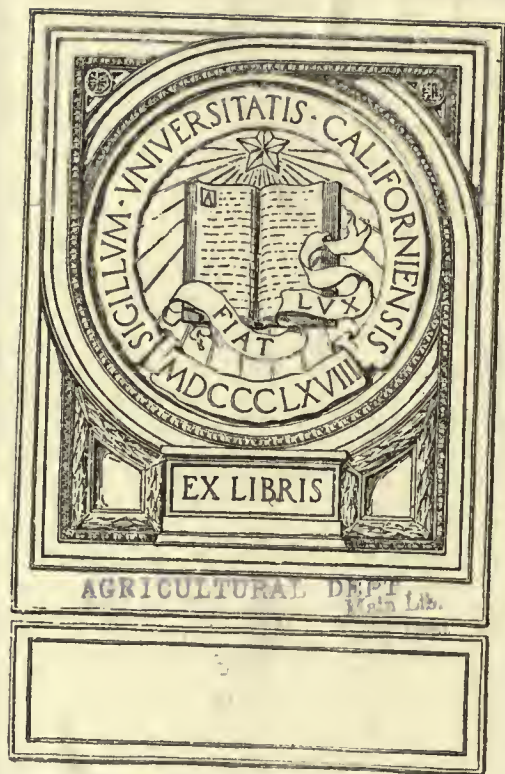


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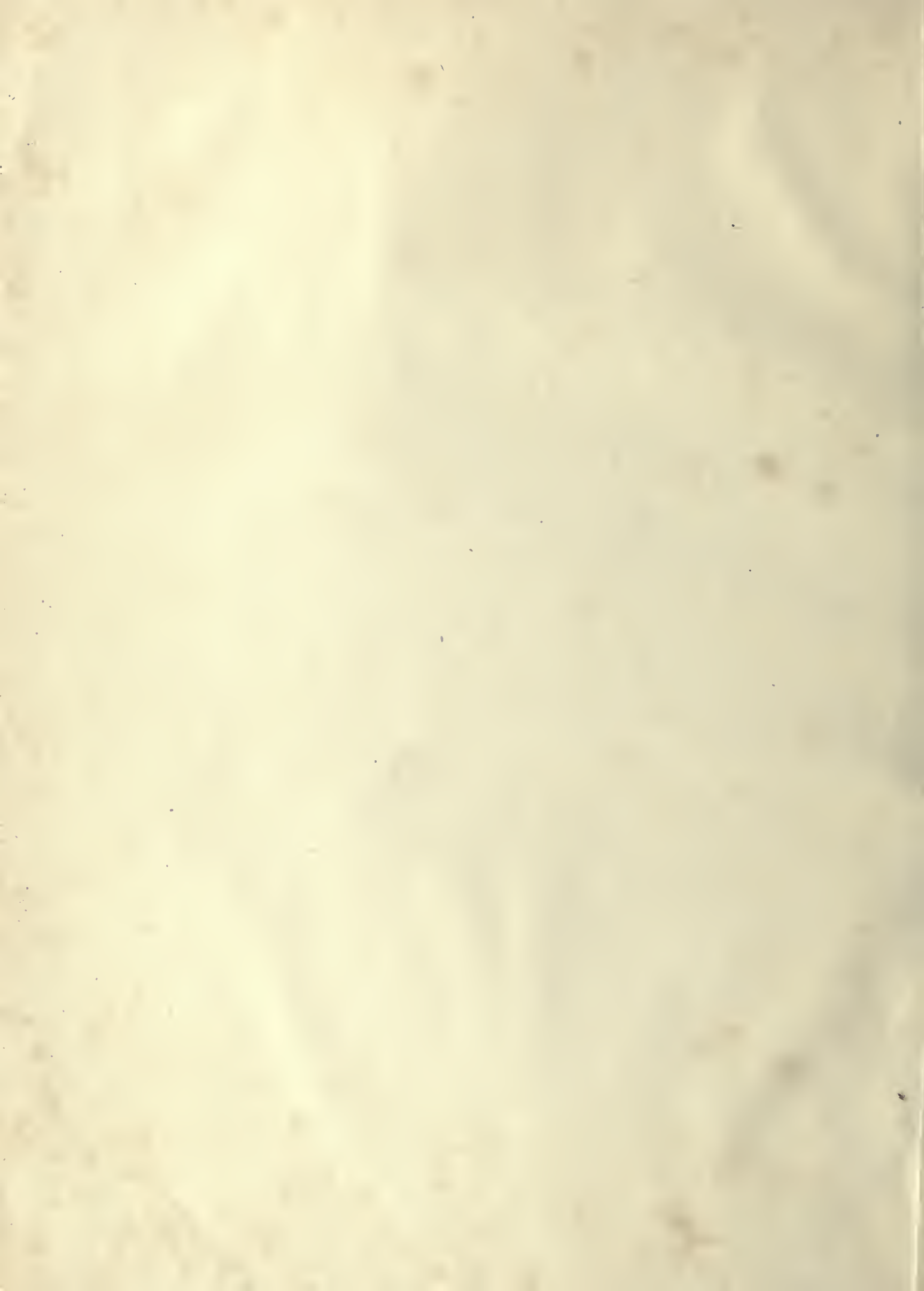
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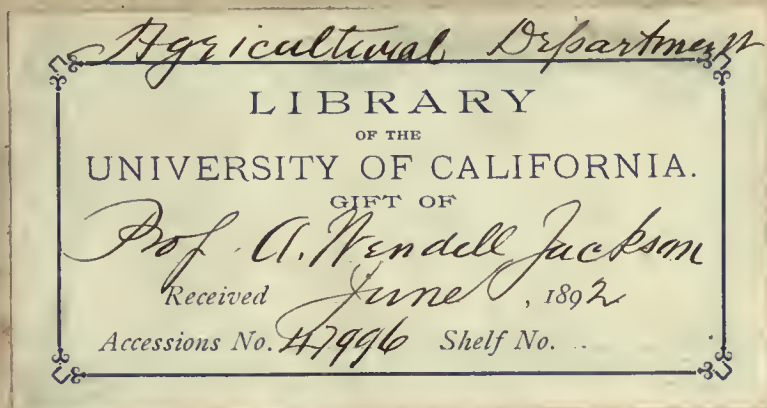
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MINUTES

IN

Agriculture and Planting.



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MINUTES

IN

Agriculture and Planting.

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| <p>I. On the structure and component principles of vegetables.</p> <p>II. On the culture and use of Nine of the best <i>Artificial</i>, and of Eight of the best <i>Natural Grasses</i>; shewing the great advantages that would arise from a more general use of them, by enabling the Grazier to keep one-fourth more Stock, and the Farmer to produce one-fourth more Corn, upon the same Land, than they did before.</p> <p>III. On the construction and use of a <i>Sward Dresser</i>.</p> <p>IV. On the construction and use of a <i>Thistle Cutter</i>.</p> | <p>V. On the construction and use of a <i>Compound Roller</i>; containing a spike and plain Roller in one Frame.</p> <p>VI. On the construction and use of a <i>Tree-Transplanter</i>, for removing and planting large Trees.</p> <p>VII. On the construction and use of a <i>Scuffle</i>.</p> <p>VIII. On the construction and use of a <i>Couch Grass Drag</i>.</p> <p>IX. On the construction and use of a <i>Couch Grass Rake</i>.</p> |
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ILLUSTRATED with SPECIMENS

OF EIGHT SORTS OF THE BEST, AND TWO SORTS OF THE WORST

NATURAL GRASSES,

AND WITH ACCURATE DRAWINGS AND DESCRIPTIONS OF THE ABOVE

Practical Machines, on Seven Copper Plates,

WHEREBY EVERY FARMER WILL BE MADE PERFECTLY ACQUAINTED WITH THE BEST

NATURAL and ARTIFICIAL GRASSES,

AND NOT ONLY BE MADE ACQUAINTED WITH THE USE OF, BUT ALSO BE ENABLED

To Construct the above Machines.

BY WILLIAM AMOS,

Of Brothertoft, near Boston, Lincolnshire,

AUTHOR OF THE THEORY AND PRACTISE OF THE DRILL HUSBANDRY, &c. &c.



BOSTON, PRINTED BY J. HELLABY,

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TO

His Grace the Duke of Norfolk, F. R. & A. S.

AND PRESIDENT OF

The Society for the Encouragement of Arts,

THE FOLLOWING WORK,

IS,

WITH HIS GRACE'S PERMISSION,

INSCRIBED BY

HIS GRACE'S

OBLIGED AND

MOST OBEDIENT SERVANT,

WILLIAM AMOS.



PREFACE.



THE numerous applications made to me by a variety of Graziers, for my opinion concerning the best *artificial* and *natural grass seeds*, for laying down land to pasture, &c. induced me to undertake the part of this work which relates to grasses. And the loss sustained by Farmers, from the best implements of husbandry in one county being scarcely known in another, induced me to undertake the *mechanical part*; in which, they are made acquainted with the construction and use of several practical machines, little known in general; and are thereby enabled to reduce the manual labour and expence attending many of the operations in Husbandry.

PERHAPS a great part of this work, so far as it relates to Grasses, will be new to many among my readers. But as agriculture cannot be practiced with any tolerable skill and advantage, without some knowledge of botany; I have therefore thought it necessary to give such a condensed account of the *structure, propagation, dissemination,* and

component parts of vegetables, as coincided with the plan of this work. I have at the same time attended to the culture and use of nine of the best *artificial*, and eight of the best *natural grasses*.

IT is a just matter of wonder in this age of improvement, that so little attention should be paid to the laying down of land with proper grass seeds. The quantity of land annually laid down makes an attention to this branch of rural œconomy essentially necessary.

EVERY husbandman ought to know how to suit his grain and plants to the quality of his soil, but few are acquainted with the nature and disposition of the best *artificial* and *natural grasses* that cover our arable and pasture fields. The surface of the earth is cloathed with a pleasing and wonderful variety of grasses. Some delight in a moist soil; others prefer a dry situation; and yet so little do we observe this order of nature, that grass seeds of all kinds, good and bad, are promiscuously sown upon the same soil.

OF late there has been much encouragement given to the collecting of grasses by hand. It is here that the botanist becomes useful to the agriculturist. He knows from his kalendar of Flora, what grasses flower together, and what

sort suits different soils, and if a mixture is required, can tell what kind of grass seeds will render that mixture beneficial. For this useful purpose some degree of botanical knowledge is necessary. Nature is ever constant and uniform. She points out to us the plants peculiar to every soil, if we could be prevailed upon to trace her along the walks which she delights to tread; and to welcome the grasses which she scatters over our best feeding pastures.

It is not unusual, to see a piece of rich and ill-managed land over-run with the coarsest grasses. In that state, it cannot maintain a stock in proportion to the goodness of the soil. Other lands of a much worse quality, being laid down with a more judicious choice of seeds, are found to be infinitely more productive. This consideration ought to awaken the attention of the agriculturist to a more attentive choice of seeds in laying down his land to pasture.

At present, the farmer is liable to the imposition of the seedsman. If he purchase the seeds of weeds, he must expect a plentiful crop of them in return for the painful care that he has taken of his land.

But I have endeavoured to remove this inconvenience, by giving specimens of eight of the best, and of two of the worst sorts of natural grasses, with descriptions of each;

by which the farmer will be enabled, not only to collect his own seeds, but also to determine on the quality of the seeds he may want to buy.

THE *mechanical part* of this work is principally directed to the construction and use of such implements as I have employed in facilitating the destruction of weeds, both on arable and pasture land.

FOR, if the total extirpation of weeds cannot be accomplished; yet their propagation, at least, ought to be checked.

WHETHER we view mankind in a natural or in a civilized state; we shall find, that not only the necessaries, but also the far greater part of the elegancies of life, are drawn from the vegetable kingdom. Every endeavour, therefore, to point out the most effectual means of accelerating the destruction of weeds, and of bringing to perfection the cultivation of the soil of Britain, must carry with it its own recommendation.

I cannot conclude this Preface, without acknowledging my obligations to several preceding authors, from whose labours I have, in many respects, derived considerable benefit.

I shall not here make any apology for offering this my second essay to the public. The favourable reception given to my first essay (on the Theory and Practice of Drill-Husbandry) will excuse me for offering this as a supplement to it.



Minutes

OF

Agriculture and Planting, &c.

DISSERTATION I.

On the Structure and component Principles of Vegetables.

1. *On the Structure of Vegetables.*

I SHALL begin this section by defining a Vegetable, and then give a cursory account of its structure.

A VEGETABLE is an organized substance,—reproducible only by a peculiar sort of generation,—augmentable in bulk, not simply by accretion, or by chemical combination, but by an enlargement of its organization,—in which a peculiar vitality co-operates with chemical, mechanical, and electrical influences, to produce the growth and salutary state of the body,—and which after rising into existence, and passing through a certain series of changes, is naturally deprived of its vitality, and dissolved into its component material elements.

THE general and most obvious parts of a vegetable are five, viz. the root, the stem, the branches, the leaves, and the flower; but a good microscope discovers six organic parts in most plants.

On the Structure of Vegetables.

1. *The Epidermis, or cuticle, is the first thing that presents itself to our view. It is a thin membrane, formed of fibres that cross each other in every direction, with horizontal perforations. Its texture is sometimes so thin, that the direction of the fibres becomes visible, by holding it against the light. The use of the epidermis is to defend the cortex, which lies next to it, from the injuries of the air; to keep open, by its callous nature, the pores of the exhaling and inhaling vessels; to modify the impressions of external objects upon the vegetable; to protect the extreme ramifications of the ærial or aqueous vessels; and to cover the cellular substance, in which the several fluids are elaborated.*

WHEN the epidermis is destroyed in the living plant, it is regenerated; adheres more firmly to the cortex, and forms a kind of cicatrix or scar.

THE *Epidermis* of the *Bark*, necessarily acts to vegetables, as the *Mouth* or organ for the selection and intromission of food. It is exceedingly fine and close in its mechanical texture; for, it is perhaps destined to perform not a chemical, but a mechanical part; and that mechanism must, of course, be extremely fine, which shall, in the relative situation of the epidermis of the bark, exclude every matter that might injure the interior organization of the vegetable.

2. THE *Cortex* or *outer bark*, is situated next to the epidermis, is of a hard texture, and loosely adheres in *trees* to the next covering or liber; but in tender plants it is soft, and called the *cutis, skin, or cellular coating*. It is the first receptacle and the reservoir of the food taken in by the *Epidermis*. Its texture consists of vesicles and utricles, so very numerous, and so close together, as to form a continued coating. In its *vesicles* and *utricles*, which run horizontally, is that food deposited for digestion and nutritive distribution. In them, begins the chemical process by which the living vegetable digests its food into a proper addition to the substance of its organs. The mechanical relations and powers of the organs and of the food, are made to co-operate with those which are chemical. In its passing from the utricles and vesicles of the *cellular tissue*, through the organs of the *cortical coating*,—the SAP, the general *chyle* or *blood* of the plant, is com-

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pletely elaborated. By this elaboration, those chemical principles are selected which can alone contribute to the sustenance of vegetable life.

3. THE *Liber*, or *inner bark*, is membranous, flexile, and sometimes wholly separable from the cortex and alburnum. These two coats of a tree, namely, the cortex and liber, are formed of laminæ, as will appear by macerating them in water; by which the cellular substance is destroyed, and the laminated appearance becomes conspicuous. They appear to be parts very essential to the life of the vegetable, for in them the principal functions of life, as nutrition, digestion, secretion, &c. are performed; as is evinced in those trees which are hollow within, and plants which are kept in vigour by the good state of their barks, although rotten internally. Of this kind of hollow tree a remarkable instance remains in Welbeck Park in Nottinghamshire, through the middle of which a coach is said to have been driven. The cortical coverings are easily detached from each other; and it is from their gross resemblance to the leaves of a book, that they have been called *liber*.

4 THE *Alburnum*, is the next integument to the liber, situated between it and the wood, composed of a soft whitish substance, not easily discernible in some trees; but in the *oak* and *elm* it is harder and more apparent. It is, as it were, an imperfect wood; not having acquired the degree of consistence proper to perfect wood; it is that state between bark and wood, that the former must necessarily arrive at, before it can become the latter. The hardness of the alburnum is in proportion to the vigour of the plant.

THE vessels, which convey the sap-juice with such amazing force, are situated in or compose the alburnum, or sap-wood, of the trunk or root of trees, nor is it surprising, that some of it when pressed by so high a column should exude into the cells between the alburnum and bark. That the vessels of the alburnum in their living state possess the property of conveying the sap juice, which is propelled upwards in the early spring by the absorbent terminations of the roots, is visible in decorticated oaks; the absorbent mouths of these sap-vessels open exter-

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nally in the moist earth on the roots of trees, and also into the air on their trunks; and thus mix the aqueous fluids, which they thus imbibe, with the saccharine and mucilaginous materials deposited previously in the alburnum of these roots and trunks. During the heat of a summer's day, the juices are highly rarefied, in those vessels; and, by the attractive power inherent in all capillary tubes, by the mutual attraction between the constituent parts of vegetables, by the irritability in those vessels, and by the perspiration constantly going on from the superior parts of those vessels, the juices are raised from the roots and other parts of the plant to the extremity of their branches, for its developement and increase, and to serve for the various secretions and depositions; by means of which every part is formed by the continued impulse of the formative nîsus, or power of vegetation. And it is wonderful that these vessels, which are found in the alburnum, and consist of a spiral line, whether they may properly be called absorbent or umbilical vessels, or consist of both, should ever have been supposed to be air-vessels. But there is another insuperable objection to this idea of their use, which is, that these vessels equally exist in the roots of plants as in their trunks; and probably terminate, externally only in the roots; and, as they are there not exposed to the atmosphere, they cannot serve the purpose of respiration; air nevertheless in its combined state, or even as dissolved in water, may be absorbed by these vessels; but as the solar heat declines, the juices condense, and fall down in the manner of the spirits of a thermometer. What seems to strengthen the opinion of the sap being thus moved, is, that nature has made no apparent provision whereby the sap might be prevented from descending, in the very same vessels through which it ascends. In the vessels of animals, whose office it is to return a fluid, there is an apparatus called VALVES, which effectually prevent the contained fluid from going back. These valves are entirely wanting in the vessels of vegetables. The bark of trees annually becomes alburnum or sap-wood; and that sap-wood gradually loses all vegetable life, and becomes heart-wood, and forms a lîgncous ring.

5. THE *Wood*, or *Lignum*, is the compact fibrous substance, disposed into

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concentric layers, surrounding the medulla or pith. We may consider wood as being formed of fibres, more or less longitudinal, connected together by a cellular tissue, interspersed with vesicles communicating with each other; which diminish gradually towards the center, where they form the pith.

6. THE *Medulla*, or *pith*, or innermost substance of trees, is soft and vesicular, and differs from cellular texture by its snow white colour. In young trees it is most copious; but, as the plant grows, it diminishes and at length disappears. Thus it is evident that the medulla is necessary in the beginning of the life of plants, but not for its continuation. Perhaps nature reserves a superfluous nutritious humour in the medulla, if from any cause the young plant should become dry; that it then may be absorbed and converted into aliment. The pith thus appears to be the first or most essential rudiment of the new plant, like the brain or spinal marrow, medulla oblongata, which is the first visible part of the figure, I believe, of every animal fetus, from the tadpole to mankind. Hence it is obvious that the wood, bark, and all the parts of ligneous or of gramineous vegetables, are but collections of *fibre* and *cellular tissue*.

BUT the grasses, fungi, &c. differ from the ligneous vegetables, as containing a smaller proportion of *ligneous fibres*.

WHATEVER part of a plant we examine, we observe these and no more. The root, its ascending stalk, and descending fibre, are one, and not three substances. This reduces the entire vegetable to one body, and what appears in the flower to be many parts; are only the extremities or terminations of the six above mentioned.

THE ROOTS OF PLANTS consist of the same parts as the stem, although less conspicuous; they are branches, enlarging the quantity of surface that the plant exposes to the contact of the earth, and constituting, at the same time, its means of mechanical fixation and support. The *root* imbibes the nutritious juices from the earth, by means of its absorbent pores or oscula, as long as it remains

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tender; but as soon as it becomes ligneous, it emits radicles on every side, which continue the absorption, and convey it, first to the root, and then to the whole plant. Thus, if a plant, or tree, be transplanted, it succeeds with greater certainty, the more absorbent radicles are preserved with the root.

THE BRANCHES are new trees implanted on the parent-stem, which serve to enlarge the quantity of surface which the whole plant exposes to the atmosphere.

THE LEAVES consist, like the rest, of *epidermis*, *cellular tissue*, and *fibre*. They are every where supplied with fibres, which commonly run in every direction, and branching out into innumerable small threads, interwoven with the parenchyma, like fine gauze or lace.

THE *surface* of the *epidermis* of a leaf, like that of an animal, is full of pores, which serve both for respiration and the absorption of air and moisture. The absorbent pores or oscula of the leaves continually take in air and moisture from the atmosphere, which, by a kind of chemical process, imparts to the sap its essential principles, which were destroyed; and the superfluous, noxious, and disengaged parts, are again expired.

THE *parenchyma* consists of very minute fibres, disposed in extremely small cells, which are of various sizes in the same leaf. All leaves, of whatever figure, have transverse ribs and a marginal fibre, by which the rest are bounded. The particular shape of this fibre determines the figure of the leaf. The use of the leaves is to nourish the plant with the nutritious juice they reserve in their parenchymatous substance; and to expire and inspire air and water. Hence the leaves of plants are to them, what the lungs are to animals.

THE SEEDS and FLOWERS, as to minute, organic structure, resemble the wood and bark.

THE FLOWER is a temporary part of vegetables allotted to generation, terminating the old vegetable, and beginning the new. It consists of seven principal parts, namely, the *calyx*, *corolla*, *stamina*, *pistillum*, *pericarpium*, *semina*, and *receptacle*; the four first belong properly to the flower, and the three last to the fruit.

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I. THE *Calyx*, empalement or flower-cup, is the termination of the cortex or outer-bark of the plant, which, after accompanying the trunk through all its branches, breaks out in the flower, and is present in the fructification in this new form. Its chief use is to enclose and protect the other parts of the flower. It receives different appellations according to the circumstances with which it is attended.

II. THE *Corolla*, foliage, or leaves of the flower, is the termination of the liber or inner-bark, continued to and accompanying the fructification in this new form of painted leaves. Its use is the same as that of the calyx, serving as an inner work of defence, for the parts it encloses; as the calyx, which is usually of a stronger texture, does for an outer one. The leaves of which the corolla consists, are called *petals*. The corolla receives different names according to the number, form, &c. of the petals.

III. THE *Stamina*, threads or chives, are the male part of the flower, designed for the preparation of the pollen, and is the termination of the alburnum. Each single *stamen* consists of three parts,

1. THE *Filament*, or thread, which serves to elevate the anthera or summit, and at the same time connects it with the flower. These vessels prepare a fluid, and convert it into the farina or pollen; which is then propelled through very minute ducts into the anthera.

2. THE *Anthera*, or summit, situated on the top of the filament, which contains within it the pollen, and when come to maturity discharges the same, for the purpose of fertilizing by the act of impregnation, the tender and concealed seed. Hence at the age of puberty, the following phenomena take place. The antheræ, when mature, on a sudden break, and explode their pollen into the whole ambit of the flower. Wax is another secretion produced with the fecundating dust on the anthers of flowers, which in wet seasons it preserves from rain, to which it is impenetrable; for the farina, or fecundating dust of plants, is liable to swell if exposed to much moisture, and to burst its shell; and it either then becomes inert

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and ineffectual, or is washed away. Whence as wheat, rye, and many of the grasses, and plantain, lift up their anthers on long filaments, and thus expose the enclosed fecundating dust to be washed away by the rains; a scarcity of corn is produced in wet summers; to which the ustilago or smut in wheat, have rationally been ascribed. Hence the necessity of a careful choice of seed-wheat; as that, which had not received the dust of the anthers, will not grow, though it may appear well to the eye.

FROM these premises, the improvers of agriculture, and even the common practical farmer, may be able to deduce very useful consequences. If the farmer dreads heavy and sudden rains, immediately after he has sown his seed, he may, with equal reason, be afraid of them at the time his corn is in bloom. For, as the wet will injure him in one case by bursting the seed, so it will in the other by washing off the *farina*, or male dust, whereby an effectual impregnation will be prevented. The farmer will not then be surprized if his grain appears small and pined at the time of threshing, when he can so readily account for the cause in philosophic terms.

3. THE *Pollen*, farina fœcundans, or meal, contained within the anthera, is a fine dust secreted therein, and destined for the impregnation of the germen. Each portion of this meal is by a microscope seen to be concealed in a very fine pellicle (which at the time of impregnation bursts) containing the prolific liquor. This very subtile, elastic *Vapour*, contained in the farina or pollen of the anthera, is the principle which fertilizes the plant.

IV. THE *Pistillum*, pistil or pointal, is the female part of the flower, designed for the reception of the pollen, and is the termination of the wood or lignum. It consists of three parts,

1. THE *Germen*, which is the rudiment of the fruit, accompanying the flower, but not yet arrived at maturity. It is situated at the bottom of the style, and is generally called germen until the antheræ have discharged their pollen; after which period, it becomes the pericarpium, which contains the tender seeds.

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2. THE *Style*, which is the part that serves to elevate the stigma from the germen, and which conveys the elastic vapour of the pollen through its cavity into the germen, where it fecundates the *seeds*.

3. THE *Stigma*, or summit of the pistillum. It is mostly covered with a moisture, or melleous juice, for the purpose of retaining and dissolving the pollen, which it attracts and receives when it is exploded upon it by the rupturing of the anthera, for the reproduction of vegetable life. For though the filaments and style, as well as the corolla and nectary or honey-cup, belong to the sexual organs of vegetables; yet it is the anthers alone of the stamina, and stigmas alone of the pistilla, which possess the power, and I suppose the passion of reproduction.

THIS amatorial attachment between the stigmas and the anthers on the summits of the stamens has attracted the notice of all botanists. In many flowers the anthers or males bend into contact with the stigmas or females, as in *kalmia*, *fritillaria persica*, *parnassia*, *cactus* and *cistus*. In the *kalmia* the ten stamens lie round the pistil, like the radii of a wheel, and each anther is concealed in a niche of the corolla, to protect it from cold and moisture; these anthers rise separately from their niches, and approach the stigma of the pistil for a time, and then recede to their former situations. In the *fritillaria persica* the six stamens are of equal lengths, and the anthers lie at a distance from the pistil; of these, three alternate ones approach first, and surround the female; and when these decline, the other three approach; and in *parnassia* the males alternately approach and recede from the female, the coition lasting some days; and lastly in the most beautiful flowers, of *cactus grandiflorus*, and of *cistus labdaniferous*, where the males are very numerous, some of them are perpetually bent into contact with the female; and as they recede, others advance.

IN other flowers the females bend into contact with the males, as in *nigella*, *epilobium*, *spartium*, *collinsonia*. In *nigella*, devil in the bush, the females are very tall compared to the males, and bending down over them in a circle, give



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the flower some resemblance to a regal crown. The female of the *epilobium angustifolium*; willow herb, bends down amongst the males for several days, and becomes upright again when impregnated. In the *spartium scoparium*, common broom, the males or stamens are in two sets, one set rising a quarter of an inch above the other. The upper set does not arrive at their maturity so soon as the lower; and the stigma, or head of the female, is produced amongst the upper or immature set. But as soon as the pistil grows tall enough to burst open the keel-leaf, or head of the flower, it bends itself round in an instant like a French horn, and inserts its head, or stigma, amongst the lower or mature set of males. The pistil or female then continues to grow in length; and in a few days the stigma arrives again amongst the upper set, by the time they become mature. This wonderful contrivance is readily seen by opening the keel-leaf of the flowers of broom, before they burst spontaneously. And lastly; in the *collinsonia* the two males widely diverging from each other, the female bends herself into contact first with one of them; and after a day or two leaves this, and applies herself to the other; the anther of which was not mature so soon as the former.

By what means are the anthers in many flowers, and stigmas in other flowers, directed to find their paramours? Is this curious kind of storge produced by mechanic attraction, or by the sensation of love?

V. THE *Pericarpium*, or seed-vessel, is the germen just described when grown to maturity, and which, when ripe, discharges the seeds it contained. The pericarpium of several vegetables has a considerable quantity of a proper juice, contained in a parenchymatous substance or in vesicles, every where supplied with very minute air and sap vessels. These are called *Fruits*.

VI. THE *Semina*, or seeds, are a deciduous part of the vegetable, each seed including the rudiment of a new one; endowed with a vital principle by the sprinkling of the pollen, which they are capable of retaining for an immense time. The following parts are observed in a seed,

1. THE *Corculum*, or embryo of the new plant, within the seed. It is di-

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vided into the plumula and rosetel.

THE *plumula* is the scaly ascending part, conspicuous when a seed begins to vegetate.

THE *rosetel*, is the plain part of the corculum and always descends into the earth.

2. THE *Cotyledon*, or side of the seed, of a porous and perishable substance. When, by a certain stimulus to the latent vital principle, vegetation commences, innumerable small umbilical vessels may be seen ramifying on the interior of the cotyledons, which, uniting as they approach the seminal plant, form a small chord to be inserted into the body of the germ, as seen in the garden bean.

3. THE *Aryllus*, or exterior covering of the seed, which comes off spontaneously.

4. THE *Hilum*, or external mark or scar on the seed, where it was fastened to the pericarpium.

VII. THE *Receptacle*, is the base which connects the other parts of the flower together, and is the termination of the pith.

FROM this survey of the STRUCTURE OF PLANTS, it is evident that there is an intimate correspondence between all their parts, and that all those parts are the same, only differing in shape. The roots are formed sharp and pointed, to make their passage easier through the earth, and the leaves are made broad, to catch the moisture of the air with more readiness, &c. The seed is preferable to all the other parts for the re-production of the vegetable; because it contains these essential parts in a natural preparation in which they are the most easily preserved, the most conveniently disseminated, and, in suitable circumstances, the most readily revived to vegetation; because, by means of the seeds, vegetables are universally re-produced,—but of some we know not to accomplish the re-production by other means.

A SORT of *saccharine fermentation*,—if we may, without impropriety, employ the term,—is necessary to prepare the *seed* for the revival of the energies of

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vegetable life, as the germination of barley in making malt. It is probably this saccharine process, which obtains in new hay-stacks too hastily; and which by immediately running into fermentation produces so much heat as to set them on fire; the violent fermentation of which may be partly owing to the sugar, which is deposited in the joints of grass before the seeds are ripe for their nourishment, and partly to a chemical production of sugar.

AT the moment when the matter of the seed, or other organized portion, has received the necessary chemical preparation,—the *peculiar energies of vegetable life*,—are, by what mysterious law of nature we know not, renewed in it. *The peculiar energy of VEGETABLE LIFE, consists in its converting into peculiar compounds, distributing in a peculiar mechanical arrangement, and employing for the general enlargement and support of its organic structure,—whatever suitable matters are presented to its proper exterior organs.*

A SEED, when put into the moist earth, by means of its vital principle, swells; the action of the vessels is induced; heat is generated, and it becomes a living plant.

AFTER *vegetable life* or *irritability* has thus commenced, its first energy is exerted in receiving from the *earth*, in which the embryo is imbedded, the impulse of *water* impregnated with various soluble or suspendible substances; *which* its exterior organs refine to gas, as they convert *it* into nourishment. It is necessarily from the *earth*, that the embryo vegetable takes its first nourishment; for, it is imbedded in the soil.

THE farinaceous matter in the cotyledons of the seed is dissolved by the absorbed fluid into a nutritious mucilage, and supplies the umbilical vessels with a fluid, which is conveyed to the embryo for its nourishment.

THE plant in this manner begins to be developed, and gradually and insensibly increases in size. The coverings, unable to resist the pressure, give way, and the radicle having penetrated the small orifice or hylum, the shell at length splits in two. The root then pierces into the earth, and absorbs from thence a more

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copious nourishment. The young plant now begins to rise to the surface of the earth; the leaves unfold themselves, and, strengthened by the nourishment the radicles supply, it pierces through the earth, and advances into the air; supplied with every part in miniature; and the gradual increase and extension of those parts, by the same vegetable energies, constitute the growth of plants.

PLANTS that propagate their species by seeds, which, at a proper season, vegetate, and produce young plants, are called *oviparous*.

PLANTS that send forth buds or radicles to be separated from the parent plant at a proper period, and which then become perfect vegetables, are termed *viviparous*.

THE CHEMICAL PRINCIPLES WHICH VEGETABLES take in as nourishment, as yet known, are *caloric or heat, light, electric matter, carbon, hydrogen or inflammable air, oxygen or vital air, azote or mephitic air, and a very small portion of phosphorus, sulphur, metals, and an earth.* Plants inhale nourishment—only in the forms of *aqueous* and *gaseous* solutions. The *roots* take in whatever nourishment they receive—chiefly in water, and in gas mingled with water, and other liquid solutions. The trunk, branches, flowers, fruits, and leaves take in, also, much *aqueous* nourishment; but receive a much larger proportion of that which they inhale, in a *gaseous* form: It is, in general, salutary for plants, to receive their nourishment, rather in a *gaseous* than in an *aqueous* form; because what they take in the former way, is, for the most part, easier to be digested into wholesome *sap*, than that which they imbibe in the latter state. Water undecomposed, hydrogen, carbon, azote, oxygen, are the only sorts of food which plants can take in. All soils, all airs, all situations, in which they grow and thrive, must afford these elementary pabula. Where these are to be obtained, in sufficient quantity; plants take in, over all their surfaces, by the energy exerted in the epidermis of the bark,—precisely that due proportion of each element, which is requisite to their healthful support, according to the respective nature of every different plant.

On the Structure of Vegetables.

EQUIVOCAL generation is now by all enlightened men exploded from animal and vegetable life; but some of the half enlightened moderns continue to hesitate with respect to vegetable life.

It is urged that plants, although fixed to the earth they grow in; are never wanting, where the soil is proper for them; that, in many soils and situations, the earth dug many fathoms deep, will, when exposed to the atmosphere, produce a variety of plants. That islands raised by a volcano at a distance from any shore, are soon covered with grass; that mushrooms and other organized bodies, spring from rotten stumps of trees, where they were never seen before; that various plants rise on the foundation of old houses, when cleared of the rubbish; and that upon liming or dunging, white clover springs up in the very central parts of a wide extended barren moor, though the seed of white clover has not wings to carry it to a distance. They see mites in cheese; and myriads of flies and creeping things in a dunghill, or a putrid marsh. Ignorance of the natural history of these animals, made way for the conjecture, that they were mere spontaneous productions, the effect, not of generation, but of corruption.

BUT the sexual system of vegetable generation, demonstrated and established by the immortal Linnæus, has entirely banished equivocal generation from vegetables, as well as from animals; for wherever the principle of life exists, there is a peculiar organization; and as much mechanism is necessary to the structure of a vegetable, as of a human being; and the reproduction of the one, is effected in the same manner as that of the other.

PLANTS from their situation have been divided into terrene, subterranean, aquatic, parasitic, indigenous, and exotic.

THE whole surface of the earth, the bottom of the sea, and even subterranean passages, are furnished with plants.

AND there is no other way by which plants are propagated, but by seeds, suckers and layers, &c.

PLANTS, it is true, are destitute of locomotion; and by means of suckers and

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layers, they can only cover contiguous spots.

BUT numerous and wonderful are the methods, which nature has employed for the dissemination of seeds. Some seeds are furnished with a plume, a wing, a tail, an awn, hooks, gluten, and curvature. Other seeds are different, from the shape and other circumstances of the pericarpium; as berrying, inflation, viscosity, elasticity, structure, &c. Hence the dissemination of seeds must be very apparent.

SOME seeds by their plumes, their wings, and their tails, fly about from place to place, and are deposited on high towers, and in distant countries. Other seeds by their awns and hooks, lay hold of animals that come near them, and are spread far and near. The gluten of some seeds attaches itself to the hair or feathers of animals and are thereby planted upon high and distant trees. Many of the berrying seeds are the food of birds: the pulp is their aliment; and they discharge the seeds uninjured, and spread them every where; upon high towers, impending cliffs, and upon inaccessible precipices.

THE pericarpium of some plants bursts with an explosive force, and their seed is thrown to a very great distance.

MANY other agents are employed by nature to stock the earth with plants.

THE sea and rivers waft more seeds than they do sails.

IN short, the formation of the organs for sexual generation in vegetables, seems to be the chef d'œuvre, the master piece of nature; and no other method is necessary, nor so easy, to fill the earth with plants, as by seeds, suckers and layers. Farewell then to equivocal generation.

2. *On the component Principles of Vegetables.*

THE structure of the glands of animals has not been yet fully ascertained; and the vessels of vegetables being still more minute, and rigid, the structure of their glands is still further removed from our discovery. Their effects are however as evident, as those of the glands of animals in the secretion or production to their various fluids.

On the component Principles of Vegetables.

THE various substances which afford food to plants, are changed by the organization of the vegetable; from which there results a fluid generally distributed, and known by the name of sap. This juice, when conveyed into the several parts of the plant, receives an infinity of modifications, and forms the several humours which are separated and afforded by the organs. It is to these component principles chiefly that I am at present about to direct your attention; and I shall endeavour in my examination to follow the most natural order. These principles are

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|----------------|------------------------------------|
| I. MUCILAGE. | IX. ACIDS. |
| II. OILS. | X. ALKALIS. |
| III. RESINS. | XI. COLORING MATTER, |
| IV. BALSAMS. | XII. POLLEN or fecundating Powder. |
| V. GUM RESINS. | XIII. HONEY. |
| VI. FECULUM. | XIV. LIGNUM. |
| VII. GLUTEN. | XV. EXTRACT. |
| VIII. SUGAR. | |

I. CONCERNING MUCILAGE.

MUCILAGE appears to constitute the first alteration of the alimentary juices in vegetables. It is viscid and insipid. It affords, by distillation,—pyro-mucous acid,—a large proportion of water,—a small portion of a brown, thick oil.—and a mixture of carbonic acid-gas with gas-hydrogen. It is soluble in water, whether hot or cold: it does not absorb oxygen from the atmosphere: desiccation gives it the hard and brittle form of gum.

MUCILAGE is sometimes found almost entirely alone, as in *mallows*, the seeds of the *wild quince*, *linseed*, the seeds of *thlaspi*, &c. Sometimes it is combined with substances insoluble in water, which it keeps suspended in the form of an emulsion; as in the *euphorbium*, *celandine*, the *convolvulus*, and others. In other instances it is united with an oil, and forms the fat oils. Frequently it is united with sugar; as in the *gramineous seeds*, the *sugar-cane*, *maize*, *carrot*, &c. It is likewise found confounded with the essential salts, with excess of acid, as in *barberries*,

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tamarinds, sorrel, &c.

THE mucilage called gum arabic is obtained from *mimosa nilotica*, gum tragacanth exudes from *astragalus tragacantha*, as a similar gum exudes from our cherry and *plumb-trees*; sagoe is the pith of the *lycas circinalis*; and salep is the root of the *orchis* dried in an oven.

THIS mucilage seems to serve as nourishment to the plant; first, because it is found in all vegetable as well as animal materials, as they decompose in dung-hills; secondly, because it forwards the growth of vegetables, when spread upon land; thirdly, because those trees, which bleed much gum, are weakened and frequently die; and lastly, because it is evidently laid up in the roots and seeds of various vegetables for the nourishment of the young plants. But in these it seems to undergo a change either in part chemical, or wholly by the digestive organs of the embryo plant, and is converted into sugar, as in the transmutation of barley into malt; and as appears from the sweet taste of onions and potatoes, when boiled after they have germinated; and as sugar abounds in the vernal sap-juice of trees in such quantity as to be capable of fermentation.

II. CONCERNING OILS.

BY common consent the name of oil is given to fat unctuous substances, more or less fluid, insoluble in water, and combustible.

THESE products appear to belong exclusively to animals and vegetables. The mineral kingdom exhibits only a few substances of this nature, which possess scarcely any of the above properties, such as the unctuous property.

OILS are distinguished, relative to their fixity, into fat oils, and essential oils. I shall describe them in this article under the names of fixed oils and volatile oils.

1. Concerning fixed Oils.

MOST of the fixed oils are fluid; but the greater number are capable of passing to the state of solidity, even by a moderate degree of cold. There are some



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which constantly possess that form in the temperature of our climates; such as the butter of *cacao*, *wax*, and *pêta* of the chinese.

If the nuclei of *almonds*, *walnuts*, *olives*, *linseed*, *rapeseed*, *hempseed*, the seeds of the *poppy*, *cocoa*, and those of the *ricinus* or *castor-oil tree*, be expressed, an unguinous oil is extracted. The manner in which the oil is generally obtained, is by first crushing the seed between large stones, into a kind of paste; which is put into bags and squeezed in a press: the oil is thus forced out of the seed, and received in a proper vessel.

SOME of these contain also a bitter or narcotic material, as *bitter almonds*, *apricot kernels*, *acorns*, *horse-chesnuts*; which, as it adheres to the mucilage, may be separated from the oil; as in expressing the oil from bitter almonds, which is as good as from sweet ones.

2. Concerning volatile Oils.

FIXED oil is combined with mucilage, volatile oil with the spiritus rector, or aroma; and it is this combination or mixture which constitutes the difference between them. The volatile oils are characterized by a strong smell, more or less agreeable; they are soluble in alcohol, and have a penetrating and acrid taste. All the aromatic plants contain volatile oil, excepting those whose smell is very transient, such as *jasmin*, *violets*, *lilies*, &c.

By distillation, plants give over with the water, a quantity of volatile oil, which floats on the top in small globules.

VOLATILE or *ethereal oil* resides in a particular appropriated part of the plant; thus it is only found in the corollaceous petals of the *rose*, *chamomile*, *jasmine* and *hyacinth*; in the stigmata of the *crocus sativus*, called *saffron*; in the calyx of the *clove-tree*; in the leaves of *mint*, *balm*, *sage* and *savine*; in the root of *valerian*, *sweet smelling rush*, and *angelica*; in the cortex of the *cascarilla tree*; in the liber of the *cinnamon tree*; in the epidermis of the *cassia tree*; in the wood of *sassafras* and *yellow saunders*; in the whole fruit or berries of the *juniper tree* and *laurel*; in the bark of the fruit of the *lemon* and *orange trees*; in the pellicle

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of the *bitter almond*; in the seeds of *aniseed*, *fennel*, and *caraways*, &c. &c.

III. CONCERNING RESINS.

THE name of resin is used to denote inflammable substances soluble in alcohol, usually affording much soot by their combustion; they are likewise soluble in oils, but not all in water.

ALL the resins appear to be nothing else but oils rendered concrete by their combination with oxygen. The exposure of these to the open air, and the decomposition of acids applied to them, evidently prove this conclusion.

RESINS in general are less sweet than the balsams. They afford more volatile oil, but no acid, by distillation.

THERE are some among the known resins which are very pure, and perfectly soluble in alcohol, such as the *balm of Mecca* and of *Copahu*, *turpentine*, *tacamahaca*, *elemi*: others are less pure, and contain a small portion of extract, which renders them not totally soluble in alcohol;—such are *mastic*, *sandarach*, *guaiacum*, *laudanum*, and *dragon's blood*.

IF the roots, leaves, barks, &c. of several plants be put into spirit of wine, suffered to stand a few days, and the spirit then evaporated; the resinous principle is obtained. Sometimes it exudes spontaneously in the form of drops, from the bark of trees; as the *gum mastic*, *anime*, *olibanum*, *benzoe*, *elemi*, *sandarach*, *guaiacum*, *laudanum*, *tacamahaca*, and *sanguis draconis*, which are found adhering to the trunks of their respective trees.

IV. CONCERNING BALSAMS.

As the chemical analysis points out a sufficiently striking difference between balsams and resins, I think it proper to treat them separately.

THE substances called balsams are therefore resins united with a concrete acid salt. We are acquainted with three principal kinds, viz. *benzoin*, the *balsam of Tolu*, and the *storax calamita*.

IF incisions be made in the trunk of balsamiferous vegetables, as the *copaifera officinalis*, *amyris gileadensis*, *toluifera balsamum*, *pinus balsamea*, &c. their

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several juices flow out; and not unfrequently spontaneously. By chemical analysis these balsams are found to consist of a peculiar resin, dissolved in volatile or ethereal oil.

V. CONCERNING GUM RESINS.

THE gum resins are a natural mixture of extract and resin. They seldom flow naturally from plants, but issue out from incisions made for that purpose. They are sometimes white, as in the *tithymalus* and the *fig-tree*; sometimes yellow, as in the *chelidonium*: so that we may consider these substances as true emulsions, whose constituent principles vary in their proportions.

THE gum resins are partly soluble in water, and partly in alcohol.

ONE character of gum resins is, that they render water turbid in which they are boiled.

THIS class is sufficiently numerous; but I shall only treat of the principal species.

WHEN the resinous principle is mixed with the gummous, it is called the gummi-resinous principle, of which nature is the gum *assa-fœtida* which exudes from the *ferula assa-fœtida*; gum galbanum, from the *bubon galbanum*; also *oilibanum*, *moniacum*, *scammony*, *gomboge*, *euphorbium*, *guttæ*, *myrrh*, *bdellium*, *opoponax*, *sarcocolla*, and *storax*, which exude from their respective trees.

VI. CONCERNING the FECULA of VEGETABLES.

FECULUM exists in all white and brittle parts of vegetables,—particularly in tuberculous roots, and in the grains of gramineous plants. It is a pulverulent, dry, white, insipid, combustible matter. It yields by distillation, a large proportion of pyro-mucous acid; is soluble in boiling water; forms, with this liquid, a jelly; is convertible by the nitric acid, into oxalic and malic acid; forms the basis of the nourishment of animals; and becomes, with sufficient readiness, a principle in the living animal body. All the solid parts of vegetables, are, more or less, capable of affording fœculum. But, some yield it in a greater abundance; and it is, therefore, prepared rather from these for the uses of the arts, as the fœcula

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of *wheat, potatoe, sago, salop, briony, and cassava.*

VII. CONCERNING the VEGETABLE GLUTEN.

THE glutinous principle, which, on account of its properties resembling those of animal substances, has been called the vegeto-animal substance by some chemists, is more particularly obtained from gramineous vegetables. In grains, it co-exists with fœculum, and saccharine substance. *Wheat* appears to contain it in a greater proportion than most other grains. It exists in the best flour; in proportion of—from a *fifth* to a *third* part. Because of its containing this matter in such a proportion, the flour of *wheat* is more wholesome and nutritious, as an article of food, than *oats, potatoes, or any other farinaceous substance.*

VIII. CONCERNING SUGAR,

THE saccharine principle is detected by the taste in many vegetables, especially in *dates, figs, siliquæ dulces, cassia in the pod, raisins, apples, quinces, plums, cherries, mulberries, currants, &c.* but the plant in which it exists in the greatest quantity, and from which it is obtained for economical purposes, is the arundo saccharifera, or sugar cane, which is bruised between iron cylinders in the west and east Indies, where it is cultivated; the juice, called Melasses, is then expressed, and by several operations made into sugar. The trunks of the acer saccharifera and fraxinus ornus also afford this principle very largely; as is evident from the quantity of manna, which spontaneously flows every season from their barks. It may likewise be obtained from *carrots, parsnips, the roots of dandelion, ferns, liquorice, &c.*

GREAT GOD of justice and wisdom! grant that this luxury may in thy good time be cultivated by the hands of Freemen; and may thence give happiness to the labourer, as well as to the merchant and consumer.

IX. CONCERNING the VEGETABLE ACIDS.

THE vegetable acids have been long considered to be weaker than the others; and this opinion was adhered to until it was observed that the oxalic acid seized

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lime from the sulphuric acid. The principal character which may serve to establish a line of distinction between the vegetable acids and others are--1. Their volatility; for there are none which do not rise with a moderate heat. 2. Their property of leaving a coaly residue after combustion, and of emitting an empyreumatic smell in burning. 3. The nature of their acidifiable base, which is in general oily.

THE acids produced by vegetable secretion have of late been much subjected to chemical inquiry, and have been found to be so numerous, that they have been named from the vegetables, or parts of vegetables, from which they have been extracted; as the *citric*, *malic*, *oxalic*, *tartaric*, *gallic*, and *benzoic acids*. The *citric acid* is obtained from the fruit of the citrus medica and aurantium, limonia acidissima, berberis vulgaris, punica granatum, rubus idæus, ribes rubra and grossularia, pinus cerasus, and vaccinium myrtillus. The *malic* resides in the fruit of the pyrus malus and cydonia, fragaria vesca, rubus chamæmorus, vaccinium myrtillus, and sambucus nigra. The *oxalic*, in the leaves of the oxalis acetocella and corniculata, geranium robertianum and acetosum; in the root of the rhæum rhabarbarum, bryonia alba, and helleborus niger; the boletus suberosus also exudes an acidulous humour, which, inspissated by the rays of the sun, goes into very pure crystallized oxalic acid. The *tartaric* is found in the fruit of the tamarindus gallica, and in the root of the rumex acetosa, and others. The *gallic acid* is detected in all astringent plants, combined with the gummy principle.

LASTLY, the *benzoic acid* is obtained from *gum benzoe* and *balsam of Peru*, and lies concealed in the balsam of *tolu* and in *storax*.

MANY unripe fruits contain an austere acid, which is gradually converted into sugar by vegetable or chemical processes for the nutriment of their seeds, in other plants it exists in the foot-stalks of the leaves, as in *rheum*, *rhubarb*; or in the leaves themselves, as in *oxales*, or sorrel.

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X. CONCERNING ALKALIS.

THE alkaline principle of vegetables is of three kinds, namely, ammoniac, soda, and potash. The former resides in volatile or ethereal oils, and most narcine plants; for it is obtained during distillation by the addition of the *carbonate of potash* or *fixed alkali*. Soda is present in the ashes of all maritime plants; and *potash* is obtained from the ashes of plants not maritime.

THE neutral salts from the vegetable kingdom, are various. The hyosciamus, borago, nicotiana, helianthus annuus, mesembryanthemum crystallinum, millefolium, and fumaria, afford *nitrate of potash*. The tamarindus gallica, the *sulphat of soda*. The muriate of soda is obtained from the salicornea herbacea, from the leaves of the american tree called cerciba, which abounds so much with it, that one leaf is sufficient to salt a sallad. There are also plants of this nature growing in the province of Jago, which is far distant from the sea; and what is wonderful, not a particle of salt can be obtained from the soil, in which they grow. The cinders of many vegetables afford the *sulphat of potash*.

XI. CONCERNING the COLOURING PRINCIPLES.

THE object of the art of dying consists in depriving one body of its colouring principle, to fix it upon another in a durable manner; and the series of manipulations necessary to produce this effect, constitutes the art itself. This art is one of the most useful and wonderful of any we are acquainted with; and if there be any one of the arts which is capable of inspiring a noble pride, it is this. It not only affords the means of imitating nature in the riches and brilliancy of her vegetable colours; but it appears to have surpassed her, in giving a greater degree of brilliancy, fixity, and solidity to the fugacious and transient colours with which she has clothed the productions around us.

ALL vegetables afford the colouring principle; it therefore must be very various. The art of dying depends upon the knowledge of this principle. If the stalk of the indigofera tinctoria, or indigo plant, be macerated in water, it affords, by precipitating the *fæculum*, a beautiful blue colour, called indigo. It

On the component Principles of Vegetables.

may also be obtained from the *isatis tinctoria*, or common woad, *lichen roccella* and *parëllus*, and the *eroton tinctorius*. In the root of the *rubia tinctorum*, or madder, *anchusa tinctoria*, or alkanet: and in the wood of the *fernambucus* or *cæsalpina vesicaria*, this principle is red. Lastly, the *carthamus tinctorius*, *crocus sativus*, *serratula tinctoria*, *amomum curcuma*, *reseda luteola*, *trigonella fœnum græcum*, *genista tinctoria*, and *bixa arenella*, afford, in the same manner, a yellow fæculum.

XII. CONCERNING the POLLEN, or FECUNDATING POWDER of the
STAMINA of VEGETABLES.

MODERN discoveries and observations have pointed out the sexual parts of plants; and we find nearly the same forms in the organs, the same means in the functions, and the same characters in the prolific humours, as in animals.

THE prolific humour in the male part is elaborated by the *anthera*; and as the organs of the plant do not admit of an actual intromission of the male into the female, because vegetables are not capable of loco-motion, nature has bestowed on the fecundating seed the character of a powder; which the agitation of the air, and other causes, may carry away and precipitate upon the female. There is a degree of elasticity in the *anthera*, which causes it to open, and eject the globules. It has even been observed that the *pistil* opened at the same time, to receive the *pollen*, in certain vegetables. The wax of bees is merely the pollen very little altered. These insects have their femora provided with rugosities to brush the pollen from the *antheræ*, and convey it to their nests.

THERE appears to exist in the very texture of some flowers, which are rich in fecundating powder, a matter analogous to wax, which may be extracted by aqueous decoction. Such are the male catkins of the *betula alnus*, those of the pine, &c. the leaves of *rosemary*, of *officinal sage*, the fruits of the *mirica cerifera*, suffer wax to transude through the pores.

It appears that wax and the pollen have for their basis a fat oil, which passes to the state of resin by its combination with oxygen.

On the component Principles of Vegetables.

BUT having described the nature and properties of the pollen, when treating on the fructification of plants, little more is necessary to be said on that head here.

XIII. CONCERNING HONEY.

THE production of honey is perhaps one of the most important vegetable secretions, except that of the prolific farina from the anthers; and of the favilla, or new embryo, in the axilla of the leaf.

THE nectary, or honey-cup, is evidently an appendage of the corol, and is the reservoir of the honey, which is secreted by an appropriate gland from the blood after its oxygenation in the corol, and is absorbed for nutriment by the sexual parts of the flower.

HONEY, or the nectar of flowers, is contained chiefly in the base of the *pistil*, or female organ. It serves as food for most insects which have a proboscis. These animals plunge their proboscis into the pistil, and suck out the nectar. It appears to be a solution of sugar in mucilage: the sugar is sometimes precipitated in crystals, as in the nectar of the flower of *balsamina*.

THE nectar undergoes no alteration in the body of the bee, since we can form honey by concentrating the nectar. It retains the odour, and not unfrequently the noxious qualities of the plant which affords it.

THE secretion of the nectar is made during the season of fecundation. It may be considered as the vehicle and recipient of the fecundating dust, which facilitates the bursting of the globules, filled with this fecundating powder.

XIV. CONCERNING the LIGNEOUS PART OF VEGETABLES.

CHEMISTS have constantly directed their attention to the analysis of vegetable juices; but they appear to have completely neglected the solid part of the vegetable, which in every point of view is entitled to particular attention.

THE ligneous part, or wood of vegetables, is the universal solid basis of all vegetable organization. In hard vegetables, it is much more copious, than in those which are soft. It is insoluble in water. It affords by distillation, that particular

On the component Principles of Vegetables.

acid which is called—the pyroligneous. It appears to be the last product of the elaboration of vegetable organs. Treated with the nitric acid, it is capable of passing into three or four different states of acidity. It is, however, insoluble in water and most other menstua. It should seem, that this ligneous matter consists of mucilage united with an extraordinary proportion of oxygen.

XV. CONCERNING EXTRACT.

THE juices of plants, obtained from them, by mechanical pressure, by the simple infusion of the plant in a liquid, or by its decoction in boiling water; inspissated; and at last evaporated to dryness; afford a dry, brown matter, slightly deliquescent in the air, and soluble in water, which is the extract. This matter yields by distillation, an acid, a small portion of ammoniac, and some oil. It absorbs oxygen from the atmosphere, and becomes gradually insoluble, in consequence of this absorption. It has constantly a tendency to take up more than its first proportion of oxygen. Its component principles are *carbon, hydrogen, azote, and oxygen*. The juices of *acacia* and *hypocistis, opium, liquorice-juice, the cachou, &c.* are extracts. Their preparation is not difficult, and may be managed, either in the great way, for the purposes of extensive commerce, or in smaller trials.

ALL the matters in the composition of vegetables, are reducible to these fifteen immediate principles. Before new truth and generalization had been introduced into chemical science by the discoveries of chemistry, it was not known that these principles were susceptible of analysis into others more simple.

BUT the ultimate resolution of vegetables by chemical analysis, affords only *hydrogen, carbon, oxygen, azote*, with perhaps, in most cases *potash, or soda*, as their proper principles, and occasional contaminations of other matters in small proportion. And it is not impossible, but future investigation and discovery may inform us of the existence of other compounds beside those fifteen in which vegetation unites *hydrogen, carbon, oxygen, and azote* in peculiar modifications.

VEGETABLES appear to be capable of combining the principles of *carbon, azote, hydrogen, and oxygen* in every possible variety of proportions.

On Artificial Grasses.

HAVING given such a condensed view of the *structure, propagation*, (by sexual generation;) *dissemination of seeds*, (by a variety of natural agents,) and of the *component parts of vegetables*, as coincided with the plan of this work; I now pass on to exhibit the culture and use of the best artificial and natural grasses.

DISSERTATION II.

On the culture and use of Nine of the best *Artificial*, and of Eight of the best *Natural Grasses*, &c.

1. *On Artificial Grasses.*

ONE of the greatest things on which modern husbandry has been made to turn, is the introduction of *artificial grasses*; and yet it is lamentable to observe how few districts make them a part of their course of cropping on arable land.

THE principal plants that are termed artificial grasses, are, LUCERNE, SAINT-FOIN, BURNET, two kinds of RED CLOVER, WHITE CLOVER, TREFOIL, and two kinds of TARES.

HERE it will be unnecessary to enter into a laboured botanical detail of those grasses, as the seeds may very readily be bought at the London seed shops. I shall therefore, only give an appropriate botanical description of each, mention a few common qualities relative to the plants themselves, and then proceed to point out their particular culture, and best mode of application.

I. MEDICAGO-SALIVA, *Purple Lucerne or Medick.*

Legume compressed, screw-shaped, bending the keel downwards from the standard.

MEDICK with racemose foot-stalks, contorted legumes, and smooth upright stem.

Perennial, flowering in June and July.



On Artificial Grasses.

Root subligneous; stems rather upright, two feet high, branched, angular-cylindric, smooth leaves alternate, footstalked, ternate, with wedge-oblong leaflets serrated at the tip, slightly mucronated, and hairy beneath. Stipules semi-ovate, long-pointed, nervose, rarely subdentated. Racemes footstalked, axillary, many-flowered, upright. Flowers footstalked, with a solitary setaceous bracte at the base of the footstalk, violaceous. Calyx hairy, with subulate teeth. Legume spiral, with two, three, or more distant spires, many-seeded, smooth.

THIS plant was discovered in Media, by Darius, during his persian expedition; from whence it derived its name *medica*. It is the most productive, and comes into use sooner than any other of the artificial grasses. Horses, beasts, sheep, and pigs are very fond of it when it is mown and given them green, which is the most useful application of it.

It thrives best on rich, dry, loamy soils, which should be made deep, fine, and clean of weeds by culture. About the middle of April, ten pounds of seed should be drilled on an acre, in rows of eighteen inches asunder, and one inch deep, with a row of common red clover between each, then bush harrowed and rolled. Nothing more is necessary to be done till weeds appear, when it should be hand-hoed well, and the weeds in the rows pulled out by the hand. As soon as more weeds appear, it must be hand-hoed and hand-weeded a second time, and even a third-time if necessary, when this is done great care should be taken not to tread upon the young lucerne.

As soon as it begins to blossom, it should be mown, carried off, and given to the stock green. By this mode of application it will keep more stock than any of the other grasses.

It requires three years in coming to perfection; hence the propriety of sowing common red clover along with it. After that time it may be mown three, four, or five times in a season.

BETWEEN every mowing, it should be well hand-hoed, and made quite clean of weeds.

On Artificial Grasses.

EVERY third year it should have a covering of rotten dung after the rate of eight or ten tons to the acre, about Martinmas.

II. HEDYSARUM ONOBRYCHIS, *Cockshead or Saintfoin.*

Legume with single-seeded joints. *Corol* transversely obtuse.

SAINTFOIN with pinnated leaves, single-seeded aculeated legumes, wings of the corol of the length of the calyx, and elongated stem.

Perennial, flowering in June and July.

STEMS decumbent, two or three feet long, furrowed, branchy. Leaves unequal-pinnate, leaflets numerous, elliptic, rather smooth, equal. Stipules ovate, acuminate, scariose. Foot-stalks axillary, ascending, very long, spiked, many-flowered, hairy. Corol deep rose-coloured, striated. Legume crested, reticulate, hairy, coriaceous, not gaping. Seed kidney-shaped, smooth.

THESE two plants belongs to *Class XVII. Diadelphia. Order Decandria.*

THIS plant produces the best crops upon dry, light, rich land; but it will thrive upon the thinnest limestone, gravelly and chalky soils with great luxuriance; even where these are so poor as to afford a very scanty crop of any of the other sorts of grasses. It thrives best when sown alone, though it is frequently sown with barley and oats.

BUT upon what ever soil it is sown, the land should be brought into a very fine and clean tilth by culture.

ABOUT the latter end of March, or beginning of April, the land should be ploughed; if it is roughish, it should be harrowed once in a place, then upon every acre sow sixteen pecks of saintfoin seed; harrow the land well, and then sow eight pounds of common red clover or trefoil upon every acre, afterwards the land should be bush harrowed and rolled,

IF weeds appear among the saintfoin, they must be destroyed as they come up, by hand.

On Artificial Grasses.

No stock should be suffered to graze upon the seeds the first year, and if it were top dressed with one quarter of rape or bone dust to an acre, about old Michaelmas, the plants would be greatly invigorated.

UPON such land as the above, it furnishes a crop of hay in summer of greater consideration, than any other of the artificial grasses. The hay is excellent for all kinds of stock, and the after math very good for cattle in autumn, and for sheep in winter, till Candlemass. Hence saintfoin is a most invaluable grass on limestone, gravelly, and chalky soils.

SAINTFOIN requires three years in coming to perfection: hence the propriety of sowing common red clover or trefoil along with it.

THIS grass should be mown before it is in full blossom.

III. SANGUISORBA OFFICINALIS, *Common Burnet.*

Cal. four-cleft. *Germ.* between the calyx and corol. *Seed* single.

Perennial, flowering in June and July.

LEAVES unequally pinnated, leaflets cordate, acutely crenated, smooth. Stem two feet high, upright, rather naked, branchy. Spikes elliptic, obtuse, blackish-red, the upper flowers opening first. Corol outwardly hairy at the base. Germen closely invested by a smooth coat rising from the base of the corol.

THIS plant belongs to *Class IV. Tetrandria. Order Monogynia.*

THERE are several varieties of this plant; but the only one worth cultivation in this country, is the above. This plant, though little cultivated, is highly valuable, either green, or in hay for horses, and cattle, and is an excellent winter food for sheep.

IT delights most in a dry, clean, light, and deep soil, but it will grow very well on poor, gravelly, and chalky soils, which must be made clean and fine by culture.

ABOUT the middle or latter end of July, the land should be ploughed for the last time, and harrowed well; after these operations, four pecks of seed should be sown broad-cast, upon every acre, and then bush harrowed and rolled.

On Artificial Grasses.

As the proper season for sowing it is the latter end of July. Hence it becomes an excellent succedaneum to turnips, when they have been destroyed by the fly.

BUT the most profitable way of cultivating burnet, is by sowing it with other seeds, when the land is to be layed down, viz.

BURNET SEED,.....	1 Peck.
WHITE CLOVER,.....	10 Pounds.
TREFOIL,	4 Ditto.
VERNAL GRASS,	$\frac{1}{4}$ Peck.
RAY GRASS,	1 Ditto.
CRESTED DOGSTAIL,	$\frac{1}{4}$ Ditto.
SHEEPS FESCUE,	$\frac{1}{2}$ Ditto.

THE above are all the kinds and quantities of seeds which ought to be sown upon an acre with burnet seed, which should be bush harrowed and rolled; and afterwards kept clean of luxuriant weeds.

BUT however much this plant has been extolled, yet it is seldom sown either alone, or with other grass seeds, since the introduction of red and white clover, though its greatest excellence is for winter pasture.

It is more common in the western than in the eastern parts of England.

IV. 1. TRIFOLIUM PRATENSE, *Meadow Trefoil, or Common Red Clover.*

2. TRIFOLIUM MEDIUM, *Middle Trefoil, or Cow Red Clover.*

1. *Of Meadow Trefoil.*

TREFOIL with dense spikes, ascending stems, unequal corols, four equal calycine teeth, and awned stipules.

Perennial, flowering from May to September.

ROOT branchy. Stems ascending, a foot or more in height, somewhat branching, subvillose on the upper part. Leaflets elliptic, generally very entire, smoothish. Upper leaves often opposite. Stipules widely ovate, connate, shortly awned, pale, nerved with purple veins branching towards the margin and anastomosing. Spikes terminal, sessile, solitary, ovate, obtuse, dense, many-flowered, sweet.

On Artificial Grasses.

smelling. Calyx hairy, ten nerved, with subulate teeth, of which the lowermost is twice the length of the rest, which are equal. Corol purple, one-petaled, with the standard longer than the wings.

THIS is a most invaluable plant, whether it be mown and used green, depastured, or made into hay. But notwithstanding its being a perennial, yet it only holds its vigour two or three years.

By its long tap root it resists the effect of excessive drought on the driest soils, and increases the quantity of vegetable mould in all. It will grow on most soils, but not equally productive, and whether it be mown and used green in the stall, depastured, or made into hay, it generally produces four or five times the quantity of fodder that the same land would have done with common grasses!

IN good rotations, it frequently makes the second crop in lieu of white corn; mown once, and the after grass eaten-off with horses, beasts, or sheep, and the land sown with wheat. In that case, two pecks of best ray grass mixed with fourteen pounds of this clover seed should be sown upon an acre, which not only increases the quantity, but also greatly improves the quality of the hay. If the clover is for stall feeding, the ray grass should be omitted.

ON poor light soils the better way is to take two or three crops of corn, and then to lay the land down to rest, three, four, five, or six years. In this case I would advise the farmer to sow the following seeds on an acre.

BURNET,	4 Pounds.
COW RED CLOVER,	4 Ditto.
WHITE CLOVER,	8 Ditto.
TREFOIL,	4 Ditto.
RAY GRASS,	2 Pecks.
VERNAL GRASS,	$\frac{1}{4}$ Ditto.
SHEEPS FESCUE GRASS,	$\frac{1}{4}$ Ditto.
CRESTED DOGS-TAIL GRASS,	$\frac{1}{4}$ Ditto.

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By this management the soil would acquire a vast increase of vegetable mould, and by the pasture maintaining one-fourth more stock than it did before, it would be greatly charged in manure, by which means the land would be kept in perpetual good condition. And when brought under tillage it would produce one-fourth more corn than it did before.

2. Of Middle Trefoil.

TREFOIL with lax spikes, flexuose branching stems, nearly equal corals, and subulate-linear stipules.

Perennial, flowering in July.

DIFFERS from the former in having a more branchy, flexuose stem, longer, linear stipules, the two upper calycine teeth shorter, and laxer spike. Leaflets elliptic, subglaucous beneath, and hairy on the margins.

THIS clover grows naturally in high chalky fields, and in gravelly fields with clay beneath. In the most improved parts of the country, where the land is to rest for some years, this seed is sown along with the white clover, as it continues in the ground much longer than the meadow trefoil, and is nearly as productive, especially on chalky and poor soils.

IF a crop of any of those clovers is taken in lieu of a crop of corn, the grain should be sown first, but less in quantity than if no seeds were sown with it, and after the land has been made fine by harrowing and rolling, then fourteen pounds of clover seed, and two pecks of best ray grass should be sown upon an acre, bush harrowed the length way, and rolled the cross way of the ridges; afterwards the whole must be well gripped or drained. Nothing more is necessary to be done on account of the seeds till the next spring, when the land should be well dressed with the sward-dresser, or harrows drawn with long bushy thorns, the latter end of March or beginning of April, then cleaned, and rolled the cross way again. In all these operations the land should be neither too wet, nor too dry, but in a due medium with respect to both.

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THE time for cutting those two grasses, is when they are in full flower, and rather shewing evidences of declining.

V. 1. TRIFOLIUM REPENS. *Creeping Trefoil, or White Clover.*

2. TRIFOLIUM PROCUMBENS. *Procumbent, or Hop Trefoil.*

1. *Of Creeping Trefoil, or White Clover.*

TREFOIL with umbellar heads, four-seeded legumes, and creeping stem.

Perennial, flowering from May to September.

ROOT fibrose, stems prostrate, creeping, widely spread, ramose at the base, leafy, smooth. Leaves on longish foot-stalks; leaflets obcordate, denticulated, smooth, often spotted with brown and white. Foot-stalks ascending or erect, very long, many-flowered, umbellated. Flowers white, sometimes flesh-coloured, upright, becoming pendulous after flowering. Calyx ten-nerved, smooth. Corol permanent. Legume covered by the corol, oblong, smooth, three or four-seeded.

It varies in a more fertile and moist soil in having a suberect and more branched stem, but is always very distinct from the trifolium hybridum of Linnæus.

THIS is the sweetest grass for all sorts of stock yet known, and makes the closest sward, and is very productive of foliage. Hence it is most peculiarly adapted to laying down land to pasture. It flourishes most upon rich, dry, warm soils; yet it will accommodate itself to most kinds. It is seldom sown alone, unless it be to raise the seed, nor should it ever be mown for hay. In laying down rich soils which are intended to remain in pasture for many years, this seed should predominate.

2. *Of Procumbent Trefoil.*

TREFOIL with oval imbricated spikes, deflected, permanent, furrowed standards, procumbent stems, and obovate leaflets.

Perennial, flowering in June and July.

ROOT thickish, short, fibrose. Stems procumbent, widely spread, slightly branched, hairy, ascending at the tips. Leaflets obovate, denticulate, subglaucescent, smooth. Stipules semiovate, very entire, nervose, ciliate. Spikes axillary,

On Artificial Grasses.

solitary, footstalked, equalling the leaf, and sometimes exceeding it, oval or elliptic, obtuse, toothed, many-flowered. Foot-stalks principally villose at the tip. Calycine teeth subulate, unequal, hairy. Corol gold-coloured. Flowers imbricated, at length deflected, with the corol permanent, scariose, dusky, and the standard longitudinally furrowed, inflected, dilated, and nearly obcordate. Legume elliptic, sharp on both sides, single-seeded.

THE flowers, which are yellow, grow from the wings of the stalks, upon long foot-stalks, collected into oval, imbricated heads, having naked empalements, lying over each other like scales, somewhat like the flowers of hops, from whence this plant took the name of hop clover.

THIS plant is not very productive, and thrives best upon dryish gravelly fields, and pastures.

VI. 1. *VICIA SATIVA*. *Common, Purple Flowered Summer Vetch, or Tare.*

2. *VICIA LATHYROIDES*. *Purple Flowered Wild Vetch, or Winter Tare.*

THE most proper soil for these tares, is a barren sandy soil; next to it, are, gravelly, chalky, and limestone soils; but they will thrive in most kinds, except strong moist clayey, or cold moory soils.

1. *Of the Summer Vetch, or Tare.*

VETCH with sessile subbinate suberect legumes, lower leaves retuse, toothed stipules marked by a spot, and smooth seeds.

Annual, flowering in May and June.

STEMS various in size, either climbing or prostrate. Plant more or less pubescent. Leaves three or many-winged, with an elongated tendril either two or three-cleft, and opposite or alternate leaflets, which are rather sharp-pointed, often retuse, and of various width. Stipules semisagittate, more or less toothed, and marked on the outside by a black or pale impressed spot. Flowers axillary, solitary or binate, subsessile, varied with purple. Legume somewhat compressed, brown, rough. Seeds numerous, a little compressed, very smooth.

On Artificial Grasses.

THE great objects of this tare, are, 1st. SUMMER HERBAGE, either depastured, or mown green, as soiling for horses, &c. 2nd. HAY, as a substitute for red clover (*on land that has tired of growing it.*) 3rd. MANURE, to be buried in by the plough. And 4th. SEED. Hence the season for sowing the seed of this tare, will depend upon the use it is intended for.

1st. IF for SUMMER HERBAGE, &c. it matters not how early the seed is sown, provided no hard frost ensue. The first sowing may be as early in February as the season and condition of the soil will allow; and to continue the sowing at due intervals through the months of March and April; which will give a good opportunity for successions of them, to the great convenience of summer feeding.

IF for DEPASTURING, it will be prudent to wait till the tares have gained a sufficient increase of haulm, before the stock are turned in upon them.

IF for SOILING HORSES, &c. they should be mown before they flower, and in no instance should the haulm be suffered to become rotten near the surface of the ground, which frequently happens, on rich soils, and moist seasons.

2nd. if for HAY, as a substitute for RED CLOVER, the seed should be sown as early in March as circumstances will allow; but the time of mowing is more optional. Some mow them when the blossoms are fallen, others just before they are quite ripe. But in either case, the same caution is necessary, as in making saint-foin, and clover into hay, and that is, to avoid breaking off the leaves, in which a great part of their virtue resides.

3rd. IF for MANURE, the seed should be sown as early in February as the season and condition of the soil will permit, and at the rate of four bushels to the acre. For this use they should be ploughed in before they get too long.

BUT whatever is the intended use in cultivating this tare, the preparation of the land is the same, and it delights most in light sandy soils. In every case therefore, the land should be ploughed, and harrowed once in a place before the seed is sown, then sow the seed broad-cast, at the rate of three bushels to the acre, for the first and second uses; harrow the land well afterwards, and then lay it dry.

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Immediately, or as soon as the land will permit, the whole field should be rolled the cross way of the lands; after this nothing more is necessary to be done till the season of application.

2. Of the Purple Flowered Wild Vetch, or Winter Tare.

VETCH with sessile, solitary, smooth legumes, subtrijugous leaves, the lower ones being retuse, entire stipules, and tuberculated seeds.

Annual, flowering in April and May.

STEMS procumbent, divaricated. Plant pubescent. Leaves two or three-winged, with a simple tendril which is often very short and almost abortive: leaflets opposite, obcordate, sometimes lanceolate and narrowed towards the top of the stem. Stipules semisagittate, commonly very entire, unspotted. Flowers subsessile, solitary, small, blueish. Legume upright, very smooth, many-seeded. Seeds cubical, rough-tuberculated.

VARIES with a white flower.

IT is distinguished from the former by its smooth legumes and rough-tuberculated seeds, not to mention that the tendrils are never branched, nor the leaflets more than six in number.

THESE six preceding plants belongs to *Class XVII Diadelphia. Order Decandria.*

THE great objects in cultivating this tare, are 1st. SPRING FOOD and SUMMER HERBAGE for cattle and sheep, especially ewes and lambs. 2nd. HAY as a substitute for red clover. 3rd. MANURE, to be buried in by the plough. And 4th. SEED.

BUT whatever is the intended use of this tare, the preparation of the land and time of sowing is the same in all. August and September is the prime season for sowing the seed of this tare. As soon therefore as the ground can be cleared of its crop, the land should be ploughed and harrowed once in a place before the seed is sown.

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1st. IF for SPRING FOOD ONLY, six pecks of rye, and six pecks of tares may be sown together, and it is not easy to contrive a crop which will pay better, and leave the land in a more favourable condition for fallowing the ensuing summer.

IF for SUMMER HERBAGE, three bushels of tares to the acre will be preferable.

2nd. IF for HAY, the same quantity of seed as for summer herbage will be sufficient.

3rd. IF for MANURE, four bushels of seed to the acre will be necessary.

AFTER the land has been ploughed, and harrowed once in a place, sow the above quantities of seed, broadcast, then harrow the land well, and lay it dry by water furrowing, and gripping or draining. Roll the land in the spring.

4th. WHEN A CROP OF SEED is the object in cultivating any of these tares, the land should be ploughed and harrowed two or three times in a place, previous to drilling the seed, then drill two bushels of seed upon every acre, harrow the land once in a place after drilling, and then lay it dry. As soon in the spring as the land will bear a horse, the field should be rolled the cross way of the lands, afterwards the crop should share the advantages of a pea culture, by horse and hand hoeing it completely.

IN all these ways, tares are absolutely invaluable, and since their merits have been known such a number of years, common sense is sadly at fault for their frequent neglect.

NOTWITHSTANDING the foregoing botanical description given of these two kinds of tares, yet many of my readers may be at a loss to distinguish either the seeds or the stems from one another. The seed of the winter tare is smaller, and darker coloured than the summer tare; but the greatest characteristic to those who are not skilled in botany, is, the winter tare vegetates with a seed leaf of a fresh green colour, whereas the summer tare, comes up with a grassy spear of a brown dusky hue.

THESE are all the kinds of artificial grasses that ought to be sown upon land

On Natural Grasses.

intended either for-pasture, hay, stall feeding, &c. by the judicious management of which, the grazier will be enabled to keep one-fourth more stock; and the farmer will be enabled to produce one-fourth more corn upon the same land than he did before, whereby the return of a scarcity might in a great measure be prevented.

OF all the evils with which this country has been lately afflicted, perhaps none carried so threatening an aspect as that of SCARCITY. Hence the necessity of a *national*, and of an *individual* interference to remove the obstacles that oppose the promoting, improving, and extending the agriculture of this kingdom.

1st. PARLIAMENT in a national capacity to grant an act for a general inclosure of the commons and wastes of the United Kingdom; to commute or consolidate tythes; and to revise and improve the corn laws. Agriculture should be the first object of legislatures, and property the leading principle of agriculture.

2nd. GENTLEMEN of landed property in an individual capacity to grant leases, to increase the number of farms, and cottages, to offer well directed premiums, &c. All these alterations and improvements would call forth the energies of the individual cultivator, so as to secure plenty, and introduce a garden-like culture upon most of the land in the Kingdom.

2. *On Natural Grasses.*

HOWEVER highly I have extolled the *artificial grasses*; yet the *natural grasses* are of the greatest importance to the grazier, as they nourish most of his domestic animals: hence the necessity of attending to the cultivation of the best sorts. The stems of the grasses are hollow, and consist in general of joint above joint, without lateral branches; each joint of which seems to be a successive plant growing on the preceding one, and generated in the bosom of the leaf, which surrounds it; the stem may therefore be esteemed a succession of leaf buds, till at length a flower bud is produced on the summit.

On Natural Grasses.

HENCE it appears, that a plant of grass consists not only of a tuft of leaves surrounding the root, but that the three or four lower joints of the stem, as of a wheat-straw, are so many successive leaf-buds, which are generated by the caudex of the leaf, which surrounds each joint, and precede the flower-bud at the summit; and that hence with the design of producing much herbage for cattle, the propagation of new leaves from the root is principally to be attended to; but with the design of producing hay, or winter fodder, the leaf-buds of the stem are principally to be attended to.

FOR the former of these purposes the stem of grass should be eaten close down as soon as it rises; whence more grass leaves will arise from the root; as is well known to those who eat down the first stem of wheat, when it is too luxuriant. For the second purpose the leaf-buds, which constitute the stems of grass, should be cut down, before the flower-stem at the summit has begun to ripen its seeds; as at that time the sweet juice lodged in the joint below the flower-stem becomes expended in the seed; and the stem becomes converted into straw rather than into hay.

FROM hence it is readily understood, why those pastures, which are perpetually grazed, are so much thicker or closer crowded with grass roots than those which are mowed annually

THAT some of our meadow and pasture land may be rendered infinitely more valuable than they are at present, by the introduction of some of the best *natural grasses*, is an opinion which has long prevailed among the more enlightened agriculturists of the present age. And while some of those have endeavoured to excite the husbandman to collect and cultivate seeds of this sort, by writings fraught with the soundest reasoning; others have attempted to attract him by the offers of well directed premiums. But hitherto, neither the writings of the one, however convincing, nor the premiums of the other, however alluring, have been productive of the desired effect.

THE difficulty of distinguishing the grasses from one another, has no doubt

On Natural Grasses.

proved one grand obstacle; many of those plants are so much alike, that the most discerning botanists are often at a loss to know some of them apart; if so, how easily may the husbandman be deterred from the arduous task.

BUT, perhaps, the chief reason has been, that persons who might be expected to collect the seeds, and to make the improvements, have not had the means fairly put into their hands of making the experiment.

IN order to remove that difficulty, and to enable every husbandman to experiment for himself, I shall here, not only give specimens, of eight sorts of the best *natural grasses*, but likewise such a brief description of them, as will enable every husbandman with certainty to collect them separately.

HE may then sow them singly on separate beds, or plats, and graze them for a considerable time, to determine their different effects in feeding and fattening different kinds of stock; and afterwards join them in different combinations and proportions, as the result of his experiments may direct.

WHETHER the method I have adopted on this occasion, may be more successful, must be determined by my readers.

AT all events, the time I have employed, the pains I have taken, and the expence I have been at, in collecting, and finishing the grasses, must be evident to every one of them.

THE natural grasses here recommended, will, I am certain, do all that can be wished for, assisted by some of the artificial grasses. They are eight in number, which constitute the bulk of our best pastures; most of them are early, six of them productive, and they are adapted to such soils and situations as are proper for meadows and pastures.

THE natural order of grasses is so conspicuous, as to have struck all beholders; they constitute nearly a sixth part of the vegetable kingdom; especially in open countries; the leaves are not easily broken by being trampled on, but die in winter, become yellow and dry; but what is wonderful, they revive in the spring,

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and become green again. This natural order of plants has been divided into cerealia and gramina, corn and grasses; which however only differ in respect to the size of the seeds.

On Natural Grasses.

I. ANTHOXANTHUM ODORATUM. *Sweet scented Vernal Grass.*

Cal. glume bivalve, one-flowered. *Cor.* glume bivalve, awned. *Seed* single.

ANTHOXANTH with ovate oblong spike, and subpedunculated floscules longer than the awns.

Perennial, flowering in May.

ROOT fibrose, subpubescent. Stems a foot high, simple, slender, furrowed, smooth, here and there jointed, naked at the upper part. Leaves short, flat, sharp-pointed, bright-green; stem-leaves very short, spreading, with extremely long and slightly ventricose sheath, which is furrowed and bristled at the opening. Stipule lanceolate, erect, sharp, many-flowered. Flowers bracteolated. Calycine glumes sheathing, scariose, sharp, sometimes hairy, with a green rough keel; the interior twice as long, and three nerved. Petals subequal, ferruginous, bristly, shorter than calyx, awned on the back towards the base, with unequal awns, of which the longest is jointed. Nectary twice as short as the petals, two-leaved, smooth, and ovate. Anthers linear. Styles white, and at length exerted. Stigmas thread shaped, villose. The spikes, after impregnation, grow yellow. The smell of the dried plant approaches to that of sweet Woodruffe, and is lighter than that of holcus odoratus.

THOUGH this grass is not so productive as some, yet it is valuable as an early grass, and for its readiness to grow in all kinds of soils and situations. Cattle and sheep appear to be very fond of it.

THIS plant belongs to *Class II. Diandria. Order Monogynia.*

II. ALOPECURUS PRATENSIS. *Meadow Fox-tail Grass.*

FOX-TAIL with upright smooth stem, sublobate spike, and calycine glumes villose and connate at the base.

Perennial flowering in May.

ROOT fibrose. Stem two feet high, leafy, smooth. Leaves smoothish, glaucescent, with a short, subpubescent stipule. Spike simplish, scarcely paniced, dense, upright, biuncial, soft, many-flowered. Glumes all nearly equal, lanceolate, com-

On Natural Grasses.

pressed, white, marked on each side by two green longitudinal lines: the calycine glumes, especially on the keel, silky-villose, mutic. Corol-glume solitary, smooth, except at the tip of the keel, awned at the base; the awn jointed, twice as long as the flower, naked.

THIS is an early grass, and very productive. It grows in fields and meadows every where, especially such as are rather moist; and it is an agreeable grass to cattle.

III. *POA PRATENSIS. Smooth Stalked Meadow Grass.*

POA with diffuse panicle, four-flowered spikelets, lanceolate, five-nerved glumes connected by a villus, and obtuse, abbreviated stipule.

Perennial, flowering in May and June.

ROOT fibrose, with creeping shoots. Stems several, erect, a foot or foot and half high, simple, round, minutely striated, smooth, leafy. Leaves spreading, slightly obtuse, keeled, smooth, a little glaucous. Sheaths of the length of the leaves, striated, smooth. Stipule short, obtuse. Panicle, elongated, upright, very much branched, spreading, smooth. Spikelets ovate, four-flowered, often five-flowered, green, a little inclining to purple. Calycine glumes sharp, rough on the back, very unequal, three nerved. Floscules rather obtuse, sharply five-nerved, scariose at the tip, rough on the back, connected at the base by innumerable, complicated, very long villi: the interior valves subpubescent on the margin.

VARIETY is distinguished by the very narrow and stiffish lower leaves, smaller panicle, roughish, lower sheaths; and abbreviated or blunt stipule, as at *a* Fig. 1.

THE foliage of this most noble grass is early, very abundant and abiding; and it rather affects a dry than a moist situation. This is a very sweet grass, and when close fed down is very acceptable to sheep, cattle, and horses.

Anthoxanthum odoratum.

Alopecurus Pratensis

Poa Pratensis.

Sweet scented Vernal Grass.

Meadow Fox-tail Grass.

Smooth stalked Meadow Grass.





On Natural Grasses.

IV. POA TRIVIALIS. *Rough Stalked Meadow Grass.*

POA with diffuse panicle, three-flowered spikelets, lanceolate five-nerved glumes connected at the base by a villus, and elongated stipule.

Perennial, flowering from June to September.

ROOT fibrous. Stems decumbent and rooting at the base, then upright, a foot and half high, simple, round, striated, roughish, leafy, often purplish. Leaves rather upright, flaccid, slightly acute, keeled, rough chiefly beneath and on the margins. Sheaths nearly the length of the leaves, subcompressed, striated, rather rough. Stipule elongated, lanceolate, sharp, by which mark, according to Curtis, this species is best distinguished from *Poa Pratensis*. Panicle elongated, upright, very much branched, spreading, rough, with alternately decomposed branches spreading horizontally at the time of flowering. Spikelets ovate, often three-flowered, purplish-green. Calycine glumes rough on the back, and of equal length: the exterior linear-lanceolate, acuminate; the interior dilated on the margin, and three-nerved. Floscules rather obtuse, sharply five-nerved, scariose at the tip, slightly silky on the edges and back; connected at the base by numerous complicated villi: interior valves thickened on the edges, which are green and scarcely pubescent.

VARIETY. has the lower leaves involute-setaceous, but with sheaths of the proper width; nor can it be referred to *Poa Pratensis*, on account of its sharp, lanceolate stipule, as at a Fig. 2.

THIS is a good grass, both for pasture, and hay; yet very inferior to the *Poa Pratensis*, as it is coarser, and apt to go off after mowing. It is very productive, and loves a moist and rather shady situation.

V. FESTUCA OVINA. *Sheep's Fescue Grass.*

Calyx bivalve. *Spikelet* oblong, roundish, distichous, with sharp-pointed glumes.

FESCUE with one-sided straitened panicle, roundish flowers smooth at their base, tetragonal stem, and rough setaceous leaves.

On Natural Grasses.

Perennial, flowering in June.

Root fibrose, turfy, with smooth, black, capillary fibres. Stems a span high, upright, simple, slender, stiffish, smooth, leafy at the base, and tetragonal chiefly towards the tip. Leaves various both in length and direction, very narrow, angular-sctaceous, sharp, rough, often glaucescent. Sheaths striated, smooth. Stipule very short. Panicle lanceolate, branching, with the midrib and footstalks angular, subflexuous, and rough. Spikelets upright, ovate-lanceolate, smooth. Calycine glumes unequal, linear-lanceolate, sharp-pointed, keeled, cornered, smooth. Floscules four or five, rather remote, roundish, a little compressed, scarcely keeled, without nerves, smooth, very smooth at the base, but towards the tip roughened by minute tubercles, often mutic, sometimes, (as in the Linnean herbarium) awned with rough awns which are upright and of various lengths. Interior valve mutic, rather sharp, concave, with perfectly smooth subrevolute margin.

VARIETY. differs only in the purple color of the panicle. In the flowers are mutic; but the leaves upright, and subflaccid, or slightly stiff and incurved, are not peculiar to any variety.

THIS grass though introduced here, is not intitled to the encomiums which some writers have bestowed upon it.

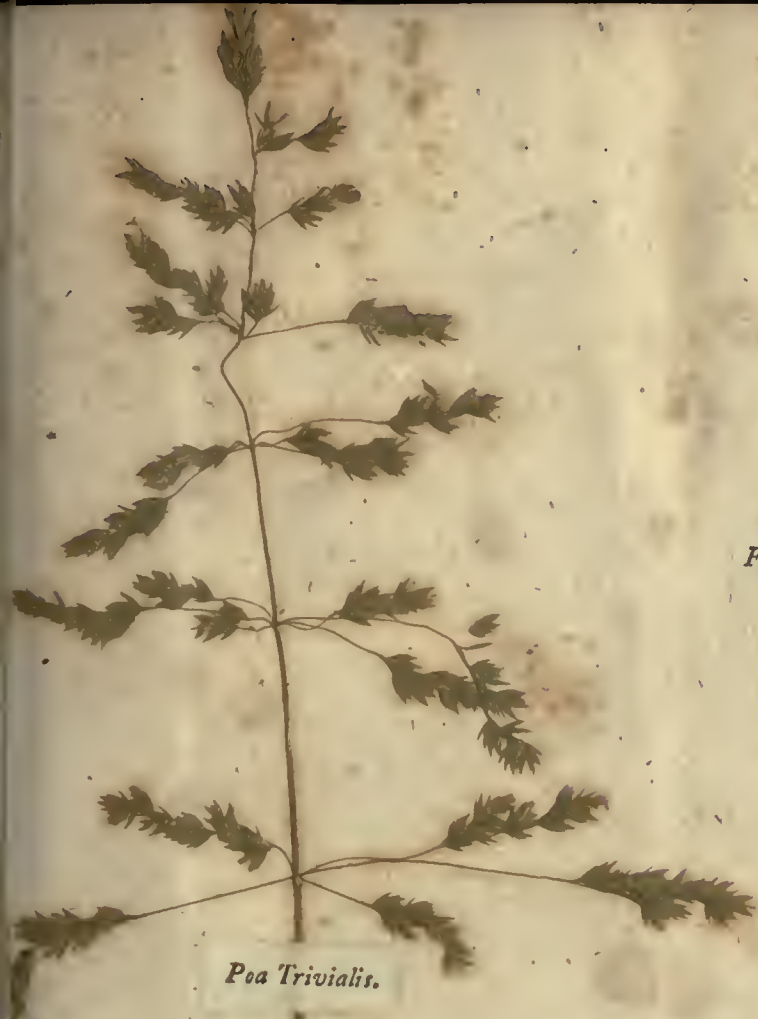
IN an experiment made upon all the grasses recommended here, which were sown each upon separate beds or plats upon a lightish dry soil, and grazed promiscuously with sheep; I found this grass was never so close fed down as the other seven. This grass delights most in dry pastures, and sunny hills, and is not productive.

VI. *FESTUCA PRATENSIS. Meadow Fescue Grass.*

FESCUE with suberect, lax, one-sided panicle, with linear, compressed, sub-obtuse spikelets, and cylindric obscurely-nerved floscules.

Perennial, flowering in June and July.

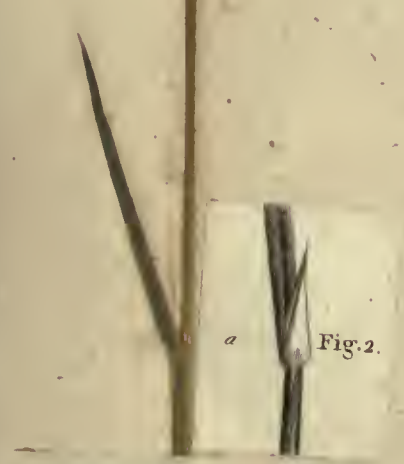
Root fibrose. Stems several, erect, about two feet high, simple, round,



Pea Trivialis.

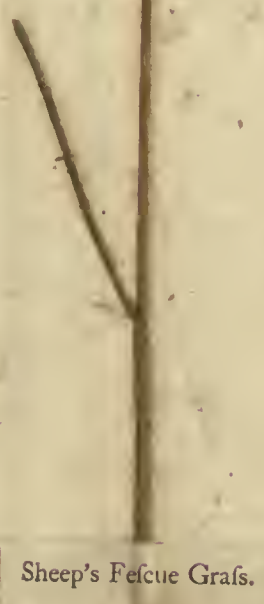


Festuca Ovina.



a Fig. 2.

Rough stalked Meadow Grass.



Sheep's Fescue Grass.



Festuca Pratensis.

Meadow Fescue Grass.

4

5

6



On Natural Grasses.

striated, smooth, leafy. Leaves linear, sharp-pointed, spreading, striated, the upper leaves rough on both sides. Sheaths striated, very smooth: Stipule very short, embracing the stem. Panicle suberect, branchy, one-sided, spreading, with binate, unequal branches which are commonly simple, subracemose, and rough. Spikelets shorter footstalked, alternate, erect-divaricated, linear-oblong, compressed, subobtuse, many-flowered, smooth. Calycine glumes unequal, subacute, keeled, smooth; the one being rather wider and three-nerved. Floscules numerous, slightly remote, distichous, smooth, cylindric, acute, eearinate (not keeled) at the base, towards the tip subearinate. (slightly keeled) obscurely five-nerved, and commonly mutic. Interior glumes concave, scarcely shorter, torn at the tip, and pubescent at the margin.

THE foliage of this most excellent grass is very sweet and productive; it is very hardy, and will grow in any kind of soil. It makes excellent hay, and all sorts of cattle and horses are fond of it.

VII. *LOLIUM PERENNE. Darnel or Raygrass.*

DARNEL with mutic spike, spikelets longer than calyx, and lanceolate floscules.

Perennial, flowering in June.

ROOT fibrose, pubescent. Stem a foot high, erect, jointed and flexuose at the base, above leafy, round, striated, and smooth. Leaves linear, keeled, smooth, deep-green. Sheaths striated, smooth. Stipule short, obtuse, embracing the stem. Spike suberect, distichous, compressed, with flexuose, smooth, striated midrib, alternately excavated for the reception of the spikelets. Spikelets alternate, erect, ovate, compressed, many-flowered. Calyx univalve, lanceolate, subconcave, acute, mutic, striated, scarcely keeled, smooth, almost twice as short as the spikelet. Floscules distichous, approximated, alternate, lanceolate, depressed, nervose, mutic, with the interior glume smaller, ciliated, and concave: The spicules are sometimes awned, and rarely, viviparous. In a barren soil, the plant grows with slenderer spikes and leaves, three or four-

On Natural Grasses.

flowered spikelets, which are less compressed, yet longer than calyx.

THIS is a most excellent grass, both for pasture and hay. The foliage of this grass is early, but not very abundant, and is highly acceptable to Sheep and Cattle. It is apt to run into flowering stems, and therefore requires to be close fed down; and as it secretes and lays up a magazine of saccharine nutriment, particularly in the joints of its stem, so it affords more nourishment to horses when made into hay than any other of the natural grasses, and it does not affect their wind: hence it is particularly preferable to hunters and racers.

VIII. *CYNOSURUS CRISTATUS. Crested dog's-tail.*

Calyx bivalve, many-flowered; *Receptacle proper* unilateral, leafy.

DOGSTAIL with pinnate-distichous mutic bractes, and simple linear spike.

Perennial. flowering in July.

ROOT fibrose, turfy. Stems (or culms) several, upright, strict, a foot high, leafy, above naked, round, striated, and very smooth. Stipule short, obtuse, eroded. Spike simple; linear, obtuse, strict, (unilateral, one-sided) with subflexuose; angular, smooth midrib. Spicules alternate, ovate, many-flowered, subsessile. Calycine glumes linear, acute, keeled, rough on the keel. Floscules alternate, subtumid, scarcely carinated, towards the tip rough, sharp-pointed. Bractes pectinated, composed, (according to Stokes) of abortive, alternate, distichous, compressed-carinated glumes, which are rough on the back, sharp, and scarcely awned.

THIS grass is not very productive of foliage, is apt to run into flowering stems; and grows naturally in dry situations.

IX. *TRITICUM REPENS. Creeping wheat, or couch grass.*

WHEAT with subulate, many-nerved, five-flowered calyces, acuminate floscules, flat leaves, and creeping root.

Perennial, flowering from June to September.

ROOT very creeping, jointed, coated, with downy fibres. Culm erect, two-feet high, slender, round, striated, leafy. Leaves very spreading, sub-

On Natural Grasses.

unilateral, linear-lanceolate, sharp-pointed, flat, striated, above and on the margin rough. Sheaths strict, nervose, smooth. Stipule very short. Spike suberect, two or three inches long. Glumes all lance-subulate, acuminate, often awned, with awns of different length. Midrib now and then hirsute. Interior glumes ciliated. Floscules vary from three to eight in number.

THIS grass, as a weed, is well known to be one of the greatest enemies which the farmer has to encounter. It is very bad herbage, and it makes the coarsest hay.

X. *HOLCUS LANATUS. Woolly Holcus, or Meadow soft Grass.*

Cal. bivalve, two-flowered, with the alternate flower male. *Cor.* bivalve, the exterior valve awned.

HOLCUS with villose glumes, hermaphrodite flower mutic, the male furnished with an arcuato-recurvate awn.

Perennial, flowering in June and July.

Root fibrose, turfy. Culms several, erect, striated, leafy, backwardly villose, smooth at the tip. Leaves flat, pale, soft, more villose beneath. Stipule truncated, short, denticulated. Panicle erect, spread out, soft, purple-whitish, at length growing paler; branchlets semiverticillate, very much branched, capillary, villose. Calycine glumes of equal length, sharp-pointed, villose, now and then tuberculated, coloured; the interior broader, three-nerved. Floscules inserted on a common footstalk, but the male above the hermaphrodite, shorter than calyx, naked at the base, with strong, smooth, glossy glumes, the exterior widest. From the exterior glume of the male flower rises an awn, which is presently arcuate-recurved, included by the calyx. Anthers the length of corol.

THE abortive pistil detected by Curtis, I have seen in some male flowers, but not in all.

THIS grass, like the former, is very bad herbage, and it makes the coarsest of all hay.

THE last nine grasses belong to *Class III. Triandria. Order Digynia.*

On Natural Grasses.

PLANTAGO LANCEOLATA. *Ribwort Plantain.*

THIS plant (strictly speaking) does not rank amongst the class of natural grasses; but as it appears in so great quantity in most of our meadows and pastures, not to mention it here might be deemed an unpardonable omission.

HORSES, cattle, and sheep are very fond of it, but it is not very productive.

THE seeds of this plant may very readily be bought at the London seed shops.

THIS plant is *perennial*, and flowers in June and July.

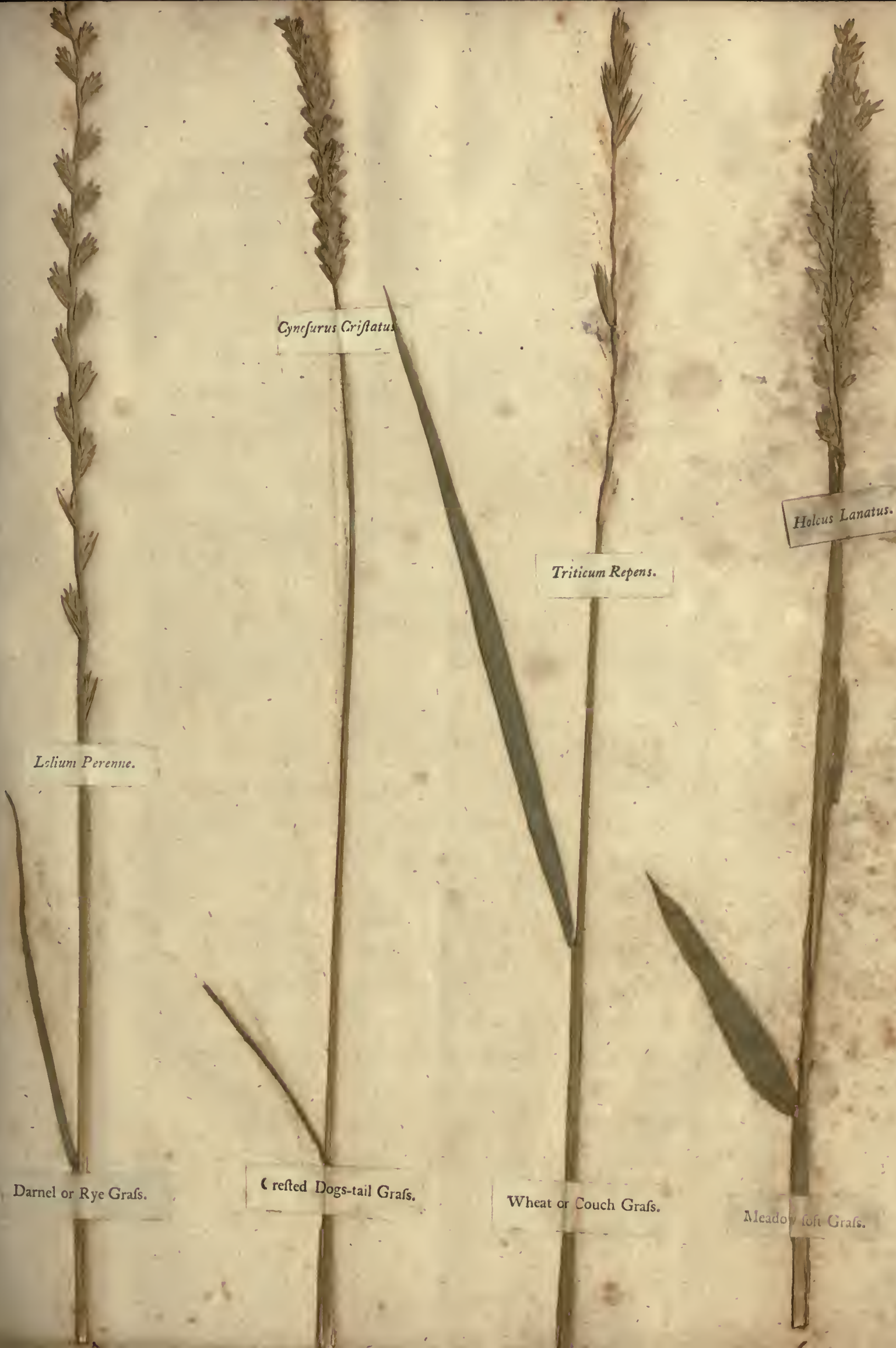
THE first eight sorts of *Natural Grasses*, are all that the husbandman ought to sow in laying land down to pasture, and according to the nature of the soil, the seed of that grass most suitable to it should predominate; but two grasses No. 9 and 10, should be held in utter abhorrence.

AND if it had not been to make them so well known, that they might be entirely rejected, I should not have troubled my readers with either a view or a detail of them. And sorry am I to see the *Holcus Lanatus*, recommended in some of the prize essays communicated to the Board of Agriculture in 1801.

HAVING given specimens and descriptions of eight of the best natural grasses; I shall next point out their mode of culture, application, and the great advantages that would arise from a more general use of them in laying land down to pasture.

THE first thing to be done in laying land down to pasture, is to bring it into a very fine clean tilth by fallowing it completely, and to allow eight or ten tons of dung to an acre.

THE next thing to be done is to plough the land into ridges of a width proportioned to the degree of moisture in the soil, and then to sow it with cole, or turnip seed at the proper season. But whatever is the fallow crop, as potatoes, cabbages, &c. early in the April following, the land should be ploughed and harrowed well the length way, then rolled and harrowed alternately the cross way of the ridges, two, three, or four times, until you get the ridges into the form and



Lolium Perenne.

Cynurus Cristatus

Triticum Repens.

Holcus Lanatus.

Darnel or Rye Grass.

Crested Dogs-tail Grass.

Wheat or Couch Grass.

Meadow Soft Grass.



On Natural Grasses.

condition wished, for the reception of the seeds.

IN preparing land for laying down with grass seeds, it should be harrowed and rolled well, both length and cross ways, so that the soil may be equally consolidated in every part.

UPON good rich soils which are intended to remain in pasture for many years, the proper kinds and quantities of seeds to be sown upon an acre, are as follows.

Of Artificial Grass Seeds.

- IV. No. 2. COW CLOVER, 4 Pounds.
 V. No. 1. WHITE CLOVER, 18 Ditto.
 2. TREFOIL, 4 Ditto.

Of Natural Grass Seeds.

- No. 1. VERNAL GRASS, $\frac{1}{2}$ Peck.
 3. SMOOTH STALKED MEADOW GRASS, 1 Ditto.
 5. SHEEP'S FESCUE, $\frac{1}{4}$ Ditto.
 6. MEADOW FESCUE, $\frac{1}{2}$ Ditto.
 7. RAY GRASS, 1 Ditto.
 RIB GRASS, $\frac{1}{4}$ Ditto.

MIX the whole well together, and then let them be sown by a good seedsman, in a calm day, then harrow them the length way of the ridges. If the land is rather moist, it should be water furrowed with a narrow double mould board plough, and then rolled the cross way of the ridges. Afterwards open drains should be cut, where wanted, in the form of a segment of a circle; as laying moist land dry, is the first step to improvement.

No stock should be suffered to graze upon the young seeds until they have got proper hold of the ground; when that happens, ewes and lambs, and yearling beasts are the most proper stock for them the first year.

ON moist soils and situations the most proper kinds and quantities of seeds to be sown upon an acre, are as follows.

On Natural Grasses.

Of Artificial Grass Seeds.

IV. No. 2. COW CLOVER,	8 Pounds.
V. No. 1. WHITE CLOVER,	12 Ditto.
2. TREFOIL,	4 Ditto.

Of Natural Grass Seeds.

No. 1. VERNAL GRASS,	$\frac{1}{2}$ Peck.
2. MEADOW FOX-TAIL,	1 Ditto.
4. ROUGH STALKED MEADOW GRASS,	1 Ditto.
6. MEADOW FESCUE,	$\frac{1}{2}$ Ditto.
7. RAY GRASS,	2 Ditto.
RIB GRASS,	$\frac{1}{4}$ Ditto.

ON light, dry, warm soils, the most suitable kind and quantities of seeds to be sown upon an acre, are as follows.

Of Artificial Grass Seeds.

III. BURNET,	4 Pounds.
IV. No. 2. COW CLOVER,	4 Ditto.
V. No. 1. WHITE CLOVER,	14 Ditto.
2. TREFOIL,	4 Ditto.
RIB GRASS,	$\frac{1}{4}$ Ditto.

Of Natural Grass Seeds.

No. 1. VERNAL GRASS,	$\frac{1}{4}$ Peck.
3. SMOOTH STALKED MEADOW GRASS, ..	$\frac{1}{2}$ Ditto.
5. SHEEP'S FESCUE,	$\frac{1}{4}$ Ditto.
6. MEADOW FESCUE,	$\frac{1}{2}$ Ditto.
7. RAY GRASS,	2 Ditto.
8. CRESTED DOG'S-TAIL,	$\frac{1}{4}$ Ditto.

Specimen of the Grasses



Anarthrum odoratum.



Alopecurus pratensis.



Poa pratensis.



Sweet scented Vernal Grass.



Meadow Fox tail Grass.



Smooth stalked Meadow Grass.

N^o 1.

N^o 2.

N^o 3.



Specimen of the Grasses



Poa Trivialis.

Rough stalked

Meadow Grass.

N^o 4.



Cynosurus Crestatus.

Crested Dogs-tail Grass.

N^o 8.



Festuca Pratensis.

Meadow Fescue Grass.

N^o 6.



On Natural Grasses.

Here follows a table, shewing at one view, the different kinds and quantities of grass seeds the most appropriate to be sown on an acre of land, for laying ten different kinds of soil down to pasture.

No.	Names.	Chacey.	Marly.	Stiff Loamy	Loamy.	Light Loamy	Sandy.	Gravelly	Chalky.	Lime Stone.	Heathy or Moory.
		Pecks.	Pecks.	Pecks.	Pecks.	Pecks.	Pecks.	Pecks.	Pecks.	Pecks.	Pecks.
1	<i>Red Clover,</i> .....	..	..	..	..	..	..	..	$\frac{1}{4}$	$\frac{1}{4}$	..
2	<i>Cow Clover,</i>	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$
3	<i>White Clover,</i>	$\frac{3}{4}$	$\frac{3}{4}$	1	1	1	1	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
4	<i>Burnet,</i> .....	..	..	..	..	..	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	..
5	<i>Saintfoin,</i> .....	..	..	..	..	..	..	..	16	16	..
6	{ <i>Sweet scented</i> <i>Vernal Grass,</i> }	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	..	..	$\frac{1}{2}$
7	{ <i>Meadow Fox-</i> <i>tail Grass,</i> .. }	1	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	..	..	$\frac{1}{2}$
8	{ <i>Smooth stalked</i> <i>Meadow Grass</i> }	..	$\frac{1}{4}$	$\frac{1}{2}$	1	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	..	..	$\frac{1}{4}$
9	{ <i>Rough stalked</i> <i>Meadow Grass</i> }	1	$\frac{1}{2}$	$\frac{1}{4}$	..	..	..	..	..	..	$\frac{1}{4}$
10	{ <i>Meadow Fes-</i> <i>cue Grass,</i> .. }	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
11	{ <i>Sheep's Fescue</i> <i>Grass,</i> .....	..	..	..	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
12	{ <i>Crested Dog's-</i> <i>tail Grass</i> .....	..	..	..	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
13	<i>Ray Grass,</i>	2	2	$1\frac{3}{4}$	1	$1\frac{3}{4}$	2	2	2	2	2
14	<i>Trefoil,</i>	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
15	<i>Ribgrass,</i>	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	..	..	..

On Natural Grasses.

IF saintfoin is the principal grass intended for laying land down to pasture, all the other seeds should be omitted, except the red clover, or trefoil.

AND the saintfoin should be omitted when the other grasses seeds are sown.

WHERE grasses are sown for the purpose of consuming the first foliage, as lucern, red clover, or saintfoin, the seed should be sown thicker, than where the plant is grown for the purpose of producing seeds, as in wheat or peas; because the quantity of the first foliage will be greater in respect to number; and the central parts of the tussocks, as is often seen in wheat and peas, when sown too thick, will rise two or three inches higher in their contest for light and air, like the trees of thick planted woods; and will hence produce a forwarder pasture as well as a more copious one.

POOR land, or even land of a middling quality, when newly laid down with good seeds as above, will keep more than double the stock that it did before, or will do in six or eight years after; because the seeds degenerates, and the pasture returns to its original state. Hence the necessity of taking up to plough, and of laying down such land with seeds alternately; viz. light and poor soils every third, fourth, fifth, sixth, seventh, or eighth year, &c. and clayey soils every ninth, tenth, eleventh, twelfth, thirteenth, or fourteenth year. Or to restore the sward by *dunging, scarifying, seeding, dressing, and rolling* it, &c.

BUT gentlemen of landed property are so afraid of the plough, that they suffer their pasture land to be managed with a great disadvantage to themselves, their tenants, and the nation. It is the abuse, and not the use of the plough that they ought to be afraid of.

WHEN a piece of land is to be improved. What is the means? The plough. Let no man then be afraid of this most useful of all instruments.

PASTURE land managed as above, will maintain one-fourth more stock upon an average than it did before, (which surplus would make the *produce* equal the *consumption* of butcher's meat, and keep the price within the ability of the poor to purchase it.) And if the grass is kept in a young succulent state by feeding it

On Natural Grasses.

close down, &c. the grazier will be enabled to receive every benefit, by eating all the produce of his pastures, and likewise be enabled to prevent the stems of some of the grasses from running into seed, an evil which *crested dog's-tail* and *ray-grass* are very subject to.

HAVING pointed out the best methods of laying down land to pasture, I shall just glance at the best method of restoring degenerated sward, without the assistance of the plough.

WHEN the sward is degenerated, mossy, or thin, the first thing to be done is to cover it with rotten dung, at the rate of eight or ten tons to an acre, sometime in March; those manures, which are designed to be spread on the surface of grass land, which is called a top-dressing, are best applied in the early spring; and should be dispersed over the soil almost in a state of powder, or in lumps of very loose cohesion; as at this time the vernal showers wash them into the soil, and they are applied to the roots of the grass, before their essential parts are diminished by winter rains or by summer exhalation, then to scafify it both length and cross ways, either with my *Sward-dresser*, or with common harrows, or to roll it with a spiky roller.

CLEAN the sward of every kind of rubbish, then sow upon every acre, of

COW CLOVER, 4 Pounds.

WHITE CLOVER, 8 Ditto.

TREFOIL, 4 Ditto.

BUSH-HARROW the sward well, and then roll it across the ridges with a heavy roller. Clear the pasture of all kinds of stock for three or four weeks, when the young seeds will have got sufficient hold of the ground to admit some ewes and lambs, or other sheep, and as the seeds advance other kinds of stock may be added.

IF any thistles or other weeds should get up so as to injure the young seeds, they must be mown by hand, or by the *Thistle Cutter*, once, twice, or thrice, in the course of the summer, which will make the pasture so clean, as to put on the

On Natural Grasses.

appearance of a perpetual spring, when close fed down.

By the above management the land will be able to keep one-fourth more stock when grazed, and it will produce one-fourth more grain when converted into tillage than it did before. How great are the advantages which such management holds out to the landlord, the tenant, and the nation!

BUT agriculture can never arrive at that pitch of perfection of which it is capable, until *leases are granted, tythes commuted, &c.* and the *ingenuity of the agriculturists unshackled* from the restraints imposed upon them by land-tasters, &c.

MILLSTONES have been called the artificial teeth of mankind, by grinding farinaceous seeds into powder, which facilitates their decomposition; and renders them more nutritious. So millstones and the chaff-cutter may be called the teeth of our most useful domestic animals. Hence the necessity of crushing their corn, and of cutting their hay and straw, which facilitates their decomposition and renders them more nutritious.

BUT besides the ten grasses which I have particularly described, there are above a hundred more; and perhaps it may be gratifying to many of my readers, to present them here with an enumeration of all the British natural grasses.

Class II. Diandria. Order Digynia.

1. *Anthoxanthum Odorum*. *Sweet scented Vernal Grass*.-- Already described.

Class III. Triandria. Order Digynia.

2. *Phalaris Canariensis*. *Matured Canary Grass*.

Sown frequently for bird's-seed. *Annual*, flowering in June---August.

3. *Phalaris Arenaria*. *Sea Canary Grass*.

THIS is an insignificant grass of ten weeks duration only. It grows on sandy beaches, and affords plenty of seed for finches.

Annual, flowering in June.

4. *Phalaris Phleoides*. *Cat's-tail Canary Grass*.

IN some parts of Norfolk and Cambridgeshire. *Perennial*, flowering in June.

On Natural Grasses.

5. *Panicum Verticillatum. Rough Panic Grass.*

BETWEEN Putney and Roehampton, near Chelsea, and in Battersea fields, &c.
Annual, flowering in June and July.

6. *Panicum Viride. Green panic Grass.*

NEAR Guilford, in Battersea field, and about Norwich.
Annual, flowering in July.

7. *Panicum Crus Galli. Loose Panic Grass.*

NEAR Guilford about Battersea and Putney, in moist places.
Annual, flowering in July.

8. *Panicum Sanguinale, Cock's-foot Panic Grass.*

IN various parts in the south of England. *Annual*, flowering in July.

9. *Panicum Dactylon. Creeping Panic Grass.*

ABOUT Pensance and Marketjew. *Perennial*, flowering in July, and August.
NONE of the English panics are worth cultivating, unless for birds; the hard billed tribe of which are fond of the seeds.

10. *Phleum pratense. Common Cat's-tail grass. Timothy grass.*

A VERY coarse grass and common in all our meadows.
Perennial, flowering in June -- October.

11. *Phleum Alpinum. Alpine Cat's-tail grass.*

ON mountains near Garway moor. *Perennial*, flowering in July.

12. *Phleum Paniculatum. Panicked Cat's-tail grass.*

NEAR Bristol, Bourn bridge, and about Newmarket.
Annual, flowering in July.

13. *Phleum Crinitum. Bearded Cat's-tail grass.*

NEAR Portsmouth, in ditches on the Essex coast, and near Cley in Norfolk.
Annual, flowering in July and August.

14. *Alopecurus Pratensis. Meadow Fox-tail grass.*---Already described.

15. *Alopecurus Agrestis. Slender Foxtail grass.*

On Natural Grasses.

Annual, flowering in July.

16. *Alopecurus Bulbosus*. *Bulbous Fox-tail grass*.

IN the salt marshes near Yarmouth, Cardiff marshes Glamorganshire, and near the Aust passage. *Perennial*, flowering in July.

17. *Alopecurus Geniculatus*. *Floating Fox-tail grass*.

IN stagnant water frequently, and between the new and old passages at Aust. *Perennial*, flowering in July.

18. *Milium effusum*. *Millet grass*.

IN shady woods frequent. *Annual*, flowering in June and July.

19. *Milium Lendigerum*. *Panic Millet grass*.

IN the isle of Sheppey, corn fields at Weymouth, and at Gillingham, Norfolk. *Annual*, flowering in August.

20. *Agrostis Spica Venti*. *Silky bent grass*.

Annual, flowering in June and July.

21. *Agrostis Canina*. *Brown bent grass*. *Perennial*, flowering in July.

22. *Agrostis Litoralis*. *Sea-side bent grass*.

IN salt marshes near Cley, Norfolk. *Perennial*, flowering in August.

23. *Agrostis Setacea*. *Bristly bent grass*.

IN the west of England frequent, and the sea coast near Weymouth.

Perennial, flowering in July and August.

24. *Agrostis Vulgaris*. *Fine bent grass*.---*Perennial*, flowering in July.

25. *Agrostis Stolonifera*, *Creeping bent grass*.

Perennial, flowering in July and August.

26. *Agrostis Alba*. *Marsh, or white bent grass*.--*Perennial*, flowering in July.

27. *Agrostis Minima*. *Smallest bent grass*.

IN Wales, frequent in sandy pastures on the south-west coast of Anglesea.

Annual, flowering in March and April.

28. *Aira Cristata*. *Crested hair grass*.--*Perennial*, flowering in July and August.

29. *Aira Aquatica*. *Water hair grass*.--*Perennial*, flowering in May and June.

On Natural Grasses.

30. *Aira Cæspitosa*. *Turfy hair grass*.---*Perennial*, flowering in June and July.

31. *Aira Flexuosa*. *Waved mountain hair grass*.---*Perennial*, flowering in July.

32. *Aira Canescens*. *Grey hair grass*.

ON the coast of Norfolk and Suffolk.--*Perennial*, flowering in July.

33. *Aira Præcox*. *Early hair grass*.--*Annual*, flowering in May and June.

34. *Aira Caryophyllea*. *Silver hair grass*.--*Annual*, flowering in July.

35. *Holcus Lanatus*. *Meadow soft grass*.--Already described.

36. *Holcus Mollis*. *Couchy, or creeping soft grass*.

AT Hampstead, and Highgate Common.

Perennial, flowering in July and August.

37. *Holcus Avenaceus*. *Oat-like soft grass*.

Perennial, flowering in June and July.

38. *Melica Uniflora*. *Wood melic grass*.---*Perennial*, flowering in May and June.

39. *Melica Nutans*. *Mountain melic grass*.

NEAR Kendal, and Helks-wood by Ingleton, Yorkshire.

Perennial, flowering in June and July.

40. *Melica Cærulea*. *Purple melic grass*.--*Perennial*, flowering in August.

41. *Sesleria Cærulea*. *Blue moor grass*.

IN calcareous, rocky soils, in various parts of England.

Perennial, flowering in April.

42. *Poa Aquatica*. *Reed meadow grass*.

COMMON in fenny land.--*Perennial*, flowering in July.

43. *Poa Fluitans*. *Flote meadow grass*.

Perennial, flowering in March---November.

44. *Poa Distans*. *Reflexed meadow grass*.

IN various parts of England.--*Perennial*, flowering in July.

45. *Poa Maritima*. *Creeping sea meadow grass*.--*Perennial*, flowering in July.

46. *Poa Procumbens*. *Procumbent sea meadow grass*.

Annual, flowering in July and August.

On Natural Grasses.

47. *Poa Rigida.* *Hard meadow grass.*--*Annual*, flowering in June.
48. *Poa Compressa.* *Flat stalked meadow grass.*
Perennial, flowering in July and August.
49. *Poa Alpina.* *Alpine meadow grass.*--*Perennial* flowering in July.
50. *Poa Flexuosa.* *Zigzag meadow grass.* *Perennial* flowering in July.
51. *Poa Bulbosa.* *Bulbous meadow grass.*--*Perennial*, flowering in May and June.
52. *Poa Cæsia.* *Sea green meadow Grass.*
Mountains in Bredalbane --*Perennial*, flowering in June and July.
53. *Poa Trivialis.* *Rough stalked meadow Grass.*--Already described.
54. *Poa Pratensis.* *Smooth stalked meadow Grass.*--Already described.
55. *Poa Annua.* *Annual meadow Grass.*
Annual, flowering in March --- November.
56. *Poa Nemoralis.* *Wood meadow Grass.*
In the North of England common.--*Perennial*, flowering in June.
57. *Poa Decumbens.* *Decumbent meadow Grass.*--*Perennial*, flowering in July.
58. *Briza Minor.* *Small quaking Grass.*
In the south-west of England common.--*Annual*, flowering in July.
59. *Briza Media.* *Common quaking Grass.*
In pastures frequent.--*Perennial*, flowering in May and June.
60. *Dactylis Stricta.* *Smooth cock's-foot Grass.*
ABOUT the mouths of rivers in the south-east parts of England.
Perennial, flowering in August.
61. *Dactylis Glomerata.* *Rough cock's-foot Grass.*
A VERY coarse ordinary grass, refused by all cattle. Too common in all pastures.--*Perennial*, flowering in June--August.
62. *Cynosurus Cristatus.* *Crested dog's-tail Grass.*--Already described.
63. *Cynosurus Echinatus.* *Rough dog's-tail Grass.*--*Annual*, flowering in July.
64. *Festuca Ovina.* *Sheep's fescue Grass.*--Already described.
65. *Festuca Vivipara.* *Viviparous fescue Grass.*--*Perennial*, flowering in July.

On Natural Grasses.

66. *Festuca Duriuscula*. *Hard fescue grass*.--*Perennial*, flowering in June.

67. *Festuca Rubra*. *Creeping fescue grass*.-- *Perennial*, flowering in July.

68. *Festuca Bromoides*. *Barren fescue grass*.--*Annual*, flowering in June.

69. *Festuca Myurus*. *Wall fescue grass*.--*Annual*, flowering in June.

70. *Festuca Uniglumis*. *Single husked fescue grass*.

Annual, or *Biennial*, flowering in June.

71. *Festuca Gigantea*. *Tall fescue grass*.

Perennial, flowering in July and August.

72. *Festuca Calamaria*. *Reed-like fescue grass*.--*Perennial*, flowering in July.

73. *Festuca Loliacea*. *Spiked fescue grass*.

COMMON near London, and frequently mistaken for *Lolium Perenne*.

Perennial, flowering in June and July.

74. *Festuca Pratensis*. *Meadow fescue grass*.--Already described.

75. *Festuca Elatior*. *Tall fescue grass*.

THIS is a very luxuriant and productive grass, but very coarse; cows are fond of it, but not horses. It grows in the moist, shady borders of our best pastures.

Perennial, flowering in June and July,

76. *Bromus Secalinus*. *Smooth rye brome grass*.

IN various parts of England.--*Annual*, flowering in July.

77. *Bromus Multiflorus*. *Downy rye brome grass*.--*Annual*, flowering in July.

78. *Bromus Mollis*. *Soft brome grass*.--*Biennial*, flowering in June.

79. *Bromus Racemosus*. *Smooth brome grass*.--*Annual*, flowering in June.

80. *Bromus Squarrosus*. *Corn brome grass*.--*Annual*, flowering in July.

81. *Bromus Arvensis*. *Field brome grass*.--*Annual*, flowering in July.

82. *Bromus Erectus*. *Upright brome grass*.

IN several parts of England.--*Perennial*, flowering in July.

83. *Bromus Asper*. *Hairy wood brome grass*.

Annual, or *Biennial*, flowering in July.

On Natural Grasses.

84. *Bromus Sterilis*. *Barren brome grass*.--*Annual*, flowering in June and July.

85. *Bromus Diandrus*. *Upright annual brome grass*.--Flowering in June.

86. *Bromus Sylvaticus*. *Slender wood brome grass*.--*Perennial*, flowering in July.

87. *Bromus Pinnatus*. *Spiked heath brome grass*.

COMMON in several parts of England.--*Perennial*, flowering in July.

88. *Stipa Pennata*. *Long awned feather grass*.

VERY scarce, if at all to be found now.--*Perennial*, flowering in July.

89. *Avena Fatua*. *Wild oat, or haver*.

A GREAT pest to corn fields, particularly in the fens of Lincolnshire.

Annual, flowering in July and August.

90. *Avena Pubescens*. *Downy oat grass*.

IN several parts of Norfolk, common. -- *Perennial*, flowering in June.

91. *Avena Pratensis*. *Narrow leaved oat grass*.--*Perennial*, flowering in July.

92. *Avena Flavescens*. *Yellow oat grass*.

Perennial, flowering in June and July.

93. *Lagurus Ovatus*. *Hare's-tail grass*.

IN Guernsey partially.--*Annual*, flowering in June.

94. *Arundo Phragmites*. *Common reed*.

Its economical use is for thatching, for which purpose it is superior to any thing growing in England, being neater and more durable than any other thatching. Very common in fenny countries.

Perennial, flowering in July.

95. *Arundo Epigejos*. *Wood reed*.

PECULIAR to fenny countries, about Ely, &c. *Perennial*, flowering in July.

96. *Arundo Calamagrostis*. *Small hedge reed*.

A STATELY grass, and an ornament to the banks and hedges; but that is all, being rejected by all sorts of cattle. In Leicestershire, Norfolk, Lincolnshire, Cambridgeshire, &c. *Perennial*, flowering in July.

97. *Arundo Colorata*. *Canary reed grass*.

On Natural Grasses.

IN gardens common, and grows wild near Cambridge.

Perennial, flowering in July.

98. *Arundo Arenaria*. *Sea reed. Marram. Sea mat-weed.*

THIS grass is of great service in keeping up the sand-banks against the sea-side, and is used for making besoms, for sweeping carpets, &c.

Perennial, flowering in July.

99. *Lolium Perenne*. *Perennial darnel. Red darnel, or ray grass.*

Already described.

100. *Lolium Temulentum*: *Bearded darnel.*

A great pest in some corn fields. It is of an intoxicating quality, and there are many instances, both on record and traditionary, of people being intoxicated with bread which has contained it.

Annual, flowering in July.

101. *Lolium Arvense*. *White darnel. Beardless darnel.*

Annual, flowering in July.

102. *Rotbollia Incurvata*. *Sea hard grass.--Annual*, flowering in August.

103. *Elymus Arenarius*. *Upright sea lyme grass.*

THIS grass, together with the sea reed, helps to support the sand-banks from the encroachments of the tide. Grows near St. Ives, Cornwall; Isle of Bute, Norfolk; and in Scotland, &c. *Perennial*, flowering in July.

104. *Elymus Genuiculatus*. *Pendulous sea lyme grass.*

Perennial, flowering in July.

105. *Elymus Europæus*. *Wood lyme grass.*

IN various parts of the north of England.--*Perennial*, flowering in June.

106. *Hordeum Murinum*. *Wall barley. Mouse barley. Way bennet.*

Annual, flowering in March---November.

107. *Hordeum pratense*. *Meadow barley.--Perennial*, flowering in June

108. *Hordeum Maritimum*. *Sea barley. Squirrel-tail grass.*

Annual, flowering in June and July.

On Natural Grasses.

109. *Triticum Junceum*. *Sea rushy wheat grass*.--*Perennial*, flowering in July.

110. *Triticum Repens*. *Creeping wheat grass*. *Couch grass*.-- Already described.

111. *Triticum Caninum*. *Fibrous, bearded, wheat, or dog's grass*.

Perennial, flowering in July.

112. *Triticum Loliaceum*. *Dwarf sea wheat grass*.

ON the north coast of Norfolk. At Lowestoft, Suffolk. Some parts of Essex, and in the Isle of Wight. *Annual*, flowering in June and July.

IN this enumeration of British grasses, I have not hazarded an opinion upon any of them; except those of which I have given real specimens.



On Natural Grasses.

A Table of the Number in each Genus of the British Grasses.

Number of Genera.	Name of each Genus.	Number of Species in each Genus.
1	Anthoxanthum	1
2	Phalaris	3
3	Panicum	5
4	Phleum	4
5	Alopecurus	4
6	Milium	2
7	Agrostis	8
8	Aira	7
9	Holcus	3
10	Melica	3
11	Sesleria	1
12	Poa	16
13	Briza	2
14	Dactylis	2
15	Cynosurus	2
16	Festuca	12
17	Bromus	12
18	Stipa	1
19	Avena	4
20	Lagurus	1
21	Arundo	5
22	Lolium	3
23	Rotbolia	1
24	Elymus	3
25	Hordeum	3
26	Triticum	4
Total.....		112

DISSERTATION III.

On the Construction of a *Sward-Dresser*.

PLATE I.
Fig. 1.

PLATE I. Fig. 1. is a perspective view of the whole machine.

A A. the outer side frames, six feet long, and twelve by three inches square, shaped as per figure.

B. the coulter bar, five feet eight inches long, and four by three and a half inches square, outside measure. Set off one and a half inches from each side frame, and divide the remainder (which is fifty-seven inches) into nineteen equal parts, in which fix nineteen coulters for scarifying the sward.

C C C C. are four bars, five feet eight inches long, and three and a half by two inches square, for bracing the side frames together, and for fixing the thorns which brush the sward after it has been scarined, as per figure.

D D. are two pieces of ash wood, three inches square, and about forty inches long, for sledging the machine from one field to another.

E. the chain by which the whole machine is drawn with two horses abreast.

Fig. 2.

FIG. 2. represents one of the coulters which is ten inches long (but here it is only eight inches,) one and a quarter inches broad, and three-eighths of an inch thick for three and a half inches within the wood of the coulter bar, below which, the fore edge is made sharp for cutting the sward.

Fig. 3.

FIG. 3. represents the screw bolt which regulates the depth at which the coulters scarify, &c.

a a. two iron plates twelve inches long, and three by a quarter of an inch square.

On the Use of the Sward-Dresser.

b b. two iron bolts twelve and a half inches long, and half an inch diameter, for fastening the iron plates to the upper and under sides of Fig. I. at 1, 1. 2, 2.

c. an iron bolt twelve and three quarters inches long, half an inch diameter at top and bottom, and three quarters of an inch diameter where the screw is made.

d. a nut screw three inches long, three quarters of an inch by one and a half inches square, fixed in the coulter bar for regulating the depth of the coulters.

m. the screw key which being turned right or left hand about, raises or drops the coulters.

THE hinder part of this machine must be drawn well with long black thorns as per figure, and then it will be ready for use.

On the Use of the Sward-Dresser.

THE use of this machine is to scarify and dress meadow land, whether it is to be mown or depastured.

THE best time of performing this operation is from the middle of February to the middle of April.

IN general, dressing the land one way is sufficient; but if the sward be very mossy, or adhesive, it should be dressed length and cross ways, cleaned, and then rolled.

PREVIOUS to turning the machine, the left hand fore corner must be lifted up and propped, and the coulters cleaned.

IF the sward be thin, it may be thickened very much, by laying eight or ten tons of rotten dung, and sowing seven pounds of white clover, four pounds of wild or cow clover, four pounds of trefoil, four pounds of rib grass, and one peck of best rye grass seeds per acre, previous to its being dressed, or bush harrowed,

On the Construction of a Thistle-Cutter.

and then cleaned and rolled.

By dressing land with this machine, *moss* is torn up, *ant* and *mole-hills* levelled and destroyed, the roots of the grass cut and horse hoed, which causes them to throw out fresh lateral shoots or stems; the *sward* thickened, and the *surface* made so clean, as to put on the appearance of a perpetual spring, when close fed down.

By the above management, and by grazing as much stock as will keep the grass in a young succulent state, and hobbing or mowing all the tufts and weeds three times in the course of the summer, the grazier will be enabled to receive every benefit from his land, and likewise prevent the stems of several grasses from running into seed.

DISSERTATION IV.

On the Construction of a *Thistle-Cutter*.

PLATE II.
Fig. 1.

PLATE II. Fig. 1. is a geometrical plan of the whole machine complete.

A. the leading share made of cast steel in the form of an isosceles triangle, whose equal sides are fourteen inches long, and its base twelve inches, about one-eighth of an inch thick in the middle, tapering to a very fine edge on the outsides.

B B B B. four pieces of ash wood three inches square, and two feet four inches long, to which the scythes are fixed as per figure, and are called the scythe handles.

C C C C. four scythes three feet long from point to point, four inches broad at the widest part, made of cast steel, and manufactured by Messrs. Hunt and Co, at their cast steel manufactory, Brades, Birmingham.

D D D D. four other pieces of ash wood, three inches square, and two feet five inches long, for throwing the two hindmost scythes to their proper distance.

Fig. 2.

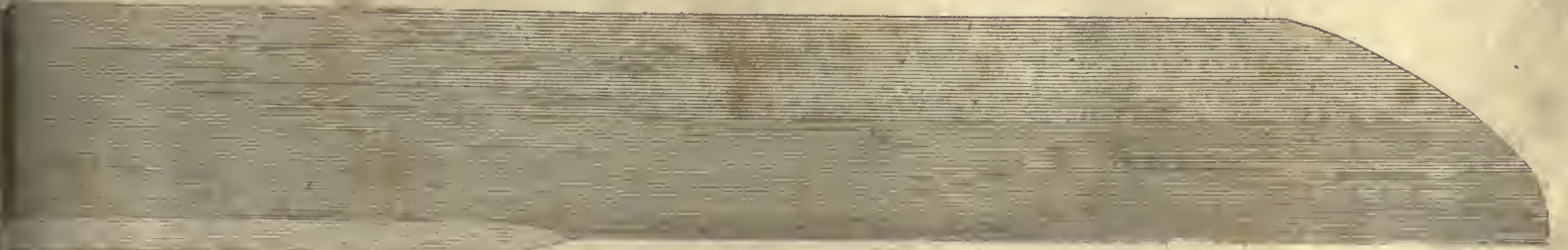


Fig. 1.

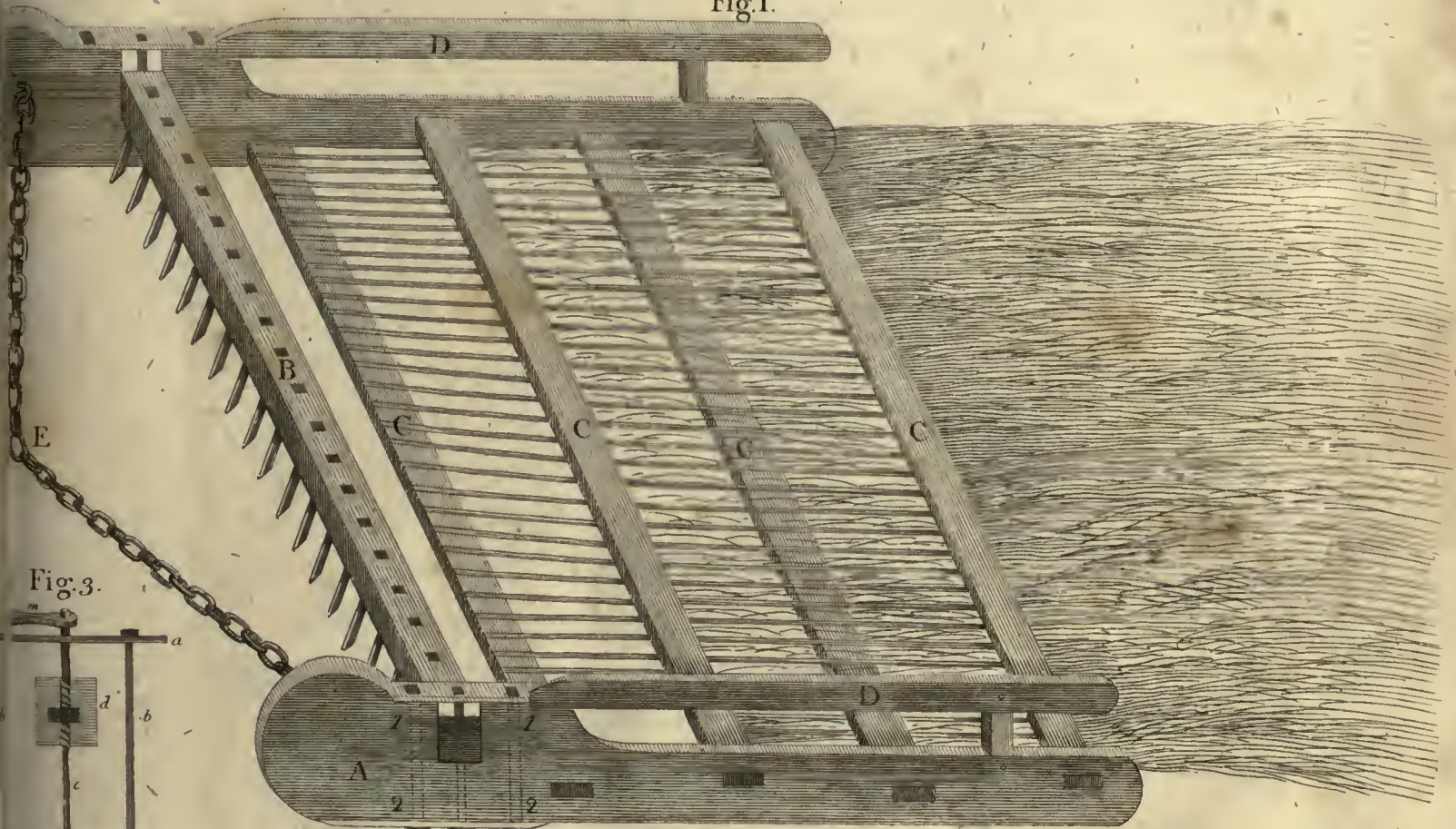
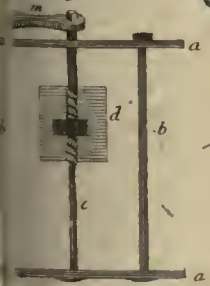


Fig. 3.





On the Construction of a Thistle-Cutter.

These pieces are braced two and two together by the four bars E E E E, which are one by two inches square, and eighteen and a quarter inches long.

PLATE II.
Fig. 1.

F. a main piece of ash, wood three by four inches square, and five and a half feet long; to which all the other pieces are fixed by hooks and eye bolts, as per figure, by which the scythe-handles acting as it were upon hinges, the scythes are thereby made to form the same parallel line with the surface of the land, whether it is concave, convex, or level. For this purpose it might be useful to make a joint in the middle of this piece, where the land is uneven.

IN the fore part of this piece a sawgate is made, three quarters of an inch from the under side, at the hind part of the share, and one inch from the under side at the front of the wood (which gives an elevation to the point of the share) to receive the share where it is fixed as per figure.

G G G G. four iron braces, one end of which is fixed in the scythe handles B B B B, and the other ends to the under side of the scythes by a screw.

a. the staple to which the chain and swinging tree is fixed, by which the machine is drawn.

b b. two mortice holes which receives the tenons of two upright studs, to which pulleys are fixed for lifting the scythes off the ground, when there is any thing to obstruct them.

FIG. 2. A. represents one of the studs, (which are both alike) one and a half by four inches square, and three feet long.

Fig. 2.

B B. two small pulleys fixed on each side of the upright studs. Through the pulleys of the foremost stud, a small rope passes (one end of which is fixed to the outsides of the fore iron braces) and likewise through the pulleys of the hindmost stud, and then the two ropes unite at about two or three feet behind the whole machine.

THROUGH the pulleys of the hindmost stud pass two other small ropes,

On the Use of the Thistle-Cutter.

PLATE II.
Fig. 2.

(one end of each being fixed to the outsides of the hindmost iron braces,) and then the four ropes unite together, where the manager holds them as a coachman does the reins of four horses. By these ropes the scythes may be lifted to any degree of elevation, by which means any unevenness of the ground, or other obstructions on its surface, such as stones, roots, ant-hills, &c. may be easily avoided.

FIG. 3. A. represents the swinging tree, thirty-three inches long.

Fig. 3.

B. represents the chain, thirty inches long, which hooks into the staple *a* of Fig. 1. for drawing the machine.

FIG. 4. represents one of the scythes by itself.

A. the scythe.

B. the part by which it is fixed to the scythe handle, three quarters of an inch from the under side, where a sawgate is made to receive it, so that the whole of the scythe projects beyond the wood, and cuts the thistles three quarters of an inch above the surface. The whole being so plain, a further description of this machine seems quite unnecessary.

WHEN the scythes want sharpening, they may be either reared perpendicular, or taken off entirely, at the same time the horses should be ungeared.

On the Use of the Thistle-Cutter.

THE use of this machine is of considerable importance on pasture land that is subject to thistles and other weeds; as it can with one man and a horse, cut twenty acres in a day.

THERE are no plants over which the economical farmer ought to keep a more watchful eye than the thistle tribe; as they are not only useless, but they

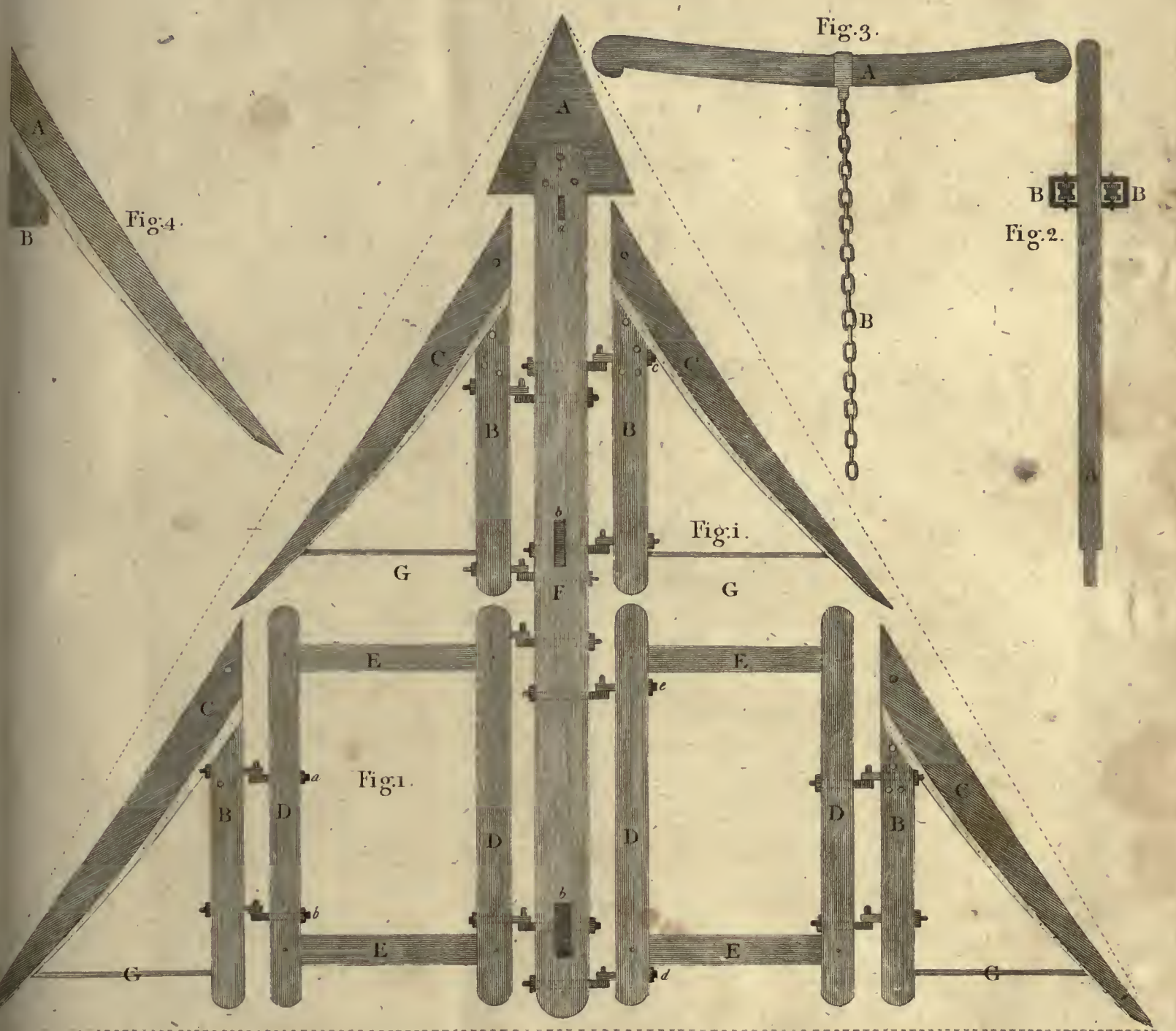
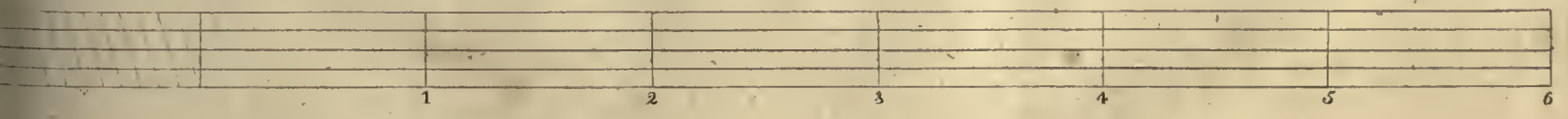


Fig. 4.

Fig. 3.

Fig. 2.

Fig. 1.





On the Use of the Thistle-Cutter.

occupy much ground, and being furnished with downy seeds, are capable of being multiplied and carried almost to any distance.

Hence the necessity of being acquainted with the qualities of each kind, in order to enable us to judge with certainty how far and by what means their destruction may be effected.

THE English thistles meriting notice, as more or less noxious, are,

1. CARDUUS LANCEOLATUS. *Spear, or bull thistle.*
2. CARDUUS NUTANS. *Musk thistle.*
3. CARDUUS PALUSTRIS. *Marsh thistle.*
4. CARDUUS MARIANUS. *Milk thistle.*
5. CARDUUS ACANTHOIDES. *Wetted, or curled thistle.*
6. ONOPORDUM ACANTHIUM. *Cotton thistle.*
7. SONCHUS OLERACEUS. *Common sow thistle.*
8. SONCHUS ARVENSIS. *Corn sow thistle.*
9. CARDUUS ARVENSIS. *Common, or field thistle.*

1. THE *spear thistle*, is a large strong biennial plant, about three or four feet high, the extremity of each leaf running out into a long sharp point, remarkably prickly; hence in some places it is called by the name of the *bull thistle*. Its heads of flowers are large, and it grows commonly by the sides of roads, near dunghills, and not unfrequently in fields and pastures. It flowers in June--September.

2. THE *musk thistle* is an annual plant, and grows to the height of two or three feet, the heads hang down, and the flowers smell somewhat like musk, it is often found occupying whole fields, particularly on chalky or barren land. It flowers in July and August.

3. THE *marsh thistle* is a biennial plant, and grows very tall and prickly; its heads of flowers are numerous, small, and of a red colour; it grows abundantly in wet meadows, and in woods. It flowers in July, and August.

4. THE *milk thistle* is an annual plant; and is found plentiful in waste places,

On the Use of the Thistle-Cutter.

and upon old banks. It is known almost to every one by its large beautiful leaves, which are variegated with white spots and veins, as if they had been sprinkled, with milk.

IT flowers in August.

5. THE *welted, or curled thistle* is an annual plant. This thistle frequently appears on banks, and by road sides, but seldom intrudes into fields or pastures.

THIS thistle flowers in June and July.

6. THE *cotton thistle* is a biennial plant, and is to be found plentifully in uncultivated places in many parts of England. The root is long and fibrous, and sends forth several oblong, sharp-pointed, whitish green, sinuated leaves, covered with a cottony down, and set with spines on their edges. In the midst of these shoots up a stalk, to the height of five or six feet, divided towards the top into diverse branches, set with leaves at their joints, and having jagged, leafy borders running along them, edged with spines, as has the main stalk also. Each branch terminates with a scaly head of reddish purple, hermaphrodite florets, having narrow tubes, and cut at their brim into five teeth. They contain five hairy stamina and one style, and are succeeded by small oblong seeds, crowned with down.

THIS thistle flowers in July.

7. THE *common sow thistle*. This is an annual plant, and a very troublesome weed in fields and gardens. In some situations the whole plant is smooth, but in others it is rough, prickly on the margins and midribs of the leaves, and also on the peduncles and calyces of the flowers. The stalks are copiously stored with a lactescent juice.

8. THE *corn sow thistle* is a perennial plant, and like the other is a very troublesome weed in arable land.

THIS thistle flowers in July and August.

9. THE *common or field thistle*, is a perennial plant, and has different provincial names in different places, as the *horse thistle*, the *cursed thistle*, &c. and

On the Use of the Thistle-Cutter.

surely if any plant deserves to have a mark set upon it, is certainly this.

THIS thistle is more general in its growth than any of the others, being found not only by the sides of roads, but also in arable and pasture lands.

IT is remarkably prickly, grows from two to three feet high, its heads of flowers are small and of a purplish colour, and sometimes white. But this thistle is too well known to require a particular description.

IT flowers in July.

OF these thistles, all, except the two last, are either *annual* or *biennial*; that is, remain in the ground not more than one or two years, unless renewed by seed. The last two having perennial roots, continues in the earth, increasing and throwing out new shoots or stems every year.

HENCE it will appear obvious, that if the first seven species of thistles are cut down, and rolled before they perfect their seed, the ground will entirely be cleared of them in two years. But the two last mentioned can no otherwise be destroyed, than by rooting them out on arable land by deep ploughing and frequent harrowings.

ON pasture land, the corn sow thistle seldom makes its appearance, but in the hedge rows; the last thistle is an inveterate plague to it.

No plants are more easily destroyed, than the first seven species of thistles; or with more difficulty, than the last two.

FALLOWING and laying the land down to pasture is the only method of destroying the corn sow thistle. But the only method of destroying the common thistle, is by cutting them in the bleeding season.

FOR which purpose I have invented this machine, which greatly reduces the expence, and cuts the thistles nearer the ground than the common scythe.

As soon as the thistles are in full flower, the machine must be set to work the length way of the ridges; and if the scythes are kept very sharp, it will make

On the Construction of a Compound Roller.

excellent work, and do a great deal of it.

AFTER the thistles are cut, they should lie a day or two, to perish by the loss of sap juice, the ground must then be cleared and the close or field rolled the cross way of the ridges with a very heavy roller, which so crushes the hollow stumps, and renders them so pervious to water, that their roots soon rot and die.

IN order to expedite the operation of the machine, and the destruction of the weeds; the land should be cleaned of all kinds of rubbish, the latter end of March or beginning of April, dressed with the *sward-dresser*, and then rolled the cross way of the lands or ridges.

Docks and nettles must be grubbed up by the root.

DISSERTATION V.

On the Construction of a Compound Roller.

THIS machine is composed of a plain and spike roller in one frame, and is one of the most useful implements of husbandry, especially upon strong clay soils; it may be used together or separately, and its weight may be accommodated to the nature of every kind of soil.

PLATE III.
Fig. 1.

PLATE III. Fig. 1. Is a perspective view of the whole machine.

A. is the spike roller, made of a piece of oak wood, seven feet long, and fifteen and a quarter inches diameter, hooped with iron at each end.

DIVIDE the circumference of this roller into twelve equal parts, from which draw parallel lines, one division oblique, the whole length of the roller.

ON the first of these lines set off two inches at each end, and divide the remainder into twenty equal parts of four inches each.

ON the second line set off four inches at each end, and divide the remainder

On the Construction of a Compound Roller.

into nineteen equal parts, and so of all the other lines alternately. In every division fix an iron spike, so that there will be twenty spikes in one row, and nineteen in the other, throughout the whole circumference, making in all two hundred and thirty-four spikes. That part of the spike which projects out of the wood is four inches long, one inch square at the circumference of the roller, and three quarters of an inch square at the point.

THE tong which goes into the wood is four inches long, seven-eighths of an inch square at the circumference of the roller, and tapers to a point at the end.

B. is the plain roller, made of a piece of oak wood, seven feet long, and eighteen inches diameter. In the centre of each end of both rollers are fixed iron bushes of two inches diameter.

C. the bow part of the left hand side of the frame, made of iron, four inches broad, half an inch thick, and is a segment of a circle twenty-seven and a half inches radius; fixed as per figure, for turning the rollers upside down.

D. is the string part of the bow, five feet two inches long, and eight by three inches square, made of oak wood. In these pieces are fixed gudgeons of two inches diameter as at *a a*, on which the rollers move, and are four feet one and a half inches asunder.

E E E E. the four shafts, eleven feet long, six by three and a half inches square at the hinder ends, through which the center bolt passes.

F F F F. four bars, four by one and a half inches square, and three and a half feet long, for bracing the shafts together.

G G. two bars, eight feet long, and three by eight inches square, with double tenons at each end for bracing the outside frames together. In the outer ends of these tenons are linchpins, for the convenience of taking the machine to pieces, but these are omitted in the plate.

H. the centre bolt made of hammered iron, two and a quarter inches diameter; at one end is a round and head, at the other a linchpin, as per figure.

On the Use of the Compound Roller.

THE principal use of this bolt is to give the uppermost roller an inclination forwards when working, and the degree of inclination is governed by the breadth of, and the distance between the two braces G G, which rest upon the shafts when the roller is at work, so as to make the horses carry a little on their backs, otherwise it would be in danger of endeavouring to fall backwards.

THE distance between G G, is twelve inches, or six inches from the centre of the bolt H.

Two neighbouring farmers joined and got one of these compound rollers made by this new plan, and they now let it out at half-a-guinea per day.

On the Use of the Compound Roller.

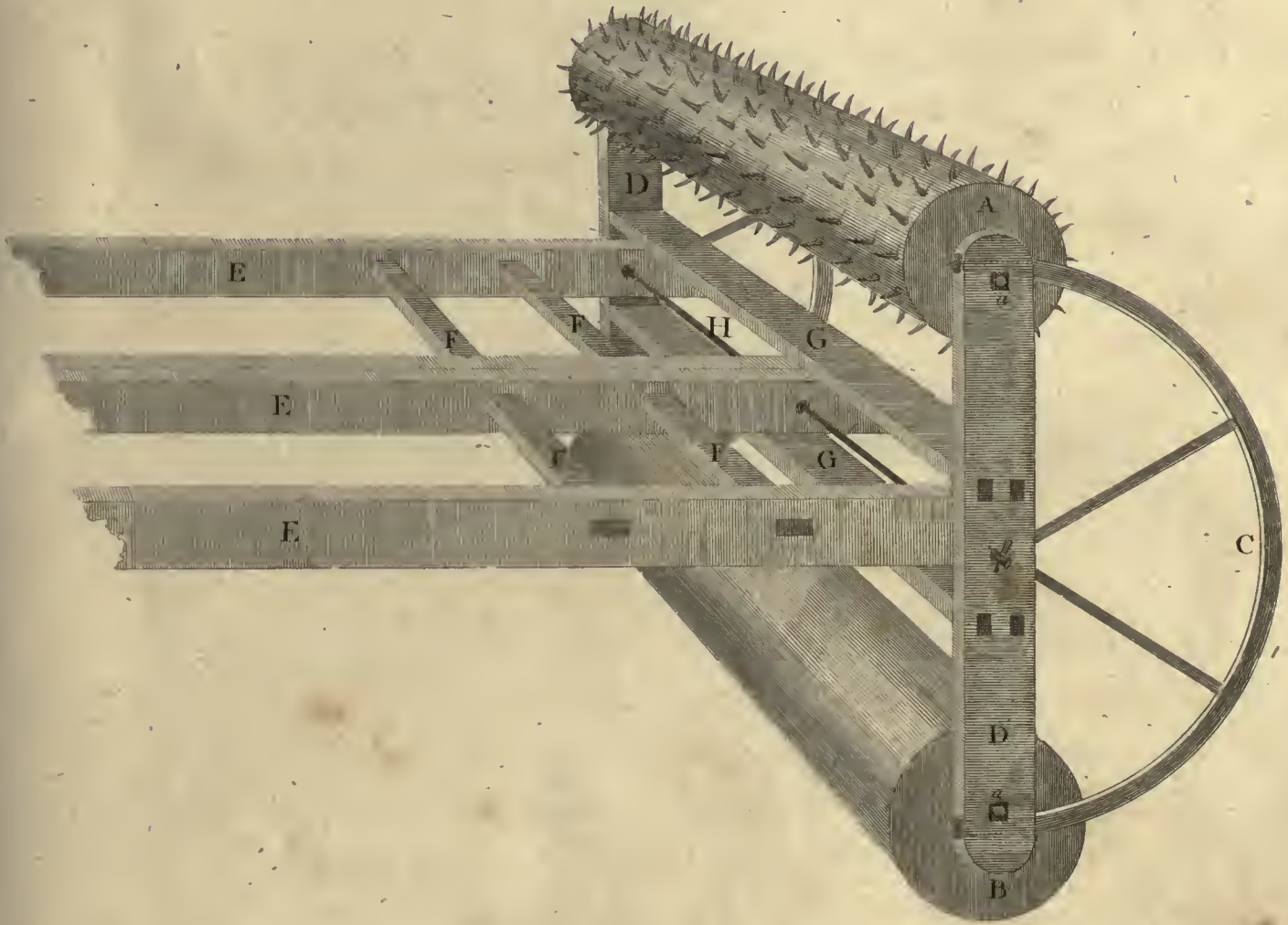
THE principal use of this instrument is to reduce strong, stubborn soils to a fine tilth; for which purpose its powers are wonderful in pulverizing such land. It gives the farmer a command over dry seasons, and enables him to sow his spring and fallow crops in proper time. It also enables him to clean his arable land of weeds, whether they are propagated by the root or by the seed.

By passing this roller over the land once, twice, or thrice, and drag harrowing it between every rolling, it will be sufficiently fine for any purpose wanted.

WHEN the clods are reduced so small that the spike roller can make very little more impression upon them, the plain roller and drag harrow may be used to advantage.

THIS roller is likewise of very great use in restoring degenerated sward.

EARLY in March, when the sward will admit the spikes of the roller, but not the horses feet; cover it first with rotten dung, or compost, at the rate of eight





On Transplanting Trees.

or ten tons to the acre. Roll the sward both length and cross ways, till the surface is pretty well broke; then sow after the rate of seven pounds of white clover, four pounds of trefoil, and four pounds of cow clover to an acre; dress the whole close both length and cross ways with the sward-dresser, clear the close of all the rubbish collected by dressing it, then roll it well down with the plain roller, after which no stock should be admitted for some time.

DISSERTATION VI.*On Transplanting Trees.*

GROUNDWORKS, consist chiefly of shrubberies, extensive lawns, and fields interspersed with large plantations of forest trees, and flowering shrubs, planted in the wilderness way, with serpentine walks, &c. running through the whole.

IN planning and designing these works, it frequently happens that for want of a variety of proper sized trees, the most stately designs are very defective.

IN order to supply that defect, plenty of various kinds of proper sized trees ought always to be at command, for the purpose of transplanting them into bare fields, parks, or about new buildings; or into any other places where they would imitate most that charming negligence of nature, which is so ravishing to the senses.

IN preparing young trees for being transplanted when large, they should continue in the *seed bed* for two years and a half, and then planted out into greater distances, reducing the tap roots considerably, and the lateral roots sparingly.

On Tree Transplanting.

IN young trees the root grows faster than the stem; for an oak plant a foot and a half high, has a root sometimes four feet in length. Hence the necessity of mutilating the root, especially the tap root of an oak, the plant then emits radicles in every direction, which grow faster than if the root had remained perfect. Hence if a plant, or tree, be transplanted, it succeeds with greater certainty, the more absorbent radicles are preserved with the root.

AFTER they have remained two years in the *nursery beds*, they should be removed again, dressing their roots as before directed, and increasing the distance between them, where they may remain three or four years more. After this they may be removed into plantations, where they may either remain for good, or till they are wanted for transplanting.

IN transplanting large trees, some branches of the roots are unavoidably mutilated, and consequently the absorption of nutriment diminished, hence it is necessary that the boughs answering to the destroyed roots, should be rescinded, in order to diminish the transpiration in proportion to the aliment.

THE trees most proper, and worthy of this labour, are the different species of elms; of which the English is the best, as it is the most aspiring, and soonest recovers its wounds.

THE lime also will bear to be removed at a great size, as its wounds soon heal, and it may be formed into any shape desired.

THE oak, the beech, and the ash, will likewise bear to be removed, but they require more care in removing than the former; those trees whose bark is the thinnest and smoothest is the most proper.

THE horn-beam, the sycamore, or plaintree, the large leaved maple, the sweet chesnut, the horse chesnut, and the laburnum, will all bear to be removed, if they do not exceed fifteen or sixteen years old, and from twenty to twenty-five feet high; if they are older they will not recover their wounds so perfectly as to become handsome trees.

On Tree Transplanting.

THE larch, the service, or mountain ash tree, will likewise bear to be removed, but they should not exceed twelve years growth.

THE balsam poplar of Canada, is by far the most beautiful and magnificent plant of all the species. The leaves are very large, of a light cheerful green, and the bark of a smooth shining brownish colour. It is propagated with much ease, is a hardy plant, a quick grower, and will bear removing at a great size.

THE crab tree and white thorn will also suffer to be removed, provided they are in a healthy growing state. And as few trees exceed them either in beauty or fragrance in the spring, or their rich glow of fruit in autumn, I should therefore recommend them to be planted singly in lawns, fields, and parks; where judiciously interspersed with other trees, they would highly decorate those scenes.

THE elevation of stately trees, in parks, clumps, lawns, or fields, has a most agreeable effect; in new designs, and about new built houses, these cannot always be got, without much labour and expence, or waiting many years. But by the help of the foregoing directions, and of the *transplanting machine*, hereafter to be described, a gentleman may soon make a fine figure in a bare field, park, or about a new built house, without much labour or expence, or waiting so many years.

THIS is a great encouragement to gentlemen, even to those advanced in years, to have the pleasure of seeing a flourishing and stately plantation of well grown trees, raised in one year with certain success.

HAVING given instructions for training up young trees for transplanting when large, and described the various kinds most proper for that purpose, I shall now proceed to the construction and use of a machine for transplanting them.

On the Construction of a Tree Transplanter.

On the Construction of a *Tree Transplanter.*

THIS machine is composed of the two hind wheels, and the two fore wheels and carriage of a waggon, with a platform, and diagonal frame erected upon them.

PLATE IV.
Fig. 1.

PLATE IV. Fig. 1. Is a profile of the right hand side of the whole machine.

A. is the hind wheel, five feet eight inches diameter.

B. is the fore wheel, four feet four inches diameter, and the fore carriage complete. But the size of the wheels is not arbitrary.

C. the right hand side of the platform, nine and a half feet long, and eight by seven inches square.

D D. two strong bars, for bracing the platform together, four feet long, and ten by three inches square.

H H. the upper and lower packings, four feet six inches long, and ten by three inches square.

E. the right hand side of the diagonal frame, seventeen feet long, and seven by six inches square.

F. an upright stud, for supporting the diagonal frame, three feet six inches long, and six by three inches square.

G. a brace, five feet long, and six by three inches square; shouldered one inch into the stud F, and diagonal frame E.

Fig. 2.

FIG. 2. Is a horizontal view of the platform, to which the same letters of reference are given as in Fig. 1.

C C. the two sides of the platform, in which are represented the different mortices and bolt holes.

On the Use of the Tree Transplanter.

D D. the fore and hindmost braces, in which are represented the waggon, and mortise bolt holes.

E. the hindmost axletree.

FIG. 3. Is a horizontal view of the diagonal frame.

Fig. 3.

E E. the side pieces.

G. an iron bolt, one and a quarter inches diameter, which ties the side pieces together in the middle.

H. another iron bolt which helps to tie the fore part together.

I. is a wooden brace, which not only braces the fore part together, but also supports the top of the tree when it is removed, and is made fast by another bolt, as per figure. The hind parts of this frame are fixed by bolts to the platform, as per figure.

FIG. 4. Is the waggon bolt which goes through the fore brace, packings, and axletree, all of which is so plain, that any further description seems quite unnecessary, I shall therefore proceed to describe the use of this machine.

Fig. 4.

FIG. 5. Is a perspective view of the whole machine, reared up against a tree ready to be removed; where the tree itself becomes the lever, and the axle of the hind wheels its fulcrum.

Fig. 5.

On the Use of the Tree Transplanter.

WHEN tall trees are designed to be transplanted for the purpose of ornamenting a pleasure ground, it is proper to dig a circular trench round them two or three feet deep in the early spring; whence many new roots will shoot from

On the Use of the Tree Transplanter.

those, which have their ends cut off, and thus the ball of earth will be better held together, when the tree is removed in the succeeding autumn, and the tree by having previously produced so many more fine absorbent radicles, will be more certain to grow in its new situation.

THE first step to be taken in the succeeding autumn, is to mark out the places where the trees are to be removed to; there dig pits three, four, five, or six feet wide, and from twenty-four to thirty-six inches deep, according to the size of the root and ball of earth which hangs to it. Throw the top soil to that side of the pit where the tree is to come, and the bottom or poor soil to the other side. In this situation the pits must remain until the trees are nearly ready for removal, which must be performed in the manner following.

HAVING dug all the pits, the next thing to be done is carefully to raise the trees (which should be of the most healthy and pyramidical form) with as many roots, herby fibres, and as much earth about them as possible. This is done by digging a trench round about them, two, three, or four feet from the body of the trees, according to their size, and about three or four feet deep, sloping it on that side where the machine is to receive the tree. Bend the tree so far to one side with the assistance of ropes, that the tap roots may be easily come at, then with a sharp hatchet, cut them across, and with a sharp hedging-bill, smooth the extremities that have been shattered, rear the tree upright again, bend it to the other side, and dress the roots as before, then raise it upright a second time, and then it will be ready for removal.

WITH one set of hands, as one, two, or three men, fill the pits half full with water, the top soil and other fresh mould mixed to the consistence of a thin puddle.

WITH another set of hands, as two, four, six, or eight men, according to the size of the tree, let the machine be reared up against it by means of the rope I fixed to the iron bar H, leaving the fore carriage upon the ground as represented



Fig. 3.

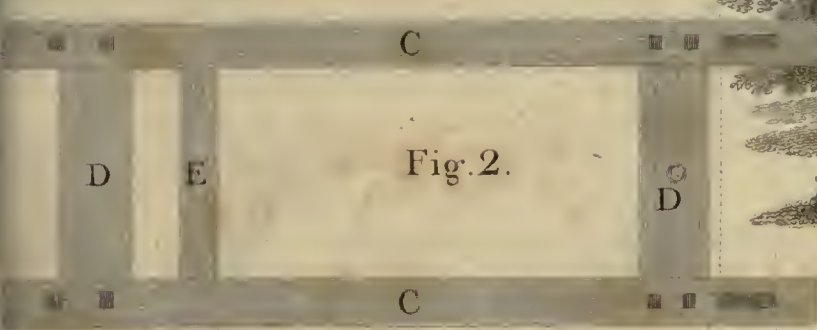


Fig. 2.



Fig. 5.

Drawn by W. Brand Esq.

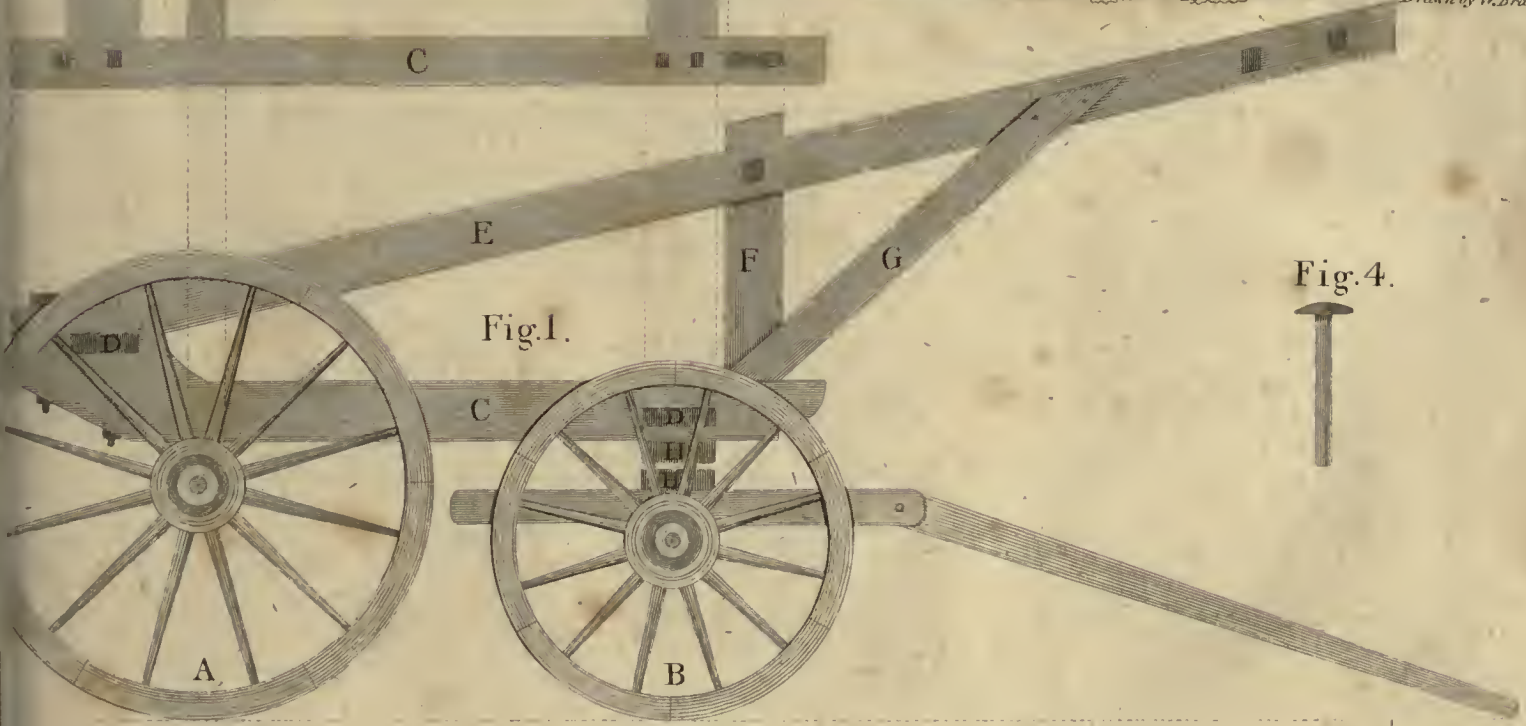


Fig. 1.

Fig. 4.





On the Use of the Tree Transplanter.

by Fig. 5. Balance the tree on the machine as nicely as possible, then make it fast to the iron bars, or bolts H and G, and the hindmost wooden bar D, taking care to surround the tree well with straw where it rests upon the bars and bolts, to prevent the bark from being galled.

PULL the whole down together gently by the rope H, let three or four men, and a horse if necessary, at the rope I steady the motion downwards, at the same time let a man or two guide the waggon bolt into the fore-carriage, into which put the horses, and then transport the tree to the pit, which will by this time be ready to receive it.

DRAW the waggon up along that side of the pit on which the top soil was laid, run it back, &c. until you get it in such a position, that by rearing the machine and tree upright, (as when loaded) the root with its ball of earth may drop exactly into the centre of the pit amongst the puddle, which will so run into all the cavities of the ball of earth hanging to the root, as to surround every fibre. Fill the pit completely up, and raise a mound of earth about a foot higher than the surface, all round the tree, two or three feet distant from the centre, observing to hollow it towards the tree, for the easier reception and retention of moisture. The tree will then be able to defy the rudest assaults of the wind, even at first planting, without any other support. Proceed in the same manner until the whole of the trees are planted, and the design finished.

DISSERTATION VII.

On the Construction of a *Scuffle*.

PLATE V.
Fig. 1.

PLATE V. Fig. 1. Is a profile of the scuffle with its appendages.

A A. represent the wheels on which it is carried from one field to another, and by which the depth of working is regulated. These wheels turn round upon their axles, and also upon the under end of the upright shank, in imitation of bed castors.

B. represents the middle beam, to which the horses are fixed.

C. the side beams.

D D D. the shank of the shares fixed in the beams by nuts and screws. They are fifteen inches long below the beams, made of iron; one inch and a half, by half an inch square.

E E E. the shares riveted on their shanks.

F. the handle for managing the machine, about four feet three inches long.

Fig. 2.

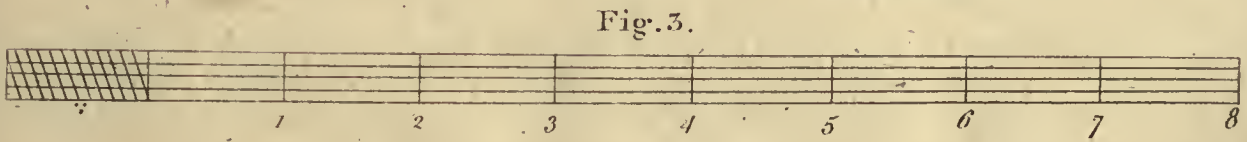
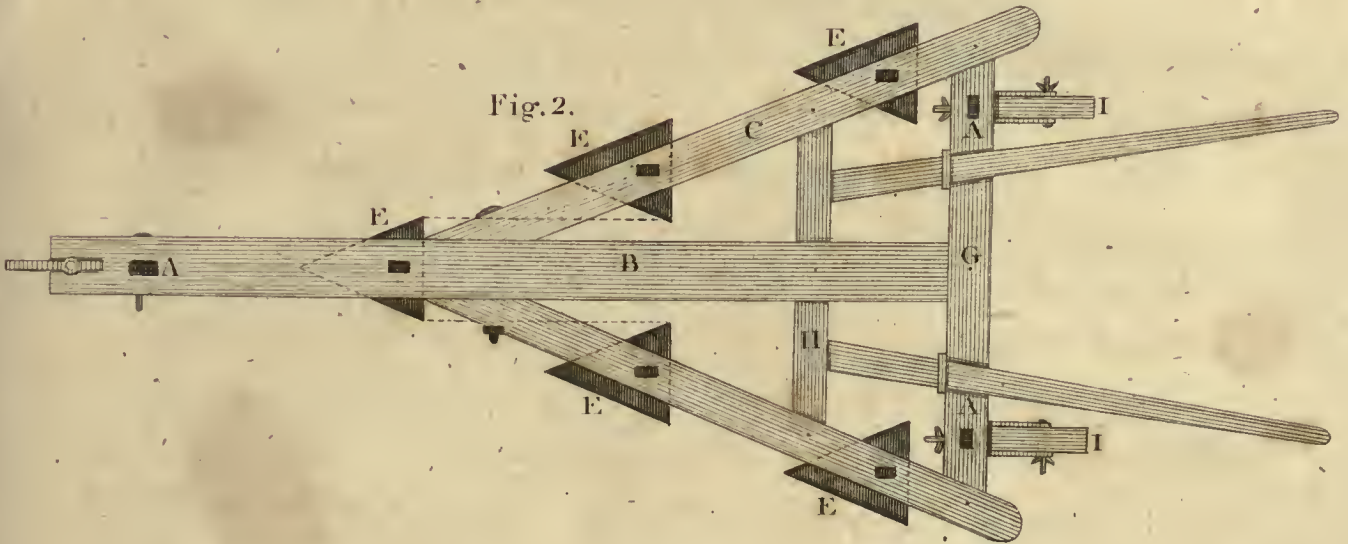
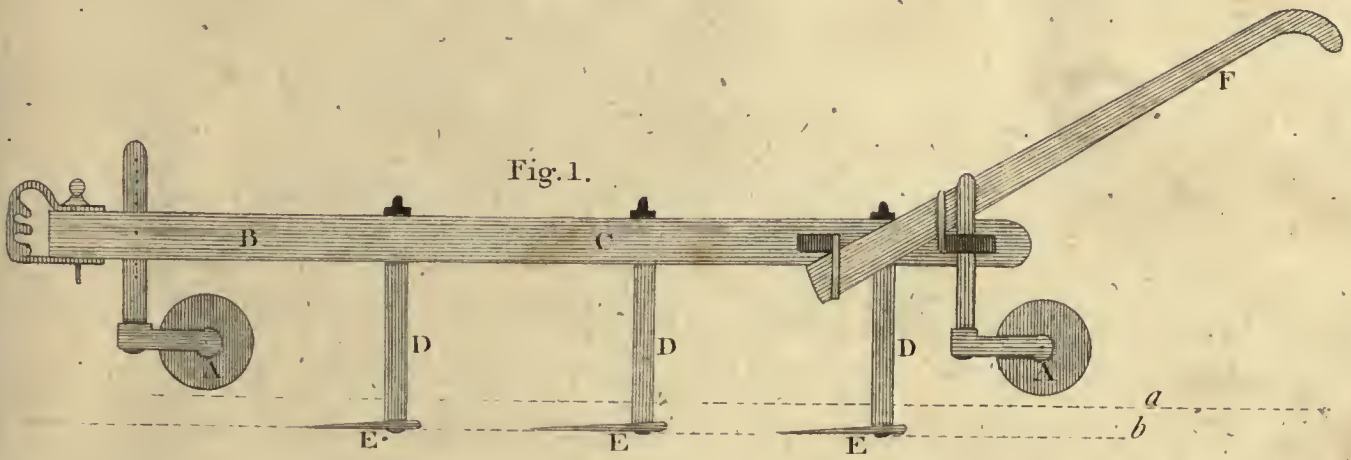
FIG. 2 is a horizontal view of the scuffle.

A A A. represent the mortise holes that receive the shanks of the wheels.

B. the middle beam, about six feet nine inches long, and five by four inches square

C C. the two side beams, which are about five feet long and four inches square.

E E E E E. are five shares in the form of an isosceles triangle, the hind side of which is nine inches long, and the other two sides are each twelve inches; so disposed as to cut forty-five inches clear.





On the Use of the Scuffle.

F F. the handles which govern the machine.

G. a bar, four inches square, for bracing the machine together, and for receiving the shanks of the hind wheels.

H. another bar, three by one inch square.

I I. the hind wheels, ten inches diameter.

FIG. 3. is a scale of feet, inches, and quarters of an inch, from which the whole has been laid down.

Fig. 3.

On the Use of the Scuffle.

THE use of this scuffle is of considerable importance in agriculture. It is excellent in cleaning beans or peas stubble, previous to their being sown with wheat. It is also very useful in destroying weeds upon fallows, where ploughing might be injurious, either from the land being too moist, or very light.

No instrument is better adapted for cleaning land that has been sown with garden peas, previous to its being ploughed, harrowed, rolled, and drilled with turnip or rape seed in the latter end of July, or beginning of August.

ONE man, with two horses, scuffles about six or eight acres per day. After the land has been scuffled, it should be harrowed twice or thrice, and the weeds collected in heaps and burnt.

On the Construction of a Couch Grass Drag.

DISSERTATION VIII.

On the Construction of a *Couch Grass Drag*.

PLATE VI.
Fig. 1.

PLATE VI. Fig. 1. Is a profile of the couch grass drag with its appendages.

A A. represent the wheels on which it is carried from one field to another, and by which the depth of working is regulated. These wheels, which are ten inches diameter, turn round upon their axles, and also upon the under end of the upright shank, in imitation of bed castors.

WHEN the machine is to be used, the wheels are taken out of their present situation and reversed, and the machine turned upside down. Then it is ready for travelling any where.

B. represents the middle beam, to which the horses are fixed, &c.

C C C C C. represent the coulter's fixed in the beams by nuts and screws. They are thirteen inches long below the beams, made of iron, one inch and a half by half an inch square, inclining forwards in the form of a segment of a circle, for the purpose of lifting up the roots of the couch grass to the surface.

E. the handle for managing the machine, about four feet three inches long.

Fig. 2.

FIG. 2. Is a horizontal view of the couch grass drag.

Λ A A. represent the mortise holes that receive the shanks of the wheels.

B. the middle beam, about six feet eight inches long, and five by four inches square, with a coulters hole near B.

C C. two side beams, which are about six feet nine inches long; and five by four inches square.

IN these beams are fixed five coulter's in each, at six inches distance, right

On the Use of the Couch Grass Drag.

and left from one another, so that the coulters drag every six inches, as per figure. The coulters must be plated with iron on both sides.

D. a bar, three by one inch square, for bracing the middle part of the machine together.

E. an iron bolt, which fixes the fore part of the side beams C C, to the middle beam B.

F F. the handles which govern the machine.

G. the hind bar, four inches square, for bracing the three beams together, and for receiving the shanks of the hind wheels.

H. another bar, three by one inch square; between these two bars the handles are placed, by means of square staples, as per figure, and are put in and taken out at pleasure.

I I. the hind wheels, ten inches diameter.

FIG. 3. Is a scale of feet, inches, and quarters of an inch, from which the whole has been laid down.

Fig. 3.

FIG. 4. Is a front view of one of the coulters, the full length before it is bent to its proper form, which is eighteen inches long below the part that goes into the beam.

Fig. 4.

On the Use of the Couch Grass Drag.

THIS machine is of vast importance in cleaning land infested with couch grass, as it tears up the couch grass to the surface, without ploughing the land, or breaking the roots, and it can with two men and four horses, drag fifteen acres in one day.

On the Use of the Couch Grass Drag.

WHEN all the couch grass is collected by the operation of the common harrow, after the second ploughing has been given, then is the time for using this machine.

DRAG the land the length way of the ridges, then harrow it once or twice, at the same time collect the couch grass into rows as much as possible with the harrows; roll the land, and then gather the couch grass into heaps by the couch grass rake, (hereafter described) and burn it.

IF the land is very full of couch grass, it may be proper to drag it across then harrow and roll as before, and afterwards gather the couch grass into heaps again by the rake, and burn it.

PLOUGH the land the third time, and if any more couch grass turns up, harrow, drag, roll, and rake it once or twice, before the fourth ploughing.

IF the coulter gather much of the couch grass, they should be cleaned occasionally.

IN cleaning the coulter, one man lifts up the side of the drag by one of the handles, while the other man knocks the couch grass off the coulter with the other handle.

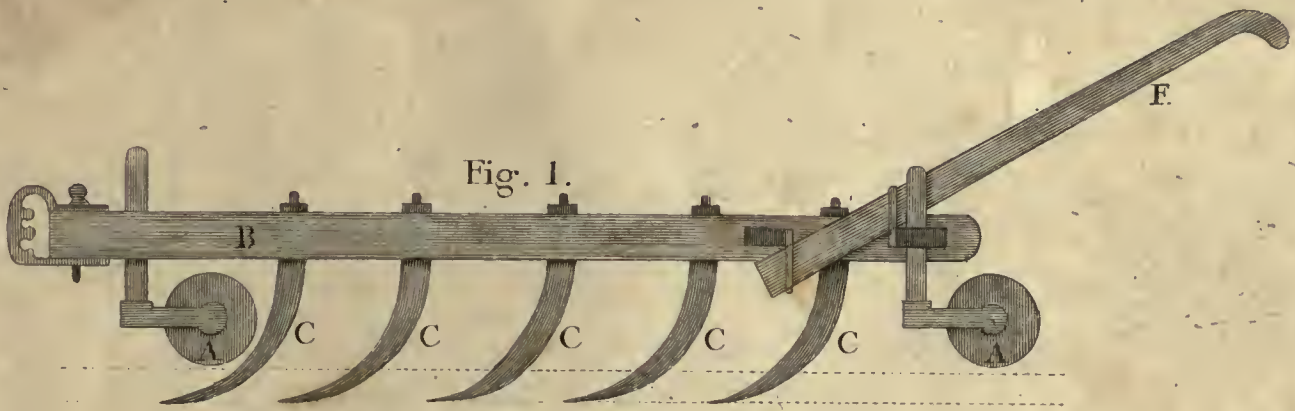


Fig. 1.

Fig. 4.

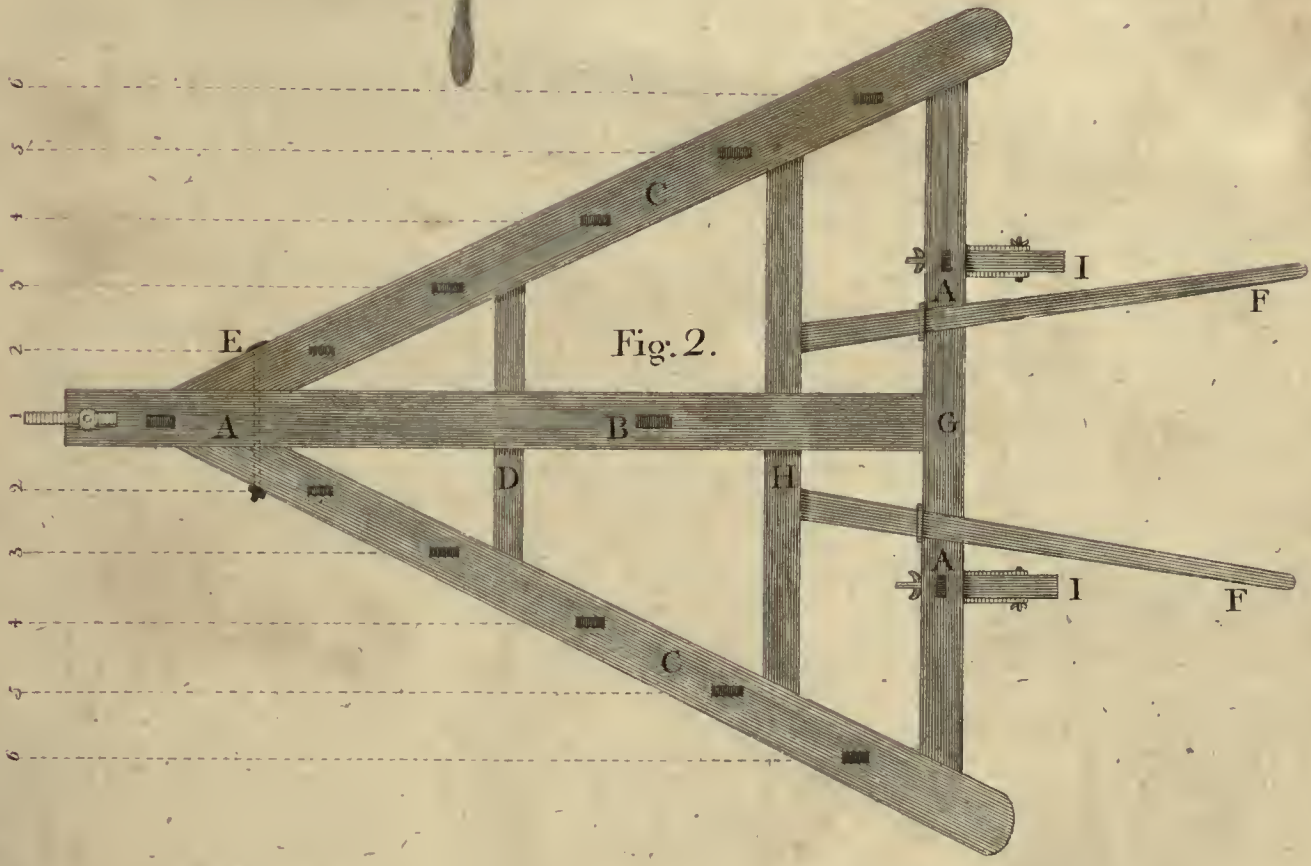
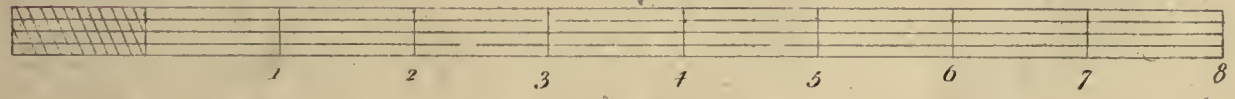


Fig. 2.

Fig. 3.





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DISSERTATION IX.

On the Construction of a Couch Grass Rake.

PLATE VII. Fig. 1. Is a profile of the whole machine with its appendages.

PLATE
VII.
Fig. 1.

A. the land wheel, thirty-two inches diameter, which turns on an iron arm, one inch and a quarter diameter, fixed on the end of the wooden axletree B. in the same manner as those of coaches, &c.

THE nave of this wheel is seven inches diameter at the thickest part, and eight inches long; the felloes are two by three inches square, and the spokes in proportion.

B. is a section of the wooden axletree, exactly the length of the distance between the two wheels, (viz.) forty-eight inches, and is five inches square. Upon the ends of this axletree are fixed two iron arms, upon which the land wheels move.

C is a profile of a part of the right hand shaft of the machine, mortised into the axle-tree, where it is about three by three inches and a half square, and is in length about eight feet.

D. is a section of the rake head, four by three inches and a half square.

E. is a profile of one of the rake teeth, which is eighteen inches long below the wood, and one by three-eighths of an inch square next the wood, tapering towards the point.

F. is the regulating wheel, ten inches diameter, and which can be so adjusted that the rake teeth may be set to any depth.

G. is a profile of the right side handle, which is fixed to the rake head, with

On the Construction of a Couch Grass Rake.

staples, as per figure. These handles are three feet four inches long, and three by two inches square.

H. is a profile of the forked iron bar, by which the rake head is fixed to the axletree by two bolts.

I. an iron bolt or hook, hooked like an L, on which the forked iron bar H. hangs.

Fig. 2.

FIG 2. Is a horizontal view of the machine.

A A. the land wheels.

B. the axletree, four feet long.

C C. the shafts.

D. the rake head, six feet six inches long, in which are fixed seventeen teeth at four inches distance from centre to centre, as per figure.

F F. the regulating wheels, fixed in the outer mortises in the rake head, and made fast by a screw at the ends of it, which presses upon the shank of the wheel.

G G. the handles by which the rake is lifted up and cleaned.

H H. the forked iron bars which hang on the hooks I I, and fixed in the rake head, as per figure.

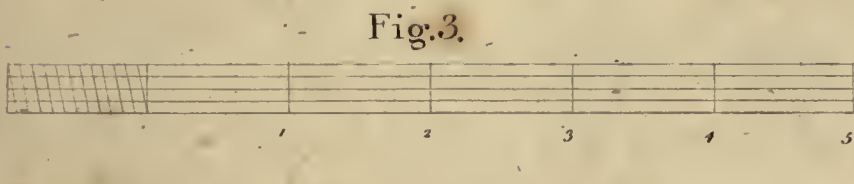
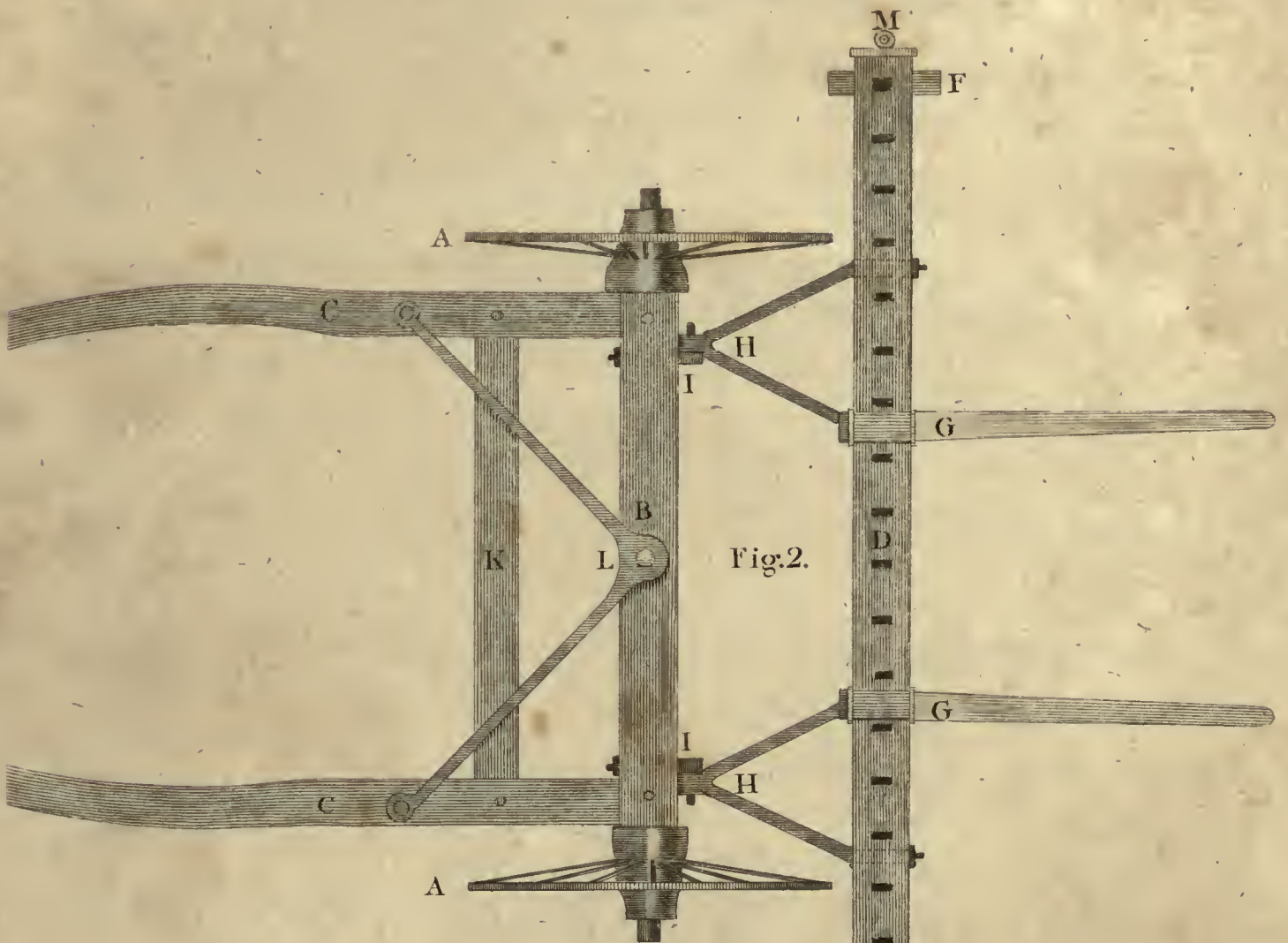
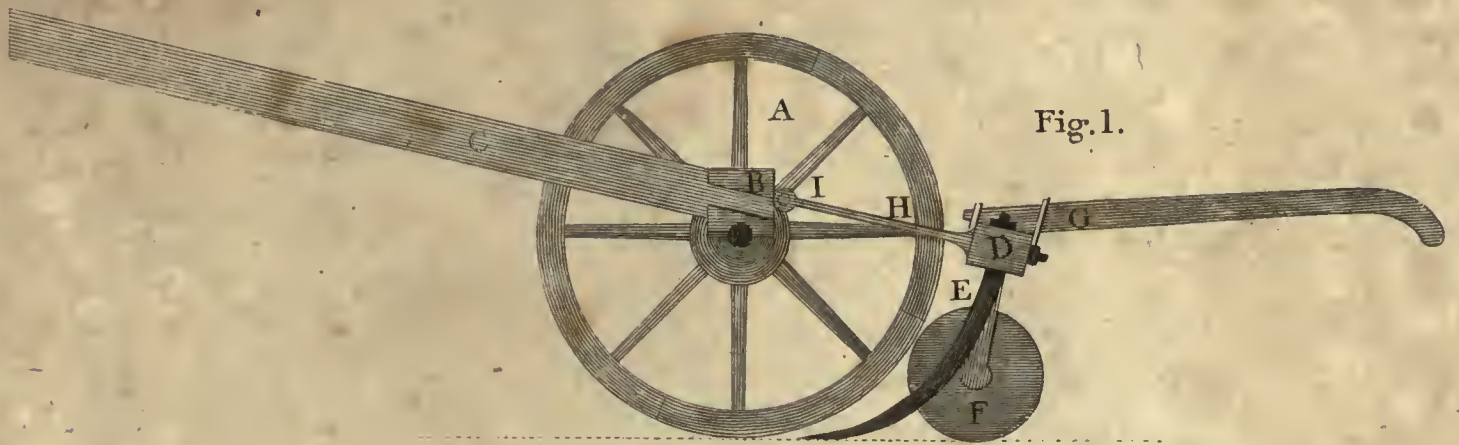
I I. iron hooks fixed in the axletree, as per figure.

K. a wooden bar, four feet long, and four by two inches square, for bracing the shafts together.

L. two iron arms for bracing the shafts more completely, and made fast to the axletree and shafts with iron bolts, as per figure.

M M. two pins for fixing the wheels at any depth.

WHEN the machine is travelling from one place to another, the rake head is reared upright and made fast to the brace K.





On the Use of the Couch Grass Rake.

COUCH grass is one of the worst of weeds among corn, and one of the most difficult to extirpate in arable land; as every joint of the root throws out a number of stems.

THE usual method of destroying couch grass, is by fallowing the land, harrowing and rolling it well, and then gathering the couch grass by hand, into heaps, and burning it; which is not only very tedious but expensive. But by the use of this machine and the *couch grass drag*, the labour and expense is very much reduced.

BETWEEN the second and third ploughings, is the most proper time to begin the operations of cleaning the land of couch grass.

THE first thing to be done is, to make the land fine by rolling and harrowing, then to leave the land under the impression of the roller, in order to level the surface, and to press down the clods out of the way of the rake.

THE next thing to be done, is to rake the land the cross way of the ridges, and when the rake has gathered as much of the couch grass as it can hold without losing any of it, the man must lift up the handles so high as to permit the couch grass to fall off from the rake teeth; the horse then going forward, he drops the rake just beyond the row thus gathered together. This he repeats as often as the rake is full, till he reaches the side of the field. He then turns, and, coming back by the side of the part raked, empties the rake adjoining to the first row. By this means the couch grass lies in straight rows the length way of the lands. When the field is finished this way, or before, the rows must then be collected into heaps, forked over to lighten the couch grass, and then burnt.

On the Use of the Couch Grass Rake.

IF the land is still full of couch grass within the surface, it must be first drag harrowed, then harrowed twice or thrice, rolled and raked a second time.

Plough the land the third time, and after it has laid two or three weeks to ameliorate; then harrow, roll, and rake the third time.

IF any more couch grass remains, the land must be dragged, harrowed, rolled, raked, forked a fourth time as before, and the couch grass burnt. These operations must be repeated until the couch grass is either got clean out of the land, or is killed by the drought.

THIS rake may also be advantageously employed in raking the hay upon meadow ground, into windrows, to be ready for putting into cock.



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