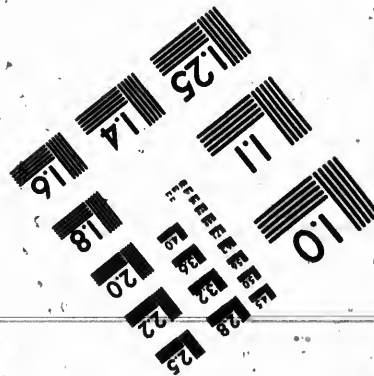
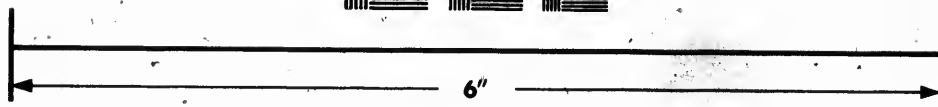
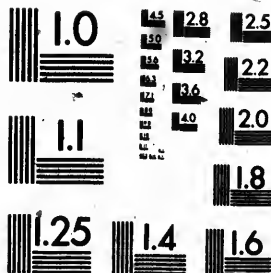


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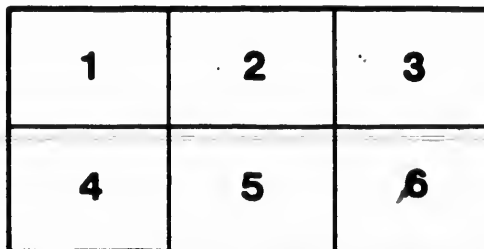
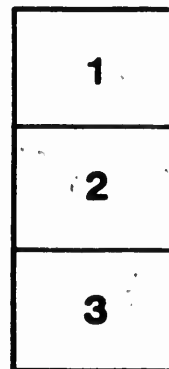
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A FEW REMARKS
ON
PLOUGHING AND PULVERIZING
BY
STEAM POWER.

TO WHICH ARE ADDED TWO ESSAYS ON THE SAME SUBJECT,

BY

C. W. HOSKYNs, B. A., LONDON,
MEMBER OF THE ROYAL AGRICULTURAL SOCIETY.

QUEBEC, 1858.

1853
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A FEW REMARKS

On Ploughing and Pulverizing by Steam Power. To which are added Two Essays on the same subject, by C. W. Hoskyns, London, Member of the Royal Agricultural Society.

THE efficient application of steam power to purposes of cultivation, is a subject which has for some time occupied the scientific world. Several experiments have already been made, and a number of patents taken out for original inventions, but as yet no great measure of success has attended these attempts, owing principally to the failure of the inventors to combine the economical with the useful. Intent only on the one subject of steam cultivation they appear to have forgotten the circumstances of the farmer, and the necessity for making such an instrument as would be within the reach of all. The undersigned has for some time been engaged in perfecting a machine, which he considers will prove more successful than any heretofore attempted, combining as it does the advantages of cheapness with entire practicability. Deeming it expedient to trace the progress of steam power, as applied to purposes of cultivation, a few extracts from different Agricultural and Scientific Journals are submitted, by which it will be seen that as yet no really practicable instrument has been invented.

The first is "Lord Willoughby D'Eresby's steam plough," a description of which is given in the following letter in the *Illustrated London News*, June, 4, 1852.

"As you have already published (p. 286, vol. XVI) a notice of the Steam Plough of Lord Willoughby d'Eresby. it may be interesting to your readers to be informed of the progress which has been made in the adaptation of such a novel and difficult application of steam power. Having had the opportunity of examining the working of the Steam Plough at Grimsthorpe, I am enabled, with his Lordship's permission, to lay the result of my observations before your readers. In the early trials a portable steam-engine was applied in the centre of the field, and its motion conveyed to a capstan fixed on the ground, on which a rope was coiled. To each of this rope ploughs were attached, which were drawn alternately towards the engine by steam power, and from the engine towards the hedge by horses. To dispense entirely with the horses, two capstans were next employed, one at each end of the field, and the ropes were endless, so that the ploughs were moved in both directions by steam power.

"In the present improved arrangement two engines are employed, one at each end of the field, the capstans being attached to the engines. The ploughs are made double-ended, and are drawn alternatively by each engine along the field, so that, whilst the rope is being wound upon the capstan of one engine, it is being unwound off the capstan of the other, and *vice versa*. Each engine, as it is alternately idle, is moved along a temporary tramway, formed of planks laid along the side of the hedge. To prevent the rope dragging in the furrow six small wooden frames are dropped into the furrow, and provided with rollers over which the rope runs. Two ploughs are arranged together, each

turning a furrow of nine inches. With a field 180 yards long between the engines, the ploughing of each furrow 18 inches wide occupies $2\frac{1}{2}$ minutes; the ploughs moving at rather less than $2\frac{1}{2}$ miles per hour. Allowing for the time lost in shifting the plough, this gives 4 acres per day at the present slow speed, which I see no difficulty in increasing to 4 miles per hour, when the men, who are only agricultural labourers, shall have acquired greater dexterity in managing the engines and ploughs.

"To produce this result, there are required two men to drive engines, four to shift ploughs and engines, one to hold plough, and three boys at trucks, and $7\frac{1}{2}$ cwt. of coke. Taking the wages of men and boys at 12s. per day, and the coke at 8s. or total 20s. the cost per acre will be 5s. which is about one-half the cost of ploughing by horse-power, with the advantage of doing it in half the time. In estimating, however, the pecuniary advantages of steam-ploughing, it must be viewed in connexion with a general system of farm machinery."

It requires but little penetration to see that this plan can never become general. The great cost of such a machine, combining two locomotives, and several ploughs, its cumbersome character, and the number of persons required to attend it, put it effectually beyond the reach, at least of the American or Canadian farmer.

The next invention is "Usher's Rotary Steam Plough," a drawing and description of which we find in the *Scientific American* of the 5th June, 1852. In this machine there are five acting ploughs. Each plough, to act continuously, has three mould boards and coulters on its axis, the one taking into the soil as the preceding one is rising out. The whole five ploughs are on one strong rotary shaft. On the carriage is placed the locomotive boiler with its cylinders; the power of the engine is applied through rods to the crank shaft, which is supported in standards. On the shaft, there is a spur pinion; this pinion, by taking into the teeth of the wheel which is mounted on a shaft, gives motion to the pinion on the same shaft. This pinion takes into the cog wheel, and gives action to the wheels of the carriage, thus moving the plough by a rotary progressive motion. The pinion is made so as to be thrown out of gear with the driving wheel. Another pinion which is on the shaft which is set in bearings to the moveable frame, is driven by a large cog wheel. On the shaft, are secured a series of plates, which are formed in such a manner as to have affixed several ploughs to them. Each is formed with a strong hop at the centre, by which it is securely fixed to the shaft. Each plate has three projectors, which terminate radially. Upon the plates and projections, thus shown, the tilling pens are secured. The mould-boards for turning the furrows are secured by screw bolts to the projectors of the plates. Plough points or shails are attached by bolts to the extremities of the mould boards. A coultter is also set before each plough point, which are moved in a rotary direction.

The following are the remarks of the Editor of the *Scientific American* upon this plough:—

"This rotary steam plow shows at once the great difference between the farmers in Britain and our agriculturists. This plow weighs five tons, and the

engines are three, or two of three feet earth; it runs hour, plow. It requires to be introduced our farmer's subservient good hints (extensive) cially in the be thrown belt, to drive

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engines are nominally ten horse-power; it can be worked with five, four, three, or two plows. When worked with four plows, it turned over a breadth of three feet at once, and stirred the ground so as to make it resemble spaded earth; it moves at a good pace, being no less a velocity than 2,550 yards per hour, plowing about six acres in one day. The price of it was £400, or \$1,455. It requires an engineer and two laborers to attend it. Such a plow will not be introduced into America; it is too large and expensive, but it will show our farmers what is doing in some other parts of the world to make steam power subservient to man in tilling the earth. It will, no doubt, also afford many good hints to some of our inventors, for steam power will yet be employed more extensively for agricultural purposes in our country than it is at present, especially in the West and South-West regions. This plow, when not tilling, can be thrown out of gear with the engine, which can then be made, by pulley and belt, to drive a threshing machine and many other machines."

Another invention has been perfected by Mr. D. S. Brown, for applying steam to the purposes of cultivation, and a patent was secured to him on the 3rd April, 1852. The *Gardener's Chronicle* and *Agricultural Gazette* of London, gives a description of this machine, which, with the remarks of the Editor, is hereto appended:—

Gardener's Chronicle, London, May 1, 1852.

"Another competitor has appeared for the prize, for so it will undoubtedly be, which is to be the lot of him who shall first succeed in the cheap and efficient application of steam-power to cultivation. We shall at present merely refer to the fact that a patent has been taken out, and shortly describe the invention which is thus secured to Mr. D. S. Brown, whose ingenuity has designed it. A framework, carrying a 3-horse power steam-engine is drawn by horses over the surface of the land to be tilled; it is about 10 feet wide, and perhaps 20 feet long: the weight of the whole will not exceed 2 tons, to draw which four horses will be amply sufficient, especially as the steam power cuts its own way, and the horses have only to draw the weight of the machine and engine, and not to force the cutters through the earth as they do the coulter of the plough. These cutters appear to be more like large boring or drilling tools than anything else. In the drawings given with the description in the *Magazine*, there are two sets represented as placed across the length of the framework—across the direction of motion: one set in the front part of the machine, the other across the hinder part of the framework. They are placed equidistantly, and the tools of the hinder set work in the intervals of the front row. These tools are spindles, inclined downwards, but pointing in the direction of the machine's motion and being armed with "bits," of any desired form, which, revolving, and at the same time, we imagine, screwing themselves forward, effectually overturn the soil and comminute it to any degree of fineness that may be deemed, desirable. The correspondent of the "*Mechanics' Magazine*" says, "The width of soil which the revolving cutters can work, with 3-horse power engine, will be 10 feet at the time; for 15 cutters of 3 inches in diameter and 15 cutters of 5 inches in diameter equal 10 feet. The reason why the forward cutters are made smaller than the hinder cutters is that the forward ones enter and cut the earth with solid earth on each side of their passage, but the hinder ones cut the solid earth with the loose earth on each side of their path, and consequently they can work easier. Cutters of all varieties, in point of shape and size, can be fitted into the sockets of the revolving spindles. The work done will necessarily vary with the sort of power and the nature of the soil, but it is important to observe that whatever is done is done at once—no second ploughing or any harrowing is needed, for the earth is completely cut up and pulverised by the cutters, so as to admit at once of the free passage of air and rain, there being no hardened substratum left at the bottom of the furrow, as in ordinary ploughing, to hold the water." It appears

to us that this machine will not leave the land in so perfectly fit a state for the seed as this extract asserts. The first row of cutters would drill out circular grooves or furrows in the hard lands throwing the comminuted soil on the intervals of hard land; the second row would undermine these; but even supposing that its tools so overlapped the former row as to entirely disintegrate the whole soil to the desired depth, it would, we conceive, leave the now thoroughly comminuted soil in ridge and furrow corresponding in width to the intervals between the tools—a very desirable state no doubt for some crops, but undesirable for others."

In all these inventions, it will be observed that the idea of the Plough is retained; this appears to have been the rock upon which inventors have been heretofore wrecked. As will be seen by the following articles, this idea must be relinquished before success can be attained. It is well remarked that the idea is "fundamentally erroneous to attempt to combine steam Machinery with the Plough," and the similes of "retaining the form of the hand flail in the threshing Machine, or that of the oar in the Steam Ship, or of putting the piston rod to work at the lever end of the pump handle" are not more than the circumstances of the case warrant, and are not in the least overdrawn. The Machine which is now submitted at once throws aside all idea of the Plough. It is a cylinder with spades or picks fastened to it, revolving at almost any speed that may be deemed necessary, and driven by a Steam Engine, the whole being drawn along by Horses. This has been thought more convenient, than attempting to make the Instrument propel itself. Every farmer is obliged to keep Horses on his farm, and it therefore becomes a matter of no extra expense to employ them in drawing over the ground, the Steam Pulverizer; whereas to have dispensed with the Horses, the Machine would necessarily have been much more expensive, as the power employed must needs have been greater and the Instrument itself would have been much more complicated. A Machine for Sowing is attached to the Instrument, by which means the seed is deposited in the earth at the same operation, and is covered in by a sectional Cylinder or Roller fastened behind.

The Machine will perform the work heretofore performed by the Plough, Subsoil Plough, Harrow and Sowing Machine at one operation and in much less time than is occupied at present. By a very moderate calculation it will prepare the ground and sow the seed in six acres of land per day, while according to the old process it would take a day and a half for a single acre and the work imperfectly done: thus the proposed Instrument will do nine acres in the time that is now occupied in doing one. Another great advantage to be obtained by the introduction of this Machine, will be the avoiding of the well known prejudicial effects of the Ploughshare on the subsoil. Mr. Hoskyns well remarks that the Plough has "the sentence of death written upon it, for its tyranny to the subsoil which bears the whole burden and injury of its laborious blundering path."

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The Machine may also be used as a motive power for general farm purposes, such as threshing grain, sawing wood, &c.— And by the removal of the Pulverizer, a reaping platform may be attached to the Machine, whereby grain may be reaped at much less expense and with less trouble than at present.

The immense advantages which the introduction of such a Machine would confer directly upon the agriculturist and indirectly upon the whole community, it needs not much reflection to determine. By a comparison of the difference between Plough and Spade labour; it has been ascertained that the productive qualities of the soil are increased about one third by the latter. The Steam Pulverizer would render the difference still greater, as the earth would be more thoroughly comminuted by it than by the Spade.

The following articles from the pen of the celebrated C. W. Hoskyns, B. A. Member of the Royal Agricultural Society of London and one of the Chief contributors to Morton's Cyclopaedia of Agriculture, will give an excellent idea of the character of the Machine submitted and its capabilities. That which Mr. Hoskyns so much desires, the Inventor flatters himself he has succeeded in accomplishing. It is worthy of remark, that the first of the articles following was written about six months previous to the great Exhibition, and the second about one year after it; thus shewing that the world's fair which brought out so many new inventions and appliances long required by the Manufacturing and Agricultural world, failed to bring forward any thing practicable for the application of Steam Power to purposes of Cultivation.

ROBERT ROMAINE.

MR. HOSKYNs says :—

"I hold it to be an idea *fundamentally erroneous* to attempt to combine steam machinery with the plow. And I hope I am not presumptuous in repeating my conviction, that, until the idea of the plow and in a word, of all draught-cultivation is utterly abandoned, no effective progress will be made in the application of steam to the tilling of the earth. I repeat what I have said before, that plowing is a mere *contrivance for applying animal power to tillage*. Get out of animal power, and you leave plowing behind *altogether*. Get into steam power, and you have no more to do with the plow than a horse has to do with a spade. It is *no essential whatever* of cultivation that it should be done by the *traction of the implement*. Spade work is perpendicular. Horse work is horizontal. Machine work is circular.

"Whoever would now dream of retaining the form of the hand flail in the threshing machine, or that of the oar in a steam ship, or of putting the piston rod to work at the lever end of a pump handle? Yet doubtless these bastard attempts were all made in their day, till the several inventors had come to see in turn that

" 'Tis good to be off with the old love
Before ye be on wi' the new! "

I am aware that I am repeating myself, unavoidably, in all this; but no one can imagine, without trying it, the difficulty of making the mechanical part of the question intelligible to the agriculturist, and the agricultural part

to the machinist. The steam engine has no taste whatever for straight draught. He is a *revolutionist*, in the most exact sense of the word. He works by revolution; and by revolution only will he cut up the soil into a seed bed, of the pattern required, be it coarse or fine. And *that*, it is my firm belief, he will be seen doing at a handsome average, before a very large portion of another century shall have passed over our head. Why should it not be? Why should not a strip, or lair, of earth be cut up into fine tith at *one operation*, (and sown and covered in, too,) as easily as a circular saw cuts a plank into (and drag a plow, to turn up a furrow, and all this as a mere prelude for an after amusement to all the ancient tribe of harrows, scufflers, rollers, and old crushers, to do supplementally the real work of cultivation, it reminds one of "the house that Jack built." One can hardly blame the iron ribs of any respectable boiler for bursting at the first pull at a task so utterly at variance with every known law of mechanical advancement, so offensive to the economics, I had almost said the very ethics of the steam engine.

"I trust I may be forgiven for so boldly speaking; but I am sorry to think of one useful shilling being thrown away in the attempt, unprofitable, even if successful, of harnessing steam with horse harness, to do horse work in a horse's way; the implement itself, whose wretched work it is put to accomplish, being a tool with the sentence of death written upon it, (be it as ancient as it may,) for its tyranny to the subsoil, which bears the whole burden and injury of its laborious blundering path.

"I say the plow has sentence of death written upon it, *because it is essentially imperfect*. What it does is little towards the work of cultivation; but that little is tainted by a radical imperfection—damage to the subsoil, which is bruised and hardened by the share, in an exact ratio with the weight of soil lifted, *plus* that of the force required to effect the cleavage, and the weight of the instrument itself. Were there no other reason for saying it than this, this alone would entitle the philosophic machinist to say, and see, that the plow was never meant to be immortal. The mere invention of the *sub-soiler* is a standing commentary on the mischief done by the plow.

"Why then should we struggle for its survival under the new dynasty of steam? The true object is not to perpetuate, but as soon as possible, to get rid of it. Why poke an instrument seven or eight inches under the clod, to tear it up in a lump by main force, for *other instruments to act upon*, toiling and sweating and treading it down again, in ponderous attempts at cultivation wholesale—when by simple *abrasion of the surface* by a revolving-toothed instrument, with a span as broad as the hay-tedding machine, or Crosskill's clod crusher, you can perform the *complete* work of *comminution* in the most light, compendious, and perfect detail?

"Imagine such an instrument, (*not rolling on the ground,*) performing *independent revolutions behind* its locomotive, cutting its way down by surface abrasion, into a semicircular trench about a foot and a half wide, throwing back the pulverised soil (just as it flies back from the feet of a dog scratching at a rabbit hole); then imagine the locomotive moving forward on the hard ground with a slow and equable mechanical motion, the revolver behind, with its cutting points, (case hardened,) playing upon the *edge, or land side* of the trench, as it advances, and capable of any adjustment to coarse or fine cutting, moving always *forward* and leaving behind perfectly granulated and precisely *inverted*, by its revolving action, a seed bed seven or eight inches deep, *never to be gone over again* by any after implement except the drill, which had much better follow at once, attached behind with a light brush harrow to cover the seed.

"Why did steam reject the *pump handle and the car*?—Because in both the leverage is obtained by loss of labor and time, occurring during the back movement of the handle, a movement necessary to the manual, but not to the mechanical agent. For the same reason, whenever it is applied to till the

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earth, it will antiquate every instrument that *cultivates by traction*, because traction is not only unnecessary to cultivation, but is inherently mischievous on other grounds, apart from the clumsiness, inaccuracy, and incompleteness of the work it turns out.

"But the stones! There is much fear expressed for the teeth of the circular cutting implement I have described, when they come in contact with stones. The objection would have been equally valid, at first sight, against the use of the plow or the scuffler. Let me see the instrument in use where there are *no stones*—(and there are plenty of broad acres in England of this class)—and it will not be long before it gets upon the others. If it cost five pounds an acre to clear them out, it must be done, and would in such case, well pay to do it. But the truth is, that the instrument itself suggests the kind of machine, which, with a little adaptation, (greater power and slower motion,) might perform this preliminary service at the least expense. If land is to be like a garden in one respect, I see no good reason why it should not in all. I do not think stones will stand long in the way of steam, nor be readily preferred to bread; if, *where there happen to be none*, a steam-driven cultivator can be brought to bear, which, after the simple and beautiful example of the *mole*, shall play out the long comedy of our present field cultivation in a *single act*, present a finely granulated seed bed by a single process, almost at the hour required, and trammel up the long summer fallow into the labor of a day, with an accuracy as perfect as the turning of a lathe, and an aëration, (and consequent oxygenation,) of the soil as diffusive and minute as that of a scattered mode heap, or the dust flying from a steam-saw bench.

"Implement makers and mechanicians would not be long in understanding all this, if they were not under the supposition, received at second hand by them, and therefore the more difficult to eradicate, that plowing is a necessary form of cultivation to be kept in view. Once let them be made fully to perceive that plowing is merely the first of a long series of *means* towards the accomplishment of a particular end, that end being the production of a *seed bed* of suitable depth and texture, and with the soil as nearly as possible inverted in its bed—and I do not think they will be long setting the steam engine about its proper task, in the proper way. But their attention is distracted, at present, from the end to the means. They are taught to think that the plow is a *sine qua non*—that steam cultivation of necessity implies steam plowing, and they are led to give up the task in despair, because they are at fault upon a false scent.

"We have many *rolling* implements employed in the field, but we have only one of a *revolving* implement. The clod crusher and the Norwegian harrow *roll*, the hay-tedding machine, (one of the best instruments ever invented,) *revolves*. I use the words arbitrarily, but the difference I allude to is very important. The first are liable to the evil of clogging; because they derive their axis motion *from the soil* as they pass over and *press upon* it. This action must not be confounded with that of a machine which *has its cause of revolution within itself*, independent, and acting *upon the soil* as a circular saw acts upon a board, or the paddle wheel of a steamer, upon the water. The teeth of a saw clear themselves, by the centrifugal motion they communicate to the particles they have detached from the substance they act upon. A circular cultivator, steam driven, will do the same, for I have proved it. It does so more effectually according to the speed, (of revolution,) and the state of moisture of the soil. This last incident is as it should be; for it is not desirable that a clay soil should be dealt with when in an improper state for cultivation; and one great advantage of such an instrument as I point to would be that it would so greatly enlarge the choice of a suitable period, by its commendable accomplishment of the whole work of culture."—*Gardener's Chronicle, London, January, 1851.*

WHEN, at some future day, and by some pen not yet out of straight strokes and pot-hooks, there shall be written, for the edification of the agricultural public, an historical sketch of the 'Rise and Progress of STEAM CULTIVATION,'

It is to be feared that some of the reflections will not be of the most complimentary kind to the genius or the faith of the generation that witnessed the Great Exhibition of 1851,—that embraced nearly in one experience the development of Steam Navigation, of the Railroad system, the Electric Telegraph, and other kindred appliances in the many-path field of practical science.

'It was strange,' we may suppose our future annalist to write, 'that amidst the blaze of surrounding discovery in the arts that economize the labour and advance the condition of man, an application of steam-power that must surely have pressed with such powerful motive and exigency on a period when an extensive change of commercial policy seemed especially to evoke the mechanical resources of the kingdom, by way of set-off to its often urged disadvantages in climate and in fiscal burthens,—should have been long regarded rather with the apathy evinced towards the cobweb speculations of dreaming enthusiasm, than dealt with as a practical question by practical minds. While zealous agriculturists were eloquently excited once a year over the weight of an ox, or the twist of an improved mould-board, 'Science' was satisfied, and 'Practice' seemed to tread on the heels of perfection. Under such patronage, 'Improvements' in the established implements of tillage, were of course as numerous as the moiety of 20 acres of ground could conveniently accommodate for annual Exhibition. A revolution impending over *Tillage itself* was of course the last thing dreamt of: It is ever so, True, a few black funnels might be seen smoking in the show yard, and the whirling drum of the steam-driven Threshing-machine had, thanks to the *previous* invention of a certain Scotch lawyer, made the agrastial mind forget to expect, or its prizes to stimulate, improvements in the Flail. But the principal and time-honoured act of agriculture proper, of *cultivation* itself—still laboured under its ancient tribe of horse-adapted implements. The Plough and the Harrow were still in the ascendant; the instruments of equine-tillage were still received as its essential agents; and people who would have smiled at the mechanical curiosity of a Steam-Flail, gravely anticipated the day when some such combination would be triumphantly achieved for the darling tool whose Heaven-invoked 'speed' had long supplied the toast and figure-head of Agricultural Prosperity.

'Yet it can hardly be wondered at,' our aggravating Critic will continue, 'that man should have slowly and with such difficulty eradicated from their minds a mode of tillage so long compelled by the very nature and necessity of animal-power; every child that has wept and smiled over the 'Death of Cock-robin' knows when he hears

"Who'll toll the bell?
'I' says the Bull,
'Because I can pull,'"

that Mr. Bull was guilty of a pun; that the 'pull' of a quadruped is only *horizontal*; that his strength can be applied in no other way; and that when you employ a four-footed beast to cultivate the soil you have no choice left but horizontal traction, from one end of the field to the other; a mode of action which commenced when the spade was abandoned in field-culture for the plough, and which was to continue so long as horse-power tillage continued; and no longer: since it formed (as the spade had already shown) no necessary element of cultivation, and had no relevance whatever with the action or capabilities of the Steam-engine.

'Steam-power having however been hitherto chiefly employed in Manufactures, and its versatile modes of application being unfamiliar to the agriculturist, we can scarcely be surprised, that even those few who gave a serious thought to the subject, looked upon the Steam-engine rather as a piece of concentrated horse-power to be harnessed as best it might to the existing horse-worked implements, than as a New Agent, whose entry on the scene of action enabled him to reconsider the whole philosophy of Tillage, to analyse

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it into its elements, to see *what it was*; what it *had been* when confined to manual power under the primeval dynasty of the Spade and Hoe; what it was under the advanced but equally special limitations of animal power, as exhibited in the Plough and every other implement of draught; and what it *might be* under the wide sphere of available process which the Steam-engine presented. What was *cultivation*? Did Steam-power offer any cheaper, better, or *more direct* mode of performing it than manual or animal power had done? Could it accomplish *in one act* the problem of converting the hard clod into fine soil? Could it, like the mole, *cut a seed-bed out of the solid*? If so, why entangle it with implements foreign to its nature, unessential to its action, and behind it in that order of inventive progress whose deep-cut label is '*Vestigia nulla retrorsum*'?

But the Plough had left its ridge-and-furrow impress not more in the fields than, alas! on the mind of the agriculturist of that day. It was long, and naturally so, before he could bring an imagination preoccupied with the old-established system of field-culture, to recognize its impending emancipation from the whole chain of subordinate necessities exacted by the employment of horse-labour. The old fable had become reversed; the quadruped was riding the man: and to shake him off was now the difficulty! For a century after its invention, the Steam-engine lay still born to the soil, and the virtue unappreciated of a new Power which could antiquate *implements* altogether, and convert the cultivating agent into a *machine*, in the strict sense of the word; a machine whose locomotion across the field was a mere collateral incident, not a *means*: just as the sheep, or ox, walks over the pasture that he may feed, and yet is not *fed by walking*.

And yet it was somewhat strange, too, that recognition should have been so tardy, and accustomed thought so ineradicable on this point, when we reflect that modes of tillage already existed, so totally and specifically different in action from all horse-worked implements, as those both of the Spade and its more ancient congener the Hoe; * and that the *perpendicular* and every effective action of these manual tools, contrasted with the farm-implements of draught, might have dimly suggested the possible discovery of other means of cultivation as different from all of these as they were from each other. Any one who had ever seen a nutmeg rasped away into fine atoms against the armed surface of a greater, or sawdust scattered in heaps from timber by the teeth of a circular saw, and could find room in his imaginative faculty for the contemplation of this *mechanical* process, side by side with the *agricultural* fact that a seed-bed was only a layer of communitated soil a few inches in depth, might surely (one should now suppose) have saved the credit of his generation by some more congenial suggestion for the effectuating of tillage by Steam-power, than attempting to bind it down to an apprenticeship in which Ploughs and Harrows, Rollers and Scufflers, or even the Spade, were still to figure as the rude terms of the Indenture, as out of keeping with its genius and aptitude, as they were irrelevant and non-essential to tillage itself analytically regarded, apart from its conventional modes necessitated by horse or hand-power.

Such will be the kind or after reflection thrown back upon his forefathers of this generation by our future agricultural historian. 'It is true' he will be obliged to add, 'there were not wanting heaps of patents and pretensions crowding in confused succession on the public notice, during this period of mental vacuity and decrepitude of invention. Wherever there is a lack of grain there are plenty of weeds to fill the gaping space. There were plough-

* In the Southern Countries of Europe, as in Italy, Spain and Portugal, and in the once dependent offshoots of the latter Madeira and Brazil, the Hoe is the almost exclusive implement of (manual) tillage. Two Spade is, originally, a form of the Hoe, adapted to more northerly climates where the moistness of the soil increases the labour of cultivation by forbidding the tread of the workman, and obliging him to stand upon the 'land-side' of the trench.

dragging engines, stationary and locomotive, there were 'ploughshares on circular frames,' 'revolving spades' and all the train of piebald monstruities and biform incongruities which mark those periods of false gestation and miscarriage in the annals of invention, when would be discovered dashing blindfold at unconsidered combinations, are each profoundly busy putting new wine into old bottles; never devoting one serious hour to study of the simple elements of the problem they undertake,—the mechanical act to be accomplished, and the mechanical means necessary to accomplish it; but, (like the scribe Dickens tells of, who ventured a treatise on Chinese Metaphysics, by looking out 'China' and 'Metaphysics' in the Cyclopaedia)—taking a plough and a steam-engine—or a spade and a steam-engine—as the inevitable sire and dam of the fore-determined 'cross,' plunged headlong into the labyrinth of complex and solitary contrivance how to join things which Nature had put asunder.

— "velut agri Somnia, vans
Fingentur species; ut nec pes, nec caput uni
Reddatur foras.
Instat operis Summa, quia pensare totum
Sociat!"

Thus we attempted to anticipate the storm of keen reflection, to be showered over our graves by some writer of the end of this, or beginning of next century, who looks back upon the origin of Steam-agriculture from just such a point as we do now on that of Steam-navigation; who will be as familiar with the sight of soil pulverised a foot deep, in one act, by surface abrasion from a steam-driven cylinder (armed with the 'Talparian claw that "works" the earth so fast," and solves in the dark, beneath our very feet, a harder problem!) as we are with ships of 2000 tons, driven through the water like a duck with her web-feet at work beside or behind her, only obedient to the steam-law, of circular motion.— We have called aloud: will no man hear? We have piped often: will no one dance? *C. W. H. — Gardener's Chronicle, London, May 22, 1862.*

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