INDUSTRY
OF THE RHINE

SERIES I

AGRICULTURE

[1846]

SERIES II

MANUFACTURES

[1848]

BY

THOMAS C. BANFIELD

REPRINTS OF ECONOMIC CLASSICS

AUGUSTUS M. KELLEY · PUBLISHERS
NEW YORK 1969

Series I: AGRICULTURE First Published 1846
(London: Charles Knight & Co., *Ludgate Street*, 1846)

Series II: MANUFACTURES First Published 1848
(London: C. Cox, *12 King William Street, Strand*, 1848)

Reprinted 1969 by
AUGUSTUS M. KELLEY · PUBLISHERS
New York New York 10001

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S B N 678 00568 0
L C N 68 55470

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Printed in the United States of America
by Sentry Press, New York, N. Y. 10019

INDUSTRY OF THE RHINE.

SERIES I.

AGRICULTURE:

EMBRACING A VIEW OF

THE SOCIAL CONDITION OF THE RURAL POPULATION OF THAT DISTRICT.

BY T. C. BANFIELD.

LONDON:
CHARLES KNIGHT & CO., LUDGATE STREET.

1846.

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CHAPTER VII.

We suppose the traveller to have fixed his head-quarters at Remagen or Sinzig as convenient spots for excursions into the valley of the Ahr and the volcanic region of the Eifel. If he crosses the Rhine with a descending steamer to Königswinter at the foot of the Drachenfels, he finds himself in a volcanic region, apparently a continuation of the chain on the opposite side, and known by the name of the Seven Hills. The summit of one of these is crowned by a former convent, now a substantial farm-house, with a considerable establishment. But we do not know anything very remarkable to attract the inquiring agriculturist up the steep ascent to the Petersberg, unless he have plenty of time to devote to the gratification of his curiosity.

If he will follow us in an excursion into the back country, taking the road from Bonn to Siegburg and Altenkirchen, there is not a little to be seen and learnt that he will find well worthy of attention. At Siegburg we reach the hills that bound the level valley of the Lower Rhine, and which grow steeper and more tortuous in proportion as we follow the road leading northwards. All the hills are covered with wood, but for the most part present a very different aspect from the stately plantations of the Upper Ardennes. From Altenkirchen to Wissen-on-the-Sieg the country becomes more romantic as we proceed, and at Wissen a wild valley, shut in by

wooded heights, offering a great variety of mountain scenery, at the bottom of which the river Sieg rolls its rapid waters, forms a striking contrast both to the broad valley of the Rhine and the narrow glens of the Ardennes in its immediate vicinity. Here the elevation of the ground and the circumstance of our being on the north side of the Westerwald, and consequently in a district exposed to cold winds, with the slope of the hills quite unfavourable for radiation of heat, forbid the cultivation of the vine, and render corn-crops precarious and scanty. The stranger is however at no loss to explain the number and good appearance of the villages through which he passes, for the heaps of earth on the mountain side and the open entrances to galleries carried from low points into the hill-side, remind him at every turn that he is traversing a mining district. In the districts of Sayn and Siegen, that long were cut off from all easy traffic with the Rhine for want of good roads, a remarkable spirit of industry and an ingenuity worthy of admiration has been displayed by the inhabitants that must surprise all to whom the circumstances of these districts are not known. There is perhaps no district in Europe of which a minute history for the last three centuries would be more useful and more entertaining. But the people have been acting and not reasoning, and although the age has in many respects run away from them, yet they have a right to claim for past times an interesting position very much in advance of their contemporaries. Both in agriculture and in many branches of manufacture the people of Siegen presented, until very recently, a model for their neighbours. Their agriculture was of course modified by the circumstances of the country, and

their woods have for centuries been managed in a peculiar manner, very well suited to the wants of miners, founders, and steel-manufacturers. The chief source of wealth for the country lies in the sparry iron ore which abounds about Siegen. The system of foresting practised at Siegen is founded upon the principle of obtaining the greatest possible yield of wood suited for charcoal-burning, combined with the best crop of bark, an article that latterly has very much improved in price. It is well known that of late years the greatest production both of charcoal and of bark for tanning has been ascertained to be derived from young trees and branches, and the forest system of Siegen turns both to the best account.

The woods lie everywhere on the hills, which are steep and often rise to the height of 1000 feet above the Sieg, being intersected with narrow valleys and glens, to which the Sieg serves as a drain. A large portion of the wood-land between Altenkirchen and Wissen belongs to the crown, and on these tracts timber is more frequently found than in the woods situated between Wissen and Siegen, and which are the property of parishes, or of companies formed by individuals. The system of cultivation adopted is a rotation of sixteen, eighteen, or twenty years, the brushwood having at that age attained its best size and strength for charcoal, and, when the stock is oak, the bark yielding at those periods its greatest profit. The woods of this last-named description form a curious illustration of the spirit of association, which is a characteristic trait in the German character, united with all the peculiarities that spring from the kind of education which the peasant works out for himself in the spirit of mistrust

that we have before noticed. The origin of many of these corporations, or rather joint-stock companies, that own woods in the neighbourhood of Siegen, goes back to remote periods. Money was furnished by the forefathers of the present holders, or of those from whom the present owners acquired the property, for the purchase and planting of the land, and the shares are still calculated in the name of the coin current at that early period, but which is now represented by a much higher value. An albus of the sixteenth century is the usual share, which then was worth one-eightieth of a dollar, and is now represented by fifty to eighty dollars. In every wood thus belonging to shareholders in common there are good and bad situations. When the period for felling arrives the wood is mathematically divided by lines drawn, if possible, evenly through good and bad sites. Sometimes, where there is a projecting angle, all the lines run out to a point. The portions are numbered, and lots decide the parties to which they respectively fall. The felling then takes place, but not by contract or by persons employed for the purpose. Every peasant takes his lot and cuts, barks, binds, and carries home what it yields at his convenience. He is, however, bound to take his share away before the peculiar cultivation resorted to on the bared ground commences. The roots of the trees are left standing in the ground to throw out shoots, which, in twenty years, are to replace the underwood of which it has been cleared. Between these the surface of the soil is pared off a few inches deep, and the sods are collected into heaps and burnt. The ashes are strewed upon the ground and lightly ploughed with a

remarkably-shaped plough, light enough to be managed upon steeps often presenting an angle of 50° to 60°. Oxen are generally used for this work, and rye is the grain that experience shows to thrive best in these cleared thickets. The paring, burning, ploughing, and sowing are again performed by each owner on his own lot. Nothing is common amongst the proprietors but the resolution to follow a peculiar system of cultivation, and the general property in the soil, which is periodically divided in the manner we have described. The year after the rye is harvested the ground is left in repose, and in the following or fourth year the whole ground is covered with broom (*genista*). This curious crop is cut close to the ground in the autumn, and does not re-appear until the fourth year after the cutting of the wood—that is to say, until twenty or eighteen years after it has been gathered in, according to the term of years which the wood is allowed to stand. The peasants use the broom for thatching roofs and the weather-side of their houses. The poorer people make it serve in their stables for litter for cows and horses—the thick stems serving for fuel. After the broom, grass appears in some abundance; and the cattle of the proprietors, where the wood is private property, or of the village, where the wood belongs to one, are driven to graze among the young trees. Many foresters are of opinion that this practice is injurious to the young shoots: the peasants maintain that their gain from the grazing exceeds their loss in the wood-crop. It is probable that the broom is kept down by the cows nibbling at the young shrub. The yield from a morgen of "hauberg," as these woods

are termed, has been stated to us on good authority * to be as follows:—

	£	s.	d.
A crop of rye, 12 bushels to the acre .	2	2	6
Ditto broom	0	10	0
Grazing, 10 years			
Wood for charcoal, 608 cub. ft. per morgen (in charcoal)	2	12	6
Bark, at 1 ton per morgen . . .	2	12	6
	£7	17	6

It is probable that the grazing in the "hauberg" brings in no gain to the peasants, who lose their dung that would otherwise accumulate in their yards, besides the loss of milk that ensues from driving the cows up the hill to these indifferent pastures. The whole sum divided by seventeen, the number of years in the rotation, gives 9*s.* 3*d.* per annum, as the return drawn from mountain land too steep for the plough, and situated under a very inclement climate.

The manner in which charcoal is burnt in the woods of Siegen is the following:—A plot of ground of a circular form is prepared by removing all stones from the surface, and making it perfectly level. The bottom is stamped hard, and if not raised by the accumulation of charcoal dust from former burnings, must have a ditch drawn round it to carry off water. In the centre is fixed an upright stake, round which the wood, split into pieces of three inches or little more in diameter, is piled on end. The wood is chosen as equal in sizes as possible, and is placed piece by piece in the round, the longer pieces 10 to 12 feet high in the centre, and the shorter gradually

* Vorländer, quoted by Schenk in his 'Statistics of Siegen.'

diminishing towards the outside until the mass assumes the shape of a flat cone.

An inner covering of moss and turf is laid over the heap, and is again covered with clay sifted to free it from stones. In this outer covering 12 to 14 holes are made after it has been stamped till it hardens. The stake in the centre is then drawn out and fire laid upon the top, the gradual progress of which is anxiously watched by the coal-burner, who opens or stops up the air-holes according to the direction and strength of the wind, that the whole may burn evenly and thoroughly. When all is burnt out, the earthy covering is loosened at bottom, and peels off the heap easily. The coals are spread out, and those not thoroughly burnt separated from the rest, which are carried as soon as they cool to the place where they are to be used.

From 2½ klafters, or 221 Prussian cubic feet of beech wood, or from 10 one-horse loads of underwood, a "wagen" of charcoal of 2500 lbs. weight or 194¼ cubic feet of charcoal is obtained, the price of which is now about 25 dollars, or 3*l.* 15*s.* The royal forests of Siegen furnish 3000 wagens yearly. The village and private woods yield something more than 2000 wagens. On 130,000 morgens of forest-land, this shews 2½ morgens to the wagen of charcoal annually, or a return of 13 dollars, including labour.

Although the good effects of the German village-system in fostering a spirit of association, and of accustoming men of small means to an independent management of their shares in the common property, may be traced in every German village, yet they are nowhere so conspicuous as in Siegen and some of the adjacent districts.

The peasants, besides the large village properties, are almost all share-holders in the forest companies that we have described. They are besides nearly all miners, and hold shares frequently in one or two iron foundries. In winter the mines are worked and charcoal is burnt for the following "campaign" at the blast-furnace. In consequence of this arrangement, which leaves them time in the spring and autumn to attend to their meadows, while the short summer is devoted to field tillage, the year is filled up in a manner suited to the habits, and which formerly was equally subservient to the interests, of the villagers. They were long in possession of a monopoly of great value—the production of steel, for which their iron is particularly well suited. The temptation that greater countries and more highly educated men have not been able to resist of shaping the market to their pleasure was too strong to be resisted by the villagers, the artisans, and even the Princes of Siegen (then a branch of the House of Nassau); and an apparently well calculated plan was laid, by which the foundries and steel-works bound themselves not to work more than a certain number of days in the year. The valuable product they furnished was thus not allowed to overstock the market, and charcoal and ore were kept at a moderate price, and were mostly worked up by the owners of the mines and woods.

The result has been that which infallibly results from all such attempts to restrict the flow of industry for the benefit of a few. The scarcity of iron in Germany obliged the neighbouring states to look elsewhere for supplies. Sweden was found to abound in ores of the best quality, and to be especially rich in the peculiar

kind of ore that was required for making steel. Trade had scarcely taken this turn in the direction of the Baltic from France and England, when the French invasion and subsequent Continental blockade cut off all remains of direct communication between England, the greatest market, and the interior of Germany. After the war not only was the very name of this once celebrated and still rich district lost to the great trading stream in the West of Europe; but the improvements effected by English steel-manufacturers enabled them, in spite of enormous duties, to send steel of superior quality to Siegen itself, where it is now sold at every dealer's shop, and of course is preferred by cutlers and other artisans.

On the cession of this district to Prussia after the war, the productions of the mines and foundries, instead of increasing in value, were every year less and less sought. It was suggested by some thinking heads, that as all the modes of restriction devisable had been tried without success, it would be well to try the effect of setting the trade in metals and charcoal free. The export of ore, which had long been prohibited even in the neighbouring circles, was allowed without much opposition on the part of the founders who could not work up their ores. Still, although large establishments immediately sprang up on the borders, which were worked by coke brought from the river Ruhr, the founders and steel-workers have not yet given up the restrictions on production, which they still look upon as a kind of privilege. The government does not urge them, as they alone are interested in the matter, and experience has shown that the present system brings no gain. The wood-owners of Siegen have thus, by a plan adopted as a specimen of perfect wisdom while all lay in

their power that could give them a command of the market, voluntarily placed themselves in the position which we have seen the German farmers for the most part occupy. Each has his own supply of wood, which seems to be of little value, because if he does not work it up himself, his neighbours being also supplied, would not take it off his hands. No third party can interfere, for by the charter of restriction (if such an absurd, although true, title may be allowed), no new foundries may be established within the district, nor may the old ones extend their period of working. It is singular that the obvious fact should escape their notice, that the competition of other countries makes it impossible that iron should permanently rise in price, whereas competition amongst iron-masters and steel-workers would infallibly raise the price of charcoal. Who, however, that has once strayed into the delusive labyrinth of restrictions ever found a simple path out of its toils?

The village system, therefore, much as it favours popular discussion, and consequently offers the surest means of protecting individual interest, is no infallible safeguard against error. The diffusion of knowledge through the means of newspapers and periodicals, is not so rapid as to pervade the widely extended class that in Germany is directly interested in the solution of difficult economical questions. In the present state of things the individuals who follow the fluctuations of the market prices possess an advantage over their simpler neighbours which gives them opportunities of gain, their address in using which is still looked upon with an invidious feeling by those who are less successful, and who not unfrequently find themselves outwitted. The cleverness of the more in-

telligent is however limited to speculation on a very small scale, and nowhere is the true trading principle of drawing a small, but sure, profit from undertakings on an extended scale acknowledged as the golden rule in Germany.

The remedy for the present state of things in Siegen is now thought to be in the construction of a railroad, connecting this mining country with the coal district on the Ruhr. The notion of any gain resulting from regulating the price of fuel by artificial means will be dispelled when this is effected, and all may return to a wholesome state of active production.

A singular contrast is presented in another branch of industry, for which Siegen has long been justly celebrated, and which, although it is impossible to protect it by restrictions, yet forms a pursuit that the people of Siegen are passionately fond of. It is not improbable that the art of laying down and managing irrigated meadows was introduced by some of the artisans who taught the people the mode of making steel. The origin of both arts points to Italy, and it is likely that some prince of Nassau, who was more than a mere Condottiere, brought them with him as the best trophy of some successful campaign in the fertile plains of Lombardy. Brescia was as probably the parent-seat of one of these arts, as Como or Lodi may have been the school in which the other was learnt. History is silent as to the original introduction of irrigation, which until lately was peculiar in Germany to the district of Siegen. The climate there is anything but a sunny one. From the sixteenth century, however, there exist laws and regulations respecting the rights of the owners of water-courses intended to fertilize

meadows, which evince that the care of the government at that early period embraced this great agricultural improvement.

At present not only the whole of the valley of the Upper Sieg, but all the side vales and glens that issue into it, have their bottoms carpeted with beautiful verdure, affording the owners a rich crop, and (after the outlay for laying down has been made) with an inexpensive mode of cultivation. To drain these glens for the purpose of extracting any other crop from their chilled soils would be attended with enormous expense. By simply adopting the oriental plan of letting the water run over the surface, the most productive crops of grass are obtained. The same principle applied in Holland has furnished that country with a rich and never-failing revenue derived from dairy produce, which no art could extract from the rich but humid soil in any other shape. Nor is the traveller left in doubt as to the natural or artificial origin of these meadows on the banks of the Sieg. The greensward is everywhere intersected by innumerable canals, the broadest of which forming the water-courses vary from three to five feet. These catch the water of the river or of its tributary brooks at the highest possible level, and carry it along the hill-side, or over an elevated bed through the centre of the meadow. Out of this are led the small cuts, nine inches deep, and nine to twelve inches broad, which carry the portion allotted to each bed in the required direction. Bed is the proper term here, and not field ; for although the absence of fences gives to a whole valley the appearance of belonging to one proprietor, yet it is not easy to imagine a more minute division of the soil, and more exclusive proprie-

tory rights and obligations than such a valley contains. A similar spirit of association on the one side, combined with tenacious adherence to private property on the other, which the "Hauberg" showed us, is presented in these water-meadows. A similar want of economy in labour may also be traced in their management; but as the return from the meadow is a better one, the loss is not of much consequence.

The meadow regulations, whose origin is lost in the obscurity of time, are stringent as far as they go, although doubtful in their nature, that is to say, partaking of both a judicial and voluntary character. Every parish or commune, called in German "Gemeinde," has its meadow-overseer! like its wood-ranger; both being peasants chosen by their fellow villagers for their experience and tact in these various occupations, and receiving a moderate salary for their trouble. Their duty is to see that every one performs his due share of the common obligation, and that the water-rights are not infringed by the rival interests of the hammers and mills that are driven by the same streams. In the autumn, generally in November, the canals are laid dry to be cleaned out. Every proprietor must clean the portion passing through or skirting his meadow, and dispose of the refuse extracted as well as he can. If he neglects to perform his part he is subject to a fine, which is levied daily until the work is done. The whole valley may then be seen filled with small mounds of clay, running in straight lines in every direction. A few days afterwards these disappear, being carried in different directions to improve the level or to regulate the slope of the surface. This is the period when changes are made in the watering and in the draining canals, and an amateur seldom lets the year go round without making some such change as the result of observation or of restless fancy.

Whoever has watched this annually repeated cultivation, and followed the care with which the owners study their little properties to find out the nature of the soil, and choose the disposition best suited to the position with regard to the sun and the wind, will be convinced that a perfect system of water-meadowing must be a work of time and of great care and observation. He will, however, be persuaded, by observing the value of the crops obtained without the aid of manure from a large extent of poor land under a severe climate, that no time should be lost in adopting this mode of treating meadows wherever circumstances make it practicable. The Duke of Portland and the Duke of Marlborough have, we believe, recently adopted irrigation on a large scale in England, where at least as much land may easily be watered as has of late years been drained, and unquestionably with a no less profitable result. Although the manure obtained from towns is of the greatest value in increasing the yield of meadows, yet it is important to make the fact known, that simple water, unaccompanied by the wash of floods, or by any extraneous matter, promotes the growth of grass on meadows in a remarkable manner. The meadows of Siegen allow the peasants to give all their dung to the arable land, which, in its cold bleak situation on the sides of the hills, would, on other terms, not be worth cultivating. The whole agricultural plan of this district thus combines whatever can be of use to a half-manufacturing population, by demanding little labour and producing chiefly

what assists the miner, or serves as fodder for beasts of burthen.

The water-meadows are now systematically laid down in three different manners according to the slope the ground commands, and the abundance or scarcity of water. The engineers are usually the peasants of the neighbourhood, who by practice have acquired great skill. The surveying instruments may be seen in their houses in all the villages, and the precision with which their levels are taken and the flow of water promoted is not a little surprising. The three modes consist in terraced beds, and in broad and narrow beds with an elevated ridge in the middle. The following are the directions given by the Oberförster Vorländer. The chief canal should be carried as high above the level of the meadow to be irrigated as possible. Where circumstances do not favour the laying down of the canal at a sufficient elevation, and the soil is too soft to allow of the construction of a high dam without great expense, the level of the meadow may be lowered sufficiently to answer the purpose. It must be kept in mind, that by constant watering the level of the meadow is raised in time, for the soil swells in consequence of the accumulation of roots and the addition of particles of humus, as well as from the depth to which vegetation is promoted. When the surface reaches the level of the water-course from which it is irrigated, it becomes necessary to break up the meadow and to lower its surface.

The mode adopted either to alter the level or to regulate the unequal surface of a meadow, is not to plough up the ground and crop it with corn or potatoes, although one would expect to obtain rich returns, especially of

oats, from a lay of 16 or 20 years' standing. The sods on the surface are pared off with a peculiar kind of narrow spade (Fig. 6, p. 139) 2 feet 2½ inches deep. Strips are previously cut in the surface with the axe, and the strips when rolled up are carried on a stick passed through the middle of the roll. One man usually marks the strips, two pare them from the surface, and a fourth rolls them up. These rolls are recommended in the place of square or oblong cuttings; amongst other advantages they insure a sufficient quantity of sod to cover the field when it is levelled. If the turf be cut off in small pieces, the quantity often proves somewhat deficient. The beginning is generally made with those parts of the meadow which being highest have the greatest quantity of ground to spare, and with those which are hollow and require filling up. The turf being removed the ground below is dug up and carried from the one to the other. Care is, however, taken by good meadowers not to carry away the soil that lies immediately under the turf-paring. Of this a portion is reserved to form the bed on which the turf is to be relaid. The ground transferred from one place to another is taken from the subsoil, unless the good ground be very deep. When the level of the whole meadow has to be lowered, the stuff taken from the subsoil that becomes useless must be carted and thrown away.

Where the surface, at a sufficient depth under the chief water-course, still offers a fall of $\frac{1}{30}$th of the length of the meadow, and there is plenty of water, the meadow is laid down in what at Siegen is called the terrace-mode of irrigation (Hangbau).

If the slope is less and there are marshy spots the meadow is laid down with narrow ridges.

Broad ridges are used where water is not abundant at all times, and the ground free from marshy spots, but commanding little fall. Where these peculiarities of site and command of water are observed, the yield of a water-meadow on an average is the same in all three systems of laying down. The first cut is made about Midsummer, and on good soils gives 3 tons of excellent hay to the morgen, or 4½ tons to the acre. The after-grass yields about half as much. On average soils the yield may be estimated for the neighbourhood of Siegen at 3 tons to 3½ tons per acre. With retentive subsoils the meadows yield below the average. It is customary in autumn to drive the cows on the meadows, their weight being supposed useful in treading down the surface, which has a constant tendency to swell and grow over the level of the irrigating canals. These meadows furnish in autumn pasturage, and in summer the cows are driven into the "Hauberg." In the morning and evening some green fodder is given them in the stables. In winter hay, straw, and chaff, mixed up and boiled with potatoes, carrots, or beatroot, form the usual fodder.

Terraced Meadows.

In the meadow that is destined to be laid down on the terrace plan, the water-course being carried over the highest part, the level of the distributing canal must be marked by a stake driven near the centre. Another stake driven at the lowest extremity of the field must mark the level of the draining conduit—the terraced meadow being supposed to have a breadth of 6 Prussian roods of 10 feet, and is divided into 4 beds each 1½ rood in breadth. The channels, laid parallel to the distributing

channel, are supplied with water from the distributing canal by means of transversal cuttings. It may seem simpler to let the water at once run over the whole surface from the distributing canal; but experience has shown that the richest grass springs nearest to the canals, although the reason why there should be a difference where there is water enough to flood the whole surface is not very apparent. By increasing the number of canals the fertilising principle is more equally distributed, and terraces of 6 roods in length by 1¼ in breadth are found to be the most advantageous size for ensuring the best yield of grass. If the level of the beds be found after a few years' watering to be raised too much, the canals can each be carried a foot or two higher up the slope, the old cuttings being closed and covered with the turf taken out of the new ones.

The sluice cuttings in the dam of the upper water-course are 5 inches wide, and their bottom is sloped, being at the upper end 6 inches higher than the level of the chief water-course. The irrigating canals are 5 inches broad and 4 inches deep. The transversal cuttings are of the same dimensions.

Irrigation by means of narrow Ridges.

In a meadow irrigated on the system of narrow ridges, the water-course, with the sluice-cuttings through its dam, are the same as in the terraced meadows. The distributing canal is kept horizontal, and is 1½ foot broad and 5 inches deep. The meadow is measured and divided into equal portions, the best size for which is between 15 and 25 feet. Each bed or ridge is supposed to have a

breadth of 20 feet, so that each slope has a breadth of 10 feet. The ridges are 60 feet in length. Stakes are driven at the openings of the transversal cuts, which are levelled, and the draining conduit must then be marked out and stakes fixed at the points. The fall does not exceed 1 foot in a length of 63 feet. With the aid of the last stakes parallel cuttings are made in a transversal direction from the draining conduit in the direction of the distributing channel, but stopping at some distance short of the latter. The bottom of these cuttings is sloped, being 5 inches higher than the level of the draining conduit. The cuttings divide the ridges and serve as drains. Between them the ground is raised in the middle so as to slope towards each draining canal, the upper part of the ridge being kept high enough to carry an irrigating canal which takes the water at the level of the distributing canal, and carries it with a slope of 5 inches to the draining canal. When this canal is full and overflows, the water runs into the lower cutting, and thence into the lower drain, in the bottom of which there is also a slope of 6 inches.

At the lower end of every ridge the surface presents the appearance of a triangle.

Irrigation with broad Ridges.

In a meadow laid down near Keppel with broad ridges, the water in the brook that supplies the main canal is scanty in summer, and is applied to turning the wheels of some steel-works. The main canal is 4 feet broad, 1½ foot deep, and has a fall at bottom of ¼ inch in soft. The dam is 3 feet broad, and the sluiced cuttings

through it are each 1 foot broad. The horizontal distributing canal is 2 feet broad and ½ foot deep. The ridge-cuttings that issue from it are 90 feet long; at the mouth they are 1½ foot, and 1 foot broad, with a depth of 5 inches. The width of each ridge is 60 feet, consequently each bed or slope is 30 feet broad.

In order to diminish the size of the intervals between the cuttings transversal canals are carried across the beds.

The drain-cuttings have a fall at the surface of only 3 inches, but at bottom of 5 inches, being 4 inches deep and 8 inches broad, and 6 inches deep and 1 foot broad. In this meadow the chief drain serves as a distributing canal for a meadow situated below and adjacent to it.

In a meadow laid out by M. Vorlünder in such a manner as to combine the terrace plan applied to the more elevated part with the narrow ridge system, the drain canals serve as distributing canals for the meadows situated below them. In a large meadow near Keppel, by a skilful adoption of the various modes of laying down the surface, the same water is carried over eight different plots of land in succession.

The instruments principally used at Siegen by the meadow-owners are—

Fig. 1, A, an axe of peculiar construction for making a sharp perpendicular cut in the turf either for raising sods or for cutting canals. The point at the back of the blade is intended to balance it and to give weight and precision to the cut. The edge is of steel and is ground sharp. The price of the axe is one dollar, or three shillings.

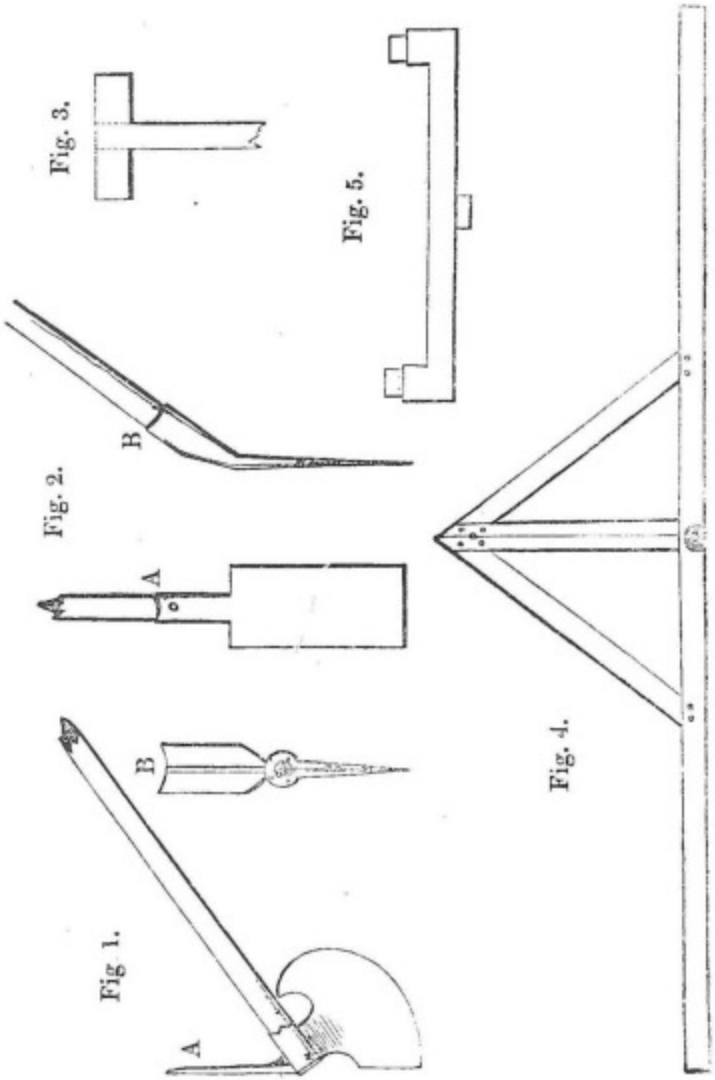
Fig. 2 is a narrow spade bent at the angle, shown in Fig. 2, B, to the handle. With this the grass is cut under the roots when sods are to be raised, and it serves to transport the soil or rubbish, as may be required, from one spot to another. The bottoms of the canals are levelled with this instrument.

Fig. 3 is a board nailed at right angles to a pole, and is used in levelling the surface and the bottoms of the canals. Three of these sight-boards are requisite.

Fig. 5 is a tube of tin, the ends of which are raised at right angles. At the top of these raised ends continuation tubes of glass are affixed, that allow the play of the water, with which the tube is filled, to be seen. The contrivance is intended to save expense in the glass, of which material the whole tube may be made. When fixed upon a pole by means of the socket this instrument shows the level of the surface.

Fig. 4 is a common plumb on a long board. It is used for ascertaining the level at short distances.

The proper time for cleaning out the ditches and canals is late in the autumn, when the cattle are no longer driven to the meadows. A day is fixed by the overseer of the meadows by which all the canals have to be cleaned out under a certain penalty. Then it is that the principal watering for the year takes place. If there has been heavy rain and the irrigating brooks are muddy, the water is not let on to the meadows until it begins to get clear. Too great a sediment fills up the canals and leaves unequal deposits on the surface that mar the labours of the meadow-owner. In the autumn no fear is entertained of the meadows being overwatered. The great point sought to



be accomplished is that the flow of the water shall everywhere be perceptible, and that none remains stagnant in any part. In the beginning of winter, when the frost sets in, the water is kept off the land. If the weather is open and rain falls, the water may be turned on again.

Spring is the season that demands the farmer's care. In mild rainy weather the irrigation may be continued; but after floods, as in the autumn, the water must be allowed to settle. When the sun grows powerful the irrigation must cease altogether. In March and April a little moistening is allowable; but in these and the following months the water may only be spread during the night. In the middle of June occasional night-watering does good, but none is let on for four weeks previous to the hay harvest.

The practice of cutting late in order that the grass may sow itself is common in the district of Siegen, and differs very much from the Italian plan, according to which the grass is cut when it attains its full length without its being allowed to ripen. The colour of the hay at Siegen is not good, and it is not greedily eaten by horses. The ripening of the seed must also exhaust the land.

As the water-meadows are not manured, all the dung of the stables is appropriated to the arable and garden land, which is usually small in extent; but of a cold meagre nature, and very unproductive. The fields lie on slopes sufficiently level to retain the soil in heavy rains, but too high to be watered. The decomposed clay slate, of which the hills are mostly composed and which forms the upper soil, is void of all mixture of limestone, and none is to be had at any convenient distance for manuring. Crops are consequently poor, and corn has to be purchased to eke out the year's consumption. The humid climate and severe winters operating on so weak a soil, make it necessary to cover the winter seed with dung in order to quicken and protect it. But the only dung in this district is that of oxen, or at best horse-dung mixed with that of horned cattle, and there is little warmth in it to impart to the soil.

The general use of oxen or of cows for draught cattle upon the banks of the Rhine is recommended, as we have seen, by the necessity for dung not likely to overheat the ground under a scorching summer sun. In these colder parts the ox is still an indispensable inmate of the stable, but for another reason.

Mining and forest work are fully as much the business of the peasants as agriculture in the level land. They are, however, carried on upon the hills, which are on all sides pierced by countless mines. Many of these lie on heights of considerable elevation, or in back valleys from the Sieg, the access to which is steep and difficult. As the ascent is commonly effected with an empty car on two wheels, the draught is not oppressive for oxen. To descend the worn-out roads towards the villages or the high road is not so easy a task, and here the ox is invaluable as a servant. They may be seen guiding with their foreheads under their yokes, the weight of ore intrusted to them, and while the deep ruts in the road act as a drag to the car, the animal's own weight adds resistance to its pressure; and loads varying from 12 cwt. to 20 cwt. are thus securely brought down with a speed, not equal to horse draught on roads well laid down, but which is all that can be accomplished with the present ones.

A macadamized road has opened the romantic valley of the Sieg since 1840, and along this line cartage is gradually being transferred from oxen to horses. The habits of the agriculturists, however, do not change so rapidly as mechanical improvements advance at the present day; and the roads to the mines being in their ancient condition, oxen are likely for some to predominate. The small miners occasionally use their milch cows for draught, as is the case all over Germany.

In the year 1837, the official returns showed for the circle of Siegen, a stock of cattle on the German square mile (20¾ English square miles), amounting to 30 horses; 1276 horned cattle; 624 sheep; 113 goats; 325 pigs.

The population in the same year having numbered 3440 on the German square mile, the number of horned cattle was nearly one for every two inhabitants, which will serve to show how great the proportion of draught oxen must have been. The circumstances of the country prevent it having any thing remarkable in arable agriculture to interest the practical farmer. Every slope in the winding valleys yields a different return, and rye, oats, and potatoes of poor quality, and scanty in quantity, repay the peasant badly for the time he abstracts from other occupations to apply to their cultivation. More than 10 to 12 bushels of rye per acre cannot be calculated upon as return from the "Hauberg," and 3 sheffes of potatoes from the Prussian "ruthe," or 150 bushels to the acre is considered a good crop of this root. Turnips are constantly sown in the oat stubbles, although the damp of the autumn and the early frost at night prevent their attaining even a moderate size. Flax is cultivated to

some extent in some of the valleys near Siegen, where hand-loom weaving is the employment of many of the peasants. The poor earnings obtained for this work have recently induced those who could do so to seek other occupations.