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Contents:

(Illustrated articles are marked with an asterisk.)

TO OUR READERS.

The day of publication falling one day earlier in the calendar each year, has gradually antedated the issue of our journal, causing thereby a serious inconvenience to ourselves, and one that has been noticed by many of our readers. We prefer in this matter not to be so far in advance of the actual time, and in order to correct the discrepancy between the date of the paper and the day of actual issue, we seize the opportunity now offered at the beginning of the new volume, to defer the issue of the first number one week. By this arrangement none of our subscribers will lose anything, as we have already published two complete volumes, of twenty-six numbers each, for 1869, and before the 1st of January the first number for the year 1870 will be published and mailed to all our subscribers. With the present number we send out a supplement of the SCIENTIFIC AMERICAN to all our readers, which contains a large and fine engraving of the Railway Bridge over the Susquehanna river at Havre de Grace, also a calendar for 1870. This supplement has been printed at considerable expense, and is sent free to all our subscribers. We would regard it as a special favor if they would post it up conspicuously where it may be seen, as it contains our annual prospectus.

Subscriptions are coming in very rapidly, and present indications encourage us to believe that our circulation will be very much increased on the new volume.

ANNOUNCEMENTS FOR THE NEW VOLUME.

The premiums in cash offered by us are as follows: Whoever sends in the largest list of subscribers, according to published terms, on or before the tenth of February, will receive $300; for the second list, $250; third list, $200; fourth list, $150; fifth list, $100; sixth list, $90; seventh list, $80; eighth list, $70; ninth list, $60; tenth list, $50; eleventh list, $40; twelfth list, $35; thirteenth list, $30; fourteenth list, $25; fifteenth list, $20.

Surely these prizes are worth striving for, as either of the sums specified will be handy to have in the pocket. To those who do not compete for the cash prizes we offer the splendid large steel engraving, "Men of Progress—American Inventors," as follows: Any one sending 10 names and $30 will receive one picture; 20 names and $50, one picture; 30 names and $75, two pictures; 40 names and $100, three pictures; 50 names and $125, four pictures. This picture is worthy of the subject, and will grace the drawing-room of any citizen of the land. We are aiming at a large subscription list and we frankly acknowledge that we can only accomplish it by the coöperation of our present patrons, who have always generously responded to our appeals. We urge them now to speak a good word for the SCIENTIFIC AMERICAN. By so doing they can induce some of their neighbors to join in making up a club. If ten or more names are sent, the subscription is $2·50 a year.

STEAM PLOWING IN AMERICA.

The time is coming when in many portions of the United States the steam plow will be permanently adopted. If, in a country of small farms like England, it can be made so useful as to render profitable lands, which, without it, can only be worked at a loss, how much wider is its scope on our broad plantations, wide prairies, and river bottoms which are devoted to grain production.

The period is ripe for the introduction of a Yankee steam plow. Some inventors in this field have had the misfortune to live some years too early. But the inventive genius of the country is now fairly turned to the solution of the problem, and the steam plow of the time to come is now imperatively demanded.

In aiming at the production of a good steam plow, we think inventors have confined their efforts too closely to the imitation of the work of the common plow. Is it not quite possible that some other method of loosening the earth may be found to answer all the purposes of the furrow, without rendering large tractive power necessary.

The early, and still favorite method with gardeners, is forking or spading up the ground, and there can be no doubt that in this way the soil is better prepared for the reception of seed than by the use of the plow.

No mowing machine inventor has ever succeeded in applying other than human strength to the working of swinging blades or scythes, though many have sought to do so. It was not till the shearing principle as used in the common cutter bar was adopted that mowing machines found an abiding place.

But it may be objected that in plowing green sward it is essential to not break the earth to pieces but to turn it over neatly, grass side down, so that the vitality of the grass roots may be destroyed and the turf may rot. We do not think the continuous furrow the only means whereby this may be accomplished, and we believe the plowing machine of the future will demonstrate the truth of our views.

A new locomotive plowing machine, capable of drawing a gang of plows through a stiff soil was recently tried at Rochester, it is said, with highly satisfactory results. The locomotive weighs scarcely more than two tuns, but its tractive power is gained by a series of out-thrusting flukes in the traction wheels, which penetrate the earth, and are withdrawn by machinery inside as the wheels revolve. By this means the flukes only project from the wheels as they approach the earth on the under side of the wheel. There are springs attached to the flukes to relieve them when they come into contact with stones or other impenetrable substances. The plows are attached to this traction engine by chains, and at the trial, three plows, each held in the usual manner by an attendant, were drawn in this way through a stubborn soil.

So much for the Rochester machine.

From New Albany, Ind., we learn of a new steam plow, the invention of a citizen of that place, and which is described at length in the *Daily Ledger*: "The framework, in fact the entire machine, is of pipes. The driving wheels are geared positively, and are driven by vertical cylinders, the pistons of which are attached by an irregular eccentric motion, direct from the engine. In addition to this motion eight toggle joints joining levers, which simulate the motion of a horse's leg, assist the driving wheels when they fail in their traction."

The description given in the *Daily Ledger* is not so clear as to give a very distinct idea of this plow; but we gather that the plows proper are attached to beams, which are raised or lowered at will, and move along with the traction engine.

A California inventor has also recently taken out a patent for a steam plow, the general principle of which, like those described, is the drawing of plows by a traction engine. We are not aware that the English method of drawing gangs of plows across fields by a wire rope and drum finds much favor with American mechanics; but if plows must be drawn through the earth after the old fashion, it seems a more economical plan than the use of traction engines for that purpose.

THE USES OF SNOW.

As we write, a few straggling snow-flakes flutter timidly past our window and quickly melt into oblivion on the flags below. They will soon cease to melt and will gradually fill our streets with the characteristic New York slush, to the utter weariness of overdone horses, and the almost total extinction of good temper on the part of drivers, who will swear that snow is a nuisance, and wish that it were in a place where it would not be long in melting.

Now it is to be admitted that so far as New York city is concerned, the benefits of a "good heavy fall of snow" are rather indirect than otherwise, yet we shall see that even the poorest, who shiver in cellars along dark and gloomy alleys, are interested to have the snow fall, although they, in their ignorance, think it "poverty's curse."

Coal is dear this winter, and for the poor, hard to get, but food costs more than coal, and food must be had at any cost. The supply of fuel may be eked out and supplemented by many a makeshift, imperfect though it be, but hunger cannot be appeased by a subterfuge.

The snow which falls upon the earth is a tender mantle to infant food-plants which would otherwise perish of frost. In what is called an "open winter," you may see whole fields of young rye and wheat and clover, all pulled up by the frost and laid on the top of the ground to wither and die in the spring sunshine. The frost heaves up the earth, and with it the plants; slight thaws permit the earth to settle and renew its hold, and so successive freezings and thawings gradually uproot entire crops. "Winter killed," is the sad verdict of the farmer, as he contemplates the loss of his labor and seed in the spring; and "winter killed," might be appropriately spoken of the suffering and dying victims of starvation prices which follow the destruction of crops.

True, Nature sometimes in her zeal to protect, covers too deep and smothers the young plants; tucks in the coverlid so tight that the unseasonable warmth of the earth stimulates their vitality into an attempt at growth, which fails for want of air and light. But such disasters are comparatively rare, and open winters are the most deadly to grain crops. It is also true that in the large territories devoted to grain growing in the United States, when a crop fails in one section it succeeds in another, and so the food-supply keeps pretty steady pace with the demand, but it is none the less true that in many sections of the country winter wheat or rye could not be successfully grown without snow to protect these crops from frost.

But snow has another important office to perform. It is a fertilizer. Ask the experienced farmer, and he will tell you that the late snows of spring falling upon the springing crops makes them look green and vigorous, and really nourishes them. It is the bearer of ammonia, an important element of the food of plants, which it collects from the air. We have known thrifty farmers to rise early to plow in a light snow before it melted, being aware of its value, though perhaps not realizing in what its virtue consisted. It is also without doubt true that open winters are more favorable to the spread of disease than the contrary. It is an old proverb that "green Christmases fill churchyards."

So we see that snow has other uses than to make sleighing, though we get so little of this in New York, and the snow so interferes with travel in our crowded thoroughfares that one may well be pardoned for wishing that in the annual distribution our metropolis might be over-looked.

WHAT REMAINS FOR INVENTORS.

A great deal has been done in mechanical invention and chemical discovery. In these respects the world has moved immensely since the beginning of the present century. It is the habit of some short-sighted people to predict that we have, as a race, arrived at the pinnacle of our greatness, so far as relates to the subjugation of the brute forces of nature We have, say they, now harnessed the forces of gravity, heat, electricity, light, and affinity, we have learned how far it is possible to make them work for man, and henceforth, whatever improvement is to be made, must be only in the form of the harness.

It is the habit of this class of men to not only regard the steam engine as capable of improvement only in trivial details, in variations in the form of cut-off, or other subordinate particulars, but to look upon electricity as a necessarily more expensive force to generate than heat, and as consequently, forever debarred from economic use as a generator of motive power for machinery. They consider the application of light as limited to the various kinds of photography now known, and which may hereafter be developed.

They discern no remote possibility in the enormous force of chemical affinity, although it is through one of the commonest manifestations of that force—combustion—that we get the heat for our engines, dwellings, dyehouses, furnaces, and forges.

Although the present era in science has given to the world the great doctrine of the mutual convertibility of these forces, and the cognate and equally important doctrine of the conservation of force, the possibilities which a consideration of these doctrines open to the mind, do not seem to force themselves upon their understandings.

To give a glimpse of some of these possibilities is the object of the present article.

When we, divesting our minds of all preconceptions, examine our relations to the things which surround us, we find all these relations resolving themselves into motion. It is primarily through motion that we get any knowledge of anything, and practically it is motion which feeds, clothes, and warms us. Growth is motion. The changes which take place in the substances which we take as food, is a movement of their molecules and their rearrangement in the tissues of our bodies, where they rest not day nor night until finally eliminated and thrown out as effete matter. Nor even then do they rest. There is no rest in nature. Motion is life: nay, more; it and matter together constitute the whole category of physical existence.

It follows that whatever force can contribute to the physical and mental welfare or the pleasures of mankind—and it is in this only that invention finds a profitable field—must be capable of being converted into mass motion; for the human control of molecular motion depends upon mass motion.

To illustrate this let us consider the growth and preparation of any article of food, as wheat. It is by the mass motion of the plow and the harrow the ground is prepared to receive the seed; in this way the molecular motions concerned in its growth are aided, and the full ear and plump berry obtained. It is by mass motion that it is harvested, thrashed, ground, and kneaded, preparatory to the molecular changes which take place in its conversion into bread. It is by mass motion that it is masticated and mixed with the saliva in the mouth, to facilitate the molecular change it must undergo in the process of digestion.

As in this, so in all chemical processes, mass motion is employed to control the molecular motion, and this mass motion is, to a very great extent, in the present age of the world, communicated through the agency of machinery. But we also find that the mass motion of machines is obtained by the aggregation of molecular motions, so that in a ceaseless cycle these forms of motion flow one into the other