

58.5

C

521

Charged at

Soa. CUTAWAY HARROW CO.

Oct. 16, 22

The Soil

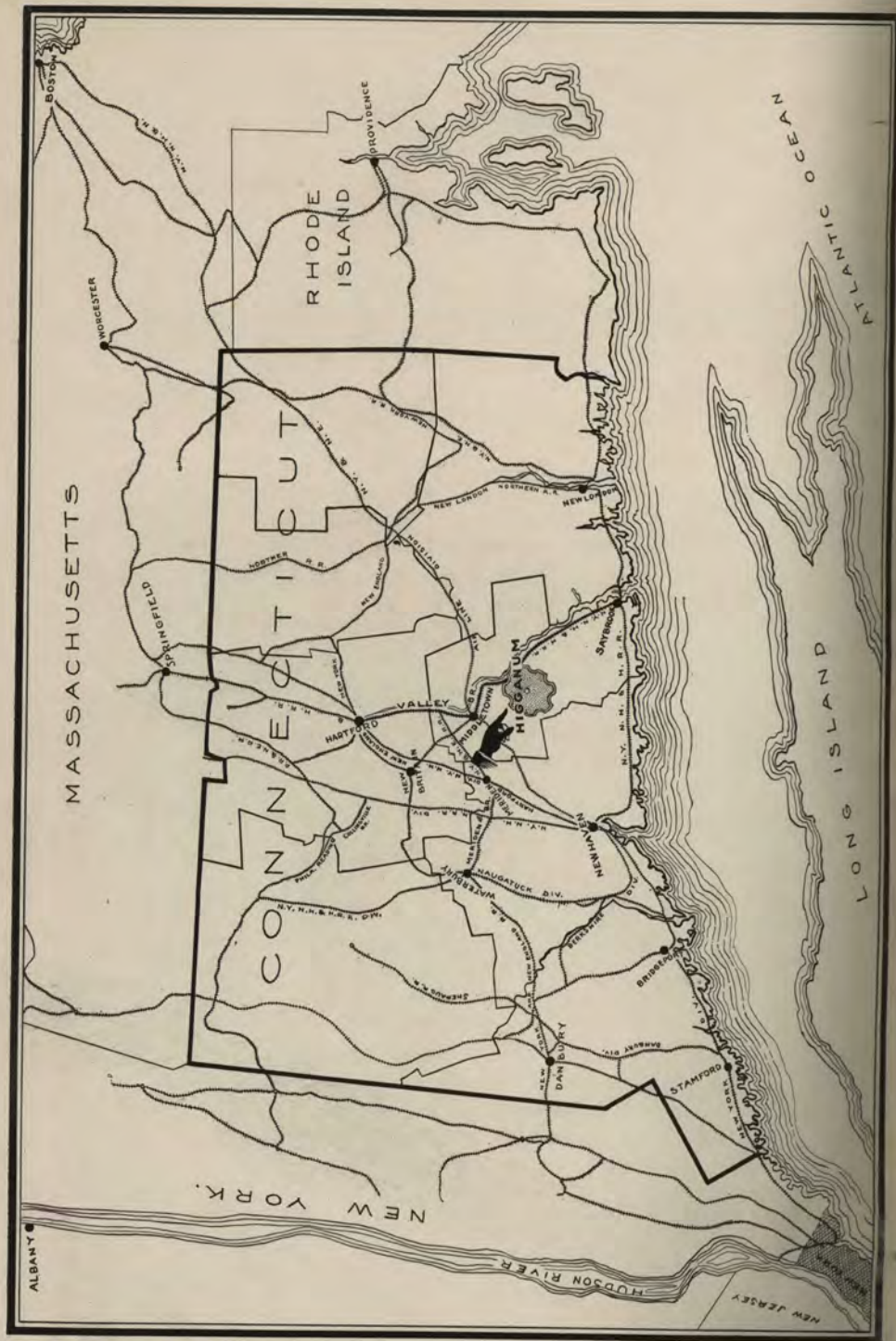


AND

Intensive Tillage



LCC



CONTENTS

	PAGE
Map showing location of Higganum.....	2
Photograph of Mr. Clark.....	4
Biographical sketch of Mr. Clark.....	5
Cutaway Double Action Engine Harrow at Work.....	6
Foreword.....	7
Photomicrographs, contrasting internal structure of forged and unfor- ged disks.....	8
Cutaway Forged-edge Disks—an article by Professor G. B. Upton.....	9
Illustration of Machine Parts.....	10
In Which We Were First.....	11
Cutaway Rigid Main Frame.....	11
Steel Heads and Wood Heads.....	11
"Cutaway" Disks and "Solid" Disks.....	11
Cutaway Hardwood Journals.....	11
Cutaway Double Action Engine Harrows—illustrated.....	12
Cutaway Double Action Engine Harrows—described.....	13
Cutaway Double Action Harrows—Regular—illustrated.....	14
Cutaway Double Action Harrows—Regular—described.....	15
Cutaway Double Action Harrows—Extension Head—illustrated.....	16
Cutaway Double Action Harrows—Extension Head—described.....	17
Cutaway Single Action Harrows—Regular—illustrated.....	18
Cutaway Single Action Harrows—Regular—described.....	19
Cutaway Single Action Harrows—Extension Head—illustrated.....	20
Cutaway Single Action Harrows—Extension Head—described.....	21
Cutaway Bush and Bog Plow—illustrated.....	22
Cutaway Bush and Bog Plow—described.....	23
Cutaway Corn and Cotton Harrow—illustrated and described.....	24
Cutaway Ever Handy Harrow—illustrated and described.....	25
Cutaway Grove Harrow—illustrated and described.....	25
Cutaway Smoothing Harrow—illustrated and described.....	26
Cutaway Tongue Truck—illustrated and described.....	26
Cutaway Baby Cultivator—illustrated and described.....	27
Cutaway Grass Hoe—illustrated and described.....	27
Cutaway Reversible Sulky Disk Plow—illustrated.....	28
Cutaway Reversible Sulky Disk Plow—described.....	29
Cutaway Right Lap Plows—With or Without Seeder Attachment—illustrated.....	30
Cutaway Right Lap Plows—With or Without Seeder Attachment—described.....	31
Cutaway California Orchard Plow—illustrated.....	32
Cutaway California Orchard Plow—described.....	33
Farmers' Favorite Cider Mills and Presses—illustrated and described.....	34
Clark's Samson Tobacco Press—illustrated and described.....	35
Clark's Root Cutter—illustrated and described.....	35
Cutaway Steel Heads—illustrated and described.....	36
Cutaway Solid Disks—illustrated and described.....	37
The Soil; an article.....	38
Feeding Plants; an article.....	42
Intensive Tillage; an article.....	43
From Forest to Cornfield in a Single Season; an article by H. O. Daniels.....	46



Inventor of the Cutaway Implements and
Founder of The Cutaway Harrow Company

June 11, 1833—March 2, 1908

“WHAT I WILL TO DO I CAN DO.” That was the motto by which the late **GEORGE MARSHALL CLARK** worked and lived. His life was one of great activity, compelled by a relentless energy directed by a forceful mind.

When he was twelve years old his father died. This made it necessary for him to quit the district school and assist his elder brother, Thomas J., in supporting the family. At the age of seventeen, after serving an apprenticeship of seventeen months at blacksmithing, he made his first trip South, where he got a job as common laborer in a Georgia sawmill. One day the main shaft in the mill broke, putting the entire outfit out of commission. Under any other circumstances this would have necessitated a long shut-down and heavy loss. But, with his characteristic energy, **MR. CLARK** jumped at the job of repairing the shaft and soon had the broken parts welded and the mill buzzing again. His resourcefulness on that occasion secured for him a contract to build three steam sawmills. These were erected and sawing 400,000 feet of lumber daily within five months. He was still under 18 years of age.

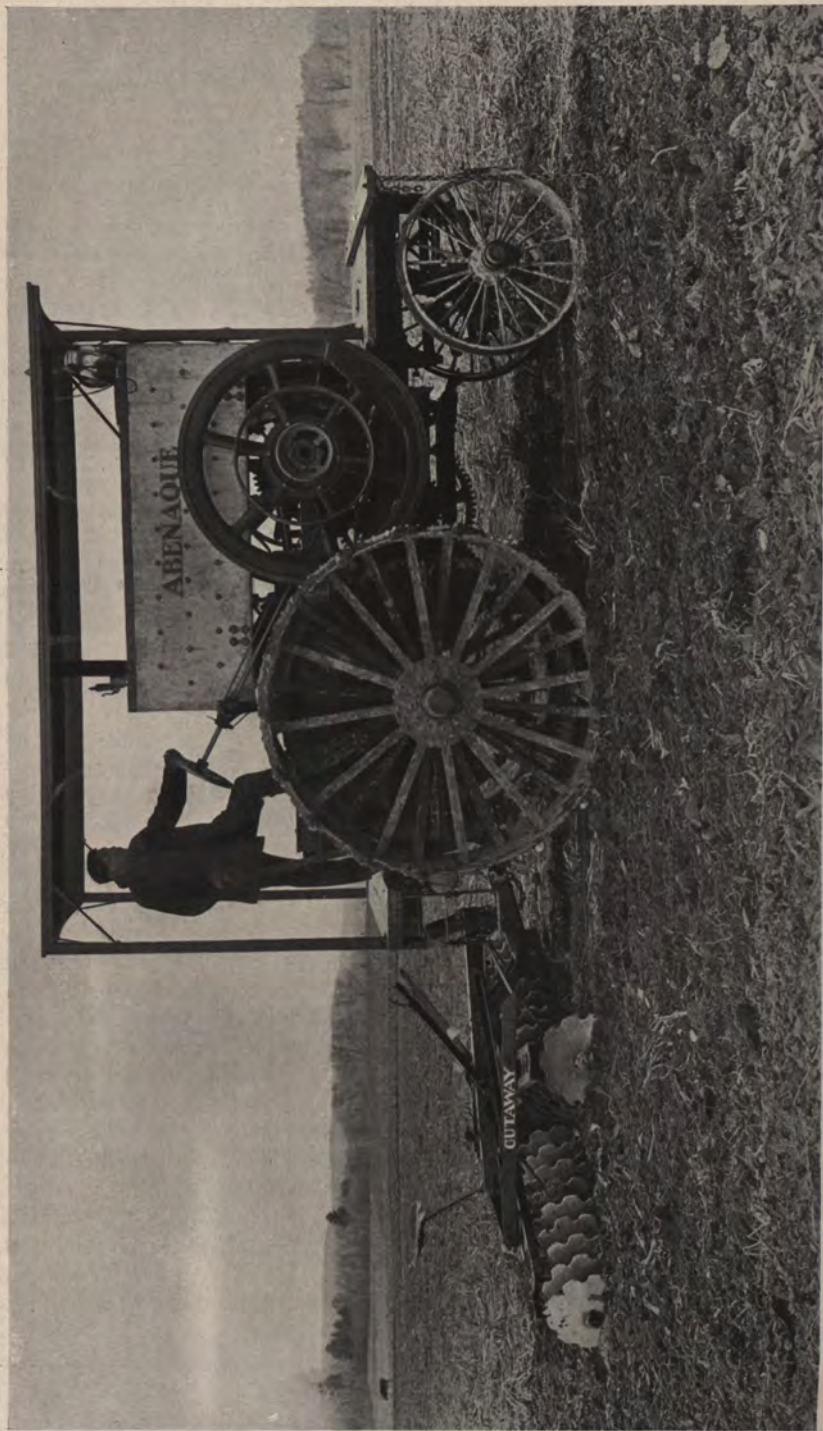
Following his mill-building experience, **MR. CLARK** worked at ship-building in the winter time and house carpentering in the summer. He worked all the way between Bangor, Maine, and New Orleans, Louisiana. This he continued until the fall of 1859, when he entered the employ of a Meriden (Connecticut) cutlery firm as a journeyman carpenter at a dollar and seventy-five cents a day. However, it was only a few days when the head man recognized the ability of his new employee, and in a short time **MR. CLARK** was made foreman over all the outside men, at a salary of ten dollars a day.

After seven years with the Meriden concern **MR. CLARK**, with his brother, Thomas, began to lay definite plans for a factory in which to manufacture agricultural implements after the designs **MR. CLARK** had long been working on. In the fall of 1867 the two brothers began the erection of their factory in Higganum, a village in the town of Haddam, Middlesex County, Conn., where **MR. CLARK** was born.

Throughout **MR. CLARK**'s entire manufacturing career he carried on experiments in scientific cultivation. He was the foremost exponent of intensive tillage. He preached the gospel of better cultivation from one end of the land to the other, and he became known the country over as the “Grass King.” This distinction was won by the wonderful yields of hay he secured from his own meadows. It is estimated that he removed sixteen thousand tons of stone and rocks from a sixteen-acre field and, after his method of intensive tillage, grew one hundred tons of hay from that field annually.

MR. CLARK was constantly at work on the solutions to our tillage problems. The origin of his inventions was his visions of implements that would do more thorough cultivation and produce larger crops. They were created in the mind of a man who demanded the highest possible degree of perfection.

MR. CLARK served as a member of the town committee for forty-six years, and held many public offices. He served five terms in the Connecticut legislature—three in the House and two in the Senate. He was chairman of many important committees. He was also a member of the constitutional convention held in Hartford in 1902. **MR. CLARK**'s life work ended at the door of his office on March 2nd, 1908.



Cutaway Double Action Engine Harrow at work. The disks on this machine are 20-inch. Note the depth to which they are running.

Foreword

THIS BOOK, "THE SOIL AND INTENSIVE TILLAGE," is written with one aim in view—namely, to assist in bringing the farmer to realize the importance of *intensive tillage*. We hope to cause him to practice more scientific cultivation, more intense cultivation, and thereby harvest larger crops, larger reward.

To accomplish this end, we use two direct means: One by which we show the *why* of intensive tillage; another by which we show the *how*. Each is essential to the other. Therefore, we have combined in this book a series of articles on the soil and its tillage, and a catalog of the implements best adapted to intensive cultivation. For the convenience of the reader, we have printed a table of contents on page three. By referring to it, any of the articles or implements may be easily found.

Our purpose is to give a clear understanding of the fundamental principles underlying intensive tillage. We try to do this in the simplest possible manner. It is common knowledge that the more thorough the cultivation the larger the yields. But you may say, "Yes, perhaps that is so; but there is a field which produced 15% more than the field next to it, and it was cultivated less." That may be true. However, bear this in mind: The field that made a large yield with poor cultivation would have made a larger yield with better cultivation; and the field that made a small yield with good cultivation would have made a smaller yield with poor cultivation.

It is our desire to show *why* better tillage makes bigger yields. We believe that when a man knows why certain operations bring certain results, and that those operations will secure those results, he will manage accordingly. So, in the latter half of this book we have sought to shed light on the problems of tillage. We feel certain that when the farmer knows more definitely—more scientifically, if you please—about the workings of the soil, he will be better prepared to appreciate *how* intensive cultivation can be done best.

And as to the *how*, knowledge is like any other kind of power; it is valueless until put to work. An unharnessed river may run for centuries without supplying more than enough power to operate a single gristmill, whereas when its power is properly utilized it lights entire cities, operates large factories and propels heavy trains. The successful farmer is the man who harnesses his knowledge of the soil and things that pertain to it, and uses it as a power to raise bigger crops, accumulate more money and live a pleasanter life.

Through the *why*, as revealed in the articles which appear in the latter part of this book, and the *how*, as explained in the first part, we hope the recipient of "THE SOIL AND INTENSIVE TILLAGE" will obtain such information as will give him power to harvest the full bounties of his fields.

THE CUTAWAY HARROW COMPANY
HIGGANUM, CONNECTICUT

U. S. A.



The above photomicrograph shows the internal structure of disk steel not forged. See article on page 9.



This photomicrograph shows the internal structure of a CUTAWAY forged-edged disk, illustrating what our forging process does to the steel. Note the contrast between this and the upper photomicrograph. Read Prof. Upton's article.

Cutaway Forged-edge Disks

By G. B. Upton

ASSISTANT PROFESSOR EXPERIMENTAL ENGINEERING, CORNELL UNIVERSITY*

THE CUTAWAY HARROW COMPANY submitted to me two specimens of steel from the edges of the disks of a harrow. One specimen had had the edge of the disk sharpened by grinding down; the other had been sharpened by forging down. The steel used was the same for both; the only difference lay in the method of sharpening.

The specimens were polished, etched with acid, and photographed under a microscope. The power used was 200 diameters, so that an area one inch square in the photographs (see page opposite) represents an actual area $1/200$ th of an inch square, or area $1/40000$ th of a square inch, in the steel itself. The spot studied was located at the very edge of the cross section of the disk, as shown by the arrowhead in the adjacent sketch.



In the photomicrographs the black areas are "pearlite"; the white "ferrite." The steel consists of islands of ferrite in a ground mass of pearlite. Ferrite is soft and tough; pearlite is harder and stronger. Both are needed in the disk, for ferrite alone would make too soft a disk, and pearlite alone would be too hard and brittle. The relative amounts of ferrite and pearlite are the same in the two specimens, as should be, since the carbon content of the two is the same.

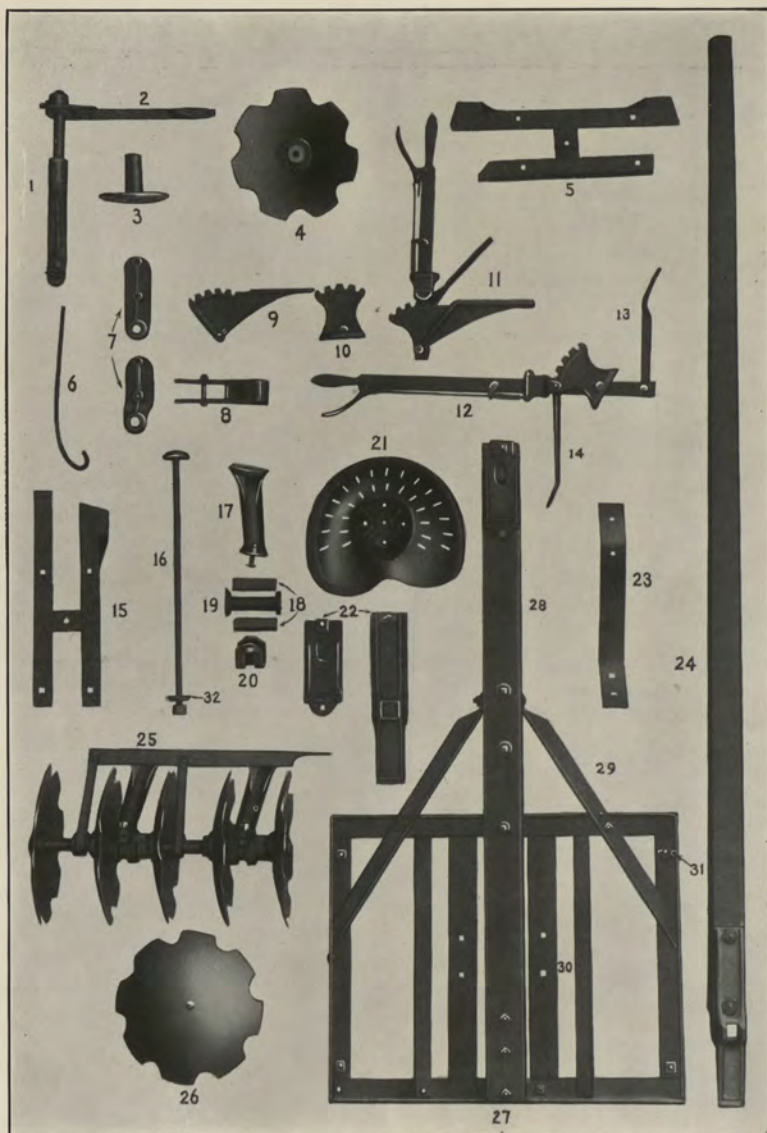
The difference between the two specimens is in the size of the crystal groups, or grain, of the steels. The forged steel has over twice as fine a grain as the ground specimen. Forging (hot working) does more to a steel than merely change its shape; it breaks up the grain of the steel, causing a more uniform distribution and a decrease in the size of the different kinds of crystals which build up the internal structure of the steel.

The refining of the grain by hot working, such as forging, makes a stronger metal as the working progresses. As an example, take the case of drawing out a bar of soft steel into wire—an extreme case of working down to a small size. The following table shows how the strength per square inch of material rises as the size decreases by continued working:

Size, diameter in inches	Strength per sq. inch, pounds
2.0	54,000
1.0	60,000
0.134	90,100
0.072	100,000
0.035	110,000

Now, the forging of the edge of the CUTAWAY harrow disk has just this same effect: it refines the grain and makes a stronger metal—one better able to resist wear or bending of the edge than if the edge were formed by grinding. Grinding would not affect the nature of the metal of the edge; would leave it the same as the inner parts of the disk. Forging makes the steel at the edge better and stronger, therefore, than grinding would do. Judging from the relative grain size of the two pieces the forged edge should be about 20% stronger and stiffer than the ground edge and should outlast it in service.

*Note—This article, written by Professor Upton, is the result of tests made for the purpose of explaining scientifically why CUTAWAY disks give more wear than other disks, why they hold a sharp edge so much longer, and why they stand up under work that would ruin other disks. We think this article fully explains it, and, even though it may be considered technical, we feel certain every user of disk implements can understand it. It will pay you to give this and the page opposite your most careful study.—THE CUTAWAY HARROW COMPANY.



- | | |
|--------------------------------------|--------------------------------|
| 1 Center Disk Fork | 17 Standard |
| 2 Center Disk Spring Lever | 18 Journals |
| 3 Center Disk Fork Socket | 19 Spool |
| 4 Center Disk | 20 Bottom Box |
| 5 Single Action Gang Frame | 21 Seat |
| 6 Clod Breaker | 22 Double Action Pole Castings |
| 7 Tongue Truck Stub Plates | 23 Seat Spring |
| 8 Tongue Truck Hammer Strap Complete | 24 Double Action Tip Pole |
| 9 Single Action Lever Stand | 25 Gang Complete |
| 10 Double Action Lever Stand | 26 Disk |
| 11 Single Action Lever Complete | 27 Rigid Main Frame Complete |
| 12 Double Action Lever Complete | 28 Double Action Stub Pole |
| 13 Front Lever Link | 29 Pole Brace |
| 14 Rear Lever Link | 30 Lever Bar |
| 15 Double Action Gang Frame | 31 King Bolt |
| 16 Axle Complete | 32 Outside End Washer |

The numbers appearing on this page are merely index numbers, and *are not* the numbers of the parts.

THE CUTAWAY HARROW COMPANY

In Which We Were First

WE MADE the first "cutaway" disk. We made the first *reversible* disk harrow. We made the first *extension head* disk harrow. We made the first *double action* disk harrow. We made the first *disk* plow. We made the first *reversible sulky* disk plow. We made the first *disk gang plow* and *seeder combined*. In all of these implements the CUTAWAY is the original. It is the genuine.

Cutaway Rigid Main Frame

WHY DO YOU so often hear other harrows spoken of as "just as good as the CUTAWAY"? Because the CUTAWAY pulverizes the soil more thoroughly and leaves the land in finer tilth than any other harrow. And why does it pulverize the soil so much more thoroughly than other harrows? Because *all four gangs are attached to one rigid main frame*.

The CUTAWAY rigid main frame is absolutely necessary to the greatest success of double action harrows. It is essential that the rear gangs be held firmly and rigidly so that the rear disks must cut every inch of land left by the fore disks. This is exactly what the CUTAWAY rigid main frame does. Every rear disk on a CUTAWAY has just as positive force as any fore disk. There is just as much weight on the rear gangs as on the fore gangs.

Steel Heads and Wood Heads

STEEL HEADS are used exclusively on all CUTAWAY DOUBLE ACTION HARROWS. See pages 12, 14, 16, and part 27 on the page opposite. This steel construction is essential to the rigid main frame—the feature upon which all successful double action harrows depend.

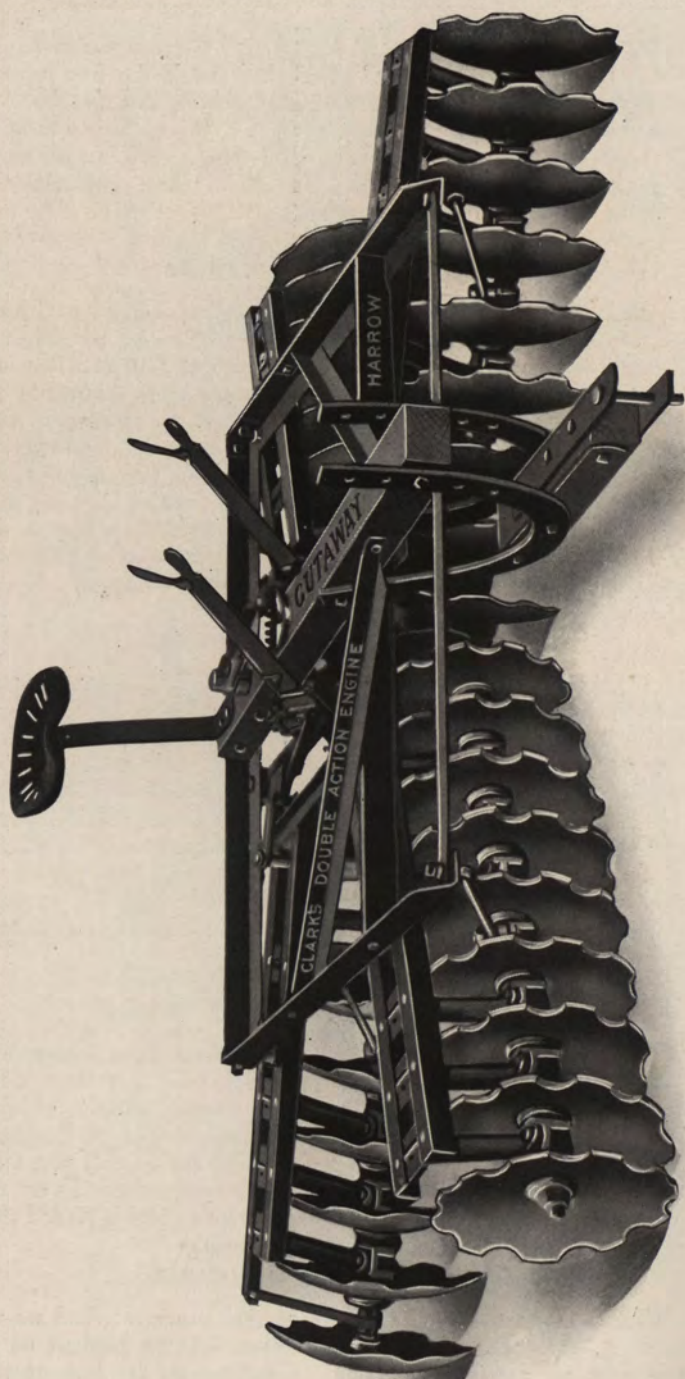
Our single action harrows are made with both wood and steel heads. You will see machines equipped with wood heads on pages 18, 20, and the succeeding pages illustrating the various single action harrows. On page 36 you will find the A-6 CUTAWAY SINGLE ACTION HARROW shown with the steel head. This is the same machine as is shown on page 18, except the difference in the head. The steel heads are made in the same extensions as the wood heads.

"Cutaway" Disks and "Solid" Disks

FOR OVER a quarter century "cutaway" disks have demonstrated their superiority over "solid" disks, with the result that thousands of farmers could not be induced to again use "solid" disks. However, for those who prefer them, we will furnish "solid" instead of "cutaway" disks. The cost and the quality are the same, which means that you are, in either case, getting the best disks put on any disk implement. Every disk, whether "cutaway" or "solid," that goes on a CUTAWAY tool is *forged sharp*.

Cutaway Hardwood Journals

WE WERE the first to use hardwood journal boxings. And we were hooted at, too! But, like in all the other leading features on disk implements, we are today imitated. Our journals are from specially selected hardwood timber. They outwear metal; they give less friction; they are cheaper to replace.



Cutaway Double Action Engine Harrow

Cutaway Double Action Engine Harrows

THE CUTAWAY DOUBLE ACTION ENGINE HARROW was the logical outgrowth of the regular CUTAWAY DOUBLE ACTION, which has long been recognized as the most perfect type of disk harrow ever made. When traction power began to replace horses and mules, users of the horse machine were not willing to abandon the harrow which had done better work for them than any other. The result was that, with the coming of the tractor, came the demand for the CUTAWAY DOUBLE ACTION especially adapted for engine power use. It was in response to this demand that we built the CUTAWAY DOUBLE ACTION ENGINE HARROW. The number of duplicate orders received indicates the success with which this engine harrow invariably meets.

We want you to study the illustration on the opposite page. It is our desire that you learn every detail possible about this machine. If you know it through and through—if you fully appreciate the design, the construction, and the material of the CUTAWAY DOUBLE ACTION ENGINE HARROW—we are certain you will do the thing that serves your own interests best—you will buy a CUTAWAY.

Observe that all four gangs are compactly hung on one rigid main frame. This feature is absolutely necessary in order that the rear disks cut with the same force as the fore disks. Pretty theories may be advanced as far as their exponents wish, but the unalterable fact remains—if you desire the rear disks to cut all the soil left by the fore disks, you must hold them to their position by the rigid main frame. Otherwise, they will follow in the trail of the fore disks.

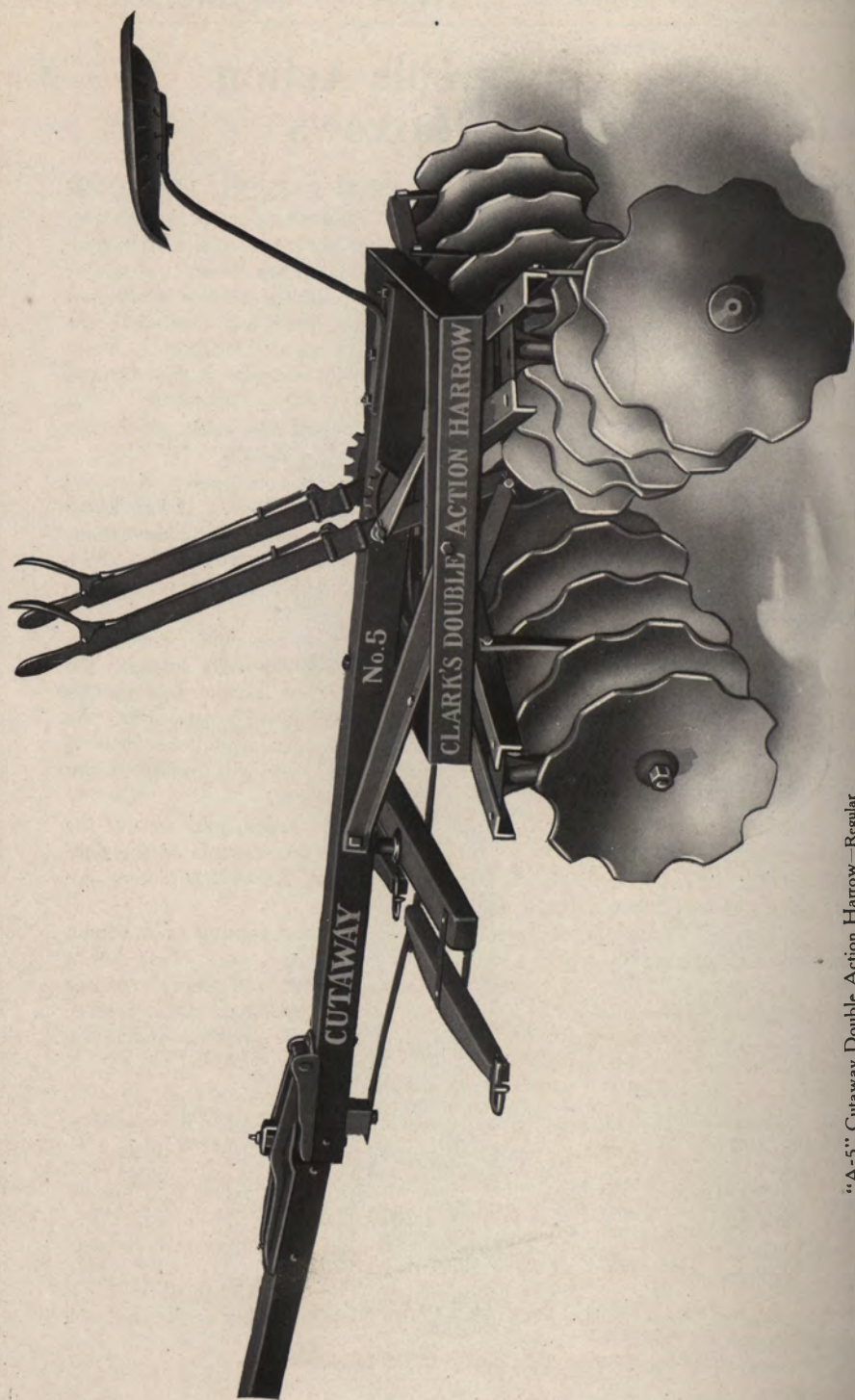
Remember, the CUTAWAY is the original double action, and *we are the only lawful makers of double action harrows built on the principle of one rigid main frame*. All other harrows that approach the CUTAWAY design are imitations or infringements.

In studying the illustration, don't fail to observe the bracing of the main frame, the axle draft rods, the adjustable hitch, and the many other details that make the CUTAWAY absolutely the most efficient and durable engine harrow made. The disks are the famous CLARK, made of cutlery steel, *forged sharp*. The standards are extra "ribbed." The journal boxings are the CLARK oil-soaked hardwood.

No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Shipping Wt.
*X- 6	25	18	7'	1250
X- 7 New No. }	29	18	8'	1360
X- 8 Old No. }				
X- 9 New No. }	37	18	10' 6"	1720
X-10 Old No. }				
X-11 New No. }	45	18	12' 6"	2140
X-12 Old No. }				

The above machines are made also with 20-inch disks (B series). They are furnished with either "cutaway" or "solid" disks.

* "X" means the disks are 18 inches in diameter; "B", 20 inches.



"A-5" Cutaway Double Action Harrow—Regular

THE CUTAWAY HARROW COMPANY

Cutaway Double Action Harrows—Regular

THE CUTAWAY is the machine that made double action harrows famous. It is the original double action, and, like all other good things, it is imitated. These imitations are acknowledgments of its superiority.

If you will study carefully the illustration on the page opposite, you will understand why the CUTAWAY is superior. Observe first that all four gangs are hung on *one rigid main frame*. This is *the first essential* to efficient double action harrows. The CUTAWAY DOUBLE ACTION works every inch of the land, and leaves it level and thoroughly pulverized. Moreover, it works when turning around, so that there are no uncut places left. In turning, the inner lever is pulled clear back. This brings the outer ends of the inner gangs close together, while the outer ends of the outer gangs are spread far apart. When the gangs are in this position the machine naturally takes a turning course.

Unlike any other double action harrow, the CUTAWAY has its weight uniformly distributed on all four gangs. The rear disks work with just as positive force as the fore disks. They are held rigidly to the exact position required to make them cut and turn all of the land left by the fore disks.

The CUTAWAY DOUBLE ACTION possesses every feature that adds efficiency, convenience, adaptability, and economy to a disk harrow. In addition to the fact that it has the rigid main frame—which fact alone makes it pre-eminently the harrow for intensive tillage—it is equipped with the CLARK *forged-edge disks*, CLARK *hardwood journal boxings*, and CUTAWAY *detachable jointed tongue*.

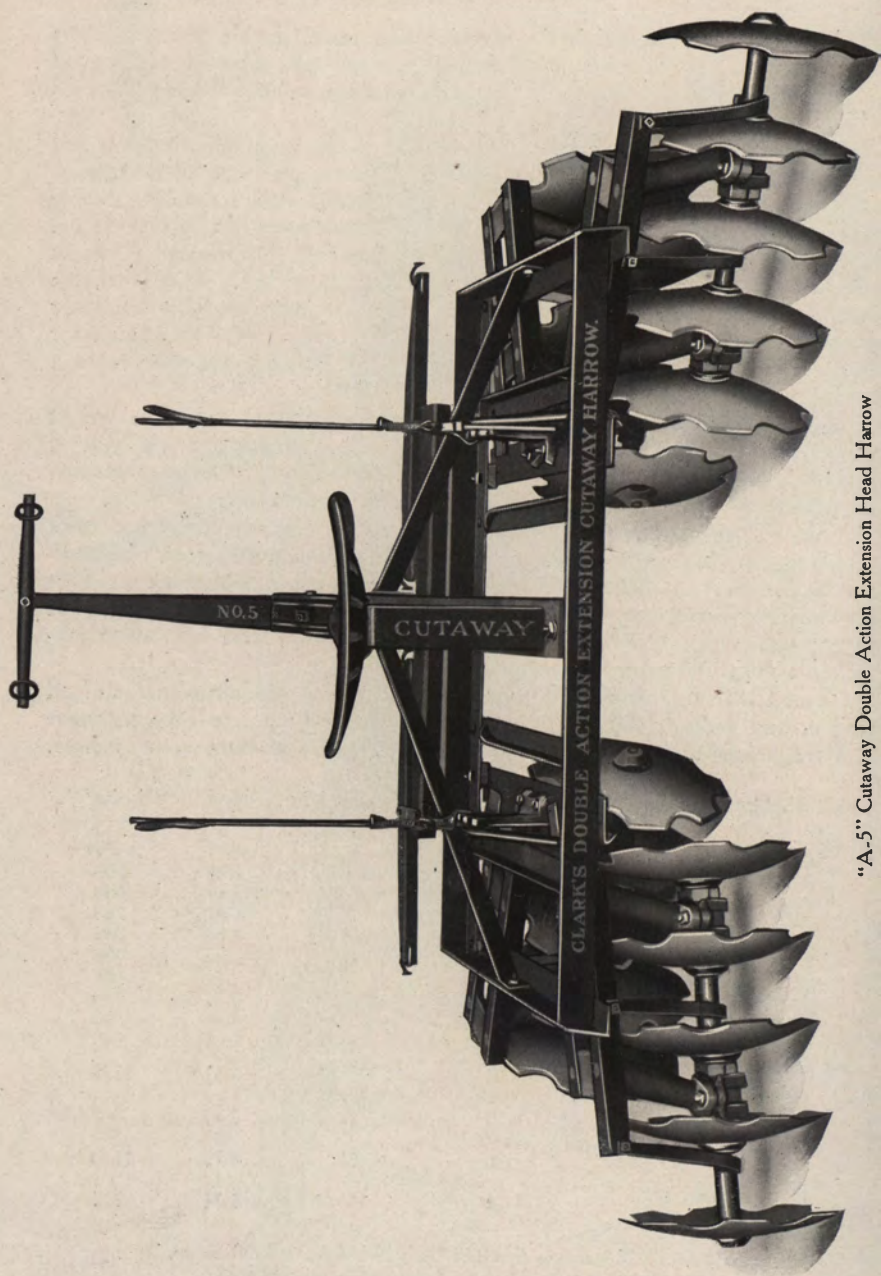
This CUTAWAY detachable jointed tongue relieves the horses' necks of all weight, and makes it easy for the user to change his machine from a tongue to a tongueless, or from a tongueless back to a tongue machine in *one minute*.

No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Wt.
*A-3	12	16	3' 6"	1-H	335
A-4	16	16	4' 6"	2-H	425
A-5	20	16	5' 6"	2-H	500
A-6	24	16	6' 6"	4-H	600
A-7	29	16	7' 6"	4-H	780
A-8	33	16	8' 6"	4-H	845
X-4	16	18	4' 6"	2-H	490
X-5	20	18	5' 6"	2-H	595
X-6	24	18	6' 6"	4-H	750
X-7	29	18	7' 6"	4-H	860
X-8	33	18	8' 6"	4-H	945
X-9 New No. }	37	18	10' 6"	4-H	1325
X-10 Old No. }					
B-5	20	20	5' 6"	4-H	670
B-6	24	20	6' 6"	4-H	775
B-7 New No. }	29	20	8'	4-H	1170
B-8 Old No. }					
B-9 New No. }	37	20	10' 6"	4-H	1375
B-10 Old No. }					

* "A" means the disks are 16 inches in diameter; "X", 18 inches; "B", 20 inches.

The above machines are furnished with either "cutaway" or "solid" disks.

All harrows with more than six disks per gang are equipped with centre disk.



"A-5" Cutaway Double Action Extension Head Harrow

THE CUTAWAY HARROW COMPANY

Cutaway Double Action Harrows— Extension Head

WHAT WAS SAID of the CUTAWAY REGULAR DOUBLE ACTION HARROWS on page 15 applies equally to the CUTAWAY EXTENSION HEAD DOUBLE ACTIONS. The extension head machines are of the same general design and construction as the regular machines, except that the main frames are longer; that is, they are what is known as the "extension heads." This feature is clearly illustrated in the harrow on the page opposite, and all the sizes listed below are of this same design. However, for those who want harrows of greater extension, we will make to order Double Extensions, Triple Extensions, Quadruple Extensions, etc. In the regular, or single extensions, the gangs on the number *4's spread 16 inches; on the number 5's, 18 inches; and on the number 6's, 24 inches. The more extended machines spread in about the same proportions.

To the orchardist the CUTAWAY EXTENSION HEAD DOUBLE ACTION HARROWS are fast becoming the most indispensable tools they use. When the farmers of every class fully understand the soil and realize the importance of intensive tillage, they will recognize how they can increase their crops with CUTAWAY DOUBLE ACTION HARROWS.

The value of the extension head feature is obvious. With the gangs extended as shown on page 16, you can cultivate just as intensively close up to the trees as in the middle of the row, or in an open field.

All CUTAWAY EXTENSION HEAD DOUBLE ACTION HARROWS close up for regular field work.

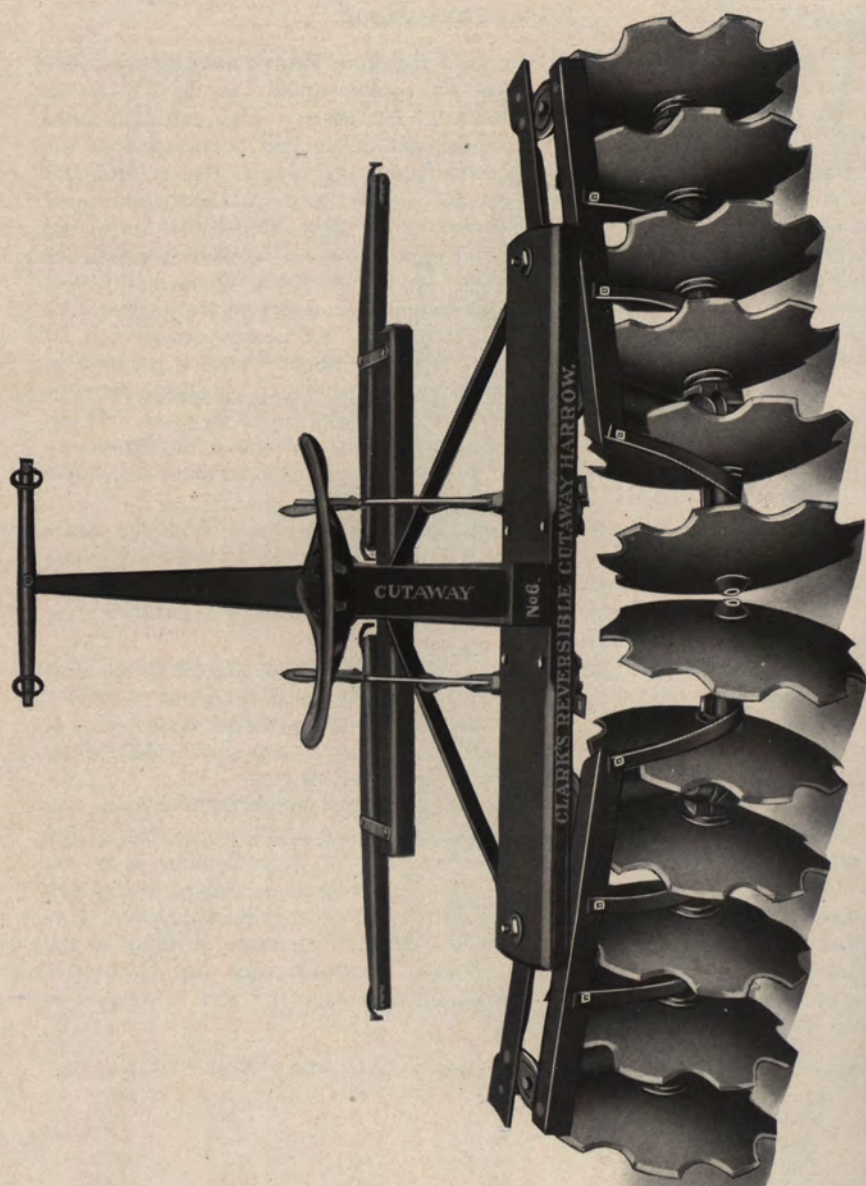
The following are features that make the CUTAWAY absolutely the most efficient orchard harrow ever made:—It has extension head—It is double action—It has the CLARK rigid main frame—It makes the land level—It is equipped with CLARK forged-edge disks—It has CLARK hardwood journal boxings—It has the CUTAWAY detachable jointed tongue.

We want you to thoroughly understand every one of these features, for individually and collectively they represent the best that is obtainable in disk harrows. We say to you that the composite of these features place the CUTAWAY so far ahead of other harrows that you cannot afford to buy any other. Since the fundamental principles upon which this CUTAWAY EXTENSION HEAD DOUBLE ACTION is built are the same as those in the CUTAWAY DOUBLE ACTION ENGINE HARROW and the CUTAWAY REGULAR DOUBLE ACTION, you should read pages 13 and 15 very carefully also.

No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Wt.
*A-4	16	16	6'	2-H	445
A-5	20	16	7'	2-H	545
A-6	24	16	8' 6"	4-H	635
X-4	16	18	6'	2-H	510
X-5	20	18	7'	2-H	620
X-6	24	18	8' 6"	4-H	790
B-5	20	20	7'	4-H	685
B-6	24	20	8' 6"	4-H	845

* "A" means the disks are 16 inches in diameter; "X", 18 inches; "B", 20 inches.

The above machines are furnished with either "cutaway" or "solid" disks.



"A-6" Cutaway Single Action Harrow—Regular

THE CUTAWAY HARROW COMPANY

Cutaway Single Action Harrows—Regular

ALMOST EVERY DAY one or more letters are received by us in which CUTAWAY SINGLE ACTION HARROWS are commended in such terms as follows: "I am still using one of your harrows which I bought over twenty years ago, and would not trade it now for a new one of three-fourths of the makes." "After a thorough field trial, I can say that your harrow leaves a better seed-bed than any I have ever used or seen used." "My neighbors are opening their eyes as to the effect of intensive cultivation with your intensive tillers." "I feel it my duty to aid in the distribution of such implements as your CUTAWAY harrows." "My CUTAWAY harrow has been a big factor in raising the largest crops ever grown on this farm." "You couldn't buy back my CUTAWAY harrow at 25% advance in price."

Why has the CUTAWAY SINGLE ACTION HARROW won the praise and support of practically every farmer who owns one? Because, first of all, it does the work; it is one of the most effective tillers ever put on any field. Second, its durability is almost unlimited. Third, it is convenient to handle and easy on horses. Fourth, it has every feature that will add to its efficiency.

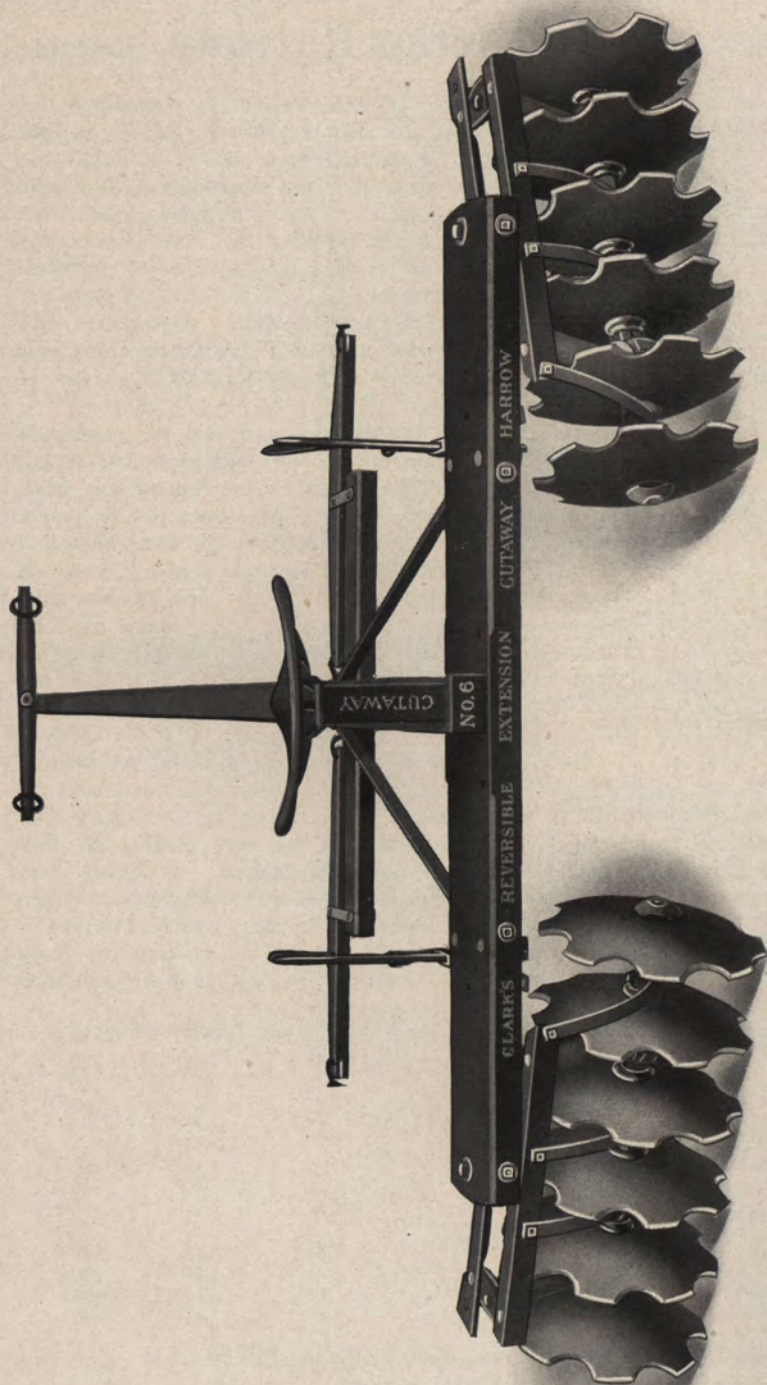
All CUTAWAY SINGLE ACTION HARROWS are reversible. If you will observe the illustration on page 18 you will see that the "dish" of the disks is out, and consequently the soil is moved outwardly. To reverse this harrow, you simply disconnect the lever links from the gang frames and swing the gangs around on the king bolts until what were formerly the outer disks become the inner disks, and reconnect the links. In this latter position the disks will throw the soil inwardly.

Like those on all other CUTAWAY implements, the disks on this harrow are the famous CLARK cutlery steel disks, *forged sharp*. This feature partly accounts for the remarkable long service always given by CUTAWAY disk implements. Forging compacts the molecules in the steel, making the disk much tougher than those sharpened in any other manner. It makes them retain a sharp edge long after ordinary disks are well worn away. While this forged-edge disk is of paramount importance to every user of disk implements, it has a significance beyond its own quality—it is a criterion by which you can judge every other part of the CUTAWAY SINGLE ACTION HARROWS.

No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Wt.
*A-4	8	16	4'	1-H	235
A-4½	8	16	4'	2-H	235
A-5	10	16	5'	2-H	260
A-6	12	16	6'	2-H	290
A-7	14	16	7'	4-H	395
A-8	16	16	8'	4-H	450
X-4	8	18	4'	1-H	255
X-4½	8	18	4'	2-H	255
X-5	10	18	5'	2-H	285
X-6	12	18	6'	2-H	340
B-4½	8	20	4'	2-H	290
B-5	10	20	5'	2-H	335
B-6	12	20	6'	2-H	390

* "A" means the disks are 16 inches in diameter; "X", 18 inches; "B", 20 inches.

The above machines are furnished with either "cutaway" or "solid" disks.



"A-6" Cutaway Single Action Extension Head Harrow

THE CUTAWAY HARROW COMPANY

Cutaway Single Action Harrows— Extension Head

THE CUTAWAY extension head machines embody the principles of intensive tillage in a specialized form for the orchardist and fruit-grower. As is evident from the illustration on the page opposite, these harrows are made to extend beyond the team under the low limbs of the trees. In other words, the CUTAWAY SINGLE ACTION EXTENSION HEAD HARROWS make intensive tillage possible where otherwise only ordinary or no cultivation could be given. And, in the words of the "American Agriculturist," "be it remembered that fruit on the trees responds to good growing conditions just as truly as potatoes, pumpkins, corn or cotton." And be it further remembered that CUTAWAY harrows make good "growing conditions." They are the intensive tillers of the soil.

In your studying of the CUTAWAY SINGLE ACTION EXTENSION HEAD HARROWS you should also read what is said of the regular CUTAWAY SINGLE ACTIONS on page 19, and vice versa. These harrows are built on the same principle throughout, and, with the exception of the extension head, what is said of one applies equally to the other. In fact, the CUTAWAY SINGLE ACTION EXTENSION HEAD includes all of the features of the regular CUTAWAY SINGLE ACTION, and has the extension feature added. *It closes up into a regular harrow for general field work.* The regular extensions spread about two feet, but for wide-spreading trees, headed down low, we make these harrows in Double, Triple and Quadruple Extensions, with special low-down levers.

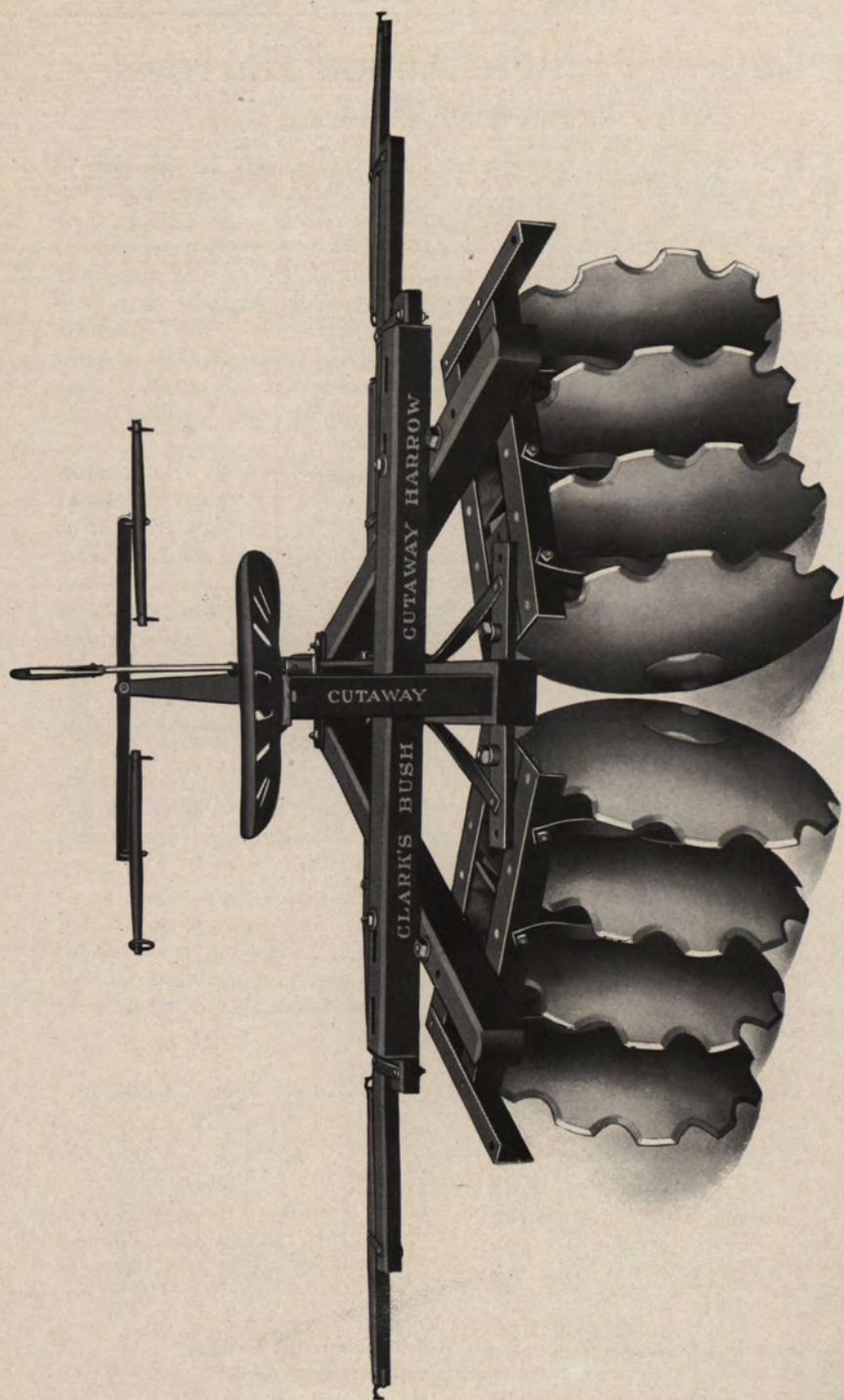
As is true with all our single action harrows, this machine is reversible. When it is used as shown in the illustration opposite, the soil is moved out. When it is reversed, the soil is moved in. It is reversed in the same manner as the regular single action described on page 19.

Bear in mind the importance to you of the following points which make the CUTAWAY SINGLE ACTION EXTENSION HEAD HARROW an orchard tool of unsurpassed efficiency: It is extension head; it closes up into a regular harrow for general field work; it is double lever; it is equipped with CLARK forged-edge disks and CLARK hardwood journal boxings; it is so perfectly balanced that there is no need for a tongue truck.

No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Wt.
*A-4	8	16	6'	1-H	240
A-4½	8	16	6'	2-H	240
A-5	10	16	7'	2-H	280
A-6	12	16	8'	2-H	310
X-4½	8	18	6'	2-H	270
X-5	10	18	7'	2-H	300
X-6	12	18	8'	2-H	350
B-4½	8	20	6'	2-H	300
B-5	10	20	7'	2-H	345
B-6	12	20	8'	2-H	405

* "A" means the disks are 16 inches in diameter; "X", 18 inches; "B", 20 inches.

The above machines are furnished with either "cutaway" or "solid" disks.



Cutaway Bush and Bog Plow

Cutaway Bush and Bog Plow

OF ALL THE IMPLEMENTS shown in this catalogue, none is more certain to prove satisfactory than the CUTAWAY BUSH AND BOG PLOW. And that is a pretty strong statement, because each of the various CUTAWAY tools has users who proclaim the excellence of their respective tools in words that could hardly be more expressive of satisfaction. CUTAWAY implements do not merely please in the sense that there is no "kick" on them; but the work they do begets enthusiastic champions who praise them as intensive tillers of the greatest efficiency ever known in disk implements.

The BUSH AND BOG PLOW was designed to reclaim bush and bog land, and do other disking that heretofore has been impossible because of the inadequate tools on which you were dependent. As you will see by studying the illustration on page 22, this machine is a harrow in design, but because of the thoroughness with which it tears up hard sod and cuts down and demolishes bushes and bogs, it has become known the country over as the CUTAWAY BUSH AND BOG PLOW.

It is heavy and strong and powerful. It is built to do hard work. Hard strains are a part of its every-day work. That is why the frame, the standards, the spools, the disks—in fact, all parts—are built with extra strength.

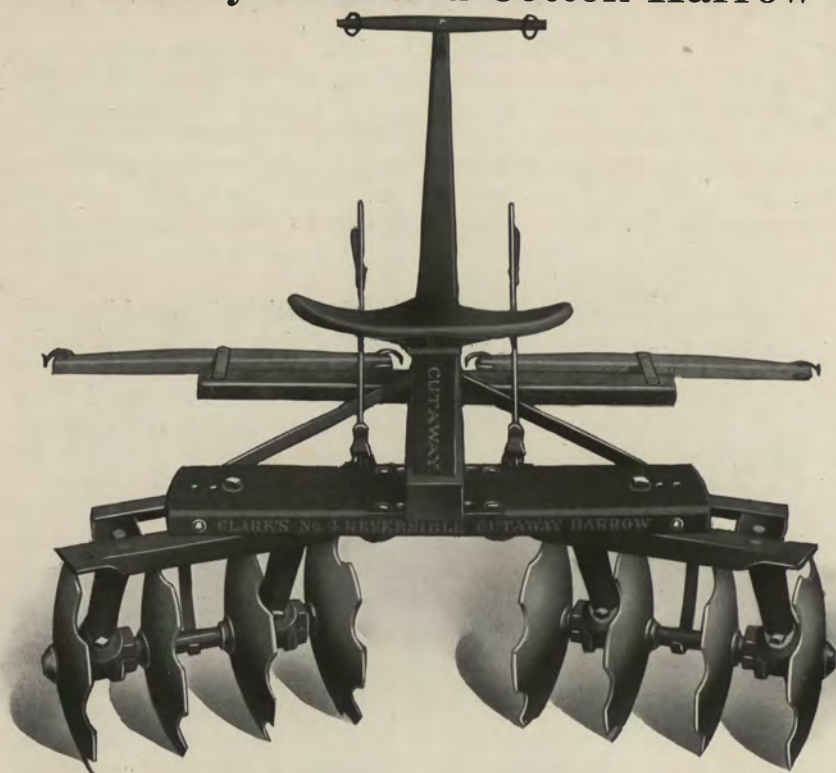
Professor W. A. Henry, Dean Emeritus of the College of Agriculture, University of Wisconsin, says: "Last season on our farm at Wallingford, Conn., we cleared about 35 acres of brush land which had, during the past forty years, been growing up to cedars, sumach, bayberry, etc. The area was covered with brush and trees. After the axe and fire had done their work, we put on your BUSH AND BOG 'cutaway' harrow, with four horses, driving over low-cut stumps, stones, etc. Observation shows that your BUSH AND BOG 'cutaway' harrow is eminently adapted to this rough, pioneer work. . . . We further find the big BUSH AND BOG HARROW very useful in other farming operations. We have used it on a piece of fall plowed sod. Here the meadow was run out and covered with many blackberry and other pests. On such land, plowed last fall, we have this spring run the big CUTAWAY, which digs down deep, completely destroying any vestige of turf, giving us a very deep, fine seed bed."

Our CLARK cutlery steel disks, *forged sharp*, are of vital importance to every disk implement that we make, but on none are they of so great importance as on the BUSH AND BOG. The work of this machine is where ordinary disks would fail utterly. In fact, there is no other disk implement made that is worthy of comparison with the CUTAWAY BUSH AND BOG PLOW.

This machine is also reversible, which means that the gangs can be changed, so that the "dish" of the disks faces either in or out as desired. This feature adds to the general efficiency of the tool and its adaptability for general farm use.

It is a four-horse machine; cuts 5 feet wide, and has 24-inch disks. The shipping weight is 625 pounds.

Cutaway Corn and Cotton Harrow



THIS HARROW is particularly adapted to intensive tillage of rowed crops. At the same time it has no superior as a small harrow for general work. It is reversible, which means that the gangs can be set so that the disks throw the soil either in or out. To reverse it you simply disconnect the lever links from the gang frames and swing the gangs "end for end," and reconnect links.

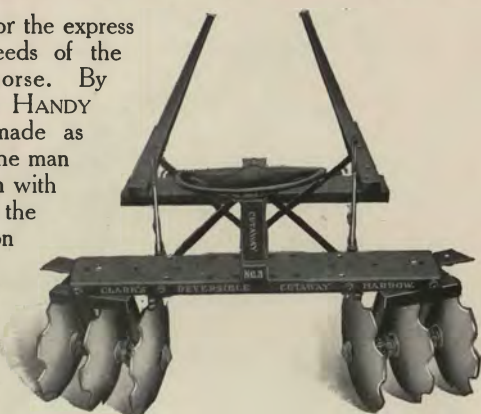
The CUTAWAY CORN AND COTTON HARROW is extensively used for preparing deep, fine seed-beds for rowed crops; for bedding up land for corn, cotton, peas, beans, potatoes, etc.; for barring off rows; and for general cultivation. It is adapted for harrowing the land before and after plowing, and for cultivating the crop after it is planted.

When we emphasize the efficiency of this harrow, we use that word *efficiency* advisedly. The CUTAWAY CORN AND COTTON HARROW is efficient from the standpoint of quality of service and length of service. It is reversible; the disks are the famous CLARK, *forged sharp*; the journal box-joints are the CLARK hardwood, soaked in oil.

When the gangs are reversed, as in the illustration above, they may be set so that the inner disks cut 10, 12, or 14 inches apart, as desired. When the gangs are in their regular position, they may be set so that the inner disks cut 4, 6, or 8 inches apart. Made with either 16-inch or 18-inch disks.

Cutaway Ever Handy Harrow

THIS HARROW is made for the express purpose of meeting the needs of the man who has only one horse. By means of the CUTAWAY EVER HANDY HARROW intensive tillage is made as economical and as practical for the man with a small outfit as for the man with large equipment. The illustration to the right plainly shows the construction of this "ever handy" tool, and reveals its adaptability to the needs of the gardener and farmer who uses but one horse. When the gangs are closed the harrow cuts 3 feet wide, each cutting $1\frac{1}{2}$ feet.



When they are fully extended the machine cuts 4 feet 8 inches wide. The EVER HANDY is reversible; that is, the gangs may be set so the disks throw the soil either out or in. To reverse it you simply disconnect the lever links from the gang frames and swing the gangs "end for end," and reconnect links. This machine is equipped with 16-inch CLARK forged-edge disks. The journals are hardwood. Shipping weight, 210 pounds.

Cutaway Grove Harrow



THE CUTAWAY GROVE HARROW is an intensive tiller, especially adapted to the needs of the gardener and orchardist. It is light, yet durable and strong. You will observe in the illustration to the left that the GROVE is shown without a seat. Though the seat may be put on for those who wish it, most users prefer it without a seat, as they are desirous of keeping the harrow as light as possible. In many orchards, groves and gardens the soil is of such nature that often harrows are kept from going too deep at the sacrifice of thorough surface cultivation. The CUTAWAY GROVE HARROW overcomes this difficulty.

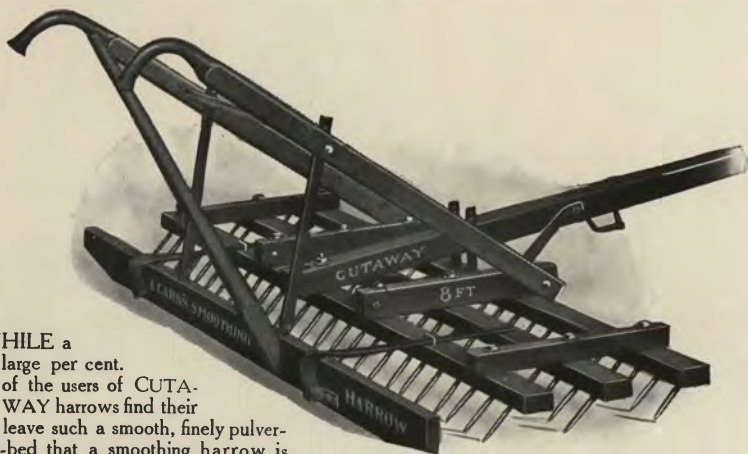
No. of Machine	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Wt.
*O-5	10	14	4'	1-H	150
O-6	12	14	4' 6"	2-H	185
O-7	14	14	5' 4"	2-H	210

* "O" means the disks are 14 inches in diameter.

The above machines are furnished with either "cutaway" or "solid" disks.

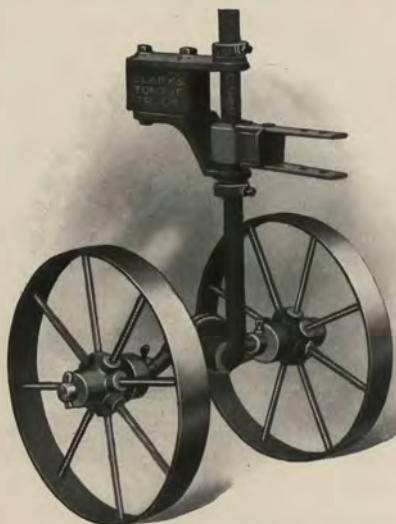
THE CUTAWAY HARROW COMPANY

Cutaway Smoothing Harrow



WHILE a large per cent. of the users of CUTAWAY harrows find their machines leave such a smooth, finely pulverized seed-bed that a smoothing harrow is not exactly necessary, we recommend this smoother to follow the CUTAWAY harrows. We know that the last degree of perfection in a seed-bed pays, and we know that the CUTAWAY SMOOTHING HARROW will secure for you that perfection. It combines the merits of the spike-tooth harrow and the plank drag. The teeth dig, tear and pulverize, and the plank levels, smooths and packs. Observe the handle, which gives the driver perfect control over the plank and makes it easy for him to carry large or small quantities of soil into the hollows. Also note the steel spring by which the plank is attached. This CUTAWAY SMOOTHING HARROW is made in two sizes: 6 foot, for one horse, shipping weight 135 pounds; 8 foot, for two horses, shipping weight 175 pounds.

Cutaway Tongue Truck



THERE are three features that you should always demand in any tongue truck you buy. They are: first, adjustable hitch to suit the height of any team; second, adjustable tongue attachment to suit the height of any harrow; third, axle joint, so that either wheel may run over clods, stones and other rough obstructions without affecting the even, regular line of draft of the harrow. These three essential features are a part of the CUTAWAY TONGUE TRUCK.

We want you to study the illustration closely, so that you will fully appreciate the simplicity of this truck. Note the principles of our axle joint. You will see how it gives the wheels a perfectly free up and down motion, yet there is no opportunity for the joint to knuckle or bind. It always works freely. The bearings are the CLARK hardwood, which have become so famous on the CUTAWAY harrows.

This CUTAWAY TONGUE TRUCK is all steel. It is durable and strong, yet light. Its shipping weight is 60 pounds.

Cutaway Baby Cultivator



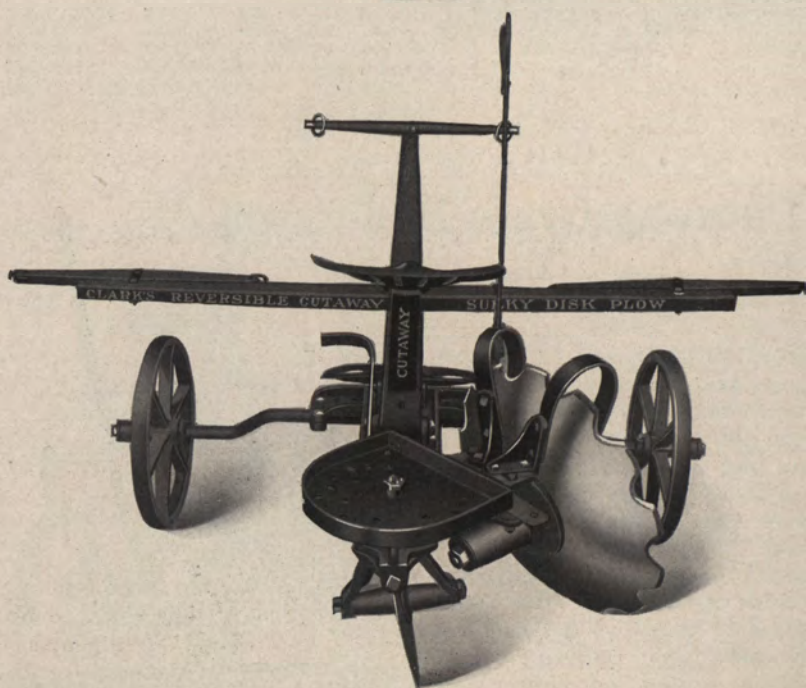
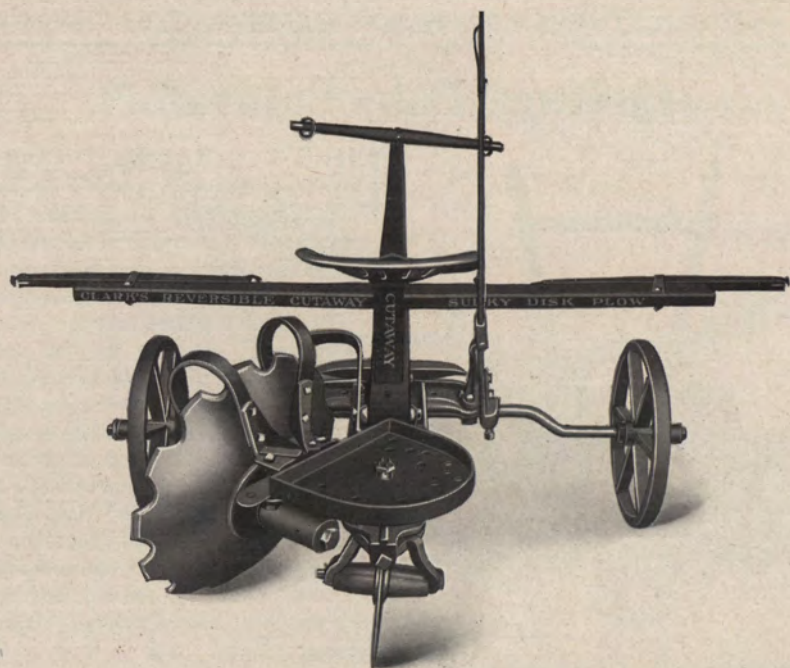
THIS CUTAWAY BABY CULTIVATOR makes it possible to extend the practice of intensive tillage in an economical way to the smaller crops. It is designed after the lines of our larger harrows. The gangs are reversible; that is, they may be swung "end for end," so that the soil may be thrown either in or out as desired. This feature, together with the fact that the gangs may be set either straight or at various angles, makes it possible to give the crops level cultivation, or throw the soil to them or from them. This little disk cultivator is equipped with the famous CLARK *forged-edge* disks and hardwood journal boxings. Every farmer and gardener should have one.

No. of Cult.	No. of Disks	Diam. of Disks	Width of Cut	Hitch	Shipping Weight
1	6	14	24"	1-H	90
2	8	14	32"	1-H	105
3	10	14	40"	1-H	120

Cutaway Grass Hoe

THIS one-horse tool is unsurpassed as a tooth cultivator. It is adapted to all kinds of rowed crops, and is strong enough for the severest sort of work. It has eleven teeth—four on each side and three in the middle—no two of which work in the same line. These teeth are curved so as to take the ground and tear out the weeds and grass that lie in their path. The wheel at the nose of the cultivator regulates the depth to which the teeth run. It is adjustable up or down. The hitch is also adjustable up or down. The gangs can be spread or closed so that the cultivator fits the rows. This feature also makes it easy to give the soil a "fine comb" working or a coarse cultivation, as desired. The CUTAWAY GRASS HOE is light to handle, yet it is so strong that it will last indefinitely.





Cutaway Reversible Sulky Disk Plow

The upper illustration shows plow when turning furrow to the left;
the lower illustration, when turning furrow to the right

Cutaway Reversible Sulky Disk Plow

THIS IS AN AGE OF SPECIALIZATION, because it is an age of efficiency. It is obvious that the implement especially designed for a specific service is more efficient for that service than any other. The CUTAWAY REVERSIBLE SULKY DISK PLOW is a specialized tool, and it should always be considered as such. It is designed for "old land" plowing and fallowing, and for such work it has no equal. When the soil conditions are right for disk plowing it disqualifies all other tools.

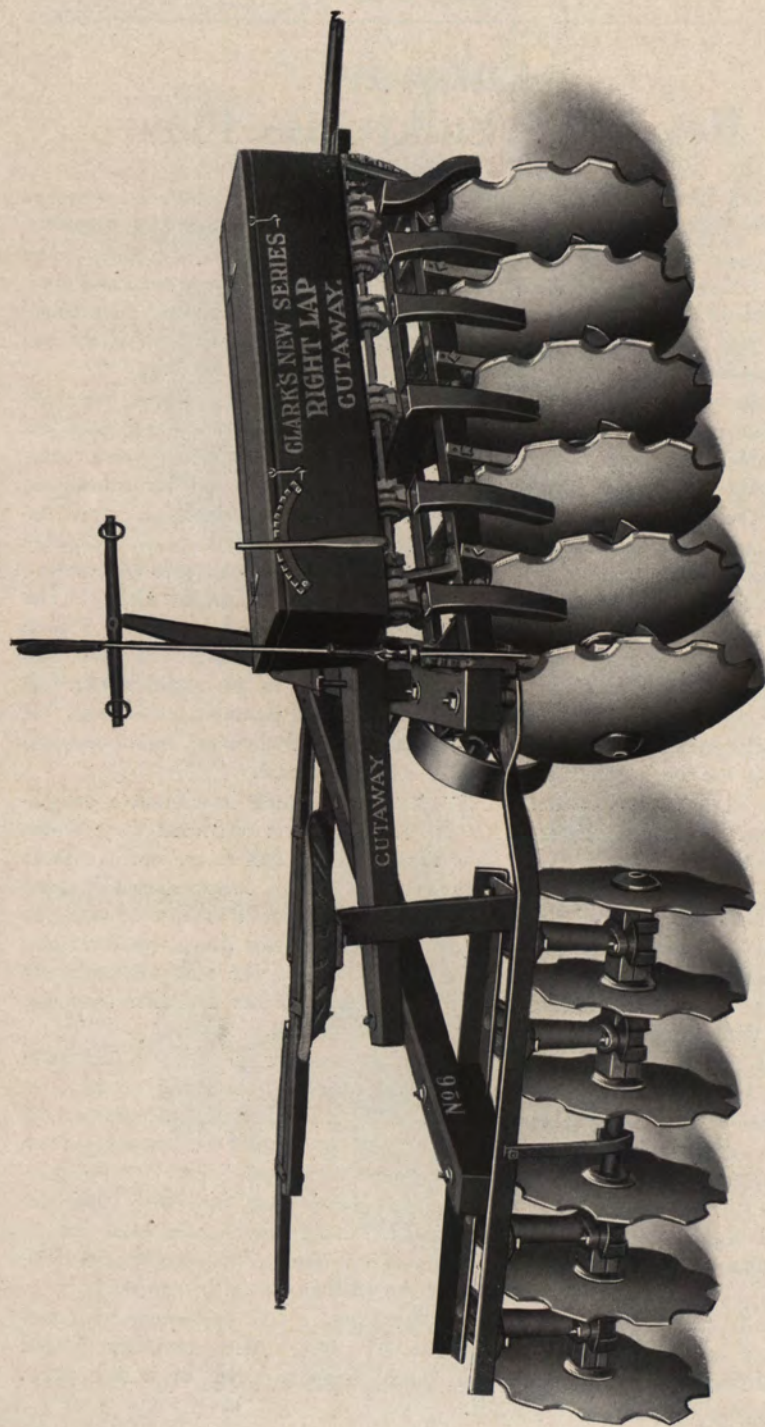
By the very nature of things, a large per cent. of the plowing on every farm must necessarily be of the land on which a cultivated crop has just been grown, such as corn, cotton, tomatoes, potatoes, tobacco, beets, peas, beans, onions and other rowed crops. Such land, prepared for subsequent crops by being plowed with a CUTAWAY disk plow, yields bigger crops because it gives a finer and deeper seed-bed than any other plow. Stubble from wheat, oats, barley, rye and other small grains can also be plowed with greater advantage with a CUTAWAY REVERSIBLE SULKY DISK PLOW than with any other. It plows a furrow 10 to 14 inches wide and 5 to 8 inches deep. It does this work with less draft than a mouldboard plow, and pulverizes the soil much finer and with uniformity to the entire depth. It also stirs the soil in such a manner as to mix the soil particles thoroughly. A farmer who understands the soil from a physical and chemical standpoint will appreciate the work done by this CUTAWAY implement.

The CUTAWAY REVERSIBLE SULKY DISK PLOW is without a complicated part. A boy can operate it. It has two levers: one hand-lever, which regulates the depth to which the plow runs; and one foot-lever, which unlocks the disk so that it can automatically reverse. This lever, shown in both illustrations on the opposite page, is conveniently located to operate with the left foot. To reverse the plow the driver simply presses down this lever and it releases the disk, and as the team turns the plow the disk automatically swings to its reversed position and locks without further attention from the driver. Nothing could be simpler or easier to operate.

This plow is not only remarkable for the manner in which it pulverizes the soil, but also for the thoroughness with which it plows under and completely covers weeds and other vegetation. This feature is important in hastening the decay of vegetable matter and preventing the moisture from escaping, as it does when weeds are only partly covered.

It is perfectly plain that the reversible feature on this plow eliminates all dead and ridge furrows, an advantage which every farmer well knows. In the illustrations on the page opposite you will observe the weight pan under the seat. This is handily arranged for the holding of extra weight.

The CUTAWAY REVERSIBLE SULKY DISK PLOW is designed for two horses. It is equipped with an extra heavy CLARK cutlery steel disk, *forged sharp*, a feature which should mean much to every buyer of a disk plow. The shipping weight is 370 pounds.



"No. 6" Cutaway Right Lap Plow, showing Clark Force Feed Seeder attached

Cutaway Right Lap Plows— With or Without Seeder Attachment

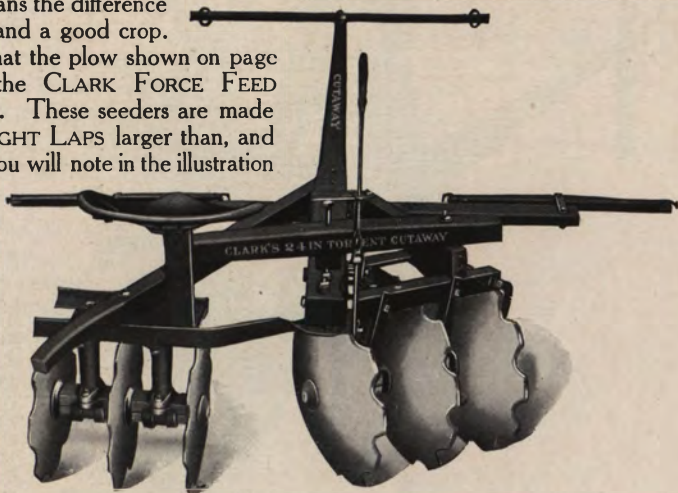
THIS SERIES has a wide popularity, especially in the West. It is adapted to conditions which other plows fail to meet. Please study the illustrations on this and the page opposite. They will make plain to you the general design and construction of the CUTAWAY RIGHT LAP PLOWS. You will observe that the left gangs consist of straight disks or colters. These break the crust and prepare the land for the right gangs, which turn the furrow. They also give the plows a perfect line of draft.

The CUTAWAY RIGHT LAP PLOWS are especially suited to all kinds of "old land" and fallow plowing. They make it easy to do a tremendous amount of plowing in the least possible time, and with the minimum draft. They broaden the great utility of disk plowing as a means of intensive tillage. Under certain conditions that prevail very extensively in the West, and often in the South and East, the soil bakes hard, so that to turn it with a mouldboard plow is practically impossible, or if possible, it comes up in great chunks which can not be pulverized. On such land the CUTAWAY RIGHT LAP PLOWS work up the surface and form a mulch as no other plow can do, making it possible to sow the seed in time to take advantage of the first rain. To the farmer in the semi-arid and arid West this series of plows often means the difference between a crop failure and a good crop.

You will observe that the plow shown on page 30 is equipped with the CLARK FORCE FEED SEEDER ATTACHMENT. These seeders are made to attach to all the RIGHT LAPS larger than, and including, number 4. You will note in the illustration that the seed tubes carry the seed down between the disks, where it is immediately covered. These seeders sow all kinds of grains, and the feed can be regulated to any quantity it is desired to sow.

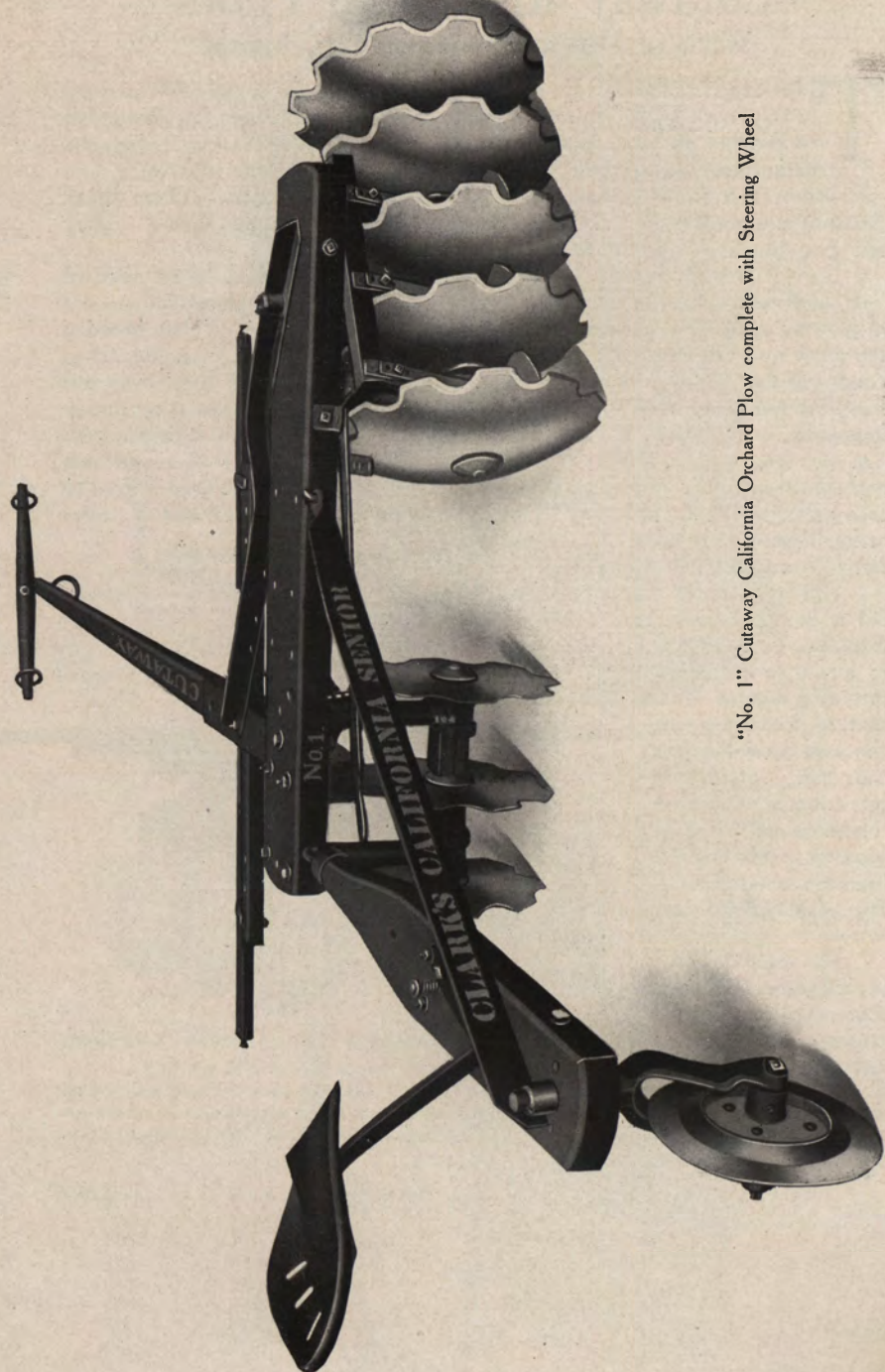
The lever, which is in convenient reach from the seat, adjusts the angles of the right gangs, so that the machine will plow deep or shallow, as desired, and controls the depth of plowing under varying conditions of the soil.

The CUTAWAY RIGHT LAP PLOWS are equipped with extra heavy CLARK cutlery steel disks, *forged sharp*. The buyer of any disk implement can not afford to overlook this feature. It means the difference between good and bad plowing, easy and heavy draft, long and short service.



No. of Plow	Disks on Left Gang	Disks on Right Gang	Width of Cut	Hitch	Shipping Wt.
3 (24-in. Torrent)	3 17"	3 22"	24"	2-H	300
4	4 18"	4 24"	34"	4-H	435
5	5 18"	5 24"	43"	4-H	535
6	6 18"	6 24"	53"	4-H	640
7	7 18"	7 24"	60"	4-H	830
8	8 18"	8 24"	70"	4-H	910
9	9 18"	9 24"	78"	6-H	1130

The seeder weighs 18 pounds for each disk on the right gang.



"No. 1" Cutaway California Orchard Plow complete with Steering Wheel

Cutaway California Orchard Plow

THERE IS no place where intensive tillage pays better than in the orchard. Because of this fact there is a big demand for the CUTAWAY CALIFORNIA ORCHARD PLOW. Its advantages will be quickly seen by studying the illustration on the page opposite. Note that the plow extends beyond the team, so that the soil next to the trees may be as thoroughly plowed as that in the center of the rows.

The CUTAWAY CALIFORNIA ORCHARD PLOW is made in three sizes, as shown in the table below. Each size is made in both regular and extension head. The plow shown on page 32 has the regular head. The extension head is much longer, allowing three different positions for the right gang: the regular, which is the same position as where the regular head is used; the full extension, which places the gangs to cut five feet beyond the team; and the intermediate, which is half way between the two extremes. All three sizes cut the same distance beyond the team when set in the same relative positions; that is, for instance, when fully extended the No. 1, the No. 2, and the No. 3 all cut five feet beyond the team.

Also note in the illustration the horizontal lever which regulates the angle at which the gang is set. By this position of the lever, low-hanging limbs cannot catch upon it. It is out of the way of absolutely everything.

The CUTAWAY CALIFORNIA ORCHARD PLOW is reversible. This is another feature which adds to its efficiency as an implement for intensive tillage. To reverse it you simply disconnect the lever links from the gang frames and swing the gangs "end for end" and reconnect links. In this manner the soil can be thrown either in or out as desired, making both ridge and flat cultivation easy.

The steering wheel, which includes the tail piece and brace, connecting the wheel with the head, may be detached, and the tongue moved toward the center. By this change the CUTAWAY CALIFORNIA ORCHARD PLOW is adapted to general "old land" and fallow plowing. The seat is also moved from the steering wheel to the center of the head. These adjustments make this plow very similar to the RIGHT LAPS, and for all practical purposes the same.

The CALIFORNIA ORCHARD PLOW may be ordered with or without the steering wheel. With it the plow has a wider range of use, for, with the attachment, it is a special orchard plow. Then the steering wheel may be temporarily detached, making it a special field plow for stubble and other "old land" plowing, for which work it has no superior.

Like all other CUTAWAY disk implements, this plow is equipped with CLARK forged-edge disks and hardwood journal boxings.

No. of Plow	Disks on Left Gang	Disks on Right Gang	Width of Cut	Hitch	Shipping Wt.
1	3 18"	5 22"	36"	2-H	435
2	3 18"	4 22"	30"	2-H	415
3	2 17"	3 22"	24"	2-H	325

Without steering wheel the shipping weight is 55 pounds less.

THE CUTAWAY HARROW COMPANY

Farmers' Favorite Cider Mills and Presses



THERE IS ONE—and only one—disadvantage in purchasing a FARMERS' FAVORITE CIDER MILL AND PRESS, namely, it will last so long that you will probably never have the opportunity of buying another. If this is a disadvantage that you are not willing to stand, these mills and presses will not appeal to you, for they are the most durable cider-making outfits on the market. Just as we began to write this one man sent in the knives of his mill to have them sharpened, stating that he has had his mill for 24 years! That's the kind of a mill you buy when you choose a FARMERS' FAVORITE—one that not only gives satisfaction the day or the year it is purchased, but for a quarter century after.

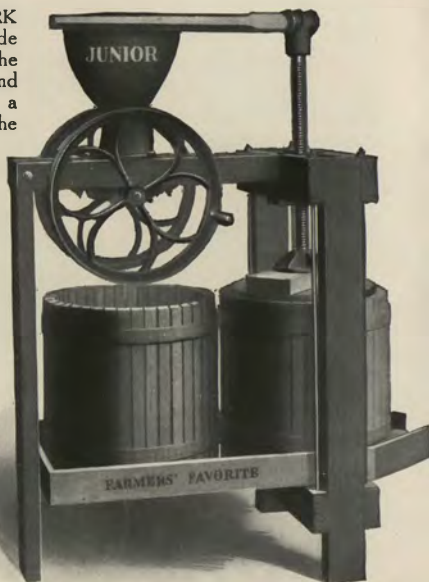
The FARMERS' FAVORITES are made in sizes to meet the needs of all. The upper illustration is of the No. 2 $\frac{1}{2}$, and shows also the general design of the SENIOR and No. 3. The lower illustration is of the JUNIOR. This shows the principle of using two curbs as adapted to it and the No. 1.

The four largest sizes are equipped with the CLARK GRATER MILLS, which consist of two cones, one inside of the other. On the outside of the inner cone and the inside of the outer cone are ribbed spiral ridges, ground to a perfect fit in emery and oil. By simply turning a thumbscrew, the inner cone can be so adjusted to the outer cone as to grate the apple into as fine a pomace as you desire. The revolving knives in the hopper slice the apple ready for the grater.

The No. 1 is equipped with the CLARK CLAPPER GRINDER. It is made on the principle of two jaws working together, and is pre-eminently the grinder for small mills.

All wooden parts of the FARMERS' FAVORITES are of selected oak and maple, a factor important, both to length of service and to high quality cider. Your selection from these outfits should depend solely on the size you need. None has a superior of its size.

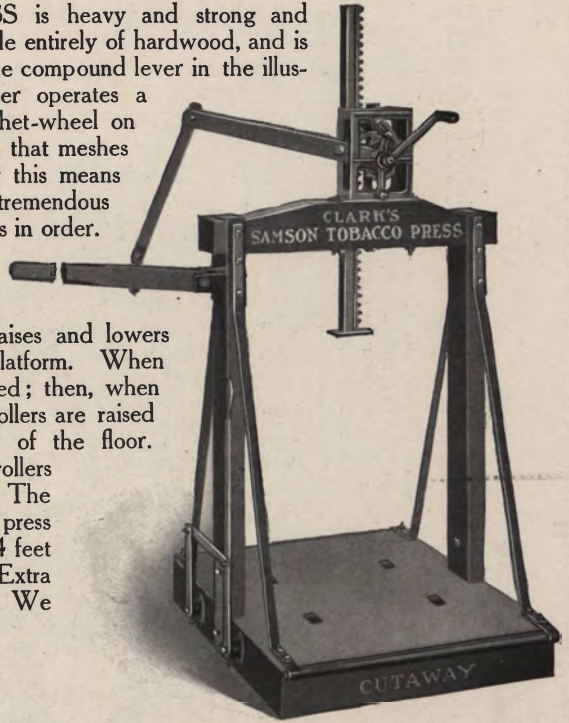
Mill	Power	Capacity of Mill per Hour	Capacity of Press per Fill	Shipping Weight
Senior	{ Engine or Hand	60-75 bu. 25-30 bu.	5 bbl.	1450
No. 3	{ Engine or Hand	50-60 bu. 20-25 bu.	3 $\frac{1}{2}$ bbl.	1070
No. 2 $\frac{1}{2}$	{ Engine or Hand	50-60 bu. 20-25 bu.	2 bbl.	660
Junior	{ Engine or Hand	18-22 bu.	20 gal.	385
No. 1	Hand	5-7 bu.	5 gal.	195



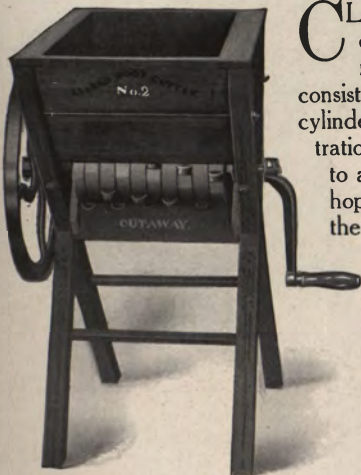
Clark's Samson Tobacco Press

THIS TOBACCO PRESS is heavy and strong and durable. The frame is made entirely of hardwood, and is stoutly braced. Observe the compound lever in the illustration to the right. This lever operates a heavy ratchet which turns a ratchet-wheel on the steel shaft, carrying the cog that meshes with the big vertical rack. By this means little effort is required to supply tremendous pressure. It is simple and always in order.

The small crank makes it easy to wind the rack up. Also note the compound lever on the left side of press, which raises and lowers the four rollers seen in the platform. When pressing, these rollers are lowered; then, when ready to remove the box, the rollers are raised so as to lift the weight clear of the floor. You will also observe the end rollers at the edge of the platform. The available platform space of this press is 3 feet wide, 4 feet long and 4 feet high. Weight, 650 pounds. Extra sizes will be made to order. We can also furnish baling boxes.



Clark's Root Cutter



CLARK'S ROOT CUTTER is in no sense a cheap tool. The hopper and frame parts are made of hardwood. The cutting apparatus consists of gouge-shaped knives, set in a series of cylinder rings. These knives are shown in the illustration. They are high grade steel and sharpened to a keen edge. In case of stones getting in the hopper with the roots and the knives thus dulled, the cylinder is easily removed and the knives replaced or sharpened at little expense. This root cutter is made in two sizes: No. 2 and No. 3. The No. 2 is shown to the left. Its hopper holds about one bushel; the cylinder is 13 inches long, and it has 27 knives. The No. 3 has just twice the capacity of the No. 2 and is adapted for power. Both machines handle all kinds of roots, of any size. They cut long, slender pieces in a fashion much superior to slicing.

Cutaway Steel Heads

Our double actions are all-steel harrows, but the double lever single actions are made with either steel or wood heads. The illustration on this page shows the CUTAWAY steel head. Observe that it forms a weight box of itself. These steel heads are made in the same extensions as the wood heads. See page 11.





Cutaway "Solid" Disks

All CUTAWAY disk implements may be fitted with either "cutaway" or "solid" disks, or they may be fitted with part of one kind and part the other. In the illustration on this page is shown a machine thus equipped. The "cutaway" and the "solid" disks are of the same quality; they are the famous CLARK, *forged sharp*. Read pages 9 and 11.

The Soil

WHILE THE SOIL is very complex in its nature, still there are a few fundamental principles concerning it which simplify its management. It might be defined as a loosely decomposed layer of mineral and vegetable matter which furnishes both food and footing for man and beast. In its earlier history the mineral elements, or inorganic matter, predominated almost exclusively, but, with the passing of many centuries, vegetation has gradually increased and added organic substances to the soil.

In the study of the soil we may approach the subject from three points of view: (1) chemical, (2) physical, (3) biological. However, for our purpose we may consider the functions of the soil twofold: (1) chemical, (2) physical—physically, because it furnishes the physical abode for plants and animals, and chemically, because it furnishes nutriment from which they directly or indirectly feed. In this article we will not discuss the biological phase of the subject further than to say that it includes the study of life contained in the soil. Our interest lies principally in the chemical and physical aspects, for from a practical knowledge of the chemical and physical properties of the soil we hope to be enabled to better understand its management and thereby obtain from it larger crops.

The study of the soil is not an end in itself. It is merely a means to an end. That end is the furnishing of food, clothing, and shelter, according to the tastes of our present civilization. We must, therefore, consider the soil from the standpoint of its chemical and physical properties.

Chemical Properties of Soil

Chemistry is said to be that science which treats of the changes that take place when matter entirely loses its identity. From this definition it is readily seen that many chemical changes take place in the soil and are very important to agriculture. Matter loses its identity many times from the time it leaves the soil until it becomes a part of the human flesh, or clothing, or shelter for the body.

In the study of matter from a chemical standpoint, we hear much about elements. The definition of an element may be given as a substance containing but one kind of matter.

There are something over eighty known chemical elements. Of these it is said that only about fifteen are of any concern to the farmer, and that about eight constitute almost 99% of the earth's crust. It is evident, if this is true, that great importance lies in the management of these very few chemical elements. These eight, which chemists tell us constitute almost 99% of the earth's crust, are: oxygen, silicon, aluminum, iron, calcium, magnesium, sodium, and potassium. The remaining one and a fraction of a per cent. is divided among carbon, sulphur, phosphorus, chlorine, manganese, and various other metals.

The farmer who has been working with great diligence to maintain or increase the fertility of his land is likely to notice at once that the element, nitrogen, is not included in the list of elements found in the soil. This is because it is almost unknown as an original constituent of the soil. However, it is of vital importance to the growth of large crops, and, fortunately, since it is the most expensive element to buy commercially, it is abundantly supplied in the atmosphere. Consequently, it is a part of the farmer's business

THE SOIL AND INTENSIVE TILLAGE

to know how to obtain this expensive element which exists in such liberal quantities in the atmosphere, but in which state it is not available to a large extent as plant-food. Herein lies the importance of growing legume crops, such as alfalfa, clovers, vetches, peas, and beans.

It will also be noticed that hydrogen is not an original constituent of the soil. Its most prominent existence is in water, which has a chemical formula of H_2O . This means that two atoms of hydrogen are united with one atom of oxygen, and when the combination is made, the result is the liquid which we know as water. Each of these elements named above unites with various other elements to form what are known as compounds.

Oxygen is found in the largest quantities of any of the elements. It constitutes almost one-half of the soil. It enters into many compounds with other elements. Combined with silicon, it forms a compound which alone makes up about 75% of the mineral content of the soil.

Silicon, in itself, is not believed to take part in plant nutrition, but it is associated with all the other elements essential to plants as food. It composes about 28% of the earth's crust.

Aluminum is found most abundantly in clay soil, and is combined often with silicon and oxygen to form what are called silicates, which are also combined with the metals iron, potassium, and calcium. Aluminum composes about 8% of the soil.

Calcium, while forming only about $3\frac{1}{2}\%$ of the soil, is one of the most important elements. It occurs very prominently in disintegrated limestone. Compounds of calcium make the soil fertile and correct acidity. In recent years we have heard a great deal about the use of lime, which is a compound of calcium. The principal function of lime is to make conditions in the soil favorable for the growth of bacteria, which live on the roots of the legumes. Since it is through these bacteria that the farmer obtains nitrogen from the atmosphere, the value of this element, calcium, becomes apparent. It also improves the mechanical condition of the soil.

Potassium constitutes only a little more than 2% of the earth's crust, and, as is the case with practically all of the other elements named, it forms a part of different compounds. And, again, like the other elements, its value as a plant food depends upon the combination in which it is present in the soil. For instance, when it is a constituent of feldspar and mica it is not valuable as a plant food, but when associated with certain other elements it is valuable as a plant food.

It is almost universally the opinion of soil experts that few soils are lacking in the essential ingredients, but that these ingredients are often found in forms not valuable as plant food. This explains why a chemical analysis of the soil does not always reveal the ability of that soil to produce crops. This is due to the fact that the chemist in the laboratory cannot accurately imitate the processes which go on when plant rootlets dissolve and take up chemical elements from the soil. However, this statement does not mean that chemical analysis does not furnish valuable information. The man who has a wide knowledge of chemistry and the soil can ascertain many things that indicate the purpose for which the soil is best adapted, and how it can be managed best. Such information also leads to the understanding of conditions which will make it possible to change unfavorable conditions into favorable conditions.

THE SOIL AND INTENSIVE TILLAGE

Physical Properties of Soil

Physical changes are those which affect the form of the matter, but not its identity. It is a generally known fact that the physical characteristics of the soil determine more largely its agricultural value than anything else. As was said above, there are few soils lacking in the essential ingredients. It is, therefore, obvious that the farmer's problem is to transform those ingredients which are not in an available form into such a form that they become available as plant food. The first and most important step in this accomplishment is securing such a physical condition in the soil as will assist in bringing about this transformation.

The texture of the soil affects the freeness with which the air may circulate among the soil particles and the readiness with which moisture may enter the soil and be conserved therein for the benefit of the plants. The texture also affects the temperature of the soil. These three factors—air, moisture, and temperature—determine the quickness and strength with which seed may germinate and young plants grow.

In view of these facts, it may readily be seen that a mechanical analysis of the soil will reveal quite as much information as a chemical analysis, in so far as a crop production is concerned. This mechanical analysis determines the size of the particles constituting the soil. The Bureau of Soils in the United States Department of Agriculture classifies soils into the following kinds: (1) Gravel, the particles of which are between 1 and 2 mm. in diameter; (2) coarse sand, the particles of which are between .5 and 1 mm. in diameter; (3) medium sand, the particles of which are between .25 and .5 mm. in diameter; (4) fine sand, the particles of which are between .1 and .25 mm. in diameter; (5) very fine sand, the particles of which are between .05 and .1 mm. in diameter; (6) silt, the particles of which are between .005 and .05 mm. in diameter; (7) clay, the particles of which are between .0001 and .005 mm. in diameter.

A millimeter is .03937 of an inch.

The soil is generally named according to the size of the particles that predominate in it. To illustrate, soils which are made up of very fine particles are usually called clay soils. These vary in their clayey and plastic nature according to the degree of fineness of the particles. Some soils which come under the class of clay are friable, while others are very sticky, puddling very readily when wet, and baking very hard on becoming dry.

The sandy soils are those in which the particles are of such size as to be classed into various grades of sand. There is perhaps a wider range in the texture of sandy soils than there is in clay soils. Sandy soils are loose and open, and readily show the characteristics of sand.

Soils made up of particles larger than one millimeter in diameter are very coarse, and are not usually classed as agricultural soils.

To illustrate the value of physical condition of the soil as regards crop production, a study of the soil in the Mississippi Delta is very illuminating. This Delta land is "made" soil, being deposited during the flood waters of the Mississippi River. Since the carrying power of a stream of water increases as the sixth power of the velocity of the stream, it is very obvious that when a stream is running at a rapid rate it may carry in suspension an enormous amount of soil. It is equally evident that when the velocity of the stream is decreased very materially it will rapidly deposit its load.

THE SOIL AND INTENSIVE TILLAGE

When a river carrying large quantities of soil overflows its banks, or empties at its mouth, its velocity is so greatly decreased that the debris at once begins to settle to the bottom. The order in which it is deposited is according to the weight of the particles. The coarsest particles, being deposited first, give the soil adjacent to the river and bayous a coarser sandy texture than that more distant from the water courses. Now, the coarser and more sandy land on the bayou "fronts" yields much heavier crops than the "buck-shot" land, which is made up of very fine particles run together. This is due to the fact that the sandy land is more easily pulverized and cultivated than the land carrying the "buckshot." It is more porous and allows the air and moisture to circulate more freely.

Color in soil has long been recognized as an index to the value of soil. This is because color indicates something of the constituents of the soil, and also indicates the warmth or coldness of the soil. It is imparted both by humus and certain chemical elements. Humus may be described as organic matter. It generally gives soil a very dark appearance, especially when it is wet, when it frequently becomes nearly black. It is a commonly known fact that dark soil is warmer than light-colored soil. This is because dark-colored materials absorb heat more readily than light-colored materials. This partly explains why seeds germinate quicker and young plants grow faster in dark soils than in light soils. Of course, this is not the sole reason, but, other things being equal, dark soils produce earlier and larger crops than light soils. The compounds in which iron forms a prominent part are among the principal materials that give color to the soil.

The reader will observe what we said before: "Other things being equal, dark soils produce earlier and larger crops than light soils." But, to emphasize the importance of the physical condition of the soil, we again refer to the delta lands, where the coarse sandy soil is much lighter in color than the black "buckshot" and produces the earliest and largest crops. This proves that the physical condition of the soil affects the temperature as much as, or more than, color. Soil that is porous allows the air to circulate freely, and consequently the heat from the sun's rays readily passes down.

What has been said above, both regarding the chemical and physical properties of the soil, points directly to one important fact: That, in order to take advantage of the chemical content of his soil, the farmer must secure its fine physical tilth, and that of the physical and chemical conditions, the physical is the more important. Especially is this true in view of the fact that few soils are lacking in the essential ingredients.



Feeding Plants

THERE ARE FOUR CLASSES OF PLANTS, according to the service they perform: (1) Those that are grown to feed our domestic animals upon, (2) those that are grown for direct human consumption, (3) those that are grown to furnish protection for man and his domestic animals, and (4) those that are grown for their æsthetic value. In this brief article we only hope to give the reader an idea of how those of the first two classes feed from the soil. Fortunately for the farmer, comparatively few plants are grown as farm products.

As stated in the article, "The Soil," the soil is made up of various chemical elements from which, in their many combinations, plants secure the greater part of their nourishment. However, it is evident that the plants receive some of their nourishment from the atmosphere; and it is also evident that certain ones can transfer that all-important element, nitrogen, from its atmospheric state into a form which can be utilized by the plants.

The Root's Function

The body of the plant has three divisions: the root, the stem, and the leaf. The principal function of the root is to penetrate the soil, giving the plant footing and securing moisture and food. There are two kinds of roots: (1) Those that have a large taproot, which goes down deep and straight into the soil, and sends out lateral branches at intervals. Plants having this kind of a root can endure droughts and utilize the soil to a much greater depth than the others. (2) Those that branch out immediately under the surface of the ground, such as Indian corn. Plants having this kind of a root establish themselves very quickly, and make quick, rapid growth.

On the rootlets are myriads of little root-hairs which grow from the surface cells just back of the root tip. These little root-hairs grow out rapidly, forcing themselves among the soil particles around which are water-films. These water-films have dissolved and taken into solution the plant-food in the soil particles. The roots on which these little root-hairs grow are known as "feeders." Consequently, in our method of tillage we must always bear in mind the conditions that will make it most favorable for these rootlets to prosper. While the penetrating power of roots is tremendous, from observation we know that the economical growth of plants depends upon the ease with which these rootlets may cast about in the soil for food.

The Leaves and Carbonic Acid

In our article on the soil we stated that only about fifteen chemical elements were of any concern to the farmer from an agricultural standpoint, and that only eight constituted nearly 99% of the earth's crust. Of the essential elements to the plant are those that comprise four bases and four acids. The bases are potash, lime, iron, and magnesium. The acids are nitric, phosphoric, sulphuric, and carbonic. With the exception of carbonic acid, all these substances are necessary for the growth of plants. The soil furnishes to the plant all these substances in varying quantities. However, carbonic acid is taken from the air by the leaves of the plants. Because of this phenomenon, plants are healthful to have in the living and sleeping rooms.

Perhaps the most important function of the carbonic acid in the soil is as a solvent to the other plant-foods with which it comes in contact. In this

THE SOIL AND INTENSIVE TILLAGE

manner the other essential elements become available for the plant's use. The principal source of carbonic acid in the soil is from decaying organic matter. This process of decay is accelerated by a liberal supply of warmth, air, and moisture, which fact emphasizes again the importance of obtaining an excellent physical condition in the soil by thorough tillage.

The Stem and Sap Movement

The stem is the connecting link between the two vital organs of the plant, namely, the roots and the leaves. Through it and into the finest veins in the leaf are carried the nourishment for the plant. There has been considerable discussion as to how the sap rises, and it is probable that we do not yet know how it takes place. Owing to the fact that freshly cut stumps bleed from the top, the theory was advanced that the sap was forced up by root pressure. It was also thought at one time that the sap was taken upward in the plant by capillarity, the same as kerosene is carried to the burner of the lamp through the wick. However, these and other theories are not in favor at the present time. We believe the one most generally accepted now is that there are water-pulling substances in the leaves which act similarly to the root-hairs in pulling the thin film of water away from the soil particles.

The part the leaves play in furnishing the plant with food is very important. Scientists tell us that the water, carried to the leaves through the roots and stems, unites with the carbon dioxide of the air. This is brought about by the sun's heat, which breaks up the carbon and oxygen in the carbon dioxide and leaves the carbon free to unite with the water, the result of which is the production of starch. By this process the oxygen in the carbon dioxide is liberated. This explains how plants consume the carbon dioxide thrown off from the lungs of animals and how they give back oxygen—the element most needed by man and animals.

Intensive Tillage

TILLAGE IS THE ART of fitting the soil to receive a crop and carry it until maturity. From this definition it is seen that tillage applies equally to treatment of the soil before planting and after planting.

Its object is to create conditions whereby we may better control the production of crops. From the two foregoing articles, "The Soil" and "Feeding Plants," the following facts stand out clearly: (1) That the soil consists of substances known as chemical elements, (2) that these chemical elements supply almost all of the plant-food, (3) that the essential ingredients of plant-food are lacking in very few soils, (4) that frequently some of the ingredients are in forms unavailable as plant-food, (5) that plant-food is most available when the soil particles are as finely pulverized as is consistent with good physical condition, (6) that pulverizing makes it easy for the air, warmth, and moisture to circulate freely in the soil, (7) that air, warmth, and moisture are the agents by which unavailable plant-food is made available, (8) that the physical condition of the soil is of greater importance than the chemical condition.

These facts point to but one conclusion: That the foundation of good farming is intensive tillage.

THE SOIL AND INTENSIVE TILLAGE

Six Minor Objects of Good Tillage

While the chief purpose of tillage is to feed the plant, there are several minor objects, all of which assist in accomplishing the main purpose. They are: (1) To make the surface soil of a uniform condition, so that the growth of the plant will be equally vigorous over all the field; (2) to effect a fine tilth to such a depth as will give the plant ample feeding room; (3) to reduce the size of the soil particles, thereby multiplying their number and increasing the total soil-particle surfaces such that the water-holding capacity of the soil is increased; (4) to improve the drainage of the surplus soil moisture; (5) to mix the organic with the inorganic matter; (6) to eradicate weeds (which are plants out of place).

Tillage was one of the earliest developed industrial arts. Its evolution has been long and slow, but at last has attained a high degree of perfection. This result has been brought about by both a more complete knowledge of the soil and a more thorough understanding of mechanics. That our progress has been real progress is proved by comparing crop yields on the best farms of today with those on the best farms during past generations.

In spite of the fact that the processes that go on in the soil are very complex, the successful management of the soil does not depend on a complete knowledge of all of these processes. The good farmer is like the good business man; he understands how to put into effect the fundamental principles upon which his business is built, and to secure results that mean dollars in profit to him. A good plowman may produce more dollars in profit from his field than an expert chemist could do. This is because he has learned what good farming practice is. He knows the result that certain practices give, and he is guided accordingly. Thus it is that the good farmer of today does not ask whether he should plow deep or shallow, whether he should pulverize his seed-bed finely or not, or whether he should continue cultivation when there are no weeds in the field. He sets to plowing deeply, pulverizing his seed-bed finely, and cultivating, regardless of whether or not there are weeds. Why? Because these practices have brought him success.

Making the surface of the field uniform throughout, so that it will produce from its entire area plants of equal strength and vigor, is in effect the same as increasing the acreage. Preparing the field uniformly in all its parts may be compared to intensely cultivating all the fields of a farm in order that the whole farm will produce its maximum yield. The loss of crops, due to a lack of equal tillage over the entire surface of a field is very great in many cases. "Dead furrows" are illustrations of loss due to lack of uniformity in the field surface. Such losses, due to these conditions, should be prevented by using such implements as will leave the surface of the land in uniform condition, so that each square foot in the field is prepared to grow as good a crop as any other square foot.

Deep Tillage is Important

The depth to which land is tilled is one of the most important factors in the production of large crops. To any reasonable extent, the greater the depth that the soil is tilled, the greater is the amount of soil from which the plants may secure their nourishment. A field given a fine tilth to the depth of eight inches has twice as much feeding space as soil tilled to a depth of only four inches. While the proportions may not be exact, due to various influences, it is certain that, other things being equal, the deeper the tillage the larger the crop. This

THE SOIL AND INTENSIVE TILLAGE

fact should be borne in mind by every farmer. Though he cannot increase the acreage of his farm by adding adjacent fields to it, he can increase its acreage by going down deep, and thus increase his crop yields almost in proportion to the increased depth to which he pulverizes his soil.

Of the six minor objects of cultivation as given above, the most important is the third, which is to reduce the size of the soil particles so as to increase their number. This object is always present wherever cultivation is practiced. Bear in mind that the ingredients of plant-food are constituents of the soil, being locked up, as it were, in it.

Plants can only take up their food in a liquid form. It is therefore necessary for the farmer to put the plant-food ingredients into such a condition that they will readily dissolve. It is common knowledge that fine particles dissolve more readily than coarse particles. This is due to their constitutional condition, and also to the fact that the smaller the particles, the larger is the total surface of the particles; that is to say, if you were to take a pint cupful of granulated sugar, the sum of the surface areas of all the grains would be many, many times greater than the surface area of the cup containing them. This makes it plain that, since the soil moisture is held by forming thin water-films over the particles, the more particles there are to a cubic inch or a cubic foot, the greater will be the capacity of that soil to hold moisture. It is also true that the smaller the particles the more accessible are the chemical elements in the soil to the water-films which must dissolve these chemical elements and take them into their own solution, so that when the root-hairs come in contact with the water-films they will be enabled to take up the plant-food.

If the reader can picture in his mind the soil as made up of millions of minute particles, each one of which contains one or more of the ingredients of plant-food, and that each of these particles is surrounded by a water-film, and that this water-film dissolves the plant-food ingredient, and that the root-lets working their way among the particles cast out little root-hairs and draw off the water-films from the particles and start that water through the plant as nourishment, he will have in his mind the secret of how plants feed.

Intensive Tillage is a Fundamental Principle

From the foregoing it must be evident to every reader that intensive tillage is the fundamental principle upon which successful plant feeding depends. It must be recognized that some soils are naturally more friable

and of finer granules than others. A fine granular condition is an advantage, because it makes cultivation more easy, but because of this natural advantage the farmer is not relieved of thorough tillage. It is still up to him to cultivate that soil, stirring it as often and as deep as is practical. In this manner he reduces his soil to a still better physical condition and breaks up particles that have run together, and prepares the soil to take in more readily the air, warmth, and moisture which are so vital to the processes of plant nutrition.

The adding of organic matter to the soil has a great deal more value than the mere addition of the fertility which that organic matter contains. This is due to the chemical reactions which it starts in the soil. These reactions change the organic composition of the soil, making the plant-food ingredients soluble. This is a fact which has been long established in regular farm practice, and it is one more evidence of the necessity of intensive tillage; for tillage mixes together the organic and the inorganic matter, so that the maximum amount of good may result from the addition of this substance.

THE SOIL AND INTENSIVE TILLAGE

This fact also shows that the addition of organic matter from barnyard manures and green manures should go hand in hand with good tillage. One assists the other.

The last of the minor objects of tillage as given above was weed eradication. It has been said that weeds are a blessing in disguise, and it is probable that there is much truth in the statement. Weeds are a visible enemy, and many farmers will fight them who would not cultivate for less visible reasons. They realize that the fertility taken up by weeds and the crowding out of the crop means a loss, whereas they do not appreciate the value of tillage as a producer of available plant-food. The farmer who raises maximum crops is the farmer who practices the best tillage. This applies to the working of the soil in preparation for the seed and its cultivation during the growth of the crop.

From Forest to Cornfield in a Single Season

BY H. O. DANIELS, MILLBROOK FARM

THINKING perhaps a little of our experience might prove interesting, we are writing you concerning our operations in transforming a field that was in forest last year, but at this writing (August 17th) is growing a splendid crop of corn. The methods employed were what might be termed the most modern. Of the machinery used CUTAWAY tools played such an important part that we feel it is due to you and to the memory of that great benefactor of modern agriculture, the late George M. Clark, that we acknowledge the splendid, effective work your machinery did in making it possible to subdue and thoroughly prepare a forest field so that other modern machinery like the manure spreader, the two-row corn planter, the sulky cultivator, etc., could be easily used within a few weeks after the forest trees and stumps had been removed.

Of course, we did not expect the CUTAWAY tools could dig out the stumps and big roots. We used dynamite for that work, employing a man familiar with the handling of dynamite, who, with our help and 700 pounds



The Bush and Bog Plow at work after dynamite and fire had done their work

It is poor policy that puts
a poor tool in a good farmer's
hands. Every farmer
owes it to himself to get
the most efficient and durable
tool. With a

Cutaway
CLARK'S

you can cover more ground
with less expenditure of
horse and man strength and
do a better job. Will you
believe your own eyes?
Then we will show *you*.