powerful enough to be available. Let us see. Eight thousand and odd feet of inch copper pipe can be coiled in a jacket 6 feet × 6, without having the pipe nearer anywhere than half an inch, and leave a core in the center. Let the pipe be filled with water; the temperature can easily be varied, one half of the number of degrees between the freezing and boiling points, by filling the jacket alternately with steam and cold water. This I know by experience. This gives an expansion of $\frac{1}{46}$ of the bulk at the minimum temperature, or enough to fill a cylinder 3 by 12 inches 20 times; and this operation can be repeated once a minute, or oftener, if necessary. Now, a piston rod of 3 inch steel fitted to this cylinder, without a follower (the pressure exerted only on the outward stroke, against the end of the piston rod) would transmit 150 horse power, while the steam (at saturation) required to fill the jacket once a minute would not be so much as whistles through a 25 horse power engine every revolution. A continuous motion is secured by having two such apparatus, one contracting, and furnishing a vacuum to exhaust into, while the other is expanding, and doing the work, and *vice versa*. Now, I repeat, *the same heat that will expand that water in the open air will make it exert one or one thousand horse power, according to the strength of materials.* I have produced over 600 pounds pressure in a small experimental tube 100 feet long, by simply pouring hot water into the jacket.

I have not the means to experiment on a large scale, or to introduce my motor to the public; hence this article. I will give any particulars, and show plans and specifications to any one who will furnish means to do so. F. SHAW.

Cordova, Ill.

Improvement in Mowing Machines.

MESSRS. EDITORS:—I have located a grass line for the mowing machine, and have made an improvement in the cutting point, the object of which is to prevent the blades from choking, a great drawback in harvesters. Choking is caused by the blades entering too far into the grass, or grain, when the cut is made. In very thick or wet grass, or grain, the blades slip over the grass, and draw it into the inside of the guards, which clogs the machine down, and stops the team. The operator is then obliged to pull the grass out with his hands, before starting again. This improvement will apply to all fashions of wheels and gearing. In all machines there are four gear wheels, two spur wheels, and two bevel wheels. Some have too many cogs, and some not enough. My grass line I fix at one fourth of an inch before the blades are full.

The following wheels and gear will cut at or before it reaches this line: Spur wheel, 62 cogs; its pinion, 11 cogs; bevel wheel, 44 cogs; its pinion, 11 cogs; total, 128 cogs.

This arrangement of gear and number of cogs will produce the result of the grass line I have described, and will work anywhere without choking. LABAN PERDEW.

Galion, Ohio.

How to Keep a Churn from Frothing Over.

MESSRS. EDITORS:—Happening one day to visit the house of a friend who kept a cow and made butter, I there saw a simple method he used to overcome the great trouble of all butter makers using the old-fashioned upright churn, viz: the overflowing of the cream during the process of churning. His plan was as follows: Take the body of the churn and cut a groove around the inside of the mouth, about three inches from the top and three eighths of an inch deep, and then remove half the thickness of the wood, making a shoulder all around; then take the cover and cut it to fit nicely inside, and you have now done away with all the old nuisances of cloths, tubs, pans, etc., heretofore required to save the cream that flowed over. Any man, almost, can do this, or the churn may be taken to a carpenter and treated for a few cents. Many an idea of less consequence than this, is patented, but all may take this one for what I gave for it.

W. A. MACKENZIE.

Eastport, Me.

A CORRESPONDENT informs us that apples may be kep from decay by covering them with dry ashes, a method easily tried, and if found satisfactory, capable of extensive application.

INTERESTING SCHOOL STATISTICS.

[CHIEFLY FROM MR. KIDDLE'S ANNUAL REPORT.]

There are, in New York city, 271 schools of all classes, attended by 102,608 pupils. The percentage of absentees in the boys grammar schools is 11½, and in the girls, 14, showing that the boys are more regular in attendance than the girls. The pupils of the colored schools are far more irregular, the percentage of absentees being 35.

Allowing 100 cubic feet of space for each pupil in the grammar schools and 80 in the primary, it appears that the school buildings in New York afford accommodations for 99,437 pupils; but owing to changes in population, some of the school buildings are situated in neighborhoods where the attendance is necessarily small, while a few others have 3,000 more than they ought properly to receive.

In the matter of discipline, 88 per cent of the girls' schools and 64 per cent of the boys' are excellent. In reading, 63 per cent of the girls' schools are excellent, and 28 per cent of the boys'. In spelling, the girls are 42 per cent excellent and the boys 27 per cent. In writing, girls 60 per cent, boys, 36 per cent. In arithmetic, girls 30 per cent, boys, 24 per cent. It thus appears that the girl schools are in every way superior to the boys.

The number of teachers in all the schools is 2,683, of whom 363 are males and 2,320 are females.

The appropriation on account of salaries for 1871 is $1,690,000, which affords an average of nearly $630 for each teacher—or $16 a year for each child instructed; but as the total expenditures of the Board of Education are $2,626,000, it will be seen that the cost to educate one child is something over $26 per annum. The average number of pupils per teacher is 38, but in some of the primary schools, we have seen classes numbering nearly 100.

It costs $83,000 per annum to heat the school buildings, and $105,000 to pay the janitors.

Keeping pianofortes in repair is a matter of $2,500, and the Board of Education want for advertising and printing, the snug sum of $36,000.

Two hundred and eighty-seven boys and girls were banished from our schools during the year as incorrigible, out of 100,000 in attendance. This number is large of itself, but is a small percentage of the whole number, and speaks well for the power of "moral suasion," which is all the teachers have to rely upon since the abolition of corporal punishment.

It appears that 21,912 persons attend the evening schools, of whom 3,846 are over 21 years of age; 15,423 are males. 6,023 are females, and 466 colored of both sexes.

The most extraordinary information of all is in relation to the instruction in the natural sciences. Botany is taught without books or plants; Mineralogy without specimens; Physiology without charts, and Natural History with no means whatsoever for illustration. Some of the teachers have extemporized for themselves limited collections, and the pupils, in self-defense, have brought such odds and ends as they have been able to procure at home or on the streets; but that the great city of New York should be so utterly destitute of everything relating to the study of the natural sciences is an unspeakable disgrace, as inexcusable as it is disgraceful, and we trust that the recommendation of the Superintendent of Public Schools, on this important subject will be carefully heeded by the Board of Education, and that the evil complained of will be fully remedied before another year.

The Honey Trade.

This article, which, twenty-five years ago, formed quite an insignificant article of trade in this country, is rapidly increasing year after year in domestic production; whilst the amount imported is growing smaller.

In 1860 the total product of honey of the United States reported, was 23,366,357 pounds. New York stood at the head of the list, with 2,369,751 pounds, followed in order by North Carolina, 2,055,969 pounds; Kentucky, 1,768,692 pounds; Missouri, 1,585,983 pounds; Tennessee, 1,519,390 pounds; Ohio, 1,459,601 pounds; Virginia, 1,431,591 pounds; Pennsylvania, 1,402,128 pounds; Illinois, 1,346,803 pounds, and Indiana, 1,224,489 pounds; all other States falling below 1,000,000 pounds. In the winter of 1868--69, the Department of Agriculture sent out circulars, to known apiarians in most of the States, and received returns from 489 counties in 32 States. The aggregate number of hives reported was 722,385. Estimating for counties not reporting, and making due allowance for the fact that many of the counties reporting were giving special attention to bee culture, 2,000,000 of hives were deemed as low a figure as the returns would warrant. Allowing fifteen pounds of surplus honey to the hive (about two-thirds of the average reported), the total product in 1868 would be 30,000,000 pounds, which, at an average valuation of 22½ cents per pound, would give $6,750,000. When we consider that the cost of production is merely nominal, it will be seen that it pays to keep bees.

Men of Progress.

O. E. Garrison, civil engineer, St. Cloud, Minn., writes; "It is with pleasure that I acknowledge the receipt of the splendid steel engraving, "Men of Progress." I desire to say that in my judgment the men there portrayed have done more real good to the world than all the warriors, conquerors, generals, and kings, ancient or modern, history has given an account of."

M. S. Sharpe, Pendleton, S. C. writes: "The papers and engraving came to hand all right. The engraving far surpassed my utmost expectations, and Mr. A. J. Sitton, to whom the credit for getting up a club is due, expresses himself highly pleased."

History of Railroad Cars.

Of the cars constructed between the years 1826 and 1850, we may first notice those made in 1830, and placed upon the Liverpool & Manchester (England) Railway. These cars had four wheels, but no springs, the bodies consisting of sills, to which the journal boxes were bolted and upon which the floors were laid. From the sills, stakes or posts arose, to which pieces of wood were attached, some longitudinally and some vertically; and these cars were formed without roofs, they being similar to those now used, and termed "rack-cars." In 1831, in October, one Mr. Joseph Knight proposed to employ springs under all cars, to support the body of the car and contents thereof. Mr. Knight also suggested an improvement in car wheels which entitles him to be ranked as among those who have excited our wonder, and who, by the exercise of his genius, has, more than most others, contributed to the successful operation of railroad cars. The improvement suggested at this time was that the treads of car wheels should be made conical, for the purpose of facilitating their passage around the curves of the road. How important this suggestion was all now fully realize, and it is not regarded as saying too much that up to this time no more important improvement, which has referred to railroad cars, has been made in this or any other country.

In 1869, cars for the transportation of passengers in England and Scotland consisted of three classes, the first class being well finished and provided with seats for the passengers to sit upon, which seats were furnished with cushions. The second class were of plain finish, without cushions or ornaments. The third class were little more than plain boxes set upon wheels and supplied with seats, but in many cases had no roof. In addition to these three classes, there were what were termed "mixed carriages," which were designated by names, and consisted of three compartments, the center one being for first-class passengers, and the two end ones for second-class passengers.

The next novelty which will be mentioned in the way of passenger cars was introduced in the year 1847, by a Mr. Hanson, of England, and consisted of a compartment car, the body of which was iron, and constructed as follows: In each of the partitions there was placed a hoop of iron, which was bound together by two cross stays, one of which connected the roof to the floor. To this frame-work a sheet or sheets of iron were riveted, a sheet of felt being placed between the heads of the rivets and the sheets of metal. These cars had only one seat in each compartment, it being so arranged that the faces of the occupants could always be in the direction in which the car was moving. At the bottom of the car there were arranged boards for resting the feet upon, which consisted of an upper and under piece, with a space between the two into which to thrust the feet, the inner surfaces being covered with sheepskin with the wool on it, the object being to provide for keeping the feet of the passenger warm during the time of his occupying the seat. At about the hight of the faces of the passengers there was placed a headboard or cushion, formed of sponge, and covered with leather or cloth, so that in the event of any sudden shock upon the cars, the head of the occupant would be brought in contact with the cushion, and thus, to some extent, be saved from injury.

A freight car, introduced at the same time and by the same inventor, was of the same general construction, except that its interior was arranged for the reception of freight, and a portion of its roof was made to slide upon rods over or under the fixed portion, the object being to provide for the reception and discharge of the goods through the roof of the car.

In the same year, 1847, a very decided novelty in the shape of a car wheel made its appearance in England, which consisted of a wrought iron wheel, which was made in sections, a portion of the hub and rim comprising each section, and parts being joined together by means of tongues and grooves formed thereon as the sections were made, and each being provided with a projection upon the outer segmental surfaces to enter a groove formed in the entire surface of the tire. The hole in the hub of the wheel for the reception of the axle was bored larger than the axle, so as to leave room for the insertion of an expanding ring, the insertion of which was to fit the axle, while its exterior was conical in form, so that, as it was forced inward, the segments would be forced outward, and thus tightened within the tire, the cone being held in place by a ring, which was cast in two parts, and placed in a groove turned in the axle.

At about the time of the last-named date, in contracting for the passenger cars to be run upon the road leading from Strasbourg to Basle, in France, it was stipulated that the roofs, partitions, and seats were to be made of American pine, three fourths of an inch in thickness, and that the roofs were to be covered with three pieces of leather, weighing at least thirty-eight pounds each.—*National Car Builder.*

EXCAVATION AND EMBANKMENT TABLES—ADDENDUM.—In connection with the article under this heading, on page 103, the following should have been included:

"The foregoing is on the basis of the slopes being 1½ horizontal to 1 vertical, and the constant number to be added must be increased or diminished, as the slope is flatter or steeper, at the rate of 27 for every half foot increase or decrease in the horizontal designation of the slope."

EVERY time a shot is fired from Krupp's 1,000 pounder, it costs the Prussian government 800 thalers ($600), and the monster of a gun itself has cost more than would keep an infantry regiment for a whole year.

OBJECTS seventy-two feet long can be distinctly seen on the surface of the moon by the great telescope of the Earl of Rosse.

Improved Sectional Tubular Steam Boiler.

Our engravings represent the Allen steam boiler, which many of our readers will recollect seeing at the late Fair of the American Institute, where it furnished steam to the Allen engine, an illustrated description of which appears on page 374, last volume of this journal. Two views are given, the first of which is a longitudinal section, and the second a half-cross section and half-front elevation. The boiler gave, on test at the Fair referred to, an evaporative capacity of ten pounds of water per pound of coal, under working pressure of from 60 to 80 pounds. When this economy of fuel is considered, in connection with the admitted safety of sectional boilers as a class, it will be acknowledged that the managers of the Institute acted wisely in engaging the same boiler to furnish steam for the exhibition of 1871.

The boiler was first exhibited at the Fair referred to, and was awarded the first premium. Its construction is such as obviates all strain due to unequal expansion, and a very large heating surface is obtained.

Perfect circulation is claimed to be obtained by inclining the tubes as shown in the longitudinal section. These tubes descend obliquely from larger tubes, in which the water line is shown in the half-cross section, and which in turn communicate with an ample steam dome, where the steam is super-heated, so that under ordinary circumstances, if any water be mechanically carried along by the steam to the dome, it is immediately converted into steam, and dry steam only can issue from the boiler. Provision is, however, made for preventing accumulation of water in the steam dome, through carelessness in carrying water too high, etc., by pipes leading from the ends of the steam dome down to the feed pipe.

The cold water descends along the under sides of the inclined tubes, and the steam rises along the upper sides.

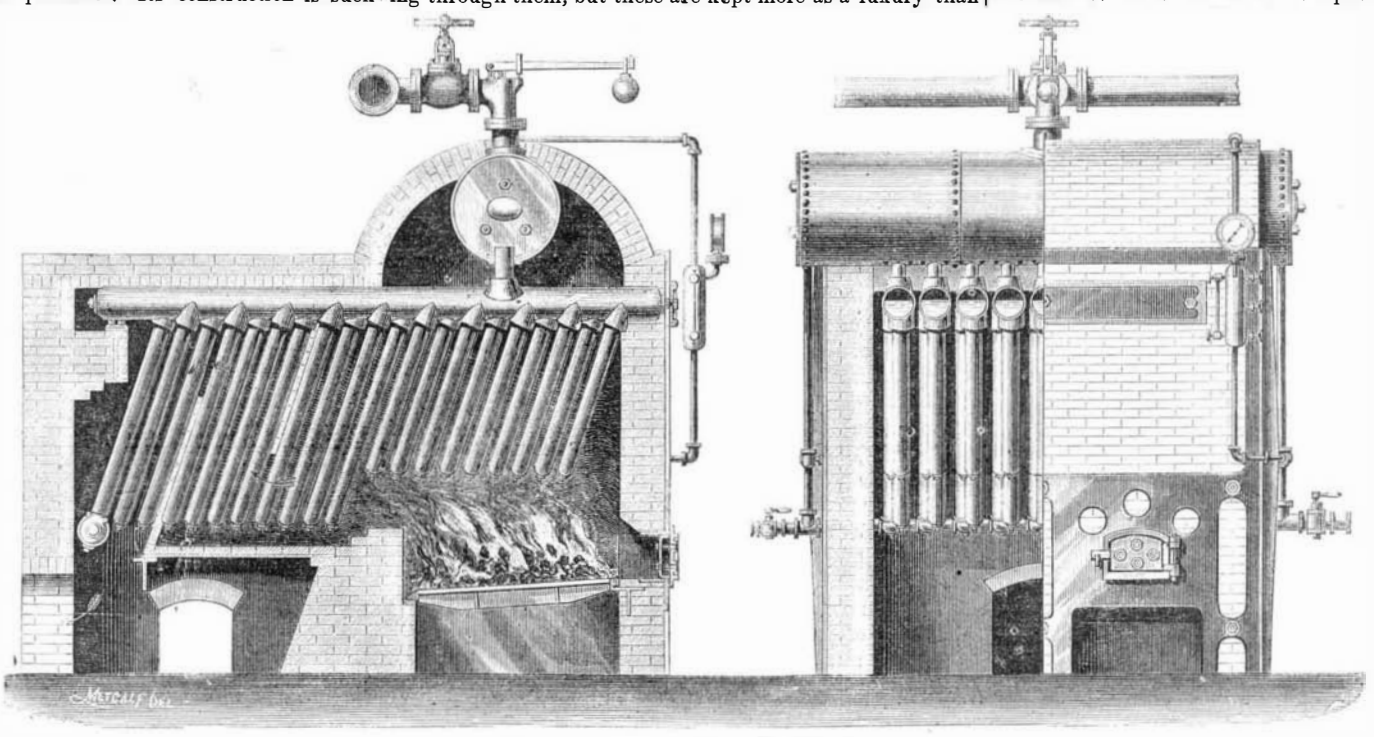
Both the outside and inside of every part of this boiler is perfectly accessible for cleaning, hand holes being formed at the lower ends of the inclined tubes, and at the front ends of the horizontal tubes. The gases have but a short distance to traverse, and ample space in passing between and around the tubes, so that a good draft is easily maintained.

The feed water is admitted at the lower end of the rear series of inclined tubes, and, coming first in contact with the cooler portions of the heated gases, passes along, as it becomes hotter, to the front tubes where the flame is the hottest. This construction enables the heat in the cooler portions of the gases to be utilized to the fullest extent.

The boiler can evidently compete in cost of construction with other sectional boilers, in market, and we have no doubt it will also be able to compete in economy.

The demand for safe boilers is daily increasing. Numerous disasters from explosions have caused people to consider whether an economy which renders steam boilers unsafe unless kept constantly under the supervision of careful experts, is not after all dearly purchased. To such as have decided this question in favor of safety, this boiler offers all they can desire on that score, while, at the same time, its evaporative power is quite equal to most of the boilers in market, whether sectional or otherwise.

For further information, address The Allen Engine Works, 4th avenue and 130th street, New York city.



THE ALLEN STEAM BOILER.

Telegraphic Possibilities.

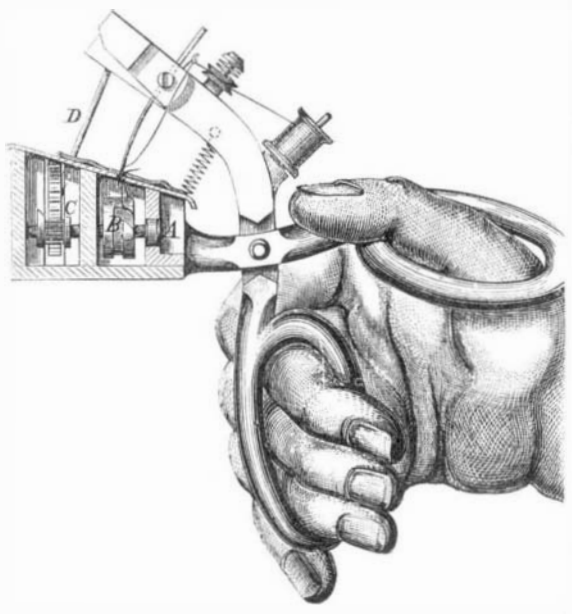
On the completion of the Russian-American telegraph line, a telegram from Alaska for New York, leaving Sitka, say at 6·40 on Monday morning, would be received at Nikolaief, Siberia, at six minutes past one on Tuesday morning; at St. Petersburg, Russia, at three minutes past six on Monday evening; at London, twenty-two minutes past four on Monday afternoon; and at New York, at forty-six minutes past six on Monday forenoon. Thus, allowing twenty minutes for each re-transmission, a message may start on the morning of one day, to be received and transmitted the next day, again received and transmitted on the afternoon of the day it starts, and finally reach its destination on the forenoon of the first day—the whole taking place in one hour.

Cheese Making.

It is absolutely necessary that means should exist in all dairies for preserving an equal temperature throughout the year; the cold of winter being hardly less injurious than the heat of summer. Care should also be taken to secure a plentiful supply of pure water, effective drainage, by which the water may be carried rapidly away, thorough ventilation, and facilities for the exercise of the most fastidious cleanliness. The building should, if possible, be built on the side of a gentle declivity facing the west, and sheltered from the north and east winds. In order to maintain an equal temperature, the walls should be of a considerable thickness, and built with a hollow space in them, through which a current of air may pass; the roof should also be of brick, of a curved or pavillion form, and the walls and roof may be plastered. The floor should be sunk about three feet under ground, made to slope to a drain (with bell trap) in the center, and paved with tiles or polished stone. On three sides of the dairy small arches should be turned about three feet high, carrying a shelf of slate or marble three feet wide, to hold the pans containing milk, and a little above this shelf, ventilating bricks should be placed with shutters sliding over them to open or shut, according to the weather. Several landed proprietors in Shropshire and Cheshire (England) have recently erected expensive and highly ornamental dairies on their estates, fitted up with massive marble tables and milk coolers, and with a constant stream of water passing through them, but these are kept more as a luxury than an object of profit, and they seldom unite all the conveniences essential to a good dairy, because the architects who plan them are seldom or never practical farmers.

HAND SEWING MACHINE.

A hand sewing machine, worked by the hand like shears, is, to say the least, a unique device. Our engraving shows such an implement. It is a lock-stitch machine. A is the bobbin; and B the hook or shuttle worked by the rack and pinion, C. The rack reciprocates in guides, and is impelled by the pitman, D. In use, the cloth is supported at one end by a sewing-bird or similar device, the other end being held tight



by the left hand. The machine is then grasped by the right hand, and worked along the seam, making one stitch for each reciprocating movement of the parts. This machine is the invention of B. W. Collier, of Oxford, Miss., who obtained a patent upon it in 1867.

The Uses of Salt.

The extent and importance of the uses of salt can scarcely be better described than in the words of Dr. Bolley, which we translate from his work, entitled "Das Kochsalz:" "We awake in the morning; the linen which we put on betrays by its whiteness that it has been bleached by the chlorine derived from salt; the shoes with which we cover our feet required salt in the hands of the tanner; in the soap that we use for the toilet, we seize a transformed piece of salt; the glass, which we bring to the mouth, hides the chief ingredient of salt; from the crude ore by means of salt, was produced the bright, white metal of the teaspoon, which is so highly esteemed by the world; the teakettle is soldered with borax which holds soda produced from salt; the milk before us contains salt; the butter has been preserved by salt perhaps for months; the bread betrays to the palate that the dough has been mixed with salt. We grasp the paper; it required the application of chlorine from salt in order to please us by its whiteness. The clean spectacles through which we see are partly composed of what once was salt. A visit is announced; a patient wishes to consult us; he enters, and, seeking scientific aid, we reflect upon the remedies at our command, and commence to write. Out of ten medicines we find that five of them owe their origin, either by their composition or the mode of their preparation, to salt. Who is able to forget for one moment this ever-present Proteus that appears in a thousand forms?"

Patent Cultivators.

Commissioner Capron, in his last report, remarks that little or no change has taken place in the manner of constructing cultivators. It is a matter of surprise, that out of the one hundred and fifty inventions patented, there should be scarcely one that for characteristic individuality merits especial mention. Inventors of this class of implements seem to be pretty well satisfied with the general construction already established, viz: a rectangular frame mounted on two wheels, and provided with a tongue and driver's seat, having swinging longitudinal beams, to which are rigidly attached standards bearing shovels or teeth, and they content themselves with improving the details. For this reason, most of the claims granted on cultivators (and patents on these machines generally embrace a long string of claims) are what are technically known as "combination claims," *i. e.*, claims on which the patentee disclaims the invention of the individual devices enumerated, but asserts that he is the first one to have brought them all together in the manner specified.

It is difficult to decide whether or not the tendency has been toward greater simplicity in cultivators. Some inventors seem to have aimed at that result and to have hit the mark, while others appear to have overlooked the idea, altogether. This remark is intended only with reference to a comparison of a few recent years, for certainly, when compared with similar inventions of twenty years ago, the complexity is all on the side of the more modern productions. Indeed, this is a safe general expression with regard to inventions of every character. The tendency of inventions at the present day is twofold, viz: to make each machine as nearly automatic as possible, and to combine in one structure the devices necessary for several purposes. These necessarily make machinery more cumbrous. It is not an exceptional thing to see combined with a cultivator, apparatus designed for several different purposes; as a breaking plow, a corn marker, a seed planter, a stock chopper, or a harrow.

In cultivators, considerable attention has been devoted to obtaining a ready and efficient expansibility and contraction of the beams, so as to admit of the adaptation of the same to the width of the rows cultivated. Successful attempts have been made to improve the shape of the teeth, that their cutting edges may act more efficiently, and to improve their adjustability, so as to throw the soil more or less to the right or left, all one way or the other, when in gangs, and to adjust their positions where more than one is used. Considerable intelligent labor has also been bestowed on constructing the teeth, so as to admit of their ready removal when worn out, or when, from any cause, it is desirable to detach them.

Several cultivators have been patented, especially devised for the culture of cotton and sugar, and which will be likely in view of the past want in those directions, to prove valuable, and consequently to go into general use.

As in the case of plows, the tendency is decidedly in favor of wheel cultivators.

METEOROLOGY IN IOWA.—The extreme dryness of last summer produced some very unusual phenomena in many parts of the United States, of which the meteorological appearances in Iowa may be specially mentioned. A correspondent, J. C. W., of Toronto, Iowa, describes the following; On March 16th, "a rare sight of sunbows;" September 24th, a magnificent aurora borealis; October 14th, "a fog sight," followed by another aurora; January 20th, a large meteor; and on February 5th, a snow storm, in which flakes of snow as large as snow birds fell in countless numbers.

TRUTH will ever be unpalatable to those who are determined not to relinquish error, but can never give offense to the honest and well meaning; for the plain-dealing remonstrances of a friend differ as widely from the rancor of an enemy, as the friendly probe of a physician from the dagger of an assassin.