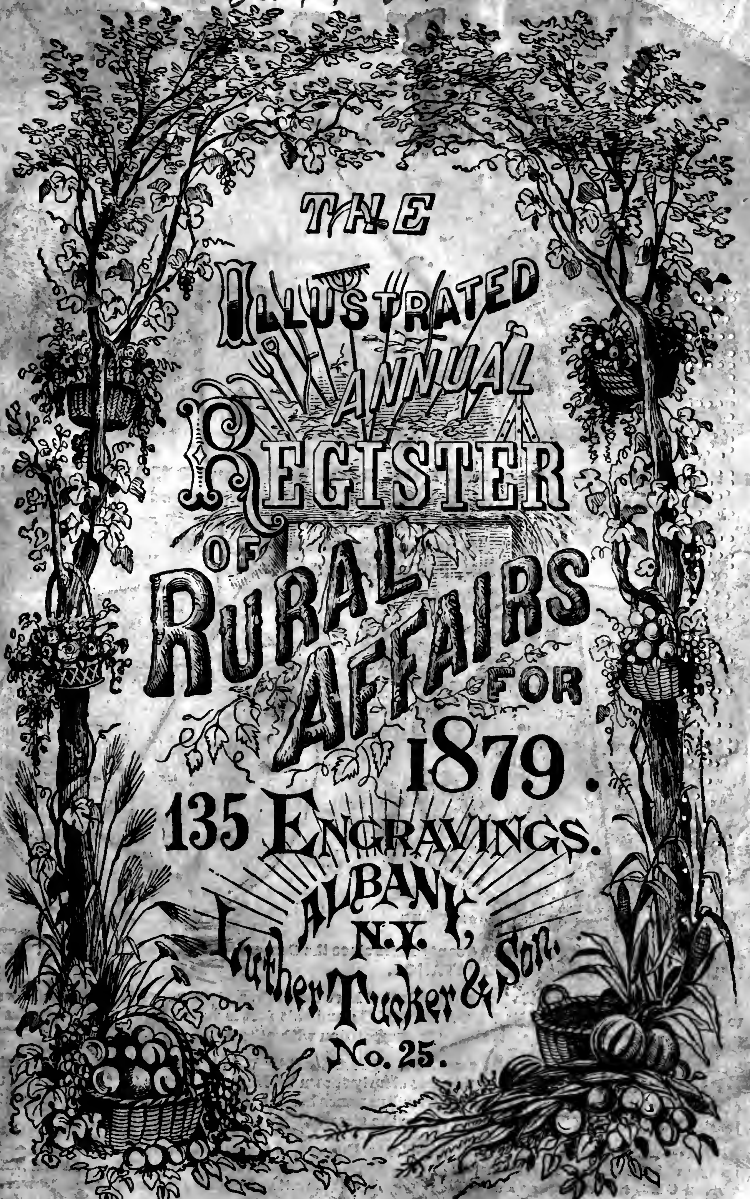
Price] [30 Cts.


THE
ILLUSTRATED
ANNUAL
REGISTER
OF
RURAL AFFAIRS
FOR
1879.
135 ENGRAVINGS.
ALBANY,
N.Y.
Luther Tucker & Son.
No. 25.

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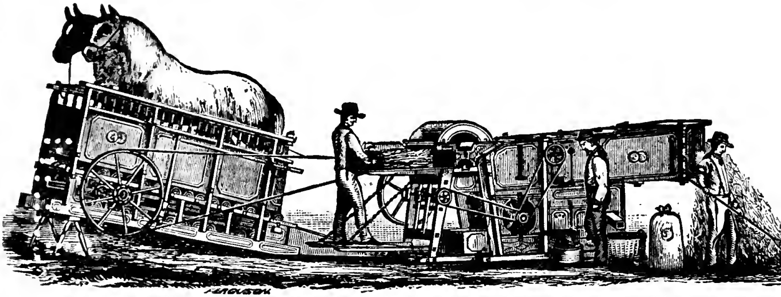

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THE

ILLUSTRATED ANNUAL

REGISTER OF RURAL AFFAIRS

AND

CULTIVATOR ALMANAC

For the Year 1879,

CONTAINING

PRACTICAL SUGGESTIONS FOR THE FARMER
AND HORTICULTURIST.

With about 130 Engravings.

BY J. J. THOMAS.

AUTHOR OF THE 'AMERICAN FRUIT CULTURIST,' AND 'FARM IMPLEMENTS;'
Associate Editor of the 'Cultivator & Country Genlleman.'

ALBANY, N. Y.:
LUTHER TUCKER & SON, 395 Broadway.
1879.

PUBLISHERS' ADVERTISEMENT.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS has now reached its Twenty-Fifth year, under the continuous Editorial charge of Mr. JOHN J. THOMAS, to whose thorough practical knowledge of the various topics it has embraced, with assistance from other accomplished writers on special subjects, its readers have been indebted for the most comprehensive and concise series of papers in the different branches of Rural Economy, within the whole range of our agricultural literature. The profuse illustrations from the pencil of the Editor, by which they are accompanied, give special attractiveness and value to the work, for which most of them are especially drawn and engraved; and the reading matter is wholly from the manuscript of the authors, and original, except to the limited extent in which it is expressly stated to be a condensation from the writings of others. Brief reference is made, under the head of "Agricultural Memoranda," to the leading events of the past year—the books published, deaths recorded, chief importations of improved stock, leading public sales, &c.

Designed to supply, in connection with the Calendar pages of an Almanac, an ANNUAL of Agriculture and Horticulture, THE REGISTER OF RURAL AFFAIRS incidentally illustrates from year to year, the progress made in these important Arts, but is especially intended to compress within a small compass the largest possible amount of information for the farmer and fruit-grower, and indeed on all points connected with the out-door or in-door labors of those whose homes are in the Country. While the previous numbers will consequently be found to contain more or less on every branch of practical cultivation, they are also especially rich in Designs for Farm and Country Houses and Workingmen's Cottages,—on Ornamental Planting, and the care of Gardens and Grounds,—and on related topics, such as Architecture generally, plans of barns, ice-houses and other out-buildings, fences and gates, vegetable physiology, entomology, farm and horticultural implements, the care of domestic animals, hints for housekeepers, underdraining, butter and cheese making, poultry and bee-keeping, &c., &c.—thus constituting in fact a LIBRARY in themselves. The Publishers can supply the Numbers in paper covers, as they originally appeared, with the exception of those for 1855, '57, 1860, '63, 1873 and '74. Either of these may at any time be obtained by remitting Thirty Cents, or any four of them for One Dollar, enclosed by mail to LUTHER TUCKER & SON, *Albany, N. Y.*

RURAL AFFAIRS.

A reprint of the ANNUAL REGISTER appears under the above title, in TRIENNIAL VOLUMES, on larger, finer and heavier paper, without advertisements or calendar pages. This is the only form in which the entire set can be procured, and it contains about *Twenty-Seven Hundred pages*, in all, illustrated with nearly *Thirty-Five Hundred Engravings.* A brief Abstract of the Contents of the several Volumes appears in the following pages, although necessarily so compressed as to convey but a very incomplete idea of the number and variety of the topics embraced, and the concise and practical manner in which they are treated.

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ILLUSTRATIONS.

THE

CULTIVATOR ALMANAC

FOR 1879.

ASTRONOMICAL CALCULATIONS IN EQUAL OR CLOCK TIME.

ECLIPSES FOR THE YEAR 1879.

THERE WILL BE THREE ECLIPSES this year, two of the Sun and one of the Moon, none of them visible in the United States.

1. An Annular Eclipse of the Sun, Jan. 22; visible in South America, the South Atlantic Ocean, Africa, and a part of Asia.

2. An Annular Eclipse of the Sun, July 19; visible in the South Atlantic Ocean, Africa and part of Asia.

3. A Partial Eclipse of the Moon, December 28.

THE FOUR SEASONS.

				H.	M.			D.	H.	M.
Winter	begins,	1878, December	21,	5	33	eve.,	and lasts	89	0	53
Spring	do.	1879, March	20,	6	26	eve.,	do.	92	20	9
Summer	do.	1879, June	21,	2	35	eve.,	do.	93	14	34
Autumn	do.	1879, September	23,	5	9	mo.,	do.	89	18	9
Winter	do.	1879, December	21,	11	18	eve.	Trop. year,	365	5	45

MORNING AND EVENING STARS.

DEFINITION.—The conspicuous planet Venus is called a Morning Star when she rises before the Sun, and an Evening Star when she sets after the Sun. The same terms may be applied to the planet Mercury under like circumstances, though this planet is seen with difficulty, because of the strong solar twilight in which it is usually immersed. The planets Mars, Jupiter and Saturn may be considered Morning Stars when they rise before the Sun, and Evening Stars when they set after the Sun, in the same manner as Venus does. But they may also be considered as Evening Stars when they rise before 12 o'clock at night, and as Morning Stars when they are visible before sunrise, until the day when they set on or before sunrise. The following tables have been prepared according to this definition:

MORNING STARS.—Mercury, until March 4; and from April 17 to June 18; and from Aug. 23 to Oct. 5; and from Dec. 10 to the end of the year. Venus from Sept. 23 to the end of the year. Mars until Nov. 12. Jupiter from Feb. 8 to Aug. 31, after which date Jupiter sets before sunrise, and rises so near to sunset as to be properly accounted an Evening Star. Saturn from March 26 to Oct. 5, after which date Saturn begins to set before sunrise earlier every day.

EVENING STARS.—Mercury from March 4 to April 17; and from June 18 to Aug. 23; and from Oct. 5 to Dec. 10. Venus until Sept. 23. Mars from Nov. 12 to the end of the year. Jupiter until about Feb. 8; and from June 11, rising before midnight, to the end of the year. Saturn until March 26; and from July 3, rising before midnight, to near the end of the year.

PLANETS BRIGHTEST.

On account of the strong twilight in which Mercury is always immersed, this planet will be taken to be *brightest*, or *best seen*, when farthest from the Sun, at its greatest elongation, as follows: January 16, before sunrise; March 29, after sunset; May 15, before sunrise; July 26, after sunset; September 9, before sunrise; November 20, after sunset; December 28, before sunrise.

Venus brightest, August 19 and October 30. Mars, November 12. Jupiter, August 31. Saturn, October 5.

CHURCH DAYS AND CYCLES OF TIME.

Septuagesima Sun., Feb. 9	Easter Sunday, Apl. 13	Dominical Letter,... E
Sexagesima " " 16	Low " " 20	Epact, ... 7
Quinquagesima " " 23	Rogation " May 18	Golden Number,..... 18
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APPARENT AND MEAN TIME.

Time is both *apparent* and *mean*. The Sun is on the meridian at 12 o'clock on four days only in the year. It is sometimes as much as 16¼ minutes before or after twelve when the shadow strikes the noon mark on the sun-dial. This is called *apparent time*. *Mean time* is determined by the *equation* of these irregularities for every day in the year, and is noted in all good almanacs. The latter is the true or correct time.

1st MONTH. **JANUARY, 1879.** 31 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
FULL MOON,....	8	7 4 mo.	6 52 mo.	6 40 mo.	1	12 3 51
THIRD QUARTER	15	6 18 mo.	6 6 mo.	5 54 mo.	9	12 7 24
NEW MOON,....	22	7 7 mo.	6 55 mo.	6 43 mo.	17	12 10 23
FIRST QUARTER,	30	7 0 mo.	6 48 mo.	6 30 mo.	25	12 12 36

DAY OF MONTH.	DAY OF WEEK.	**CALENDAR** For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				**CALENDAR** For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				**CALENDAR** For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
		SUN RISES	SUN SETS.	MOON SETS.	H. W. BOST'N	SUN RISES	SUN SETS.	MOON SETS.	H. W. N. Y.	SUN RISES	SUN SETS.	MOON SETS.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	W	7 30	4 38	0 58	5 13	7 25	4 44	0 55	1 59	7 19	4 49	0 53
2	T	7 30	4 39	2 0	6 4	7 25	4 44	1 56	2 50	7 19	4 50	1 54
3	F	7 30	4 40	3 3	6 59	7 25	4 45	2 58	3 45	7 19	4 51	2 54
4	S	7 30	4 41	4 7	7 54	7 25	4 46	4 1	4 40	7 19	4 51	3 55
5	S	7 30	4 42	5 9	8 51	7 25	4 47	5 0	5 37	7 19	4 52	4 56
6	M	7 30	4 43	6 8	9 50	7 25	4 48	6 1	6 36	7 19	4 53	5 54
7	T	7 30	4 44	rises.	10 47	7 25	4 49	rises.	7 33	7 19	4 54	rises.
8	W	7 29	4 45	5 2	11 39	7 24	4 50	5 8	8 25	7 19	4 55	5 14
9	T	7 29	4 46	6 15	ev. 23	7 24	4 51	6 20	9 9	7 19	4 56	6 25
10	F	7 29	4 47	7 29	1 3	7 24	4 52	7 32	9 49	7 19	4 57	7 36
11	S	7 29	4 48	8 43	1 45	7 24	4 53	8 45	10 31	7 19	4 58	8 47
12	S	7 28	4 49	9 56	2 28	7 23	4 54	9 57	11 14	7 18	4 59	9 57
13	M	7 28	4 50	11 10	3 12	7 23	4 55	11 9	11 58	7 18	5 0	11 8
14	T	7 28	4 52	morn	3 59	7 23	4 56	morn	ev. 45	7 18	5 1	morn
15	W	7 27	4 53	0 25	4 52	7 22	4 57	0 22	1 33	7 17	5 2	0 20
16	T	7 27	4 54	1 41	5 55	7 22	4 59	1 37	2 41	7 17	5 3	1 33
17	F	7 26	4 55	2 56	7 6	7 21	5 0	2 51	3 52	7 17	5 4	2 46
18	S	7 25	4 56	4 9	8 15	7 21	5 1	4 3	5 1	7 16	5 6	3 57
19	S	7 25	4 58	5 15	9 22	7 20	5 2	5 8	6 8	7 16	5 7	5 1
20	M	7 24	4 59	6 8	10 26	7 20	5 3	6 2	7 12	7 15	5 8	5 56
21	T	7 23	5 0	sets.	11 21	7 19	5 4	sets.	8 7	7 15	5 9	sets.
22	W	7 23	5 1	5 23	morn	7 19	5 6	5 27	8 50	7 14	5 10	5 32
23	T	7 22	5 3	6 31	0 4	7 18	5 7	6 35	9 27	7 13	5 11	6 38
24	F	7 21	5 4	7 37	0 41	7 17	5 8	7 39	10 2	7 13	5 12	7 42
25	S	7 20	5 5	8 41	1 16	7 16	5 9	8 42	10 38	7 12	5 13	8 43
26	S	7 20	5 6	9 43	1 52	7 15	5 10	9 43	11 14	7 11	5 15	9 42
27	M	7 19	5 8	10 44	2 28	7 15	5 12	10 43	11 50	7 11	5 16	10 41
28	T	7 18	5 9	11 46	3 4	7 14	5 13	11 43	morn	7 10	5 17	11 40
29	W	7 17	5 10	morn	3 43	7 13	5 14	morn	0 29	7 9	5 18	morn
30	T	7 16	5 11	0 48	4 27	7 12	5 15	0 44	1 13	7 8	5 19	0 40
31	F	7 15	5 13	1 51	5 18	7 11	5 17	1 46	2 4	7 7	5 20	1 41

AGRICULTURAL MEMORANDA—*October* 1, 1877, *to October* 1, 1878, *with reference to date of* THE COUNTRY GENTLEMAN *containing particulars:*

Agricultural Exports of 1877, $297,686,238—Jan. 3, 1878.
Agricultural Steam Engine Trial at Syracuse, Nov. 22, 1877; March 21, 1878.
American Berkshire Record. Vol. 2d. P. M. Springer, Springfield, Ill. Jan. 3, 1878.
American Cotswold Association Organized at Chicago. Jan. 31; March 14, 1878.
American Dairyman's Association—13th Annual Report. L. B. Arnold, Sec. May 9, '78.
American Guernsey Cattle Club Herd Register No. 1. Edw. Norton, Sec. Aug. 1, '78.

2d MONTH. **FEBRUARY, 1879.** 28 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N. H. M.	SUN ON MERID. D.	H. M. S.
Full Moon, ...	6	8 58 ev.	8 46 ev.	8 34 ev.	1	12 13 51
Third Quarter	13	2 10 ev.	1 58 ev.	1 46 ev.	9	12 14 27
New Moon, ...	20	11 19 ev.	11 7 ev.	10 55 ev.	17	12 14 14

		CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
DAY OF MONTH.	DAY OF WEEK.	SUN RISES	SUN SETS.	MOON SETS.	H. W. BOST'N	SUN RISES	SUN SETS.	MOON SETS.	H. W. N. Y.	SUN RISES	SUN SETS.	MOON SETS.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	S	7 14	5 14	2 54	6 17	7 10	5 18	2 48	3 3	7 6	5 22	2 42
2	**E**	7 13	5 15	3 53	7 22	7 9	5 19	3 47	4 8	7 5	5 23	3 40
3	M	7 12	5 17	4 48	8 23	7 8	5 20	4 41	5 9	7 5	5 24	4 34
4	T	7 10	5 18	5 35	9 26	7 7	5 21	5 29	6 12	7 4	5 25	5 23
5	W	7 9	5 19	6 15	10 25	7 6	5 23	6 10	7 11	7 3	5 26	6 5
6	T	7 8	5 21	rises.	11 19	7 5	5 24	rises.	8 5	7 2	5 27	rises.
7	F	7 7	5 22	6 25	ev. 3	7 4	5 25	6 27	8 49	7 0	5 28	6 29
8	S	7 6	5 23	7 40	0 41	7 3	5 26	7 41	9 27	6 59	5 30	7 42
9	**E**	7 5	5 25	8 56	1 21	7 1	5 28	8 56	10 7	6 58	5 31	8 55
10	M	7 3	5 26	10 13	2 4	7 0	5 29	10 11	10 50	6 57	5 32	10 9
11	T	7 2	5 27	11 30	2 50	6 59	5 30	11 26	11 36	6 56	5 33	11 23
12	W	7 1	5 28	morn	3 39	6 58	5 31	morn	ev. 25	6 55	5 34	morn
13	T	6 59	5 30	0 44	4 36	6 57	5 32	0 42	1 22	6 54	5 35	0 37
14	F	6 58	5 31	2 0	5 44	6 55	5 34	1 55	2 30	6 53	5 36	1 49
15	S	6 56	5 32	3 8	6 59	6 54	5 35	3 1	3 45	6 51	5 37	2 55
16	**E**	6 55	5 33	4 5	8 8	6 53	5 36	3 59	4 54	6 50	5 39	3 53
17	M	6 54	5 35	4 52	9 11	6 51	5 37	4 46	5 57	6 49	5 40	4 41
18	T	6 52	5 36	5 30	10 7	6 50	5 38	5 25	6 53	6 47	5 41	5 20
19	W	6 51	5 37	6 0	10 57	6 48	5 39	5 57	7 43	6 46	5 42	5 53
20	T	6 49	5 39	sets.	11 40	6 47	5 41	sets.	8 26	6 45	5 43	sets.
21	F	6 48	5 40	6 28	morn	6 46	5 42	6 29	8 59	6 44	5 44	6 30
22	S	6 46	5 41	7 30	0 13	6 44	5 43	7 30	9 30	6 42	5 45	7 30
23	**E**	6 45	5 42	8 32	0 44	6 43	5 44	8 31	10 2	6 41	5 46	8 29
24	M	6 43	5 44	9 33	1 16	6 41	5 45	9 31	10 37	6 40	5 47	9 29
25	T	6 42	5 45	10 36	1 51	6 40	5 46	10 32	11 14	6 38	5 48	10 28
26	W	6 40	5 46	11 38	2 28	6 38	5 48	11 29	11 54	6 37	5 50	11 28
27	T	6 39	5 47	morn	3 8	6 37	5 49	morn	morn	6 35	5 51	morn
28	F	6 37	5 49	0 40	3 52	6 35	5 50	0 34	0 38	6 34	5 52	0 29

3d MONTH.	MARCH, 1879.	31 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
FIRST QUARTER,	1	3 14 mo.	3 2 mo.	2 50 mo.	1	12 12 23
FULL MOON,....	8	8 25 mo.	8 13 mo.	8 1 mo.	9	12 10 42
THIRD QUARTER	14	10 57 ev.	10 45 ev.	10 33 ev.	17	12 8 29
NEW MOON,....	22	4 20 ev.	4 8 ev.	3 56 ev.	25	12 6 5
FIRST QUARTER,	30	8 21 ev.	8 9 ev.	7 57 ev.	31	12 4 15

DAY OF MONTH.	DAY OF WEEK.	CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon. SUN RISES H M	SUN SETS. H M	MOON SETS. H M	H. W. BOST'N H M	CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois. SUN RISES H M	SUN SETS. H M	MOON SETS. H M	H. W. N. Y. H M	CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California. SUN RISES H M	SUN SETS. H M	MOON SETS. H M
1	S	6 35	5 50	1 40	4 44	6 34	5 51	1 33	1 30	6 32	5 53	1 27
2	**E**	6 34	5 51	2 35	5 45	6 32	5 52	2 29	2 31	6 31	5 54	2 22
3	M	6 32	5 52	3 25	6 52	6 31	5 53	3 18	3 38	6 29	5 54	3 12
4	T	6 30	5 53	4 7	7 57	6 29	5 55	4 2	4 43	6 28	5 56	3 57
5	W	6 29	5 55	4 43	8 58	6 28	5 56	4 39	5 44	6 26	5 57	4 35
6	T	6 27	5 56	5 14	9 55	6 26	5 57	5 12	6 41	6 25	5 58	5 9
7	F	6 25	5 57	rises.	10 49	6 25	5 58	rises.	7 35	6 24	5 59	rises.
8	S	6 24	5 58	6 32	11 36	6 23	5 59	6 32	8 22	6 22	6 0	6 32
9	**E**	6 22	5 59	7 50	ev. 18	6 21	6 0	7 49	9 4	6 20	6 1	7 48
10	M	6 20	6 1	9 10	0 57	6 20	6 1	9 7	9 43	6 19	6 2	9 4
11	T	6 19	6 2	10 30	1 41	6 18	6 2	10 26	10 27	6 17	6 3	10 21
12	W	6 17	6 3	11 48	2 32	6 16	6 3	11 42	11 18	6 16	6 4	11 37
13	T	6 15	6 4	morn	3 27	6 15	6 5	morn	ev. 13	6 15	6 5	morn
14	F	6 14	6 5	0 59	4 27	6 13	6 6	0 53	1 13	6 13	6 6	0 46
15	S	6 12	6 6	2 1	5 36	6 11	6 7	1 54	2 22	6 11	6 7	1 48
16	**E**	6 10	6 7	2 51	6 47	6 10	6 8	2 45	3 33	6 10	6 8	2 39
17	M	6 8	6 9	3 31	7 51	6 8	6 9	3 26	4 37	6 8	6 9	3 21
18	T	6 7	6 10	4 3	8 46	6 6	6 10	4 0	5 32	6 6	6 10	3 55
19	W	6 5	6 11	4 30	9 37	6 5	6 11	4 27	6 23	6 5	6 11	4 24
20	T	6 3	6 12	4 53	10 23	6 3	6 12	4 51	7 9	6 3	6 12	4 50
21	F	6 1	6 13	5 14	11 4	6 1	6 13	5 14	7 50	6 2	6 13	5 13
22	S	6 0	6 14	sets.	11 40	6 0	6 14	sets.	8 26	6 0	6 14	sets.
23	**E**	5 58	6 15	7 23	morn	5 58	6 15	7 21	8 59	5 59	6 15	7 19
24	M	5 56	6 17	8 25	0 13	5 57	6 16	8 22	9 31	5 57	6 16	8 18
25	T	5 54	6 18	9 27	0 45	5 55	6 17	9 22	10 4	5 55	6 17	9 18
26	W	5 53	6 19	10 28	1 18	5 53	6 18	10 23	10 44	5 54	6 18	10 18
27	T	5 51	6 20	11 29	1 58	5 52	6 19	11 23	11 26	5 52	6 19	11 17
28	F	5 49	6 21	morn	2 40	5 50	6 20	morn	morn	5 51	6 20	morn
29	S	5 47	6 22	0 25	3 26	5 48	6 21	0 19	0 12	5 49	6 21	0 12
30	**E**	5 46	6 23	1 17	4 19	5 47	6 22	1 10	1 5	5 48	6 22	1 4
31	M	5 44	6 25	2 1	5 18	5 45	6 24	1 55	2 4	5 46	6 23	1 50

Booth, John, Sherburne, England. Obituary, May 16; Booth, T. C., Sept. 26, Oct. 17, '78.
Connecticut Experiment Station—Report for 1877, by Prof. S.W. Johnson. March 28, '78.
Connecticut State Board of Agriculture—13th Annual Report. T.S. Gold, Sec. May 16, '78.
Cotswold Breeders' Association of Canada Organized. Jan. 31, 1878.
COUNTRY GENTLEMAN goes to 5,999 different Post-Offices. April 25, 1878.
Crane, A., Durham Park, Kan. Sale of Duchess Short-Horns in England. Nov. 8, 1877.
Dakota Wheat Farm—25 bushels per acre averaged on 2,300 acres. Aug. 27, 1878.

4th MONTH. **APRIL, 1879.** 30 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N. H. M.	SUN ON MERID. D.	H. M. S.
FULL MOON, ...	6	5 40 ev.	5 28 ev.	5 16 ev.	1	12 3 57
THIRD QUARTER	13	9 25 mo.	9 13 mo.	9 1 mo.	9	12 1 36
NEW MOON, ...	21	9 11 mo.	8 59 mo.	8 47 mo.	17	11 59 33
FIRST QUARTER,	30	9 32 mo.	9 20 mo.	9 8 mo.	25	11 57 54

CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.

CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.

CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.

DAY OF MONTH.	DAY OF WEEK.	Boston: SUN RISES. H M	SUN SETS. H M	MOON SETS. H M	H. W. BOST'N. H M	New-York: SUN RISES. H M	SUN SETS. H M	MOON SETS. H M	H. W. N. Y. H M	Washington: SUN RISES. H M	SUN SETS. H M	MOON SETS. H M
1	T	5 42	6 26	2 39	6 22	5 43	6 25	2 33	3 8	5 44	6 23	2 29
2	W	5 41	6 27	3 11	7 26	5 42	6 26	3 8	4 12	5 43	6 24	3 4
3	T	5 39	6 28	3 40	8 24	5 40	6 27	3 38	5 10	5 41	6 25	3 35
4	F	5 37	6 29	4 6	9 20	5 38	6 28	4 5	6 6	5 40	6 26	4 4
5	S	5 35	6 30	4 31	10 15	5 37	6 29	4 32	7 1	5 38	6 27	4 33
6	E	5 34	6 31	rises.	11 6	5 35	6 30	rises.	7 52	5 37	6 28	rises.
7	M	5 32	6 32	8 3	11 54	5 34	6 31	7 59	8 40	5 35	6 29	7 55
8	T	5 30	6 33	9 24	ev. 38	5 32	6 32	9 19	9 24	5 34	6 30	9 14
9	W	5 29	6 35	10 42	1 26	5 30	6 33	10 35	10 12	5 32	6 31	10 29
10	T	5 27	6 36	11 50	2 20	5 29	6 34	11 43	11 6	5 31	6 32	11 37
11	F	5 25	6 37	morn	3 17	5 27	6 35	morn	ev. 3	5 29	6 33	morn
12	S	5 24	6 38	0 46	4 17	5 26	6 36	0 40	1 3	5 28	6 34	0 33
13	E	5 22	6 39	1 31	5 19	5 24	6 37	1 25	2 5	5 26	6 35	1 19
14	M	5 20	6 40	2 6	6 21	5 22	6 38	2 1	3 7	5 25	6 36	1 57
15	T	5 19	6 41	2 34	7 19	5 21	6 39	2 31	4 5	5 23	6 37	2 28
16	W	5 17	6 42	2 58	8 10	5 19	6 40	2 56	4 56	5 22	6 38	2 54
17	T	5 16	6 44	3 20	8 57	5 18	6 41	3 19	5 43	5 20	6 39	3 18
18	F	5 14	6 45	3 40	9 41	5 16	6 42	3 40	6 27	5 19	6 40	3 41
19	S	5 12	6 46	4 0	10 24	5 15	6 43	4 2	7 10	5 18	6 41	4 4
20	E	5 11	6 47	4 21	11 5	5 13	6 44	4 24	7 51	5 16	6 42	4 23
21	M	5 9	6 48	sets.	11 43	5 12	6 45	sets.	8 29	5 15	6 42	sets.
22	T	5 8	6 49	8 22	morn	5 11	6 46	8 16	9 6	5 13	6 43	8 11
23	W	5 6	6 50	9 22	0 20	5 9	6 47	9 16	9 40	5 12	6 44	9 11
24	T	5 5	6 51	10 20	0 54	5 8	6 48	10 13	10 21	5 11	6 45	10 7
25	F	5 3	6 52	11 12	1 35	5 6	6 49	11 6	11 6	5 9	6 46	10 58
26	S	5 2	6 54	11 57	2 20	5 5	6 51	11 52	11 53	5 7	6 47	11 46
27	E	5 0	6 55	morn	3 7	5 4	6 52	morn	morn	5 6	6 48	morn
28	M	4 59	6 56	0 37	3 57	5 2	6 53	0 31	0 43	5 5	6 49	0 22
29	T	4 58	6 57	1 10	4 50	5 1	6 54	1 6	1 36	5 4	6 50	1 2
30	W	4 56	6 58	1 38	5 49	5 0	6 55	1 36	2 35	5 3	6 51	1 33

Domestic Animals—Chart of Ages, by Dr. Liautard. Orange Judd Co., N. Y. Oct. 3, 1878.
Douglas, James, Athelstaneford, Scotland. Obituary. April 4, 1878.
Ellwanger & Barry, Rochester, N. Y. New Rose Catalogue. March 21, 1878.
English Cart Horse Stud Book Association Organized. April 25, 1878.
English Jersey Herd Book instituted. John Thornton, Editor. Sept. 5, 1878.
Entomological Contributions. By Prof. J. A. Lintner, Albany, N. Y. Aug. 22, 1878.
Exportation of American Short-Horns by Mr. Fox. Jan. 3, 1878.
Famous Horses of America. Porter & Coates, Philadelphia. March 28, 1878.
Flagg, Willard C., Moro, Ill. Obituary. April 11, 1878.

MAY, 1879.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N. H. M.	SUN ON MERID. D.	H. M. S.
FULL MOON,....	6	1 28 mo.	1 16 mo.	1 4 mo.	1	11 57 0
THIRD QUARTER	12	9 52 ev.	9 40 ev.	9 28 ev.	9	11 56 17
NEW MOON,....	21	1 6 mo.	0 54 mo.	0 42 mo.	17	11 56 11
FIRST QUARTER,	28	6 52 ev.	6 40 ev.	6 28 ev.	25	11 56 41

		CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
DAY OF MONTH.	DAY OF WEEK.	SUN RISES	SUN SETS.	MOON SETS.	H. W. BOST'N	SUN RISES	SUN SETS.	MOON SETS.	H. W. N. Y.	SUN RISES	SUN SETS.	MOON SETS.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	T	4 55	6 59	2 5	6 50	4 58	6 56	2 4	3 36	5 2	6 52	2 2
2	F	4 53	7 0	2 30	7 48	4 57	6 57	2 30	4 34	5 1	6 53	2 30
3	S	4 52	7 1	3 1	8 44	4 56	6 58	2 57	5 30	4 59	6 54	2 59
4	**E**	4 51	7 3	3 23	9 40	4 54	6 59	3 26	6 26	4 58	6 55	3 39
5	M	4 49	7 4	rises.	10 39	4 53	7 0	rises.	7 25	4 57	6 56	rises.
6	T	4 48	7 5	8 14	11 35	4 52	7 1	8 8	8 21	4 56	6 57	8 2
7	W	4 47	7 6	9 29	ev. 26	4 51	7 2	9 22	9 12	4 55	6 58	9 16
8	T	4 46	7 7	10 32	1 14	4 50	7 3	10 26	10 0	4 54	6 59	10 20
9	F	4 45	7 8	11 23	2 9	4 49	7 4	11 18	10 55	4 53	7 0	11 12
10	S	4 43	7 9	morn	3 3	4 48	7 5	11 59	11 49	4 52	7 1	11 54
11	**E**	4 42	7 10	0 3	3 58	4 47	7 6	morn	ev. 42	4 51	7 2	morn
12	M	4 41	7 11	0 35	4 49	4 46	7 7	0 32	1 35	4 50	7 3	0 28
13	T	4 40	7 12	1 1	5 42	4 44	7 8	0 59	2 28	4 49	7 3	0 57
14	W	4 39	7 13	1 24	6 35	4 43	7 9	1 23	3 21	4 48	7 4	1 22
15	T	4 38	7 14	1 45	7 26	4 42	7 10	1 45	4 12	4 47	7 5	1 45
16	F	4 37	7 15	2 5	8 11	4 42	7 11	2 7	4 57	4 46	7 6	2 8
17	S	4 36	7 16	2 26	8 58	4 41	7 12	2 29	5 44	4 45	7 7	2 31
18	**E**	4 35	7 17	2 49	9 44	4 40	7 13	2 52	6 30	4 44	7 8	2 56
19	M	4 34	7 18	3 15	10 30	4 39	7 14	3 19	7 16	4 44	7 9	3 24
20	T	4 33	7 19	sets.	11 16	4 38	7 15	sets.	8 2	4 43	7 10	sets.
21	W	4 33	7 20	8 14	11 58	4 37	7 16	8 8	8 44	4 42	7 11	8 2
22	T	4 32	7 21	9 8	morn	4 37	7 16	9 2	9 24	4 42	7 11	8 55
23	F	4 31	7 22	9 56	0 38	4 36	7 17	9 50	10 4	4 41	7 12	9 44
24	S	4 30	7 23	10 37	1 18	4 35	7 18	10 31	10 48	4 40	7 13	10 26
25	**E**	4 29	7 24	11 11	2 2	4 35	7 19	11 7	11 34	4 40	7 14	11 3
26	M	4 28	7 25	11 41	2 48	4 34	7 20	11 38	morn	4 39	7 15	11 35
27	T	4 28	7 26	morn	3 33	4 33	7 21	morn	0 19	4 38	7 15	morn
28	W	4 27	7 27	0 7	4 22	4 33	7 21	0 6	1 8	4 38	7 16	0 3
29	T	4 27	7 27	0 31	5 14	4 32	7 22	0 31	2 0	4 37	7 17	0 31
30	F	4 26	7 28	0 56	6 11	4 32	7 23	0 57	2 57	4 37	7 18	0 58
31	S	4 26	7 29	1 22	7 12	4 31	7 24	1 24	3 58	4 37	7 18	1 26

Georgia Horticultural Society. Proceedings for 1877. J. S. Newman, Sec. May 9, '78.
Grant, George, Founder of Victoria Colony, Kansas. Obituary. May 9, 1878.
Hannan, John, a well known English Agriculturist and Author. Obituary. May 16, '78.
Helm's Am. Roadsters and Trotting Horses. Rand, McNally & Co., Chicago. Aug. 15, '78.
Highland and Agricultural Society of Scotland. Transactions for 1877. June 6, '78.
Hints and Helps to Horsemen. A. Cogswell, Publisher, New-York. Nov. 8, 1877.
House Plans for Everybody. By S. B. Reed. Orange Judd Co., New-York. Sept. 12, '78.
Illinois Crops of 1877—aggregate value estimated at $168,570,088. Feb. 28, '78.

6th MONTH. | **JUNE, 1879.** | 30 DAYS.

MOON'S PHASES.	D.	Boston. H. M.	New-York. H. M.	Washingt'n. H. M.	Sun on Merid. D.	H. M. S.
Full Moon, ...	4	8 52 mo.	8 40 mo.	8 28 mo.	1	11 57 33
Third Quarter	11	0 12 ev.	12 0 M.	11 48 mo.	9	11 58 56
New Moon, ...	19	3 35 ev.	3 23 ev.	3 11 ev.	17	12 0 35
First Quarter,	27	1 12 mo.	1 0 mo.	0 48 mo.	25	12 2 19

Day of Month.	Day of Week.	CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
		Sun Rises	Sun Sets.	Moon Sets.	H. W. Bost'n	Sun Rises	Sun Sets.	Moon Sets.	H. W. N. Y.	Sun Rises	Sun Sets.	Moon Sets.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	E	4 25	7 30	1 50	8 13	4 31	7 25	1 54	4 59	4 36	7 19	1 58
2	M	4 25	7 31	2 24	9 15	4 30	7 25	2 29	6 1	4 36	7 20	2 34
3	T	4 24	7 31	rises.	10 20	4 30	7 26	rises.	7 6	4 35	7 20	rises.
4	W	4 24	7 32	8 13	11 22	4 30	7 27	8 6	8 8	4 35	7 21	8 1
5	T	4 24	7 33	9 11	ev. 16	4 29	7 27	9 5	9 2	4 35	7 22	8 59
6	F	4 23	7 34	9 58	1 4	4 29	7 28	9 53	9 50	4 35	7 22	9 46
7	S	4 23	7 34	10 34	1 53	4 29	7 29	10 30	10 39	4 34	7 23	10 26
8	E	4 23	7 35	11 2	2 40	4 28	7 29	11 0	11 26	4 34	7 23	10 57
9	M	4 23	7 35	11 27	3 25	4 28	7 30	11 26	ev. 11	4 34	7 24	11 24
10	T	4 23	7 36	11 49	4 10	4 28	7 30	11 48	0 56	4 34	7 25	11 48
11	W	4 22	7 37	morn	4 56	4 28	7 31	morn	1 42	4 34	7 25	morn
12	T	4 22	7 37	0 9	5 44	4 28	7 31	0 10	2 30	4 34	7 25	0 11
13	F	4 22	7 38	0 30	6 35	4 28	7 31	0 32	3 21	4 34	7 26	0 34
14	S	4 22	7 58	0 52	7 26	4 28	7 32	0 55	4 12	4 34	7 26	0 58
15	E	4 22	7 38	1 17	8 16	4 28	7 33	1 21	5 2	4 34	7 27	1 25
16	M	4 22	7 39	1 45	9 8	4 28	7 33	1 50	5 54	4 34	7 27	1 56
17	T	4 22	7 39	2 19	10 0	4 28	7 33	2 26	6 46	4 34	7 27	2 32
18	W	4 22	7 39	2 59	10 52	4 28	7 34	3 6	7 38	4 34	7 28	3 15
19	T	4 22	7 39	sets.	11 41	4 28	7 34	sets.	8 27	4 34	7 28	sets.
20	F	4 23	7 40	8 37	morn	4 28	7 34	8 31	9 9	4 34	7 28	8 26
21	S	4 23	7 40	9 13	0 23	4 29	7 35	9 9	9 48	4 34	7 29	9 4
22	E	4 23	7 40	9 45	1 2	4 29	7 35	9 41	10 29	4 35	7 29	9 38
23	M	4 23	7 40	10 12	1 43	4 29	7 35	10 10	11 12	4 35	7 29	10 8
24	T	4 23	7 41	10 36	2 26	4 29	7 35	10 35	11 54	4 35	7 29	10 35
25	W	4 23	7 41	11 0	3 8	4 30	7 35	11 0	morn	4 36	7 29	11 1
26	T	4 24	7 41	11 24	3 53	4 30	7 35	11 25	0 39	4 36	7 29	11 29
27	F	4 24	7 41	11 50	4 42	4 31	7 35	11 53	1 28	4 36	7 29	11 56
28	S	4 24	7 41	morn	5 39	4 31	7 35	morn	2 25	4 37	7 29	morn
29	E	4 25	7 41	0 20	6 44	4 31	7 35	0 25	3 30	4 37	7 29	0 30
30	M	4 25	7 41	1 1	7 55	4 32	7 35	1 7	4 41	4 38	7 29	1 9

Indiana—Report of State Board of Agriculture for 1877. A. Heron, Sec. July 18, '78.
International Agricultural Exhibition at London in 1879. June 20, 1878.
Iowa—Report of the State Agricultural Society for 1877. May 16, 1878.
Iowa State Agricultural College—Seventh Biennial Report. March 14, 1878.
Jersey-Red Swine—23 head at 22 months, average 677½ pounds, dressed. March 14, '78.
Johnson, Cuthbert W., Croydon, England. Obituary. April 4, 1878.
Jones, J. B., Nurseryman, Rochester, N. Y. Obituary. April 25, 1878.
Killebrew, J. B., Nashville, Tenn. Report on Wheat, Jan. 10; on Grasses, Aug. 29, '78.
Kirtland, Dr. J. P. Cleveland, Ohio. Obituary. Dec. 20, 1877; June 17, 1878.

JULY, 1879.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
FULL MOON,....	3	4 54 ev.	4 42 ev.	4 30 ev.	1	12 3 33
THIRD QUARTER	11	4 10 mo.	3 58 mo.	3 46 mo.	9	12 4 55
NEW MOON,....	19	4 22 mo.	4 10 mo.	3 58 mo.	17	12 5 52
FIRST QUARTER,	26	5 52 mo.	5 40 mo.	5 28 mo.	25	12 6 16

DAY OF MONTH.	DAY OF WEEK.	CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon. SUN RISES	SUN SETS.	MOON SETS.	H. W. BOST'N	CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois. SUN RISES	SUN SETS.	MOON SETS.	H. W. N. Y.	CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California. SUN RISES	SUN SETS.	MOON SETS.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	T	4 27	7 41	1 44	9 0	4 32	7 35	1 51	5 46	4 38	7 29	1 58
2	W	4 27	7 41	2 42	10 8	4 33	7 35	2 59	6 54	4 39	7 29	2 57
3	T	4 28	7 40	rises.	11 12	4 33	7 35	rises.	7 58	4 39	7 29	rises.
4	F	4 28	7 40	8 29	ev. 4	4 34	7 34	8 24	8 50	4 40	7 29	8 19
5	S	4 29	7 40	9 1	0 46	4 35	7 34	8 58	9 32	4 40	7 28	8 55
6	E	4 30	7 40	9 28	1 28	4 35	7 34	9 26	10 14	4 41	7 28	9 24
7	M	4 30	7 39	9 51	2 10	4 36	7 34	9 50	10 56	4 41	7 28	9 50
8	T	4 31	7 39	10 13	2 49	4 36	7 33	10 13	11 35	4 42	7 28	10 14
9	W	4 32	7 38	10 37	3 28	4 37	7 33	10 35	ev. 14	4 43	7 27	10 37
10	T	4 32	7 38	10 55	4 10	4 38	7 33	10 58	0 56	4 44	7 27	11 0
11	F	4 33	7 37	11 18	4 55	4 38	7 32	11 22	1 41	4 45	7 26	11 27
12	S	4 34	7 57	11 45	5 45	4 39	7 32	11 50	2 31	4 45	7 26	11 56
13	E	4 35	7 36	morn	6 42	4 40	7 31	morn	3 28	4 46	7 25	morn
14	M	4 35	7 36	0 17	7 39	4 41	7 31	0 23	4 25	4 47	7 25	0 29
15	T	4 36	7 35	0 56	8 36	4 41	7 30	1 3	5 22	4 48	7 24	1 10
16	W	4 37	7 35	1 43	9 34	4 42	7 29	1 55	6 20	4 48	7 24	1 57
17	T	4 38	7 34	2 38	10 30	4 43	7 29	2 52	7 16	4 49	7 23	2 52
18	F	4 39	7 33	sets.	11 21	4 44	7 28	sets.	8 7	4 50	7 22	sets.
19	S	4 40	7 32	7 47	morn	4 45	7 27	7 43	8 51	4 51	7 22	7 39
20	E	4 41	7 32	8 16	0 5	4 46	7 27	8 13	9 28	4 51	7 21	8 10
21	M	4 42	7 31	8 41	0 42	4 46	7 26	8 40	10 6	4 52	7 20	8 39
22	T	4 43	7 30	9 5	1 20	4 47	7 25	9 5	10 47	4 53	7 19	9 5
23	W	4 43	7 29	9 29	2 1	4 48	7 24	9 31	11 28	4 54	7 19	9 32
24	T	4 44	7 28	9 54	2 42	4 49	7 24	9 57	morn	4 55	7 18	10 0
25	F	4 45	7 27	10 23	3 27	4 50	7 23	10 27	0 13	4 56	7 17	10 31
26	S	4 46	7 26	10 58	4 18	4 51	7 22	11 3	1 4	4 56	7 16	11 9
27	E	4 47	7 25	11 39	5 17	4 52	7 21	11 45	2 3	4 57	7 15	11 52
28	M	4 48	7 24	morn	6 29	4 53	7 20	morn	3 15	4 58	7 14	morn
29	T	4 49	7 23	0 31	7 42	4 54	7 19	0 38	4 28	4 59	7 13	0 45
30	W	4 50	7 22	1 33	8 52	4 55	7 18	1 40	5 38	5 0	7 12	1 50
31	T	4 51	7 21	2 43	9 59	4 56	7 17	2 49	6 45	5 1	7 11	2 56

Live Stock Journal Almanac for 1878. Cassell, Petter & Galpin, London. April 18, '78.
McCoun, W. T., Oyster Bay, Ex-President N.Y. State Ag. Society. Obituary. July 25, '78.
Macdonald's "Food from the Far West." W. P. Nimmo, Edinburg, Publisher. Mch 21, '78.
Manual of the Apiary, Revised and Enlarged. By Prof. A. J. Cook, Lansing, Mich. June 20, 1878.
Manual of Vegetable Plants. Tillinghast Brothers, Factoryville, Pa. Dec. 13, 1877.
Massachusetts Hort. Society's Transactions for 1877. Robt. Manning, Sec. April 11, '78.
Meehan's "Our Native Flowers and Ferns." L. Prang & Co., Boston. May 23, 1878.

8th MONTH. **AUGUST, 1879.** 31 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
FULL MOON, ...	2	2 28 mo.	2 16 mo.	2 4 mo.	1	12 6 6
THIRD QUARTER	9	9 25 ev.	9 13 ev.	9 1 ev.	9	12 5 18
NEW MOON, ...	17	3 26 ev.	3 14 ev.	3 2 ev.	17	12 3 54
FIRST QUARTER,	24	10 28 mo.	10 16 mo.	10 4 mo.	25	12 1 58
FULL MOON, ...	31	2 14 ev.	2 2 ev.	1 50 ev.	31	12 0 12

CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.

CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.

CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.

DAY OF MONTH.	DAY OF WEEK.	Boston: SUN RISES H M	SUN SETS. H M	MOON RISES. H M	H. W. BOST'N H M	New-York: SUN RISES H M	SUN SETS. H M	MOON RISES. H M	H. W. N. Y. H M	Washington: SUN RISES H M	SUN SETS. H M	MOON RISES. H M
1	F	4 52	7 20	rises.	10 58	4 56	7 16	rises.	7 44	5 1	7 11	rises.
2	S	4 53	7 19	7 28	11 45	4 57	7 15	7 26	8 31	5 2	7 10	7 23
3	**E**	4 54	7 18	7 53	ev. 25	4 58	7 14	7 52	9 11	5 3	7 9	7 51
4	M	4 55	7 16	8 15	0 59	4 59	7 12	8 15	9 45	5 4	7 8	8 15
5	T	4 57	7 15	8 36	1 36	5 0	7 11	8 38	10 22	5 4	7 7	8 39
6	W	4 58	7 14	8 58	2 12	5 1	7 10	9 0	10 58	5 5	7 6	9 2
7	T	4 59	7 13	9 22	2 49	5 2	7 9	9 24	11 35	5 6	7 5	9 28
8	F	5 0	7 11	9 46	3 29	5 3	7 8	9 51	ev. 15	5 7	7 4	9 56
9	S	5 1	7 10	10 16	4 13	5 4	7 6	10 22	0 59	5 8	7 3	10 28
10	**E**	5 2	7 9	10 52	5 3	5 5	7 5	10 58	1 49	5 9	7 1	11 5
11	M	5 3	7 7	11 35	6 2	5 6	7 4	11 42	2 48	5 10	7 0	11 49
12	T	5 4	7 6	morn	7 6	5 7	7 2	morn	3 52	5 11	6 59	morn
13	W	5 5	7 4	0 26	8 7	5 8	7 1	0 33	4 53	5 12	6 58	0 40
14	T	5 6	7 3	1 25	9 6	5 9	7 0	1 32	5 52	5 13	6 56	1 39
15	F	5 7	7 2	2 31	10 3	5 10	6 58	2 36	6 49	5 14	6 55	2 42
16	S	5 8	7 0	3 40	10 55	5 11	6 57	3 44	7 41	5 14	6 54	3 49
17	**E**	5 9	6 59	sets.	11 41	5 12	6 56	sets.	8 27	5 15	6 52	sets.
18	M	5 10	6 57	7 9	morn	5 13	6 54	7 8	9 6	5 16	6 51	7 8
19	T	5 11	6 56	7 34	0 20	5 14	6 53	7 34	9 42	5 17	6 50	7 35
20	W	5 12	6 54	7 59	0 56	5 15	6 52	8 2	10 22	5 18	6 49	8 4
21	T	5 13	6 52	8 27	1 36	5 16	6 50	8 31	11 7	5 19	6 47	8 35
22	F	5 15	6 51	9 0	2 21	5 17	6 48	9 5	11 55	5 20	6 46	9 10
23	S	5 16	6 49	9 39	3 9	5 18	6 47	9 45	morn	5 21	6 44	9 52
24	**E**	5 17	6 48	10 27	4 4	5 19	6 45	10 34	0 50	5 22	6 43	10 41
25	M	5 18	6 46	11 25	5 8	5 20	6 44	11 32	1 54	5 23	6 41	11 39
26	T	5 19	6 45	morn	6 22	5 21	6 42	morn	3 8	5 23	6 40	morn
27	W	5 20	6 43	0 31	7 36	5 22	6 41	0 37	4 22	5 24	6 38	0 44
28	T	5 21	6 41	1 41	8 40	4 23	6 39	1 47	5 26	5 25	6 37	1 53
29	F	5 22	6 40	2 53	9 40	5 24	6 38	2 58	6 26	5 26	6 35	3 2
30	S	5 23	6 38	4 4	10 33	5 25	6 36	4 7	7 19	5 27	6 34	4 10
31	**E**	5 24	6 36	rises.	11 19	5 26	6 34	rises.	8 5	5 28	6 32	rises.

Michigan Board of Agriculture—Fifteenth Annual Report. Dec. 13, 1877.
Milk Record for Dairymen. By John Lorentzen, Monticello, Iowa. April 18, '78.
Minnesota Horticultural Society. C. Y. Lacy, Sec'y. Report for 1877. April 11, '78.
Miner, T. B., Late Publisher Rural American. Obituary. June 13, 1878.
Morrell, L. A. Author of the American Shepherd. Obituary. June 13, 1878.
National Agricultural Congress. Proceedings at New-Haven. Sept. 5, '78.
New-Brunswick—Report of Provincial Secretary for Agriculture, J.L. Inches. May 2,'78.

9th MONTH. **SEPTEMBER, 1879.** 30 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
THIRD QUARTER	8	3 20 ev.	3 8 ev.	2 56 ev.	1	11 59 54
NEW MOON,....	16	1 13 mo.	1 1 mo.	0 49 mo.	9	11 57 15
FIRST QUARTER,	22	4 36 ev.	4 24 ev.	4 12 ev.	17	11 54 24
FULL MOON,....	30	4 33 mo.	4 21 mo.	4 9 mo.	25	11 51 40

DAY OF MONTH.	DAY OF WEEK.	**CALENDAR** For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon. SUN RISES	SUN SETS.	MOON RISES.	H. W. BOST'N	**CALENDAR** For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois. SUN RISES	SUN SETS.	MOON RISES.	H. W. N. Y.	**CALENDAR** For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California. SUN RISES	SUN SETS.	MOON RISES.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	M	5 25	6 35	6 40	11 56	5 27	6 33	6 41	8 42	5 29	6 31	6 41
2	T	5 26	6 33	7 2	ev. 30	5 28	6 31	7 3	9 16	5 30	6 29	7 5
3	W	5 27	6 31	7 27	1 2	5 29	6 30	7 29	9 48	5 31	6 28	7 30
4	T	5 28	6 30	7 49	1 36	5 30	6 28	7 53	10 22	5 32	6 26	7 57
5	F	5 29	6 28	8 17	2 14	5 31	6 26	8 22	11 0	5 33	6 25	8 28
6	S	5 30	6 26	8 50	2 56	5 32	6 25	8 56	11 42	5 33	6 23	9 2
7	**E**	5 31	6 24	9 29	3 40	5 33	6 23	9 36	ev. 26	5 34	6 21	9 43
8	M	5 33	6 23	10 16	4 31	5 34	6 21	10 23	1 17	5 35	6 20	10 31
9	T	5 34	6 21	11 11	5 30	5 35	6 20	11 18	2 16	5 36	6 18	11 25
10	W	5 35	6 19	morn	6 34	5 36	6 18	morn	3 20	5 37	6 16	morn
11	T	5 36	6 17	0 13	7 37	5 37	6 16	0 19	4 23	5 38	6 15	0 25
12	F	5 37	6 16	1 20	8 34	5 38	6 15	1 25	5 20	5 39	6 13	1 29
13	S	5 38	6 14	2 29	9 30	5 39	6 13	2 33	6 16	5 40	6 11	2 37
14	**E**	5 39	6 12	3 41	10 23	5 40	6 11	3 44	7 9	5 41	6 10	3 46
15	M	5 40	6 10	sets.	11 11	5 41	6 10	sets.	7 57	5 42	6 8	sets.
16	T	5 41	6 8	6 0	11 55	5 42	6 8	6 2	8 41	5 43	6 6	6 4
17	W	5 42	6 7	6 29	morn	5 43	6 6	6 31	9 21	5 44	6 4	6 35
18	T	5 43	6 5	7 0	0 35	5 44	6 4	7 5	10 2	5 45	6 3	7 10
19	F	5 44	6 3	7 38	1 16	5 45	6 3	7 44	10 52	5 46	6 1	7 50
20	S	5 45	6 1	8 24	2 6	5 46	6 1	8 31	11 45	5 47	5 59	8 38
21	**E**	5 46	6 0	9 20	2 59	5 47	5 59	9 27	morn	5 48	5 58	9 35
22	M	5 47	5 58	10 24	3 58	5 48	5 58	10 31	0 44	5 49	5 56	10 38
23	T	5 49	5 56	11 33	5 4	5 49	5 56	11 39	1 50	5 50	5 54	11 45
24	W	5 50	5 54	morn	6 14	5 50	5 54	morn	3 0	5 51	5 53	morn
25	T	5 51	5 53	0 44	7 20	5 51	5 53	0 49	4 6	5 51	5 51	0 53
26	F	5 52	5 51	1 53	8 19	5 52	5 51	1 57	5 5	5 52	5 50	2 1
27	S	5 53	5 49	3 1	9 11	5 53	5 49	3 3	5 57	5 53	5 48	3 6
28	**E**	5 54	5 47	4 6	10 0	4 54	5 48	4 7	6 46	5 54	5 46	4 8
29	M	5 55	5 45	rises.	10 43	5 55	5 46	rises.	7 29	5 55	5 45	rises.
30	T	5 56	5 44	5 28	11 23	5 56	5 44	5 31	8 9	5 55	5 44	5 33

New-York State Ag. Society. G. W. Hoffman, Elmira, chosen President. Jan. 24, '78.
New-York State Census—Agricultural Returns of 1875. Feb. 21; July 11, 1878.
New-York State Dairyman's Association—First Annual Report. March 14, 1878.
Nitrate of Soda—New Beds Discovered in Chili. Aug. 15, 1878.
Norfolk and Suffolk Polled Herd-Book—2d part. H. F. Euren, Norwich, Eng. Oct. 18, '78.
North Am. Ayrshire Register. Vol. 3d. E. L. & J. N. Sturtevant, Editors. Aug. 22, '78.
Nurserymen's Third Annual Convention. Proceedings at Rochester. June 27, 1878.
Ohio Poland China Swine Record. Vol. 1st. M. J. Lawrence, Cleveland. April 11, '78.
Ohio State Board of Agriculture—31st Annual Report. Feb. 21, 1878.

OCTOBER, 1879.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
THIRD QUARTER	8	8 59 mo.	8 47 mo.	8 35 mo.	1	11 49 40
NEW MOON, ...	15	10 25 mo.	10 13 mo.	10 1 mo.	9	11 47 18
FIRST QUARTER,	22	1 35 mo.	1 23 mo.	1 11 mo.	17	11 45 25
FULL MOON, ...	29	9 25 ev.	9 12 ev.	9 1 ev.	25	11 44 10

DAY OF MONTH.	DAY OF WEEK.	CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon. SUN RISES H M	SUN SETS. H M	MOON RISES. H M	H. W. BOST'N H M	CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois. SUN RISES H M	SUN SETS. H M	MOON RISES H M	H. W. N. Y. H M	CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California. SUN RISES H M	SUN SETS. H M	MOON RISES. H M
1	W	5 57	5 42	5 52	ev. 1	5 57	5 43	5 56	8 46	5 56	5 43	6 0
2	T	5 58	5 40	6 19	0 33	5 58	5 41	6 24	9 19	5 57	5 42	6 29
3	F	6 0	5 39	6 51	1 7	5 59	5 39	6 56	9 53	5 58	5 40	7 2
4	S	6 1	5 37	7 28	1 46	6 0	5 38	7 34	10 32	5 59	5 39	7 41
5	**E**	6 2	5 35	8 11	2 29	6 1	5 36	8 18	11 15	6 0	5 37	8 25
6	M	6 3	5 33	9 2	3 15	6 2	5 34	9 9	ev. 1	6 1	5 35	9 16
7	T	6 4	5 32	10 0	4 4	6 3	5 33	10 6	0 50	6 2	5 34	10 13
8	W	6 5	5 30	11 3	4 59	6 4	5 31	11 9	1 45	6 3	5 33	11 14
9	T	6 6	5 28	morn	5 59	6 5	5 30	morn	2 45	6 4	5 31	morn
10	F	6 7	5 27	0 9	7 0	6 6	5 28	0 14	3 46	6 5	5 29	0 18
11	S	6 8	5 25	1 18	7 57	6 7	5 26	1 22	4 43	6 6	5 28	1 25
12	**E**	6 9	5 24	2 29	8 52	6 8	5 25	2 31	5 38	6 7	5 26	2 33
13	M	6 11	5 22	3 42	9 46	6 9	5 23	3 43	6 32	6 8	5 25	3 43
14	T	6 12	5 20	4 58	10 39	6 10	5 22	4 57	7 25	6 9	5 23	4 56
15	W	6 13	5 19	sets.	11 30	6 12	5 20	sets.	8 16	6 10	5 22	sets.
16	T	6 14	5 17	5 33	morn	6 13	5 19	5 38	9 3	6 11	5 21	5 43
17	F	6 16	5 15	6 17	0 17	6 14	5 17	6 23	9 49	6 12	5 19	6 30
18	S	6 17	5 14	7 11	1 3	6 15	5 16	7 19	10 43	6 13	5 18	7 25
19	**E**	6 18	5 12	8 14	1 57	6 16	5 14	8 21	11 39	6 14	5 16	8 28
20	M	6 19	5 11	9 24	2 53	6 17	5 13	9 30	morn	6 15	5 15	9 37
21	T	6 20	5 9	10 35	3 51	6 18	5 11	10 40	0 37	6 16	5 14	10 46
22	W	6 21	5 8	11 46	4 50	6 19	5 10	11 50	1 36	6 17	5 12	11 54
23	T	6 23	5 6	morn	5 51	6 20	5 9	morn	2 37	6 18	5 11	morn
24	F	6 24	5 5	0 53	6 52	6 21	5 7	0 56	3 38	6 19	5 10	0 59
25	S	6 25	5 3	1 59	7 45	6 23	5 6	2 0	4 31	6 20	5 8	2 2
26	**E**	6 26	5 2	3 2	8 33	6 24	5 4	3 3	5 19	6 21	5 7	3 3
27	M	6 28	5 0	4 5	9 20	6 25	5 3	4 4	6 6	6 22	5 6	4 3
28	T	6 29	4 59	5 7	10 5	6 26	5 2	5 5	6 51	6 23	5 5	5 2
29	W	6 30	4 58	rises.	10 48	6 27	5 0	rises.	7 34	6 24	5 3	rises.
30	T	6 31	4 56	4 52	11 30	6 28	4 59	4 58	8 16	6 25	5 2	5 3
31	F	6 33	4 55	5 27	ev. 8	6 30	4 58	5 34	8 54	6 26	5 1	5 40

Onondaga County Agricultural Society Organized. April 11, 1878.
Ontario Fruit-Growers' Association—D. W. Beadle, Sec'y. Report for 1877. April 11, '78.
Pearl Spring Wheat, introduced by W. C. Allen, Grand Island, N. Y. March 7, 1878.
Photographs of Trotting and Running Horses at Full Speed. By Muybridge, San Francisco. July 4, 1878.
Poultry Cholera. By Drs. A. M. Dickie and W. H. Merry. Dec. 13, 1877.
Rivers, Thos., Horticulturist, Sawbridgeworth, England. Obituary. Nov. 29, 1877.
Self-Binding Reapers from the United States Successful in England. Aug. 29, 1878.

11th MONTH. **NOVEMBER, 1879.** 30 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N. H. M.	SUN ON MERID. D.	H. M. S.
Third Quarter	7	1 11 mo.	0 59 mo.	0 47 mo.	1	11 43 42
New Moon,....	13	7 55 ev.	7 43 ev.	7 31 ev.	9	11 43 57
First Quarter,	20	2 5 ev.	1 53 ev.	1 41 ev.	17	11 45 7
Full Moon,....	28	4 13 ev.	4 1 ev.	3 49 ev.	25	11 47 10

		CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				**CALENDAR** For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				**CALENDAR** For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
DAY OF MONTH.	DAY OF WEEK.	SUN RISES	SUN SETS.	MOON RISES.	H. W. BOST'N	SUN RISES	SUN SETS.	MOON RISES.	H. W. N. Y.	SUN RISES	SUN SETS.	MOON RISES.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	S	6 34	4 54	6 10	0 44	6 31	4 57	6 16	9 30	6 28	5 0	6 22
2	E	6 35	4 52	6 57	1 24	6 32	4 56	7 4	10 10	6 29	4 59	7 11
3	M	6 36	4 51	7 47	2 7	6 33	4 54	7 59	10 53	6 30	4 58	8 6
4	T	6 37	4 50	8 53	2 52	6 34	4 53	8 58	11 38	6 31	4 57	9 4
5	W	6 39	4 49	9 56	3 38	6 35	4 52	10 1	ev. 24	6 32	4 55	10 6
6	T	6 40	4 48	11 2	4 28	6 37	4 51	11 6	1 14	6 33	4 53	11 10
7	F	6 41	4 46	morn	5 21	6 38	4 50	morn	2 7	6 34	4 52	morn
8	S	6 43	4 45	0 10	6 17	6 39	4 49	0 12	3 4	6 35	4 52	0 16
9	E	6 44	4 44	1 19	7 16	6 40	4 48	1 20	4 2	6 36	4 51	1 22
10	M	6 45	4 43	2 31	8 12	6 41	4 47	2 31	4 58	6 37	4 50	2 32
11	T	6 46	4 42	3 46	9 10	6 43	4 46	3 44	5 56	6 39	4 50	3 43
12	W	6 48	4 41	5 4	10 9	6 44	4 45	5 1	6 55	6 40	4 49	4 54
13	T	6 50	4 40	sets.	11 9	6 45	4 44	sets.	7 55	6 41	4 48	sets.
14	F	6 51	4 39	4 55	morn	6 46	4 43	5 1	8 51	6 42	4 47	5 8
15	S	6 53	4 38	5 56	0 5	6 47	4 42	6 3	9 39	6 43	4 47	6 10
16	E	6 54	4 37	7 4	0 53	6 48	4 41	7 12	10 33	6 44	4 46	7 19
17	M	6 55	4 37	8 19	1 47	6 50	4 41	8 25	11 27	6 45	4 45	8 31
18	T	6 56	4 35	9 33	2 41	6 51	4 40	9 37	morn	6 47	4 44	9 41
19	W	6 57	4 34	10 44	3 32	6 52	4 39	10 46	0 18	6 48	4 44	10 50
20	T	6 58	4 34	11 51	4 24	6 53	4 39	11 53	1 10	6 49	4 43	11 55
21	F	7 0	4 33	morn	5 15	6 54	4 38	morn	2 1	6 50	4 43	morn
22	S	7 1	4 32	0 56	6 9	6 55	4 37	0 56	2 55	6 51	4 42	0 57
23	E	7 2	4 32	1 58	7 1	6 56	4 37	1 57	3 47	6 52	4 41	1 57
24	M	7 3	4 31	3 0	7 51	6 58	4 36	2 58	4 37	6 53	4 41	2 56
25	T	7 5	4 30	4 1	8 38	6 59	4 36	3 59	5 24	6 54	4 41	3 55
26	W	7 6	4 30	5 3	9 26	7 0	4 35	4 59	6 12	6 55	4 40	4 55
27	T	7 7	4 30	6 4	10 16	7 1	4 35	5 59	7 2	6 56	4 40	5 50
28	F	7 8	4 29	rises.	11 4	7 2	4 34	rises.	7 50	6 57	4 39	rises.
29	S	7 9	4 29	4 54	11 48	7 3	4 34	5 1	8 34	6 58	4 39	5 8
30	E	7 10	4 29	5 47	ev. 27	7 4	4 34	5 54	9 13	6 59	4 39	6 1

Severe Live Stock Losses from heavy storms in California. Feb. 14, 1878.
Shattuck, John, Norwich, N. Y. Obituary. Dec. 27, 1877.
Short-Horn Association's Convention at Lexington, Ky. Nov. 8, 1877.
Short-Horns—25 head average £532 each at Mr. Cheney's Sale, Oct. 11, 1877—30 head average £664 each at Duke of Devonshire's Sale, Oct. 10, 1878.
Short-Horn Sales of 1877 in United States—3237 head average $230. Feb 21, 1878.
Small Yorkshire Swine Association Organized at New-York. Sept. 5, 1878.
Talks on Manures. By Jos. Harris. Orange Judd Co., New-York. Sept. 12; Oct. 10, '78.
Trotting Horses—Table of all Races in which first-class Time has been made. Jan. 24, '78.

12th MONTH. **DECEMBER, 1879.** 31 DAYS.

MOON'S PHASES.	D.	BOSTON. H. M.	NEW-YORK. H. M.	WASHINGT'N H. M.	SUN ON MERID. D.	H. M. S.
THIRD QUARTER	6	2 59 ev.	2 47 ev.	2 35 ev.	1	11 49 13
NEW MOON,....	13	6 20 mo.	6 8 mo.	5 56 mo.	9	11 52 32
FIRST QUARTER,	20	6 31 mo.	6 19 mo.	6 7 mo.	17	11 56 21
FULL MOON,....	28	11 31 mo.	11 19 mo.	11 7 mo.	25	12 0 20

		CALENDAR For Boston, New-England, New-York State, Michigan, Wisconsin, Iowa, and Oregon.				CALENDAR For New-York City, Philadelphia, Connecticut, N. Jersey, Penn., Ohio, Indiana and Illinois.				CALENDAR For Washington, Maryl'd, Virginia, Kent'ky, Miss'ri, and California.		
DAY OF MONTH.	DAY OF WEEK.	SUN RISES	SUN SETS.	MOON RISES.	H. W. BOST'N	SUN RISES	SUN SETS.	MOON RISES	H. W. N. Y.	SUN RISES	SUN SETS.	MOON RISES.
		H M	H M	H M	H M	H M	H M	H M	H M	H M	H M	H M
1	M	7 10	4 29	6 46	1 5	7 5	4 33	6 52	9 51	7 0	4 39	6 59
2	T	7 11	4 28	7 49	1 46	7 6	4 33	7 54	10 32	7 1	4 38	7 59
3	W	7 12	4 28	8 53	2 29	7 7	4 33	8 57	11 15	7 2	4 38	9 1
4	T	7 13	4 28	9 59	3 11	7 8	4 33	10 2	11 57	7 3	4 38	10 5
5	F	7 14	4 28	11 5	3 56	7 9	4 33	11 7	ev. 42	7 4	4 38	11 9
6	S	7 15	4 27	morn	4 43	7 10	4 33	morn	1 29	7 5	4 38	morn
7	**E**	7 16	4 27	0 14	5 37	7 11	4 33	0 14	2 23	7 6	4 38	0 14
8	M	7 17	4 27	1 24	6 37	7 12	4 33	1 23	3 23	7 7	4 38	1 22
9	T	7 18	4 27	2 38	7 38	7 13	4 33	2 36	4 24	7 7	4 38	2 33
10	W	7 19	4 27	3 55	8 42	7 14	4 33	3 51	5 28	7 8	4 38	3 48
11	T	7 20	4 27	5 14	9 48	7 14	4 33	5 9	6 34	7 9	4 38	5 4
12	F	7 20	4 28	sets.	10 55	7 15	4 33	sets.	7 41	7 10	4 38	sets.
13	S	7 21	4 28	4 39	11 54	7 16	4 33	4 45	8 40	7 10	4 38	4 53
14	**E**	7 22	4 28	5 53	morn	7 17	4 33	5 58	9 29	7 11	4 38	6 5
15	M	7 23	4 28	7 9	0 43	7 17	4 34	7 14	10 17	7 12	4 39	7 20
16	T	7 24	4 29	8 24	1 31	7 18	4 34	8 28	11 5	7 13	4 39	8 32
17	W	7 24	4 29	9 36	2 19	7 19	4 34	9 38	11 50	7 13	4 40	9 41
18	T	7 25	4 29	10 43	3 4	7 19	4 35	10 44	morn	7 14	4 40	10 45
19	F	7 25	4 30	11 48	3 48	7 20	4 35	11 47	0 34	7 14	4 40	11 48
20	S	7 26	4 30	morn	4 33	7 20	4 35	morn	1 19	7 15	4 41	morn
21	**E**	7 26	4 30	0 51	5 21	7 21	4 36	0 49	2 7	7 15	4 41	0 48
22	M	7 27	4 31	1 53	6 14	7 21	4 36	1 50	3 0	7 16	4 42	1 47
23	T	7 27	4 32	2 55	7 7	7 22	4 37	2 51	3 53	7 16	4 42	2 48
24	W	7 28	4 32	3 56	8 0	7 22	4 38	3 51	4 46	7 17	4 43	3 47
25	T	7 28	4 33	4 56	8 52	7 23	4 38	4 51	5 38	7 17	4 44	4 45
26	F	7 29	4 33	5 53	9 46	7 23	4 39	5 47	6 32	7 18	4 44	5 41
27	S	7 29	4 34	rises.	10 38	7 23	4 39	rises.	7 24	7 18	4 45	rises.
28	**E**	7 29	4 35	4 39	11 17	7 24	4 40	4 45	8 13	7 18	4 46	4 51
29	M	7 29	4 36	5 41	ev. 9	7 24	4 41	5 46	8 55	7 19	4 46	5 52
30	T	7 30	4 36	6 46	0 46	7 24	4 42	6 50	9 32	7 19	4 47	6 54
31	W	7 30	4 37	7 51	1 23	7 24	4 43	7 55	10 9	7 19	4 48	7 58

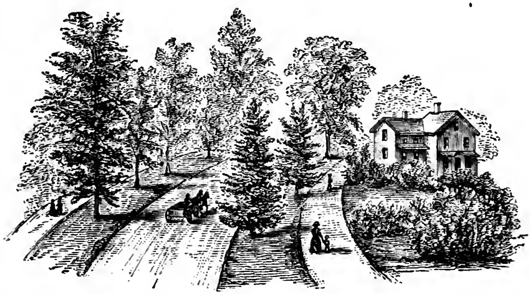
United States Entomological Commission—First Annual Report, for 1877. Aug. 15, 1878.
Vick's Illustrated Monthly established by Jas. Vick, Florist, Rochester, N.Y. Dec. 20, '77.
Virginia—First Annual Report State Commissioner of Agriculture. March 28, 1878.
Whitman, S. S., Little Falls, N. Y. Obituary. Oct. 11, 1877.
Winter Greeneries at Home. By Rev. Dr. Johnson. Orange Judd Co., Publishers, New-York. Sept. 12, 1878.
Wisconsin Horticultural Society. Transactions for 1877. F. W. Case, Sec'y. July 18, '78.
Woodward's National Architect. Vol. 2d. American News Co., New-York. May 23, '78.

THE

ILLUSTRATED ANNUAL REGISTER

OF

RURAL AFFAIRS.



IMPROVING PUBLIC ROADS.

ONE OF THE ESSENTIAL ELEMENTS of civilization consists in excellent public roads. They are a financial, moral and religious blessing. Proximity to market and to mechanics' shops is quite important to successful farming, and nearness to the post-office is a matter of great convenience in maintaining intercourse with the rest of the world. To the occupant of the farm who goes on business to the neighboring village, three miles distant, twice a week—one hundred times in the year—it makes some difference whether he passes these six hundred miles freely over a smooth, hard road, or through mud and ruts a foot deep, and over stones and other obstructions. Good roads facilitate attendance on lectures and places for religious worship; they favor in many ways the dissemination of literary and scientific knowledge, and thus become important educators to the community. In short, if we were called upon to name some distinguishing characteristic to mark a civilized from a rude and barbarous people, we should undoubtedly at once point to the excellent roads of the first, and the wretched roads of the latter. So, likewise, if we should see in one portion of our Union the people blessed with fine smooth roads, and in another should find them in a state of neglect, we should unhesitatingly affirm that the former had reached refined civilization, and that the latter must be a good deal mixed up with barbarism.

One of the chief objects in these remarks is to show the value and importance of converting our public roads into pleasant and shady avenues, but before reaching this ornamental department of the subject, it may be well to examine some of the modes by which they may be made substantially useful by giving them a hard, smooth surface. The easiest and cheapest mode of effecting improvement of this kind, is by removal of stones from the track. A single loose stone, which might be thrown out in two seconds, is often struck by passing wagon wheels fifty times in a day, or more than ten thousand times in a year. What would be the effect of ten thousand blows as hard from a sledge-hammer on a single wagon? The solitary stone does no less damage, even if its blows are divided among a hundred vehicles. No outlay would pay a higher rate of profit than a few dollars applied in every neighborhood, in clearing the public roads of loose and fixed stones. If a single obstruction of this kind, by striking the passing wheels ten thousand times, costs the community who owns them no less than fifty dollars, and could be removed with half a minute of labor, which is only one-thousandth part of a day, then the fifty dollars would be saved by the appropriation of only two mills of money, affording a profit of many thousand per cent. A moment's reflection ought to induce every one who has charge of a single district of our public roads, to keep them entirely free, at all times, of every obstruction in the shape of stones.

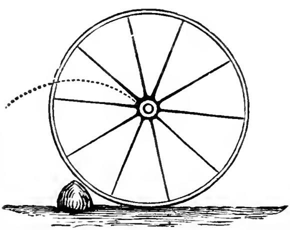


Fig. 2.—*Wheel Striking Obstruction.*

In fig. 2 the dotted line shows how high the load must be lifted in order that the wheel may surmount the stone beneath it, giving a formidable blow to the whole wagon and its load.

Fig. 3.—*Surface of Road*—a a a, *low points for drain discharge—level shown by dotted line.*

There is another way by which the highways might be greatly improved, although at a greater expense than that already described. It is by *tile draining*. Several weeks every spring witness the passage of wagons and carriages plowing through mud and ruts six inches, or even a foot, in depth along some of our public highways. This evil would be greatly diminished by extending a tile drain lengthwise under the centre of the carriage track.

An opening or side branch should be made at the bottom of every depression to carry off the water into the ditches at the roadside (fig. 3). The drain might be partly or wholly filled with gravel. The best mode would be to cover the pipe tile first with small stone, then coarse gravel, and lastly with fine gravel or earth (fig. 4). Two or more parallel drains would give a more perfect drainage.

What is specially needed is a little reflection. Men seem to act without thinking. We sometimes see large quantities of gravel drawn and deposited at much expense in the soft mud of the road-bed, where the passing vehicles work it into mortar, simply because no adequate drainage has been provided. A free escape for the water below would prevent this waste of labor, and give a hard and dry foundation, with a smooth and compact surface above.

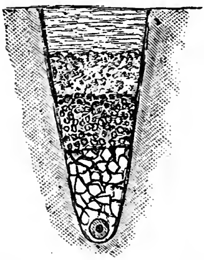


Fig. 4.—*Cross-section of Drain—stones, coarse gravel, fine gravel, earth.*

But we should by no means stop at securing a good hard surface for the easy passage of wagons and carriages. Many of our people appear to regard the public roads as something more than mere conveniences for driving vehicles. They show these thoroughfares great respect by studiously placing their residences so as to face them squarely, in preference to facing a beautiful view in some other direction. But a most singularly contradictory course is at the same time adopted. For while they most respectfully stand facing the road, as to an object of deference, they express their utmost contempt for it by emptying into it all the refuse matter from their premises whenever a house-cleaning occurs, or rubbish is to be discharged from their yards or gardens. It is quite common in certain portions of the country to see broken bricks, plaster from walls, straw from beds, weeds from gardens, brush from orchards, chips from the wood-house, and decayed vegetables from the cellar, all strewn along the borders of the public passage, or heaped in its centre. Some untidy farmers, to save land, make a barnyard of the highway, and in the absence of a sufficient tool-house, scatter along in front of their barns the various implements which they use on the farm, or cast off as useless when broken or done with, such as harrows, plows, wheelbarrows, rollers, boxes, barrels, boards and wagon racks, in variously broken and decayed conditions.

Now, instead of these defacing objects, we should endeavor to make beautiful landscape gardens of our public thoroughfares. It would be the cheapest of all kinds of ornamental planting, for the owners would have to pay nothing for the land; and each could enjoy not only his own portion opposite to his farm, but also, as one beautiful whole, all the portions planted by his neighbors, as he passed along them. All that would be necessary in carrying out this admirable design, would be to smooth the surface and plant the trees, and avoid defacing the view with rubbish. Let this rubbish go into the brush or compost heap, where it properly belongs. Keep the roadsides clear of noxious weeds, which cost many times more than the labor of extirpating them, in the scattering of their abundant seeds to the adjacent fields. Mow the grass at least twice in the season for hay, although more frequent mowing, if it can be done with horses, will give the roadsides a more finished appearance, and cost but little. Trees should be planted along the borders of the track so as to give ample space for a sidewalk. They are often planted too near together, and crowd and distort each other as they become older. In order to afford sufficient shade, and at the same time admit free circulation of air between them, they should be planted about three rods apart where in single lines for common streets. In wide avenues they may be occasionally set in small oblong groups (fig. 5). But even here, especial care should be exercised that they may have ample room to develop their forms.

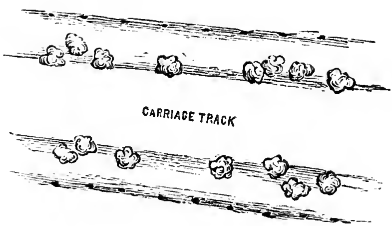


Fig. 5.—*Tree-planting in Avenues.*

The vignette at the head of this article represents a mode adopted in some places, of planting trees between the wagon track and the sidewalk, which presents a very pleasing appearance.

There are two modes of planting streets and highways; one is to place one sort in a continual row in one street, and another sort for another street, and so on. For instance, Washington street may be planted with oaks, Jefferson street with maples, Franklin street with elms, Clinton street with the ash, and so on. This mode has a pleasing effect for villages and the suburbs of larger towns. In the open country such continued lines of one sort would prove monotonous, and it would be well therefore to give short portions, or a tenth of a mile, to each sort, or alternate them individually, in which case a pleasing as well as scientific effect would be produced by intermingling the different species of the same genus, as for example, the sugar maple, black maple and red maple; the white, red and scarlet oaks; as well as the single species of the chestnut, black walnut, white elm, &c.,—see cut, top of next page. In bleak and windy points, place screens of Norway spruce and other evergreens near enough together to shut off the

Elm. *Maple.* *Oak.*

wind and snow drifts when they have grown ten or twelve years (fig. 7.) These screens may be easily cut back with a knife, and the trees prevented from attaining full size. and be made to grow more compactly. It may

Fig. 7.—*Evergreen Screens at Windy Places in Roads.*

not be out of place here to remark that if the owners and managers of railroads should plant such cheap screens along the most windy portions of their lines, it would save much expense in shovelling snow, erecting costly board barriers, and perhaps occasionally prevent destructive collisions.

It is, of course, necessary, in making public roads neat, smooth and ornamental, to exclude cattle and other domestic animals. A great improvement has been made in some of the States in this respect of late years. The cattle law of New-York has been a great public and private blessing. When cattle had the range of the streets, where they obtained a very scanty living, they were driven by starvation to acquire all the arts of opening gates, or breaking or leaping fences. No garden or cornfield was safe. The cost of the extra fencing required to exclude them would more than have paid for good pasturage. The loss of the crops in gardens was still greater in amount. In many places it was ascertained by careful estimate that the extent of scanty pasturage afforded by the roadsides was not more than one-tenth of the feed actually required to sustain the animals that thronged them. Most of their feed was of necessity obtained by plunder.

When the new law was enacted, some of the owners of street cattle declared they would not regard it. The history of the way in which the law was enforced and sustained affords some interesting incidents. An extensive farmer in the western part of this State was told by some of his neighbors that they should still continue to pasture their cows in the streets. He had a fine thirty-acre wheat field just coming into head. He removed all the fences between this field and the highway. The cattle owners knew they would have to pay heavy damages if they turned them in the streets, and the practice was broken up. In other places the owners of fine gardens threw their gates wide open, and announced that they would remain open night and day. No one dared to run the risk of paying for the damages; or if in any case formidable mischief was done, this only served the more speedily to entrench the law in all its strength, and it still remains in the full force of its civilizing majesty.

We have reached a great point in thus securing our public thoroughfares from the intrusions and defacements of these lawless intruders. Let us now aim with all our energy to make them objects of landscape attraction, by the exclusion of all defacing materials, and by planting beautiful shade trees. If this were carried out generally, what would be the result? A summer-evening ride would be an occasion of real delight; an evening walk would be a promenade through a handsome landscape garden; smooth and hard roads would bring farmers nearer "to mill, to market and to meeting;" purchasers of farms would seek such pleasing neighborhoods, and land would sell at higher prices; education and refinement, in connection with the increase in the attractions of home, would give a higher position to life in the country, and young men would prefer a refined agricultural home to one of turmoil and anxiety in towns and cities.

Singular Extravagance.—S. B. Parsons remarks in the Rural New-Yorker, that he knows a gentleman of refined horticultural taste, who planted a beautiful landscape garden, containing some very rare trees, for which he had to pay $25. But this is not the "extravagance" we allude to. His friends from the city come to see his grounds, and when they find young trees which cost so much, look on him as if he were half crazy—and then go to the city and buy a piece of furniture costing $500,that would be truly beautiful and useful at fifty. We know a man who erected a $20,000 house, when one at $15,000 would have been quite as good, but who could not expend $50 to plant the grounds, which would have made more show than $5,000 in his house.

Fertile and Sterile Flowers.—English gardeners find a great difference in the perishable character of flowers when fertilized with pollen, or excluded from it. One of the orchids will remain in good condition a month or six weeks if not fertilized; but operated on by pollen, the flowers fade in a day or two, and the seed-pods elongate rapidly. Hence they find it important to exclude bees from pelargoniums to prevent the petals dropping.

CONSTRUCTING LIGHTNING RODS.

THE FIRST QUESTION which the owner of an unprotected building asks, on being advised to put up a lightning-rod, is: "Will it really afford protection, or is it a sham?" A correct answer would be: If properly made, it will give ample protection; if badly constructed, it may do little or no good, or positive harm. In proof of the utility of good rods, some striking cases may be cited. The following are mentioned in Phin's excellent little work on this subject: The monument in London, which is over 200 feet high, and has stood two centuries, has never been struck by lightning, which has often fallen on the lower buildings around it. The metal connections which unite the different parts of the monument, afford a free passage for the electric fluid to the moist earth below; the other buildings have no such connections. A church in Carinthia, standing on a hill, was struck on an average five times a year, and in one instance several times a day. It was deemed unsafe to celebrate service within its walls. A lightning-rod was then placed upon it, after which it was struck but once in five years, and in this instance no harm was done, the stroke falling on the metallic point without damage. The church of St. Michael, in Charlestown, was frequently damaged by lightning, but after the erection of a rod it had escaped for fourteen years. St. Mark's steeple in Venice, 340 feet high, was often struck until protected by a rod, after which it escaped. The celebrated Strasbourg cathedral was struck three times within a quarter of an hour in 1833, causing damages which required millions to repair. In 1835 lightning conductors were erected, since which no harm has occurred.

The cathedral at Geneva, the most conspicuous and highest in the city, has entirely escaped for centuries, while another tower much lower has been frequently injured. The great central tower of the cathedral is built of wood, but covered with metallic plates, which are connected with the roof of metal, and this, through the rain pipes, with iron drain pipes imbedded in the earth. During the sixteen years prior to 1816, no less than 156 vessels of the British navy were struck by lightning, 73 men were killed and 183 injured; while the loss in property amounted to over a million dollars. But since the adoption of the efficient system of conductors devised by Sir W. Snow Harris, the losses and damages have almost totally ceased, notwithstanding the greatly increased number of vessels.

Many buildings however have been struck with lightning, although furnished with rods, and in some cases destructive conflagrations have been the consequence; but in all these instances, where an examination has been made, obvious and glaring defects have been discovered in their construction. It has been estimated that more than half the lightning rods now in use throughout the United States are of little or no value, and some may be even positively detrimental; probably not one in ten proves as safe and efficient as it might easily be made. It is the object of this article to point out the common defects, and show how to avoid them, as well as how to erect a perfect protector. To put up a rod understandingly it is necessary to know something of the nature of electricity, in relation to which there are perhaps more mistakes committed than with any other science.

Leading Principles.

Dr. Franklin, who first proved the identity of lightning with common machine electricity, supposed it to be a very subtile fluid, possessing great force, but no weight, which pervaded the whole earth and all bodies at its surface. Unless disturbed by unusual influences, these bodies were supposed to have alike a natural quantity. But if this equilibrium were disturbed, and any of them were made to contain more, or to have less than the natural quantity, they were *electrified.*

Those substances which allow the electricity to pass freely through them, or which offer but slight resistance to its passage, are termed *conductors;* others, which resist the passage, are *non-conductors.* The metals are the best conductors; glass and the resins are among the non-conductors. Water, and all substances containing it in a free state, such as moist earth, green wood, and flesh, are moderate conductors

When two non-conductors are rubbed briskly together, one of them takes the electricity from the other, and according to Franklin's theory, becomes positively electrified; while the other, thus losing a part, is negatively electrified. The one has more than its natural share, the other less. The accompanying diagram (fig. 8) may represent two such bodies, the dark portion indicating the accumulated or positive electricity in one, and the white part the negative condition of the other; the shaded portions are the natural condition where no disturbance has taken place. Both will show their electric condition by attracting small, light substances, as feathers, bits of paper, &c. If conducting bodies are rubbed together, they will exhibit no signs of electricity, because as fast as one takes it from the other, it is instantaneously restored by their conducting power.

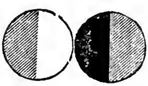


Fig. 8.

It is now generally believed that electricity is not really a separate fluid, as supposed by Franklin, but merely a property of matter, like attraction and sound. The waves on a lake or sea are only conditions of the water; and the sounds which strike the ear are only waves in the air. If, therefore, we look upon electricity as merely a *force* and not a fluid, we may adopt the theory of Franklin, with this modification, and apply it to all ordinary phenomena.

An electric machine is made by causing a conductor and a non-conductor to rub together—the latter a revolving glass plate or cylinder. The rubber or conducting substance supplies the glass with the electricity, which thus becomes positively electric, and this electricity is then taken off by metallic points from its surface as it revolves, and fills a conducting cylinder on the opposite side of the machine, the escape of the electricity from which, is prevented by its being supported on a glass leg or non-conductor. If the knuckle, or any other conducting substance, is now brought near this insulated and electrified cylinder, a spark flies through the air with a crackling noise between the cylinder and the knuckle. This is lightning on a very small scale; and the same properties and

Fig. 9.—*Silent Discharge by a Point.*

influences govern one as the other, and we can thus study the principles of the science on a table before us, more safely and conveniently than with lightning-rods on a larger scale out of doors with the accompanying danger.

Among the properties thus discovered is the important one that a sharp metallic point will draw off the electric charge from a conductor silently and without the crackling spark, (fig. 9.) A round ball or knob, on the contrary, causes an instantaneous discharge, with a noise like an explosion, (fig. 10.) This principle has been applied in giving sharp points to the upper ends of lightning-rods, for drawing off the lightning from the clouds or vapor above, without the violent explosion which would otherwise take place.

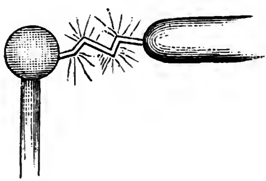


Fig. 10.—*Electric Spark.*

Induction.

This is one of the most important principles in the science, and should be well understood. It is founded on the fact that bodies charged with the same kind of electricity repel each other; but are attracted when it is unlike. When a highly charged conducting body is brought near enough for a spark to pass, the charged body drives the electricity out of the other, or to its further side. Suppose, by way of illustration, that *N*, fig. 4, represents a metallic ball, insulated on a glass leg. *P* is another similar ball, also insulated, and connected with the electric machine. The electricity from the machine accumulates in *P*, and this repels the fluid from *P N*, (which is too far off for a spark to pass,) and drives it away from the side *N* to *P*. This accumulation in the middle

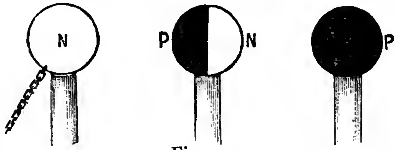


Fig. 11.

ball to the side towards the ball *N* tends to drive the electricity from *N*, which will escape through the chain, and leave *N* negatively electrified, although nothing has actually passed between them. By using a hundred or a thousand insulated balls, the first may be thus made to control the last at an indefinite distance. This influence, without the passage of the electric fluid, is termed *induction*.

When a spark is drawn from the electric machine, we may suppose that it merely represents the discharge between an electrified body and one in the natural state. But where it passes between two bodies, the one strongly positive and the other strongly negative, the spark is shorter, louder and more brilliant. This is exhibited by the Leyden jar, (fig. 12,) which has its inner and outer surfaces coated with tin-foil, except near the top. A ball and chain supported by the cork connects with the inner coating, and as the glass sides of the jar prevent it from passing through them, the inside may be strongly charged. This repels by induction the electricity from the outside, which becomes strongly negative. When a nearer connection is made between them, a quick and violent discharge takes place, which, if it passes through the human body, produces the *electric shock*. If the glass jar is quite thin and is heavily charged, the discharge sometimes takes place through the glass, the hole thus bored being filled with the pulverized glass.

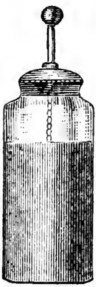


Fig. 12.
Leyden Jar.

Sharp, quick flashes of lightning are like the spark of the Leyden jar. A cloud overhead, when strongly charged with electricity, tends to drive away a part of the natural electricity of the earth below, and that portion of the surface becomes negative. A discharge in the form of lightning is sharp and violent between them, for the same reason that the spark from the Leyden jar is sharper than a simple spark from the electric machine. Hence the reason that low clouds often produce more frequent and dangerous crashes than the more common and less violent lightning high in the clouds above.

Electricity of the Clouds.

The clouds—the moisture of which makes them partial conductors—are nearly always more or less charged with positive electricity. In ten thousand observations made at Kew, about one in three hundred, on an average, showed negative electricity. When the clouds are strongly positive, the tendency is to produce the common appearances of lightning with thunder, the discharge moving downwards. When negative, the lightning may strike upwards—an instance of which occurred within the knowledge of the writer, where mud was thrown from the earth against the window and eaves of a dwelling, accompanied with a loud report, the sill-board being perforated and torn, and the pieces thrown upwards. The negative state of the clouds is usually more feeble than the positive, and the noise is not so violent. In several cases those discharges have been nearly silent. A gentleman on horseback, on a damp and dark night, saw a brush of light on the tips of his horse's ears, the electricity slowly escaping from the earth to the damp negative air above. In another case, an ignorant laborer, returning at dark from the hayfield, saw similar brushes of light on the tips of the pitchfork on his shoulder, and being superstitious, he dropped it in terror and fled, (fig. 13.)

Fig. 13.—*Frightened by Electricity.*

Clouds charged with electricity are often two or three miles high, or even more; and when this is the case, the lightning rarely or never strikes the earth or the objects at its surface, but the discharges are from one cloud to another. Sometimes, however, their lowest surfaces may be within half a mile or less. When very near the earth, there is greater danger to buildings, trees and animals. There is no doubt that the moisture in apparently clear air may sometimes contain much electricity, but less than dense clouds.

Buildings and trees, although they are imperfect conductors, may be sufficiently so to invite the discharges of lightning in their downward course, but not enough to afford a perfect passage, and hence they may be torn or shivered to pieces, or set on fire. The object of lightning rods is to provide a safe and complete passage for the discharge by using metal, which is thousands of times a better conductor than moist wood, stone or brick.

The intensity of the discharge may be increased, when a strongly charged positive cloud is overhead, by the process of induction already described, rendering buildings and other objects negative, through the repelling influence of the electricity above, and the lightning will be sharper in its restoration of a state of equilibrium between those two opposite states.

The flash of lightning is instantaneous, but thunder usually continues for some seconds, and often half a minute. This results from the comparatively slow progress of sound, four and a half seconds being required for it to travel a mile; and when the flash is several miles in length, the sound is a half minute or more in coming from the more remote portions of the flash. The distance of a thunderstorm from the spectator may be nearly determined by counting the seconds between the flash and the thunder, and allowing about four and a half seconds to the mile, or thirteen miles for a minute. In the accompanying cut, (fig. 14,) that part of the flash at *b*, if two miles distant, will be heard by the spectator more than four seconds after the part at *a*, only a mile off,

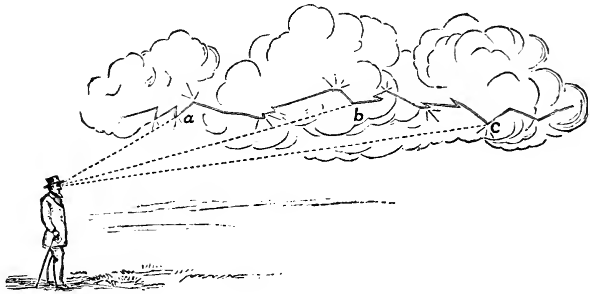


Fig. 14.

and still more time will be required for the sound to come from *c*, while there will be a continued roll of thunder between.

The Importance of Artificial Protection.

A large number of persons are killed every year by lightning. Statistics give the average number of deaths at 22 in England, 75 in France, and 40 or more in the United States. No less than 2,250 were killed in France in a period of 30 years, and a larger number more or less injured. This was an average of one death annually in half a million, which, although small compared with the whole population, is large enough to induce every precaution for safety. In 1807 the powder magazine in Luxembourg, containing 14 tons, was struck, and thirty persons killed by the explosion. Spang says that in the thunderstorms in August 1872, in in New-York and New-England, over 200 dwellings were struck, and ten persons killed. Telegraph wires were melted by the half mile, and poles shattered in all directions. This, however, was an extraordinary season.

Essentials of a Lightning Rod.

Having explained the leading principles of electricity, there will be no difficulty in understanding what the lightning rod must do, and what essentials are required for its successful operation. Being made of iron or copper, it will conduct the electric current many thousand times better than the common materials of which houses and barns are built, and the current will take this metallic course in preference to the building. If the rod is high enough above the building, so that any discharge may find it before reaching the building, it will be carried safely downwards, provided there is no break or interruption in the rod, and provided it reaches a permanent conductor at the bottom, to convey the discharge into the earth. These then are the three essential parts: 1. Height above the building;

2. Continuity throughout; 3. Connection at the bottom with permanently moist earth or water.

1. If the rod is not high enough, there will be danger that the lightning may strike the chimney, the soot of which is a conductor, or it may strike other elevated portions. As a general rule, the top of the rod should be at least as much above the roof as half the length of the roof from the the rod. In other words, a rod will commonly protect a horizontal space, the diameter of which is four times as great as the height of the rod above it, if the rod stands in the middle; or twice as great, if the rod is at one end. There may be some possible exceptions where this rule will not apply, as in a case shown by Phin, where the clouds are represented as driven towards the end of a building away from the rod. But such danger must be of rare occurrence, especially if the rod extends well above the roof, or one is placed at each end.

In fig. 15 the rod is attached to a chimney nearly at the centre of the

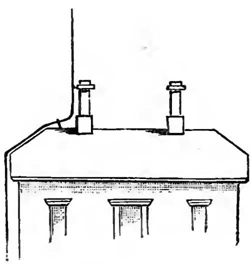


Fig. 15.

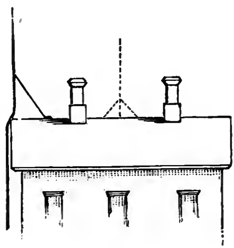


Fig. 16.

roof, in which case it must be half as high as the distance between the the chimney and the farther end of the building. Sometimes it may be more convenient to place the rod at one end, (fig. 16,) a more direct connection being thus obtained with the earth. In this case the rod must be twice as high as when placed at the centre, where the dotted lines indicate the diminished height. Probably a still better way would be to place a rod at each end, and secure a direct communication with the earth at both ends. Or, if the two are well connected by a metal bar on the roof, this arrangement will be nearly as good.

2. The importance of a continuous rod is self-evident; for if made up of several parts or sections, and one is displaced, the rod would do more harm than good, by inviting the discharge without conveying it from the building.

3. For the same reason, a sufficient earth terminal is absolutely essential, to convey the discharge away from the building. If defective in this particular, no rod, however perfect in all other respects, can be of any use, but would be a source of danger. Nearly all the cases of failure in con-

ductors are doubtless from this cause. They afford a partial passage for the discharge, or convey it into the building. In this way buildings have been crushed, torn, and set on fire by the lightning, and water and gas pipes torn up and melted at the joints.

Water and moist earth are conductors, while perfectly dry earth has scarcely any conducting power at all. The rod must therefore penetrate the ground deep enough to reach permanently moist earth. In most localities a depth of six or eight feet will be enough, if branching in various directions at the bottom, so as to dissipate the electric discharge.

Details in Construction.

Nearly all the houses and barns erected in the country have shingle roofs; a few have slate; rarely a roof is seen of tin or galvanized iron. Most of the directions here given apply therefore to roofs made of wood.

The best material for the rod, all things considered, is iron. Copper is a better conductor, but is more expensive, and for the same cost is not equally stiff in its position. A round iron rod one-half or five-eighths of an inch in diameter is commonly large enough, although three-fourths of an inch is safer. The advantages of a larger rod are that it will be more certain to carry off all the discharge. If a good conductor is small, a part of the electric current seeks additional channels, even in poorer conductors, and the danger is increased of passing down through the walls of the building. No discharge was ever known however to melt a half-inch rod.

For most buildings it is best to weld the different pieces together, which makes the rod stiffer, and less liable to become separated into parts than if simply screwed together, or connected by staples or links. Any owner of a building who is about to erect a rod should measure with a cord or tape-line the distance from the top of the house to the ground where the rod is to pass, and then add to its length eight or ten feet for the portion beneath the surface; and also for the height above the building one-quarter or more of the length of the roof if the rod is placed at the centre, or one-half the length if placed at one end. The pieces of rod sufficient for this length may be easily welded together by a blacksmith, and it may then be taken home by fastening the pointed end to a wagon and dragging the length on the ground. Two or three men will then erect it and place it in position on the building.

The Upward Points.

Dr. Franklin, having observed that a sharp point would silently draw off the electricity from a charged body, concluded that the upper end should be a sharp point, with a view of exhausting the charge from the clouds and preventing the instantaneous discharge of lightning. Some late writers have objected to a sharp point, thinking it insufficient to effect a silent discharge. There is no doubt, however, that when the electricity is near the rod, and in the damp air above, the point will prevent a sudden flash, and when the cloud is higher, it would tend more or less to diminish the force of the lightning. Some years ago, a rod on a dwelling occupied by the writer, with a single point, received a terrific discharge, louder than any cannon, which melted the point into a ball the size of a small bullet, (fig. 17,) but did no other harm. There is no doubt that the rod saved the house from destruction. If instead of a single point there had been several, to divide the discharge, (fig. 18,) probably none would have been melted. It has been objected by some electricians that several points together operate precisely like a ball; but experiments with an electric battery show that this opinion is a mistaken one, a dozen or more fine wire points within a space of half an inch drawing off nearly silently a heavy charge. The best form therefore would be a terminal with several diverging

Fig. 17.

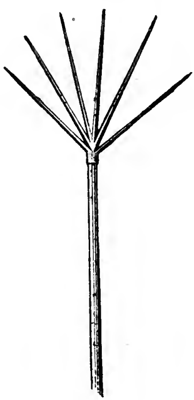


Fig. 18.

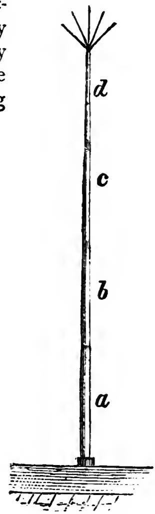


Fig. 19.

points, spread out like a fan, as in fig. 18. Or they may expand in the form of a circle. These points may be easily made by welding six or eight smaller rods to the end of the main rod, sharpening the ends and then bending them in a diverging position The points are sometimes expensively tipped with silver or platinum, but this is needless, as the iron is easily hammered sharp enough for all practical purposes, and the points will remain so an age.

It is important for preserving the stiffness of the rod above the building, that it have a gradual taper upwards. This may be effected by making this portion of the rod of several pieces welded together, the larger, say an inch in diameter below, and the smaller about half an inch in diameter at the top, each piece before welding being about two or three feet long, as shown in fig. 19, *a*, *b*, *c*, *d*.

Supports for the Rods.

Buildings made chiefly or wholly of wood may have supports which shall hold the rod several inches off from the building, so that in case of a violent discharge, the building may be in less danger of being set on fire. Such occurrences however would be very rare, and it might be unimportant whether the rod was held off or in actual contact. To attach a rod to chimneys, a light wood frame should be fitted around them, as in figs. 20 and 21.

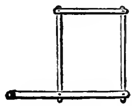


Fig. 20.—*Frame for Chimney.*

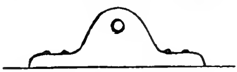


Fig. 22.—*Support for Rod.*

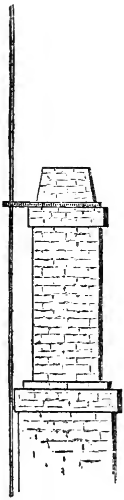


Fig. 21.

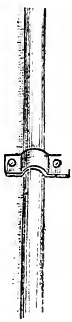


Fig. 23.

Fig. 24.

If, however, there is a metal cornice, eaves-trough or roof, it is important that there be an actual contact with the rod, that the latter may convey to the earth any portion of a lightning discharge which those metallic portions might receive.

The supports for a wooden building may be simply small pieces or blocks of plank, like fig. 22, nailed or screwed against the building. These are slipped over the lower end of the rod before it is erected, and afterwards distributed along the places required. If the building has a metal roof, eaves, or other large metal portions, the rod should be secured in close connection with these, by a metal staple screwed on, as in fig. 23.

If square or flat bars are used, instead of round rods, (and they will also answer a good purpose,) they may be screwed to the sides of the building in the same way, by means of staples and screws This mode answers well when the building is partly made of iron, as already described. Fig. 24 represents a convenient mode of bracing rods on the roofs of barns.

TERMINATION IN THE GROUND.

This is a matter of vital importance, and should be well understood. A hole should be dug for the foot of the rod, deep enough to reach permanently moist earth, that will retain its moisture during the severest seasons of drouth; this in common soils is not less than seven or eight feet. If this depth cannot be reached, one method is to provide several branches to the lower end, welded or wired on, and spread in every direction. Charcoal being a good conductor, a bushel of it may be spread over the bottom of the hole before being filled with earth. Another mode is to attach a rope of copper wire to form the lower end of the rod, spreading the wires. The union between the iron and copper should be above ground, to prevent the iron from becoming oxidized by the generation of galvanic electricity.

The objection to the expanded copper rope for the earth terminal is the want of surface. To enable the imperfectly conducting earth to convey away the electric current as it comes down the powerful metallic conductor, a *broad surface* of the metal should be placed against the earth. For this reason, a large copper sheet is better than rods or wires, and is the best of all terminals.

One of the safest connections with the earth, and undoubtedly much better than any other, is to make an excavation large enough to place a sheet of copper with several square feet of surface, the lower end seven or eight feet below the ground, and connect the rod with this copper sheet—taking care, as already stated, that the union between the copper and the iron rod be above the ground where the iron is dry. If the daily drainage from the kitchen is made to run down against the side of this surface of copper, it will tend to preserve constant moisture in the earth in contact with it, and render the earth terminal absolutely safe and perfect. The great advantage which copper possesses over iron is in not rusting away when exposed to moisture. It is advisable to place the foot of the rod a few feet away from the building, where the earth receives more moisture from the clouds above than under the shelter of its walls.

METAL ROOFS.

Roofs covered with tin or galvanized iron afford protection against injury by lightning, provided a good and ample connection is made with the moist earth below. Should the lightning then strike any part of such a roof, it would be instantly conveyed to the earth. As electricity does not leave a good conductor for a poor one, it would not pass to the wood, stone or brick of the building.

As a matter of additional safety, and to prevent striking the roof at all, one or more rods should extend from it to a suitable height above, as already described. All the metallic water pipes should also be connected with ground terminals.

The common opinion that paint injures the conducting power of a rod is entirely groundless. Paint is no worse conductor than *air*, which surrounds all rods. The paint is a positive benefit by preventing rust.

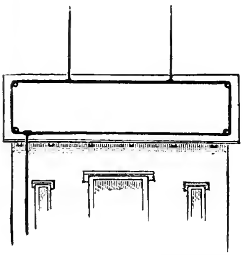


Fig. 25.—*Frame of Flat Bars connected with Rod on Roof.*

Where roofs are made of wood, and a sufficient amount of rod protection above them cannot be easily given, flat iron bars laid on them and connected together and with the rod, form a safe protection, (fig. 25.)

Common Errors.

Rods on wooden buildings extend but a short distance above the roof or chimney, which does not remove the danger of the lightning striking some other part of the building. The height should never be less than already pointed out in this article.

It is common to use iron supports for the rod, with a small glass separation between the two, (fig. 26.) Such supports are worse than useless. A small spark from the common electric machine will leap over the narrow glass surface, which could be of no possible protection against a heavy lightning discharge; and as soon as the glass becomes wet by the rain, it conducts freely. The iron supports would tend to convey the discharge into the building. Supports of wood, as already described, would be far better; and where there is a metal roof or cornice, the rod should be in direct contact with it.

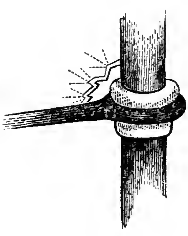


Fig 26.—*Useless Glass Support.*

Rods are sometimes made broad, thin and flat, or thin and hollow, with the supposition that the electricity passes only through the surface, and that a solid round or square rod is a needless use of metal. When at a state of rest the electricity is confined to the surface; but when passing rapidly, it enters the body of the conductor. This has been fully proved during the past year by Dr. Kedzie, in a series of carefully conducted experiments; and it has long been known that while a small wire would allow the free passage of a heavy charge from a Leyden jar, a thin piece of gold leaf with ten times the surface would be destroyed. On the whole, therefore, a round iron rod is probably as good, if not better, than any other form, although a square or flat bar may answer as well.

Imperfect ground connection is the most common cause of failure. Phin gives an account of three large buildings struck in Philadelphia, involving a loss of two hundred and fifty thousand dollars. All had lightning rods, but none of them had good earth connections, as was afterwards found on careful examination.

Sometimes a hole is made with a common crowbar, and the foot of the rod thrust into this hole. The rod may not be in contact with the earth, or the earth may become dry so near the surface, and the rod fail to afford protection against lightning.

Employing a common lightning-rod agent or vender is one of the many errors commonly committed. Most of them, knowing little of the science, erect imperfect rods, with many needless appendages, at a cost to the owner of several times that of a good, simple rod. To make one which shall be both cheap and efficient, every owner should construct and put up his own, according to established principles.

Termination in the water of cisterns or wells is not advisable. The water will rust the rod if of iron; or become poisoned if of copper. The cistern may become dry, and then the connection would be worthless; or if the cistern is surrounded with dry earth, the escape of the discharge would be nearly prevented.

It is a common opinion that a barn full of fresh hay is more liable to be struck than other buildings, on account of the column of vapor passing upwards from the hay. It has even been asserted by high authority that an ice-house is peculiarly liable to be struck, because the evaporation from the melting ice forms a partial conductor. A little reflection will show the fallacy of these opinions. There is not so much vapor passing off from nearly dry hay as from an equal surface of moist earth over all parts of the farm; and the cold moisture in an ice-house would not furnish a larger amount of vapor than a warm surface of earth. Of the many barns which the writer of these remarks has known to be struck, more were struck early in the season, when nearly empty, than after being filled with hay.

High-priced and patented lightning-rods have been made with various points and angles, wings, corrugations and spiral coils, with the claim that the angles and points would draw the electric fluid and increase the safety, when in fact they would equally tend to discharge it from those points into the building. None of these patents are better in any respect than a simple round or square rod.

The owners of all buildings on which rods have stood many years should occasionally examine them, to see that the earth terminals have not become unsafe by rusting away.

WASTE PRODUCTS.—The Bradford (Eng.) town council has been offered $50,000 per annum for the next seven years for the refuse of the gas works. The average price received during the last ten years was $4,000. The increase is partly due to the advance in the price of sulphate of ammonia, but mainly to the aniline and other products now obtained from the "refuse" of coal distillation.

PURE WATER FOR HEALTH.

AN ARTICLE ON VENTILATION, showing the evils of impure and confined air, appeared in the ILLUSTRATED ANNUAL REGISTER for 1877. As the deleterious effects of the use of impure water are not less formidable, they should be well understood and guarded against by the whole people, whether they occupy city or country dwellings. As George Geddes justly remarks, when speaking on this subject: "There are families who live on farms and who fancy they are drinking the best of water, while in fact they are constantly imbibing poison, that sooner or later will appear perhaps in the dreaded form of diphtheria or typhoid fever." There are thousands of the members of the families of farmers in this country who perish annually in consequence of the impurities which are permitted around their doors and in their houses.

It has long been known by scientific men that good drainage and pure water are essential to health. As long ago as 1834, a leading physician of London gave his evidence that *four-fifths* of the cases of typhus or typhoid fever were caused by foul drains or streams.

DISEASE FROM IMPURE WATER.

A distinct and striking proof of the poisonous effects of polluted water was given by Dr. T. H. Bailey, in the Sanitarian for June, 1875. A hotel at Lake Mahopac, fifty miles north of New-York City, capable of holding five hundred guests, was proved to be healthy, scarcely a case of sickness occurring during its first years. In enlarging the water reservoirs, an old cistern fell into disuse; slops from the kitchen found their way into it, and a portion became mingled with the pure drinking water of the other cistern. As a consequence, there were cases of cholera morbus and typhoid fever at the hotel. The cistern was cleaned, and the sickness ceased. This was in 1871. It was kept clean in 1872, and there was no sickness. In 1873 it was again neglected, and typhoid fever recommenced. The cistern was again cleaned, and health was the result A new landlord came, who was a stranger to the place. On the 1st of July there were five hundred people there. In two weeks disease broke out worse than ever, over one hundred were sick, twenty-five had fever, and five died. On examination the cause was found; the old cistern was torn out, the pipes were cut, and the vacancy filled with fresh earth. Since that time the hotel has been as healthy as ever. Impure water caused all the sickness and death, and kitchen slops polluted it.

Careful statistics were procured many years ago, when at different times the cholera broke out in London.* In 1849, over 14,000 died; in 1854 there were over 10,000 fatal cases; in 1866 the deaths amounted to about

* Some of these facts are quoted from Prof. Brewer's paper on this subject.

6,000, or less than half the number 17 years before. Long and full investigations were made, and it was demonstrated that in every instance after the disease was first introduced, it was spread through drinking water. But the question will occur, why did the disease diminish in each successive year of the malady? It is easily answered. There were many water companies supplying the city, and among them two that pumped the water from the river. Of 167,000 persons supplied by the lower company, one died in 80; of the 268,000 supplied by the upper company, one died in 85—the water becoming more polluted from sewers as it passed through the city. The lower company then changed its source of supply some miles further up the stream, and when the disease again appeared, only one died in 270.

Laws were then passed (after its second appearance) compelling the adoption of methods for purifying the water, and twelve years elapsed before the disease again made its appearance, when the number of deaths was but little more than one-half. Most of these deaths occurred in the lower portion of the city, where they were seven times as great to the population as elsewhere. An investigation was made by the British government, and it was found that one company had supplied the people with water which had not been purified as required by law, and the crime of this omission cost thousands of lives.

A case of special interest was connected with the "Broad-street pump." Its water was so clear and sparkling as to be unusually popular, and it was largely used in the neighborhood. Yet without any apparent change in the water, over 500 persons who used it died of cholera. "On careful investigation it was found that the dejections of an early cholera patient had been thrown into a cess-pool near the well, and the underground track was found, along which water percolated into the well, but not enough to disturb its transparency or taste, but enough to cause hundreds of victims."—(*Prof. Brewer.*)

A vast amount of evidence has accumulated of late years, both in Europe and America, showing that thousands of fatal cases of sickness have occurred from drinking impure water, rendered so by underground leaks from the vaults of closets. Dr. Pinkham of Lynn, in his report on the sanitary condition of that city, containing over 30,000 people, made to the Massachusetts Board of Health, says that "the most erroneous ideas in regard to the liability of wells to contamination prevail among the people. Persons of high intelligence on most points, feel perfectly secure in regard to their wells, with a cess-pool within a few feet of them." He gives illustrations of several, showing the manner in which wells are contaminated by them, one of which we copy, (fig. 27.) As a consequence, five cases of typhoid fever occurred in 1875 in the family living in one of the houses, and seven more, with one death, among other persons using the water. An analysis of the water showed it to be highly contaminated. In another case a well ten feet distant from a vault, where the premises were kept clean, and containing water that was clear and of good taste, received impurities from the vault, and caused five typhoid

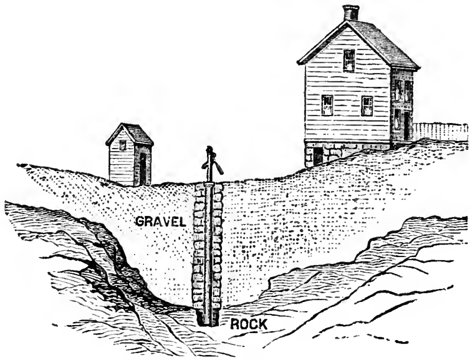


Fig. 27.—*Well Contaminated by Vault.*

cases in one family, and several others and one death, among neighbors who used the water. It was analyzed and found to contain objectionable matter.

It may be thought that such formidable sources of disease, which prevail in cities, do not affect the country, and that farmers need not trouble themselves about them. But it must be remembered that much greater care is taken in cities to secure systematic efforts for prevention, and that the various epidemics, as typhoid fever, diphtheria, and other diseases increased by a want of cleanliness and drainage, prevail frequently and fatally all through the country, and that thousands are carried off annually by these maladies away from large towns. Typhoid fever is more frequent in the country and in villages than in cities. There is less excuse for a want of care on the part of country residents, seeing that they have the space to effect a thorough removal of all impurities.

Filtration through the Earth.

Vaults and other receptacles for impurities, if newly dug in the earth, retain for a time all the contents within their bounds. But gradually the earth absorbs these substances, and as it becomes saturated they extend further, and frequently small crevices or channels between the layers of soil convey the contents to long distances. If the earth is compact clay, the process is slow; if loose gravel, sand, or rocks with seams, it is more rapid.

It is well known to farmers that water will flow through the soil horizontally, far enough to bring the water of the soil into drains when they are two or three rods or even more apart, (fig. 28.) If therefore the water from impure sources is within a rod of the well, (which is deeper than a

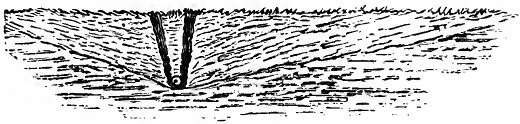


Fig. 28.—*Water Drained Horizontally Long Distances.*

drain and will extend its drainage further,) the water will freely flow towards it, and pass into it, (fig. 29.) For a time the soil may absorb the impurities, but when it becomes saturated there is nothing to prevent the

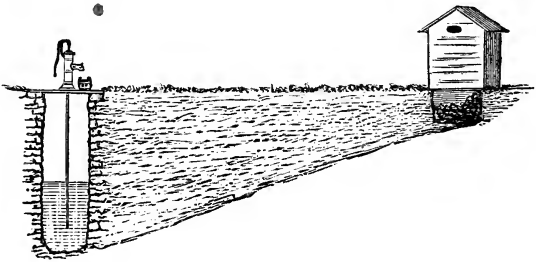


Fig. 29.—*Well-water Polluted by Vault.*

water of the well from becoming heavily contaminated. Instances are recorded where water from the sink spout has flowed forty feet through soil and polluted the water of wells.

It may happen that while all the family remain in health, the impurities from vaults may not produce positive sickness; but if any one happens to be attacked with the epidemic, those impurities will then become a deadly poison. In this way whole families are sometimes prostrated, and the disease, which spreads only through the poisonous influence of the bad water, is supposed to be contagious, and wrong means for prevention are resorted to.

Dr. H. O. Hitchcock of Kalamazoo, Mich., who has given much attention to the subject, insists that no vault without a cemented bottom and sides should be allowed within four rods of a well supplying human beings with water for drinking and culinary purposes. He adds that "in the villages and cities of Michigan, and even in the country, there are hundreds and thousands with deep, uncemented and full vaults, within twenty or thirty feet of wells, the sources of water for hundreds and thousands of families. No wonder that statistics record so many deaths from zymotic and low diseases of a typhoid type."

Where the soil is gravelly and porous, and rests on an impervious hard-pan, or has horizontal seams and fissures, even so great a distance as four rods, would be insufficient, and it is hard to say under such circumstances what the distance should be. The French government, in the early part of the present century, forbade digging wells within twenty rods of cemeteries, and ordered those to be filled which were nearer.

The Michigan Health Reports furnish a large number of instances where typhoid fever was brought on by the pollution of the water of wells from barnyards, and in such cases the disease was arrested, or new cases prevented, by the discontinuance of its use. In one instance typhoid occurred in a family that used water from a "driven well" thirty feet deep, and sixty feet from barn and vault, the soil being porous sand and gravel, and the ground sloping towards the well. Such wells afford strong protection against surface water, but in this case it settled down outside the pipe and entered below.

An extraordinary instance of the conveyance of disease to a distance of one mile, partly in a stream of water, and partly by the water soaking through porous soil, occurred in 1872, in the village of Lausen, in Switzerland. The village contained over 700 inhabitants in ninety houses. A mile distant was an isolated house in which a man was taken sick of typhoid fever, which was supposed to have been imported. The village had had no disease of the kind since its occupation by soldiers in 1814. Yet, although there was no communication between the isolated house, a mile distant, and the village, there was an outbreak of the disease, and one hundred and thirty cases of the sickness occurred, of which eight proved fatal. On a careful investigation it was found that a small stream of water near the isolated house had been polluted from the sick room, and this stream, used for irrigation, had carried the impurities to a public well, from which nearly all the inhabitants were supplied. There were six houses which had wells of their own, and their occupants did not use water from the public well; they remained in health except two, who had, when from home, used the public water. Every one of the one hundred and thirty who became sick drank of the water from the public well. There had been no communication between the isolated house and the village, and the disease was not conveyed by contagion, but was wholly the result of the use of poisoned water.

Absorbents for Vaults.

In the country, and away from cities, there are some very important advantages gained by the use of dry absorbents in vaults. If kept dry till used, and they are employed in sufficient quantity, they wholly prevent any possible drainage to wells or other sources for water supply. No liquid portions can escape from them. In this respect they possess a most important advantage over water-closets, the discharge from which must be always taken away by water, for which an escape must be secured. The dry absorbents, on the contrary, obviate the necessity of any care of the kind, and if constantly attended to, are accompanied with no odor, and the contents of the vaults are as easily shoveled out and drawn to land to be used as a fertilizer, as sand is shoveled and drawn from a sand-hole. There is no danger from frost, so much dreaded with water-closets.

One of the most perfect absorbents for this purpose is dry soil which contains a large amount of clay, the best and most convenient form of which is *road dust* where such soils prevail. Clear sand or gravel is of very little or no value. Coal ashes are more generally accessible in large portions of the country, and when sifted and perfectly dry answer an excellent purpose, in sufficiently large quantity to keep the whole mass dry. The best of all absorbents for common use is a mixture of ashes and road dust.

Contrivances have been made by which the movement of the cover in the closet throws down a pint of ashes; and other and simpler ones require only the pulling of a knob or button to effect this purpose. The first mentioned is liable to get out of order, and the latter is little better than to keep a supply at hand in a box or barrel, with a long-handled tin dipper, for every visitor to use. This mode costs almost nothing, is never out of order, and if every person uses it, there will be no odor and no drainage. A trial of this method by the writer, with perfect success, for about thirty years, has proved its value. There is no excuse whatever for any country resident or farmer who has not made provision for something at least as good as this simple and cheap contrivance, or does not see that it is properly attended to and used.

It must be remembered that this treatment applies only to vaults; and that slops and dishwater must be carefully excluded, and be provided for in a way elsewhere mentioned. If the absorbents are left exposed to the wet, or not regularly applied, tbe result will be a failure; but there is no necessity whatever for any such neglect; a few seconds daily is all that is necessary in applying it, and the coal used by any family will more than supply all the absorbents needed to abolish utterly all offensive odor.

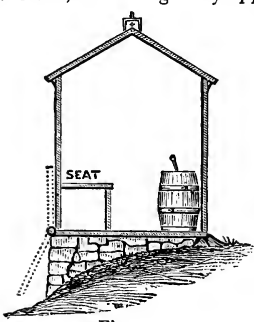


Fig. 30.

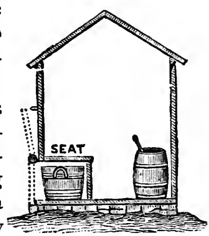


Fig. 31.

There are two modes of applying these absorbents, as represented by the accompanying figures. In fig. 30 a small vault is made by excavating in sloping ground, and building a stone wall on three sides, and leaving it open in the rear, where the bottom is nearly level with the ground. A door hung on hinges at the top keeps the vault closed, except when the contents are drawn away, when it is hooked up, as shown by the dotted lines. A small, neatly painted barrel is filled with sifted coal ashes or road dust, and a dipperful is thrown down by each person. In fig. 31 there is no vault below, and a door at the rear, which may be hooked up, admits a tub, which receives the ashes, and is carried out when full, and wheeled to the manure yard. This tub may be made of a kerosene barrel sawed in two, with iron handles screwed on at the sides. The tub is to be emptied when nearly full, which may be in two weeks or a month; the vault beneath will not need emptying in less than three months or more, provided all effluvium is completely prevented by a regular and copious use of absorbents. It is better to use these freely and abundantly than to permit any odor or moisture, and it is important that all rain or surface water be excluded.

With these precautions constantly observed, it will answer to place

Fig. 32.—*Sheltered Avenue.*

these closets near the dwelling; but as a matter of safety, in case of the carelessness of occupants or servants, it may be better to give greater space between them. To prevent exposure in winter, the walk should be flanked with evergreens, which may also extend over head and form a sheltered avenue, (fig. 32,) a plan for which is shown in fig. 33, by the walk on the left leading to the boundary of the vegetable garden.

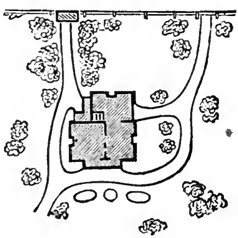


Fig. 33.—*Sheltered Walk.*

Kitchen Slops.

When these impure slops have been discharged so as to pass under the dwelling, typhoid fever and other diseases have sometimes been the result. The most fatal effects have arisen when portions of these slops have found their way, through leaks, into the water used for drinking. When they have been discharged into an offensive puddle at the kitchen door, the effluvium is less poisonous, as the sunshine and wind diminish the deleterious effects. It has long been a puzzling problem to devise some easy and safe way to get rid of these slops at country residences, one of the difficulties being the carelessness of the hired "help." If they could be induced to carry these slops several yards from the door, and discharge them on the grass, *selecting a new spot each successive day*, the remedy would be nearly perfect.

Another mode is to provide a large underground drain, extending several rods distant, and discharging in a large underground reservoir, where the earth will gradually absorb all impure matter. If the surrounding earth is insufficient to absorb all, the reservoir may remain open, with only a cover against rain, and be filled with dry loam, road dust, coal ashes, or other absorbent, which is shoveled out and drawn away before it becomes saturated. Wherever this mode is adopted, or an underground drain is used, there spould be a "trap" at the kitchen sink, or at the place where the slops are poured, to prevent the bad air from the drain from entering the house or poisoning the premises.

Another mode, which may be adopted where the owner can give personal supervision to see that it is faithfully carried out, is to place a large tub (half of a kerosene barrel answers well) at the kitchen door, and fill it with coal ashes, road dust, or other absorbent, to receive the slops. When saturated. it is carried and emptied on the vegetable garden or adjacent grounds. It may be carried by two men by means of poles fastened with screw bolts to the sides of the tub, (fig. 34,) or it may be more conveniently placed on wheels. This mode is better than providing a cover for the tub and pouring in the slops without any absorbent.

Fig. 34.—*Tub for Carrying Slops.*

Whatever be the mode which is adopted, it is absolutely necessary, so long as health is an object, that putrid air shall be excluded, and more important than all that no impure water shall find its way into reservoirs used for drinking, by soaking through the earth, or through any leaks. No one mode can be recommended or adopted for universal use, and different localities may require different systems for their special peculiarities.

TRAPS.—The simplest trap to prevent the escape of bad air from an underground drain to tbe kitchen, is the pipe-trap represented by fig. 35. The pipe has simply a descending curve, sufficient to become filled by the water which settles in it, and thus, although the water can flow freely, the air cannot pass from one part to the other. An objection to this trap is the liability of sediment settling in the lower portion and eventually filling the tube, which may be prevented by

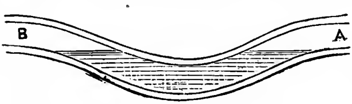


Fig. 35.

"flushing," or driving a strong current of water through it for a moment. Fig. 36 exhibits a mode by which the sediment is easily removed by taking off the

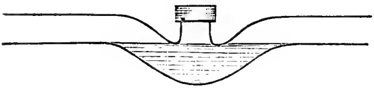


Fig. 36.

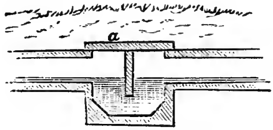


Fig. 37.

cap from the short tube. When the channel or sewer is made of masonry, with hydraulic cement, under ground, the trap shown in fig. 37 may be adopted, and the iron plate *a* removed for cleaning, after having taken off the earth above it. A "bell trap" is shown at *a*, fig. 38.

While pure water is readily conveyed in pipes less than an inch in diameter, the soap and grease from sink-water will after a while choke up those which are much larger, or even three or four inches in diameter, by adhering to the interior surface as it becomes cooled in its progress. Henry F. French describes a method for treating sink-water, which had been in successful use five years, the out-door fall being only one foot in a hundred, and requiring little skill in construction: "At the sink is a common bell trap, *a*. A lead-pipe of an inch and a half or two inches bore runs down and out, through the ground, into a reservoir, *b*, which may be a strong oil-cask of fifty or a hundred gallons. It should be a foot below the surface, and properly covered, so as not to freeze. The lead pipe

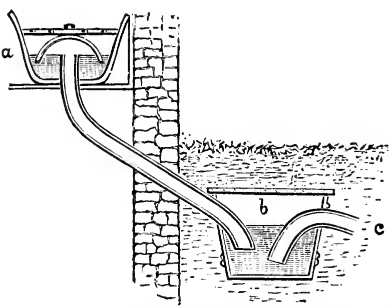


Fig. 38.—a, *Bell-trap*; b, *Reservoir*; c, *Dircharge-pipe*. (*The engraver has made the pipes much too large.*)

should discharge under water, making a second trap, which prevents any bad air passing up the pipe. The outlet pipe, *c*, starting one-third up from the bottom, may be of lead, two inches bore, and should run upward and out of the reservoir at a third from the top, into a large pipe of stone or iron. Thus the water enters by the lead pipe about mid-way from top to bottom, leaving the greasy particles floating on the top, and the heavy particles at the bottom, so that what runs off is comparatively clear. It still carries off a great deal of soap and deposits it at a long distance. At our house a five-inch stone pipe runs one hundred feet to the barn cellar, where it is again trapped in a cask, and carried thirty feet further, to the manure heap under the stable, far enough and low enough to keep it out of the well. The stone pipes fit, and are made tight with cement.

A swab should be used to rub down the cement inside as each joint is laid. Three or four times a year the cover of the reservoir should be removed, and everything cleared out "

Another contrivance, copied from the Massachusetts Health Report, is shown in fig. 39, and is similar in its operation to the one just described, but is built of masonry, is on a larger scale, and is more complete in its parts. A brick tank is laid in hydraulic cement, plastered smooth inside, and placed near the cellar wall, with the sink close to the opposite side of the same cellar wall, so as to give a short pipe between the two, and prevent the grease from congealing in the inlet pipe between the two. For houses of medium size the tank may be about two feet or two and a half feet square, the bottom about two feet below the outlet pipe, which turns down about a foot, with a smooth, round turn, the mouth being always under water. The inlet should be half a foot higher than the outlet, to allow the grease to collect that thickness above the water line. The whole must be covered so as not to freeze. This tank is to be cleaned out as often as the grease and sediment collects in large quantities. If care is taken to separate the richer portions of the dishwater for the pigs, and to pour only watery slops into the sink, the tank will not need frequent cleaning.

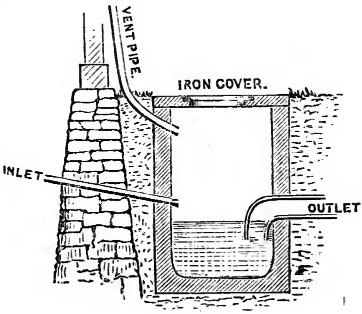


Fig. 39

Filtered Rain-Water.

While there are so many dangers on almost every hand from the use of the water from wells, especially in towns and villages, there is one resort that is always safe, and that is *filtered rain-water*. The water which comes from the clouds is not absolutely pure, as it brings down in small quantities the impurities which float in the air, or which lodge on roofs or in gutters, but nearly all may be removed by filtering, and the water will be rendered clear and tasteless. The addition of pure ice makes it entirely palatable.

George Geddes, whose scientific and practical knowledge combined is equalled by few persons, gave a detailed description in the Country Gentleman, of a cistern and filter for the use of rain-water, from which we condense the following account :

"The cistern is made only six feet wide, for convenience in covering.* It is twelve feet long and seven feet deep, and will hold 4.000 gallons. The

*The accompanying cut (fig. 40) is not an accurate representation of this cistern, but will serve to explain its general operation.

walls are of stone laid in hydraulic cement. The bottom is four inches thick, of concrete, made of nine parts of gravel and sand to one of hydraulic lime, just moistened, laid on in a mass and pounded hard. The lower course of the flat stones of the wall (the footing) projects four inches into the cistern, preventing any crack. The top is covered with two limestone flags six inches thick, resting on the walls, with a man-hole at one corner, the whole so covered and fitted with cement that no insect or surface water can enter, except through the leader from the roof. A flag-stone cemented at the edges covers the man-hole; and this is surrounded with a

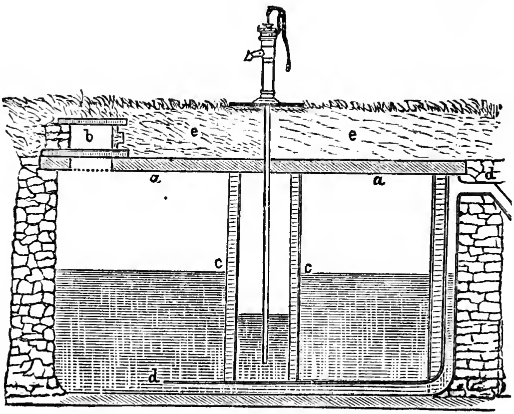


Fig. 40.—*Cistern for Filtering*—a a, *Flags for Cover;* b, *Man-hole;* c c, *Vertical Shaft for Filtering;* d d, *Overflow;* e e, *Earth.*

brick wall a foot high, and covered with another flagstone, made air tight with cement. This leaves a foot of confined air, and excludes frost. This is covered with a foot of earth and turfed, and the whole cistern covered with earth.

The filter in this cistern is a vertical hollow cylinder, of brick, two feet inside diameter, laid in hydraulic cement, and extending from the concrete bottom to the top covering, with an air-hole an inch in diameter, to allow the air to escape as the cylinder fills with water. The bricks used are good weather bricks, such as would be used for the top of a chimney. The circular form resists like an arch any sudden pressure of water against the outside. The water soaking through the four inches of brick is so well filtered that it answers perfectly the intended use.

The overflow from this cistern is made so as to give an escape for the filth which comes from the roof, preventing the necessity for frequent cleaning. The leader from the roof enters at one end, and the waste passes from the other end. A channel is made of five-inch tiles across the bottom, beginning about three feet from where the entering water strikes the bottom, and thence by a brick flue against the side, four by six inches, to the overflow channel at top, which has a sharp descent through tiles, terminating in a four-inch galvanized pipe, with a self-acting valve at the bottom, which is closed when no water is running, thus excluding vermin. The whole channel inside the cistern is well cemented.

Mr. Geddes adds that for more than a quarter of a century he has used filtered rain-water for all domestic purposes in his family, and during all that time there has been no disease that could be charged to bad water.

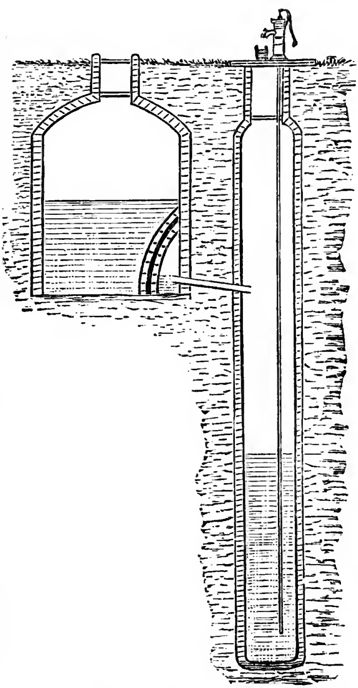


Fig. 41.—*Deep Cistern for Filtering and Cooling the Water.*

When ice cannot be procured for cooling the filtered water, the following method described by Suel Foster in the COUNTRY GENTLEMAN for 1877, may be successfully adopted: The cistern for holding the filtered drinking water is twenty-four feet deep, and the water it contains is as cold as in a well of this depth, (fig. 41.) It is arched with brick over the top, the arch starting six feet below the surface. The cistern which receives the water from the roof is seven feet deep, and is placed at the side of the deeper one, with a pipe-tile connecting them The filter is made of two walls of brick on edge, enclosing two inches of charcoal, the whole in a curve, with about ten square feet of surface. The water passes freely through the brick. The washing of the roof, and all warm rains are turned off, and no waste pipe is required. The accompanying cut (fig. 41) will show the general structure of these cisterns. Mr. Foster employs a chain pump, which keeps the water stirred, and plastered the cement on the smooth face of the earth, using bricks only for the arch at the top.

POISONED MILK.—Milk watered from impure sources has brought on the same diseases as when bad water is used alone. A case is reported in an English city where a milkman, by impure watering, infected forty-seven out of fifty families with disease.

Water in Sewers.

The impure water of sewers in towns should be conveyed away from the neighborhood of dwellings, and one of the best modes of disposing of it for useful purposes is to apply it for irrigating land. In towns and cities where there are large quantities, two modes have been adopted, one of which is to discharge the sewers into rivers and smaller streams. This pollutes the water of the streams, and has in this way carried disease to the lower portions of the towns or to inhabitants living on the banks in the country.

The other mode is to employ it for irrigation. If it can be securely conveyed in large pipes or sewers to farms in the neighborhood, it is quickly absorbed by the soil, and gives an increased growth to the crops.

From English government reports made two years ago, it appears that of a large number of towns, mostly varying in population from ten to eighty thousand, over one-half derived an actual profit from this mode of irrigation, while the remainder made no profit, or met with financial loss, the chief object being the removal of the causes of disease at whatever cost.

When sewage is applied to land by way of irrigation, it is necessary to adopt a regular and systematic mode of application. The land must not be flooded at random, but the water evenly distributed through channels methodically laid out, and no more used than the soil will absorb and purify. At Milan, in Italy, 4,000 acres of land are treated with the sewage from the city, or at the rate of an acre to forty persons. At the meadows near Edinburgh, only 400 acres are provided, and the area is not sufficient to take up all the putrid matter, although large crops of coarse grass are obtained. In some low places the abundant supply has made the meadow a mere marsh, that cattle cannot walk over.

The Massachusetts Health Report gives an account of the well conducted sewage farm which receives the discharge from Romford, a town of 7,000 inhabitants, near London. The farm contains 125 acres, or an acre to fifty-six inhabitants. The sewage is brought from the town in iron pipes, and received in storage tanks, from which it is pumped and conveyed in conduits. Among the crops cultivated are cabbages, potatoes, turnips, peas, beans, onions, Indian corn and grass, all of which grow luxuriantly. The lessee of the farm pays the town $3,000 per annum for the sewage supplied for use.

These extensive experiments, although not applicable to common farming, serve to show the value of the impure refuse matter from every dwelling, if used on a small scale and for similar purposes.

A drawback in the successful use of town sewage is the fact that it must be disposed of day by day throughout the entire year, and that its quantity is often greatest when of the least service to the land.

Disease Prevented by Draining.

Dr. Kedzie of Michigan estimates that 20,000 miles of underdrains were constructed in that State in the ten previous years, with a marked decrease of malarial diseases, some physicians stating that they had been reduced to only one-half, or even to one-fourth of their previous numbers. Draining would strongly tend to prevent impurities from passing into wells.

The Massachussetts Health Report states that "intermittent fever has ceased in certain parts of Great Britain, and in this country, under the influence of tillage and drainage of the soil." Official records state that in England and Scotland "the life of the people gains from 20 to 25 per cent. in years, and they suffer less than half the average sickness and disability in the well-drained districts."

An interesting case bearing on this subject is given by Dr. Wilson of Flint, in the Second Report of the Michigan Board of Health: "In the town of Gaines, in this county, twelve years ago, was a marsh of over four miles in length, by one and a half miles in width. So fatal were its emanations in summer and early autumn that it had acquired the name of "dead marsh." Since then it has been drained, and been made into one of the finest farms in the State. The drainage has been thorough and complete, and a more salubrious and healthy region is not to be found in the State." The same report states that in former years dysentery and malarious fevers prevailed in Detroit; but with the general introduction of pure lake water, and the extension of the sewerage system throughout the city within the past ten years, they are rarely met with and never in any endemic form.

Pulmonary Consumption from Bad Drainage.—The Fifth Annual Report of the Massachusetts Board of Health states that "investigations in Europe and America have proved that residence on a damp soil brings consumption, and that the drainage of the wet soil of towns tends to lessen the ravages of that disease." For this reason the dwelling should be placed on ground which is always dry, either naturally or by through underdrainage; and the cellar must be cemented so as to be always dry.

Many instances are given in the report above mentioned, proving the influence of damp situations in producing consumption. A few may be quoted as samples of the rest: In one case the house was low, with many shade trees, and cold springs issued from the hillside back of the house. The children all died of consumption before twenty years old. They were always better when sent from home; returning, the cough came back. A farmer resided in a valley near a stream; he lost his wife, two sons and one daughter from phthisis, within five years. A farmer near Pittsfield built a house on wet soil. He and his wife lived to advanced age; there was no consumptive taint in either. Of their eight children all died of consumption. In the same neighborhood, another farmer lived on high and dry soil. He lived to be ninety, his wife eighty, and their seven children, who have reached or passed middle age, are all living.

Impure Ice.—The opinion has been thoroughly disproved that the freezing of water removes its impurities. A case is reported by Dr. A. H. Nichols of Boston, furnishing strong testimony on the subject. At Rye Beach, in New-Hampshire, in 1875, a large number of the three hundred guests of a hotel were attacked with a mild epidemic. The two hundred guests at another hotel, one-eighth of a mile distant, entirely escaped, and so did the five hundred visitors at boarding houses.

A careful examination was made to discover the cause. The wells were on an elevated ridge far removed from any source of impurity. Good drainage of the house had been secured by competent engineers from Boston. The kitchen utensils were found to be scrupulously clean. Some of the guests, suspecting the water, had entirely avoided drinking it, and substituted melted ice. This, in several instances, produced nausea, and on examination was found to be more or less turbid, and with a slightly fœtid odor. This ice, it was ascertained, had been taken from a shallow pond, containing, among other decaying matter, large quantities of sawdust from two neighboring sawmills, which, being mixed with mud, created a mass of offensive matter. The use of the ice was immediately discontinued, and all the guests at once recovered. The water from this ice was analyzed and found to contain eighteen times as much foreign matter as that supplied by the Boston Ice Company.

Barnyard Odors.—In order to escape the bad air from barnyards and pig-styes, it is often recommended to place them at a distance from the dwelling. This recommendation of distance is well, but a good farmer should not permit offensive odors at his barns. Absorbents should prevent fumes from manure; stables should be kept constantly clean; and the quarters for pigs should be entirely free from effluvia, by thorough cleaning twice a day, and by plenty of dry litter and absorbents. Pure air is important for the health of animals, and the milk of cows which is placed on the table should not come from scenes of pollution. So long as human beings eat pork, pigs should be supplied with clean apartments and pure air.

Water Purified by Boiling.—When the late David Thomas conducted the company of exploring engineers for the Erie Canal between Rochester and Buffalo, he directed all his assistants to drink no water in that newly settled region, that had not been boiled. Those who adhered to this order remained in health through the season; those who disregarded it all became sick with fever. An English commission on this subject say, in their report, that "boiling the infected water for half an hour is a probable means of destroying its power of communicating these diseases." They allude to cholera and typhoid fever. Prof. Brewer reports the case of a prisoner at Andersonville, during the war of the rebellion, who was one of the first sent there, and who came out well. He never drank impure water without boiling it. He was often detailed to bury the dead, and on these occasions he brought back roots and wood for this purpose.

TEST FOR WATER.—To ascertain if water is free from organic matter, fill a quart glass jar, perfectly clean, with the water, and set it uncovered in a closet free from dust, and if it will remain bright and sweet for several weeks, it may be regarded as good and pure.

Water is sometimes poisoned by remaining in lead pipes. If there is much tendency to colic, and if the gums have a slightly bluish color, lead poisoning may be strongly suspected. Whenever lead pipes are used, although all kinds of water will not dissolve it, make it an invariable rule to run off, the first thing every morning, all the water that has stood in them over night.

MUSHROOM CULTURE.

THE FOLLOWING PRACTICAL REMARKS on this subject are furnished by JAMES VICK of Rochester, N. Y., to whom we are indebted for the illustrations:

"Many of our readers, were they to see the immense consumption of this fungus in Europe, especially in France, and were they as fond of mushrooms as we are, would appreciate its importance. There are growers of mushrooms in the suburbs or Paris that gather and send to market more than two thousand pounds a day each, and some that have nearly a score of miles of mushroom beds. Then there is something so singular, almost wonderful, about mushroom culture—no seeds or roots planted—only a few pieces of dirt, apparently, stuck into the bed—and yet a crop of pearly whiteness is produced, as if by magic. Until it becomes an old story it is quite as exciting to the boys as 'going-a-fishing.'

"Our readers are, of course, acquainted with mushrooms of the meadows, so abundant in many places in the damp, cool weather and dewy nights of autumn. Some pass them without notice, or think of them only as toad-stools, while others seem to rush for every tiny specimen as eagerly as though they were gathering diamonds. We were desired to show how mushrooms can be cultivated so as to secure a supply during the spring and summer season, and before they can be obtained from the fields.

"The mushroom is a very accommodating plant, and will grow in the cellar, in sheds, stables, tubs, old hats, on shelves in the garden, in dark or light. We have seen them growing in old tubs, somewhat as represented in the engraving, (fig. 42,) in out-of-the-way corners of sheds, in dilapidated and abandoned greenhouses, on shelves in stables, the per-

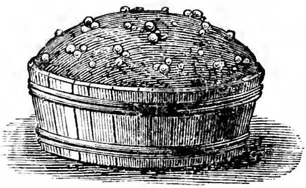


Fig. 42.—*Tub with Mushrooms.*

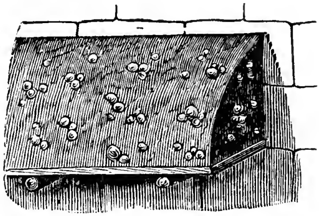


Fig. 43.—*Bed against a Wall.*

quisites we presume, of the hostler, and in every case giving apparently a good and healthful crop. Fig. 43 shows a shelf-bed attached to a cellar wall.

"All that is needed for success is a temperature from 50 to 60 degrees, some fresh horse manure, and a little *spawn*. Having procured what fresh horse manure is needed, mix it well with about one-third its bulk of good loam, and you are prepared to make your beds in whatever form and in whatever place you prefer. If you determine to form beds, make them narrow, certainly not more than five feet in breadth, and about fifteen inches in height. The material must be made compact by beating down as evenly as possible. If under cover, the beds may be made flat on the top; but if in the open air, should be rounded, to shed the rain, somewhat as shown in the engraving, (fig. 44.) After the beds have been

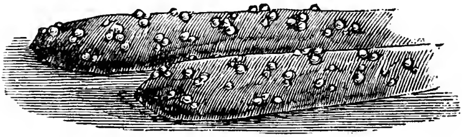


Fig. 44.—*Rounded Beds.*

made a week there will be considerable heat produced by the fermentation of the manure. Bricks of spawn should be secured previously, and they can be had of most seedsmen, postage or expressage free, at about thirty cents a pound. Break them into pieces about as large as walnuts, and insert in the beds, just below the surface, about ten inches apart. One pound of spawn is sufficient for a space two by six feet. If there seems to be much heat, do nothing for a week or ten days, until it somewhat subsides. Then cover the bed with an inch or more of good earth, pressing it down with the back of a spade. It is not likely, in a large bed, water will be needed at all; but if the material should appear very dry, water lightly with warm water. In small beds or pails, or anything of the kind, it is probable water will be needed once or twice. Mushrooms will begin to appear in about six weeks after planting the spawn, and can be gathered for three or four weeks. In gathering, take up the mushroom entire, leaving no stem in the bed, and placing a little earth in the hole made by its removal. When the crop is gathered, cover the bed with a little more earth, beating it down gently, and give a pretty good moistening with tepid water, and in about a month more another crop will be produced.

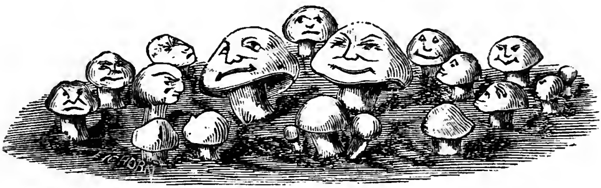


Fig 45.—*Bed of Mushrooms Painted with Lamp-black.*

"In closing we give a view (fig. 45) of what some mischievous and artistically inclined boys did to a mushroom bed by the aid of a little lamp-black, converting the innocent fellows into goblins or fairies, or something of the kind."

Peter Henderson, who has raised mushrooms for many years with success, gives the following among other essentials in their culture: Raising under some shelter, as in a shed, stable, cellar, &c., and not in open air; giving them a temperature of 40 to 60 degrees; using fresh loam from a pasture or sod land to mix with manure, as old manured soil may contain spurious fungi; turning the heap every day, to prevent violent heating; beating each successive layer down compactly in making the bed; beginning preparations early in winter, so as to obtain mushrooms in February and March; not allowing the temperature to go below 40 degrees to retard the crop, and to be careful to delay covering the bed with mould, when first made, ten or twelve days. Mr. Henderson says he utterly failed the two first years by putting on the mould as soon as the bed was made.

Out of hundreds of species, there is but one that is commonly employed in mushroom culture—the *Agaricus campestris.* It is distinguished by its small, round, whitish head, of a delicate pink color beneath; the stem about three inches high. When well opened, it appears as shown in fig. 46. The top changes to brown when old. When it first appears it is almost globular, and is then called a *button.* It is found in all the four quarters of the globe. There are some other species which may be eaten, but this is preferred; and there are many species which are poisonous, and have caused deaths, most of which have a disagreeable odor. There is one, *A. muscaricus,* which is a beautiful red, but is a deadly poison. It is safe to use only the common, well-known, cultivated sort. Mr.

Vick gives a figure, however, of a good edible mushroom, which we add, and known as the Morel (*Morschella esculenta*,)—fig. 47—which is much esteemed in some parts of the country.

COOKING MUSHROOMS.—Mr. Vick says: "When we were younger, and hunted

Fig. 49.—*Agaricus campestris.*

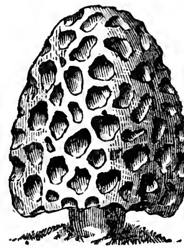


Fig. 47.—*Morel* (*Morschella esculenta.*)

mushrooms in the meadows, we sometimes made a bonfire, and after skinning them, would turn them upside down, like an inverted umberella, put a little salt around the stems and roast them on the live coals. They are excellent put in a frying-pan with a little butter and salt, to be eaten with beefsteak or roast beef. A dozen in a meat-pie is a treat fit for the King of the Sandwich Islands." He adds the following mode, which is not unlike the many modes adopted by different persons: "Peel both tops and stems, put into a stew-pan, with one ounce of butter and a pinch of salt to each pound; cover with water and stew gently, after once coming to a boil, ten minutes: then put in three tablespoonfuls of milk, or one of cream, to each pound, and serve up hot. This is a dish for fish, flesh and fowl, fit for a king. Season to suit, with more salt, red or black pepper. Mushrooms fully opened, but still flesh-colored underneath, are best. They are also excellent broiled on toast.

TO FRY MUSHROOMS.—Peel, then dip in egg and roll in cracker crumbs. Season with pepper and fry as oysters."

The following is the substance of the mode of making the spawn, as described by Peter Henderson: Take equal parts of horse-droppings, cow dung and fresh loam; work them very thoroughly together, like mixing mortar; make into cakes like bricks; half-dry them on edge, under cover; insert into each a piece of spawn as large as a hickory nut; when quite dry make a pile of them a yard wide and a yard high, on a floor on which eight inches of horse-dung has been spread, and cover with manure, to get a gentle heat. In two or three weeks they are thoroughly inoculated, and if removed to a dry place, will keep good for years.

FARM BUILDINGS—COUNTRY IMPROVEMENTS.

THE MISSION of every patriotic land owner should be to improve and elevate the farmer's business. This every one may do by presenting to his neighbors a specimen of neat cultivation, and finished and convenient buildings. He may exhibit an attractive specimen of country life, which will not only enable others to imitate or excel him, but he will make the occupation of the farmer appear attractive to his sons and daughters, and they will be less disposed to seek town life and town business.

Beautiful, well cultivated fields, with heavy crops, scarcely ever fail to interest any one who sees them To make the entire surroundings of the farmer's home really attractive, his dwelling and his barns should be pleasing objects, and should possess a neat, comfortable, home-like exterior, as well as interior. We have heard the successful farmer falsely described as the man who can heap up the most money without regard to anything else. He has no dooryard properly so called, or its rear is occupied with cattle and fat pigs, and the front of his house is cut up with wagon-tracks in drawing his heavy loads of grain to market. His study is to raise the heaviest crops at least cost, which is well; but he lives parsimoniously, in order that he may accumulate money without making his family comfortable. His wife is a slave, and his children see nothing pleasing in living on a farm. Such men are often pronounced good managers, but we cannot at all agree with that opinion. The best farmer is he who has, through his calling, done the most good to his family and those around him; who has enamored his children with the beauties of the country and its occupations; who has in this way kept his sons from seeking for their amusement the drinking saloon and gambling hall, and has given them a taste for intellectual pursuits instead of remaining in ignorance and mental idleness. The good farmer not only makes agriculture financially successful, but he elevates it in character and respectability. He can teach his children the arts of gardening—to raise fruit, to bud and graft, to cultivate flowers, to study ornamental planting, to experiment in vegetable physiology. One room in his dwelling should be a domestic museum—occupied with a collection of minerals, a herbarium, cases of insects, and a literary and philosophical library, where all may resort during stormy days or long winter evenings, for instruction and entertainment. "What is the reason," is a common anxious inquiry, "that so many young people leave the farm for the city?" Simply because so little is done to make country life attractive in the many ways and with the many facilities that are so richly afforded on every hand.

Improved Farm Buildings.

Much may be accomplished for the improvement of the farmer's business, in making it both more profitable and more interesting as a pursuit by the proper construction and finish of the house he is to live in, and the buildings which are to furnish appliances and shelter, in the working of the great annual routine of operations. Good barns are all-important. They should comprise three great leading requisites: They must give ample room for the shelter of the harvested crops, and for the animals which stock, and feed on, and ornament, and enliven the farm; they must be readily accessible for entrance in filling; and they must be so arranged internally, that the daily feeding and attendance of the animals they contain, and the transfer of hay, grain, and other feed, from one part to another, may be attended with as little labor as possible, including the various operations connected with threshing, cleaning and storing grain, and the conveyance of manure.

Construction of Barns.

It may be well, in this connection to devote a few minutes to some of the general details in the construction of barns. It is important that the farmer who is about to erect any building, should make a careful estimate of what he wants, of the amount of, grain, hay and other products which he wishes to secure and shelter. He must determine approximately what his crops will be, and then ascertain the required capacity. He must then sit down and count the cost. Such estimates are often the vaguest guess-work, instead of the result of careful computation. As a consequence, barns are made too small, and grain, instead of being housed, is stacked outside, and exposed to rains and rotting. Additions, if erected, are at the expense of convenient arrangement.

Estimating their Capacity.

The mode by which accurate estimates are to be made, may be illustrated by an example. Suppose that we have a moderate-sized farm of 100 acres of land, devoted to meadow, pasture and grain. Ten acres may be corn, but this, when husked, will go into a separate building. Thirty acres of meadow, at two tons per acre, would give us sixty tons. Twenty acres of sown grain would afford a corresponding bulk of straw, and amount to forty tons. No estimate need, of course, be made for the pasture and smaller enclosures. Now, for the 100 tons of hay and grain, estimating an average of 600 cubic feet to the ton, there would be required 60,000 cubic feet of space in the bays. This bulk would be sufficient to fill three bays each 20 feet wide, 25 feet high and 40 feet long. Very few hundred-acre farms have anything like this amount of barn space provided. But the owners may never expect to raise two tons of hay to the acre, although no good farmer should be satisfied with a pound less. Take off then one-third of the whole amount, and still this moderate farm would require two bays 20 by 40 feet, and 25 feet high. But it must not be forgotten that the barn is to contain, beside this ample capacity, space for stables, granary, threshing floor, horse-power, and for other purposes. This estimate is intended to show that on most farms very insufficient provision is made for the storage and protection of farm products.

On large farms, some owners thresh their grain as it is conveyed from the field to the barn. We remember being much interested some years ago in witnessing this operation on the fine farm of Robert J. Swan, near Geneva, N. Y. He has over 350 acres of excellent land, which he has drained with 60 miles of pipe tile, and on which it is not unusual for his wheat to yield more than forty bushels per acre through the whole of large fields. His grain when harvested is not drawn in till it is ripe enough to thresh. He had four or five teams at work conveying the wheat to the barn, so that one load after another kept a constant supply at the mouth of the machine. The thresher was thus in constant operation from morning till night, and several hundred bushels were thus prepared each day for the granary or for market. This mode of management is more easily accomplished now than in former years, since the general introduction of farm steam engines, leaving the horses of the farm at liberty for drawing the wagons.

In such cases, the threshed straw takes the same space in the barn as would be otherwise occupied by the unthreshed grain; and the improved quality of the sheltered straw for the various purposes for which it is intended, must be obvious to any one who has observed the difference between that which is dry and bright, and the half-rotten masses carelessly exposed to the rain and weather.

The increased labor of transfer, when grain is stacked out-of-doors, would soon amount to more than the additional cost of convenient and spacious barns.

Planning a Barn.

The owner who is about to erect a barn should, in the first place, make a systematic arrangement of his wants. We have already pointed out the way for him to ascertain the required capacity. He should next make a list of his several requirements. For example, he may write down the names of the various apartments and divisions, like the following:

1. Bays for hay.
2. Space for unthreshed grain.
3. Room for straw.
4. Threshing floor.
5. Area for horse-power.
6. Granary.
7. Room for heavy tools and wagons.
8. Harness-room.
9. Horse-stables.
10. Stables and pens for cattle and calves.
11. Shelter for sheep.
12. Root-cellar.
13. Manure sheds.

Some would add other apartments, and others would omit a portion of these. But in either case the plan should be fully determined beforehand, and all that is wanted brought distinctly before the eye, and carefully and deliberately arranged in the best manner. In doing this there is an endless exercise of skill. We have named thirteen different spaces or apartments; arithmeticians will tell us how many million combinations may be made with them. There will scarcely be an end of the various plans which may be devised by or presented to the farmer; but a good arrangement may be reached without great difficulty by bearing in mind that the reception of the largest and heaviest products must have the preference for convenient access; that the threshing floor must be contiguous to the grain bay, and either above or on a level with the granary; that stables for animals should be where they have ready access to the feed, and which will permit an easy conveyance of the manure; and that the thresher and cleaner should stand in a central position for threshing and storing the grain. A short article like the present will not allow entering into minute details; but if some of these leading requirements are borne in mind, they will enable the ingenious owner to devise a plan to suit his peculiar wants, by a comparison with some of the best published and accepted plans, and to correct the errors of badly arranged designs.

Since the general introduction of horse-forks and horizontal hay-carriers on the larger farms, it is less necessary than formerly to build low barns,

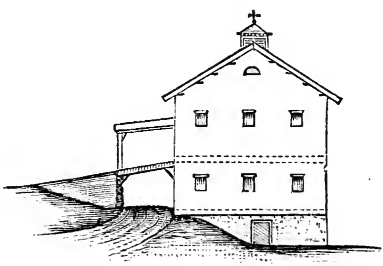


Fig. 48.—*Three-Story Barn.*

or to construct three-story barns the upper floor of which may be reached by tbe team with loaded wagons. There is however a great convenience in a three-story building, where the surface of the ground has a sufficient inclination for the purpose (fig. 48.) The upper floor is reached over an inclined embankment and short bridge, and loads of hay are easily discharged downwards, and grain on a level. If the threshing floor is at this story, the grain, as it runs from the fanning mill or separator, passes down to the granary on the next floor below, from which again it is drawn off into the wagon in the basement for conveyance to market. The lifting of the grain is thus entirely avoided. The intermediate floor is the base of the bays for hay, and may be occupied with horse-stables, tool-rooms, harness-room, granary, and with a central floor for drawing in crops, threshing, horse-power, and for other purposes. The basement may include the cattle stables, sheep pens, root cellar, cistern and water-troughs, and area for manure.

Three-story barns require sloping ground; but if it is nearly level, two-story barns should be adopted (fig. 49,) with at least 20-foot posts, to give

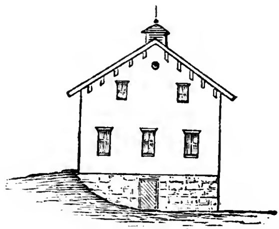


Fig. 49.—*Two-Story and Basement Barn.*

ample space under the roof, and in this case the horse-fork becomes indispensable.

Every barn should have a basement. It is roofed with no additional cost; and the protection afforded against the decay of the lower timbers, by resting well above the ground on the stone walls, is nearly equal to the cost of excavation and walls. The space thus obtained is therefore nearly clear gain.

In other words, every barn should be at least a two-story one. Even when the ground is quite level, it is not difficult to obtain enough earth for the comparatively narrow roadway embankment on one side, by excavating a foot and a half or two feet in depth (fig. 50.) A slope of one foot in the breadth of the building would make the work easy of accomplishment.

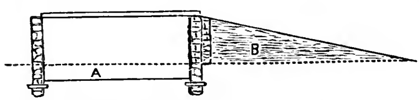


Fig. 50.—*Dotted Line, natural Surface of the Ground—A, Space excavated to form embankment B.*

Since the introduction of the horizontal hay-carrier, wider bays may be stored with hay without the labor of side-pitching by hand.

Form of Barn Buildings.

It was formerly a common practice to place the various barn structures in the form of a hollow square. This form protected the cattle yard on each side from the sharp winds of winter, and the central portion was conveniently occupied with the manure heap. There are, however, several objections to this arrangement. A greater surface of outside walls is required than for a single, large, compact structure. The different apartments are necessarily remote from each other, and more labor is consequently required for the daily attendance in feeding animals. It is more difficult to secure a spacious basement. Fodder cannot so well be thrown down through shoots to animals below. More surface is required for the roofs.

OCTAGONAL BARNS.—Many octagonal barns have been constructed of late years, and they appear to be coming into favor for large farms, or where great capacity is required. Among their advantages over the rectangle may be named the following: 1. They enclose a greater space with a given surface of exterior wall. 2. They require fewer cross timbers and ties when properly constructed, and the roof is mainly self-supporting, possessing somewhat the character of an arch resting on the walls. 3. Shorter timbers may be used in building, as the building has narrower sides when compared with its capacity. 4. The horse-fork, placed near the centre, may be employed for working on all sides of the surrounding circle, without changing its position.

The rectangular form for small barns would, of course, be more simple in construction, and may be best adapted to farms of small extent.

ESTIMATING THE COST OF BARNS.

No enterprise should ever be undertaken without "counting the cost." The owner has made a plan of his proposed barn, spacious enough for all his requirements, but the very important question comes up: "Have I available means sufficient to meet the expense?" To answer such questions as this, we adopted a simple rule many years ago, by which we could quickly make a general estimate with approximate accuracy. The result will, of course vary with the price and convenient access of the materials, and more with the ability and skill of the builder. Nevertheless, it will give a fair average for the country at large, and for good management. It is this: For a common rough barn, well built with unplaned lumber, with a good stonewall basement, one dollar will pay for two and a half feet surface; or if the materials are cheap and accessible, three square feet may be had for each dollar. Take an example: A rough barn 35 by 70 feet has an area of 2,450 square feet. Divide this number by 3, and the quotient will be 817, the lowest sum in dollars for which the barn could be built; or by dividing by 2½ we obtain the number 980, which represents the number of dollars it would be more likely to cost under ordinary circumstances.

If the barn is built of planed lumber, with good finish, and painted outside, one dollar will pay for two feet square, with the variations already mentioned. The barn, 35 by 70 feet, and containing 2,450 square feet as before, would cost about $1,225. By adopting ornament and high and costly finish, the price might, of course, be increased indefinitely.

By employing this rule, with its modifications, the young farmer may arrive at a tolerable knowledge of what he will have to expend, and he may know whether the builder who takes the job will charge an extravagant price.

OTHER BUILDINGS, as sheep-barns on large sheep farms, pig-houses, corn cribs, dairies, ice-houses, &c., are mostly separate buildings, each of which would require a treatise for its construction and management.

Various General Details.

There are many details of general application which should be borne in mind in building barns, a few of which may be worthy of being briefly mentioned:

1. All barns should have good eaves-troughs, connected with spacious underground cisterns. They will protect the walls, and furnish domestic animals a large supply of water, or no less than five barrels daily through the year, from a roof 35 by 70 feet, if there is an annual rainfall of 3 feet.

2. A broad, projecting roof, by sheltering the sides of the building, adds to its durability.

3. The basement walls should stand on a broad, deep trench filled with small stone or coarse gravel, to effect drainage; and if thick flagging, projecting some inches beyond the walls on both sides forms their base over the small stone, rats will not burrow under them (fig. 51.)

4. In building basement walls, there should be a space of a foot between their outer face and the bank of earth, the excavation being a foot wider on each side for this purpose, which enables the mason to build a smooth outside, and to avoid the projecting points of stone, which, when the earth freezes in contact with them, dislocates the wall. The outside space is afterwards filled with broken stone or gravel, and allows a free drainage into the ditch under the walls, as shown in fig. 51.

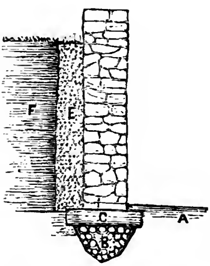


Fig. 51.—*Cellar Wall*—A, *Cellar Bottom;* B, *Drain;* C, *Flagstone;* E, *Gravel Space;* F, *Earth.*

5. Never allow an embankment of earth subject to freezing to press against a basement wall, the successive thrusts of the frost, sooner or later, throwing it over. A vertical stratum of coarse gravel or small stone should be interposed, as already mentioned.

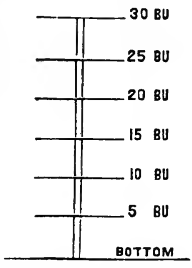


Fig. 52. — *Graduated Granary, inside.*

6. The most convenient barns now built have the interior of the main floor entirely free from partitions, so that loads of hay and grain are driven in on any part, and separate narrow bays of any desired width are built up successively. When consumed or threshed these portions are taken down in succession.

7. Every granary should be graduated on the inside, to show the number of bushels it contains below each graduating mark—enabling the owner to know at a glance how much grain he has on hand (fig. 52.) This graduation may be easily made by multiplying the cubic feet by 45, and dividing by 56.

8. Petroleum for inside floors makes them more durable; and for outside woodwork it is better than paint, penetrating into the pores, and giving common wood the character of cedar. Applied to the outside of this a coat of Averill paint (which adheres better to the oiled surface than any other paint we have tried) forms, with the oil, a very durable and perfect protection against weather.

9. Cattle yards connected with a barn which consists of a single compact building, should be well sheltered with evergreen screens. These form the most pleasing kind of shelter against winter storms, and any one who has seen cattle and sheep reposing comfortably under their broad, green, dense arms, while the snow clouds are sweeping over open fields, could not fail to be struck with their real value. They are the cheapest of all barriers against the storm. Trees of Norway Spruce planted in a line from three to six feet apart, and growing, as they usually do, three feet yearly, will in a few years form a screen so dense that storms cannot penetrate it. For more ample security of earlier growth, it may be well to plant two rows of the trees, alternating, and not opposite to each other.

10. Barns and all out-buildings, whether of high exterior finish or made of rough boards, may be neatly constructed with an architectural or symmetrical exterior. We sometimes receive instructions in works on landscape gardening to conceal, by plantings of trees, the unsightly barn buildings of the farm. They should never be unsightly; but be made

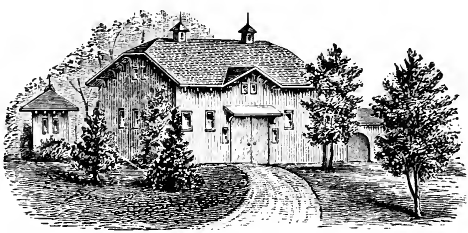


Fig. 53.

positive ornaments—not by useless or costly architecture, but by simple attention to a pleasing outline. A total absence of farm buildings would give to a farm an expression of incompleteness. Well-formed structures, slightly obscured by trees, add to the landscape effect of a country home (fig. 53.)

Farmers' Homes.

It is hardly necessary to speak of the great advantages which a dwelling with beautiful surroundings possesses over one that is unattractive or positively repulsive. But it may be well to remark that an agreeable home must have *three* essential requisites (beside the pleasant and kind faces to be seen there), and these are a neat, well-arranged and pleasing interior: a symmetrical, architectural, and home-like expression of the house outside, (not necessarily ornate or elaborate, but rather the reverse); and handsomely planted and well kept grounds around it. In these days of diminished finances, none need start back for fear of the expense required to secure these essentials of a complete country home; for the interior arrangements require only skill in designing; the exterior an architectural taste; and the grounds, when once planted, are kept in order mainly by the use of the new lawn mowers at one-fifth the expense of the discarded scythe. Men often put too much money in ambitious buildings and costly structures, when a twentieth part of the difference between these and more modest dwellings, would secure infinitely more beauty in the grounds. We remember well two scenes which we often witnessed in the same neighborhood,—one of a large, showy and expensive dwelling

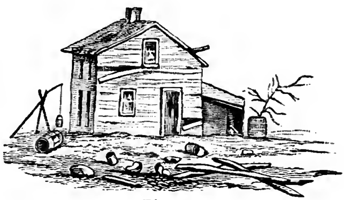


Fig. 54.

with an unplanted and bleak exterior, and with nothing to make it really attractive; and another house, costing precisely one-tenth the money, converted into a rural paradise, by blooming shrubbery, brilliant flowerbeds, a green velvet of grass, and ornamental trees nearer the boundary. It was once not very unusual to see the contrast between the cheaper class of cottages—the one marked with neglect, with dilapidated walls—hats and rags thrust into broken windows, obsolete barrels, broken boxes, heaps of rubbish, and slop puddles about the premises, (fig. 54); and the other a

Fig. 55.

gem of neatness—a white-walled, vine-embowered home, with its glad surroundings (fig. 55.) We need not ask which would have the best educating influence on the young members of the families who occupied them, and whether it is possible to make a better investment of time and labor than in the few minutes expended daily morning and evening in brushing up and improving such a home.

Selecting a Residence.

The owner who is about to erect a dwelling should, in the first place, secure certain essential or desirable points. He may arrange these in the following order:

1. Healthfulness, as all essential, for nothing can atone for ruined health.
2. Good neighborhood, nearly as important.
3. Good soil—requisite for the successful culture of crops.
4. A favorable climate for the business, so far as other requisites will permit.
5. Convenience of access to market, shops and to places of worship.
6. Scenery and landscape views.

Some would place the last named—pleasant scenery—among the first, and with such we have no disposition to enter into controversy. In fact, we should hardly attempt to convince the man of anything connected with the subject, who did not value beautiful scenery.

Planning a House.

It is entirely out of the question to furnish, in the brief space allotted to this subject, the details for constructing dwellings, and we can only enumerate some of the most essential points. The owner, as in the erection of barns, should make out a list of his needs. If he builds a moderate house, he will at least require:

1. Kitchen.
2. Parlor.
3. Small entry or porch.
4. Nursery or bed-room on the ground floor.
5. Bed-rooms, with closets, upstairs; and, never to be omitted—
6. A good, spacious, clean, well ventilated cellar.

The smallest farm-house should contain all these, and if a larger and better one is intended, the owner should add store-room, wood or coal room, iron closet and laundry to the kitchen; a separate dining-room, and bath-room; and he should not omit one apartment for a library, mineral cabinet, herbarium, cases of insects, and simple apparatus for chemistry and natural philosophy, for the gratification of his growing children, if not for himself.

We wish to urge the importance of making the kitchen and the cellar as neat and clean as any part of the house. The kitchen walls should be neatly papered, and the windows should give abundant light. The conveniences of ready access to coal, and to cistern and well water without passing a door, will be the means of securing a better class of domestics, as we have had occasion to prove by long experience; or if the farmer's wife herself does the work, it will prevent much bodily fatigue.

The cellar should be covered with water-lime cement, kept clean at all times, and perfectly free from anything that can cause the faintest bad odor. If the house is large, the cellar should be divided by 8-inch brick walls, into fruit-room, milk-room, and apartments for roots, coal, and for furnace.

General Rules.

A few general rules may be added:

1. The kitchen in every country house should be on a level with the principal floor.

2. It should have ample windows, for free ventilation, if possible, on opposite sides.

3. The pantry or dish-closet should be placed between the kitchen and the dining-room, readily accessible to both.

4. Every entrance, except to the kitchen, should be through some entry or hall, for seclusion, and to prevent cold draughts.

5. The cellar stairs should be easy and broad, as they are passed thousands of times yearly.

6. Place the rooms most frequently used in positions for the most easy access; and those less frequently oecupied, as bed-rooms, more remote. The entrance hall should, for this reason, be near the centre of the house.

7. It is scarcely necessary to add that the partitions on the upper floors should stand exactly over the lower, to secure firmness to the whole.

Avoiding Household Drudgery.

A formidable drawback on the comforts and attractions of country life, exists in the drudgery to which farmers' wives and daughters are subjected in boarding and lodging a number of hired men. Farmers who are in comfortable circumstances as to property, often compel the women to work early and late in feeding these men, and many have been thus reduced to a condition but little better than slavery. To them rest never comes; through the week days and on the Sabbath the same ceaseless round of cooking, and the many labors connected with it, must be submitted to, and more than a thousand meals must be annually prepared for the men who have their seasons of labor and of rest. The wife of a man who owned 700 acres of beautiful land told us, in her worn-down and premature old age, that she had cooked fifty tons of food, by careful estimate, for the hired men who performed the labor of the farm. But the labor alone is not the only drawback. The rooms of the house are occupied, and the privacy and repose which women ought to enjoy, at least a part of the time, is not to be found. Farmers' daughters see the contrast between their condition and that of wives and daughters of mechanics and tradesmen, and they resolve not to continue in such a life of discomfort by marrying a young farmer. This is a silent but powerful influence operating all through the country to a greater or less degree, and effecting a wide-spread injury to agriculture.

For all this trouble there is an easy and simple remedy, which in our own case we adopted forty years ago with entire success. We found it attended with much satisfaction, as well as financial economy. It is merely to erect laborers' cottages, and employ married men who board at home. Most of these men continue in our employ for a long series of years. They become familiar with the work, are worth more than fresh hands, and are steady and reliable. By giving them neat and comfortable dwellings, as that shown in fig. 55, the better kind of men are secured. They can board at home more cheaply than we can board them, as their wives, who cook for them, would otherwise have little to do. By adopting this plan, the farmer's wife is placed in almost as comfortable a condition as the wives of the hired men; the farmer's family can have a share of quiet and seclusion, and can indulge in some intellectual enjoyment; home becomes pleasant and attractive, and the women live longer. She who is pronounced by the poet "Heaven's last, best gift to man," may thus receive a share of the help, and kindness and pity, and cheering comfort, which it is so eminently every man's duty to award to her.

Recapitulation.

The chief points which we have endeavored to present, may be briefly summed up in a few words:

Give your farms the best cultivation; raise as heavy crops as you can on a paying basis; let your fields be specimens of neatness and beauty, instead of disorder and waste; the farm buildings marked with convenience and finish, and all their surroundings with purity and cleanliness; the grounds encircling the dwelling handsomely planted with shade trees, and gemmed with blooming shrubbery and brilliant flower-beds; the interior of the house arranged with a view to comfort and the abridgement of household labor; laborers' cottages provided for the men who work the farm; and everything throughout made pleasant and attractive to the young members of the family, with all influences to promote intellectual pursuits. The business of the farmer would thus be placed in a high position among the occupations of the community; domestic influences would take the place of unsettlement and dissipation; and all would tend to favor the cultivation of those social and benignant virtues which smooth the path of life, and brighten all the real enjoyments of the world in which we live.

Botanical Knowledge.—We learn from W. J. Beal, Professor of Botany in the Michigan Agricultural College, that among a quantity of imported flower seeds, was some of the *Leucanthemum vulgare*, recommended as "rare and new, and as excellent for cutting." Prof. Beal's knowledge of botany at once showed it to be the well known *ox-eye daisy*, existing as a persistent weed in the Eastern States by countless billions and whitening the pasture fields of whole States. It is rare in most parts of Michigan, and this timely detection excluded it from the college grounds. Otherwise it might have made a fine display there in a few years.

ICE-HOUSES AND REFRIGERATORS.

A NUMBER OF DESIGNS FOR ICE-HOUSES were given in the ILLUSTRATED ANNUAL REGISTER for 1876, some of which were specially intended as specimens of cheapness and simplicity. Full directions were furnished in the article for the successful management of ice, to retain it without serious loss through the heat of summer. The several designs here given are intended as an appendix to that article. Some of these are for ice-houses below ground, some partly below, and some wholly above. Those partly below, so as to be filled from the high part of the sloping ground, are the most convenient in some respects, but the cheapest structures, and usually the most easily managed, are those which are wholly above ground. These are, of course, the only ones adapted to level ground, where underdrainage cannot be properly employed. But whatever may be the mode adopted, the three requisites must be carefully secured, namely, ventilation above, drainage below, and a non-conducting stratum of sawdust nearly a foot thick, on all the sides, top and bottom.

A CONVENIENT ICE-HOUSE.

GEORGE GEDDES gives, in the COUNTRY GENTLEMAN, the following description of his ice-house, which he has had in use more than twenty years, and which will answer for half a dozen families:

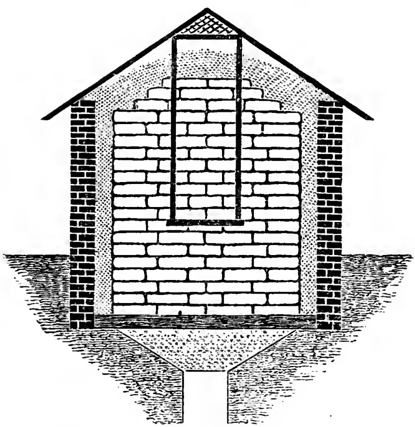


Fig. 56.

"The ground on which it is situated happens to be so open that water will readily sink into it. Taking advantage of this fact, I was able to drain the ice into a pit under it, (fig. 56,) and thus I could have part of the ice below the level of the ground surface. Convenience in stowing the ice makes it best to have the door-sill just level with the top of the sleigh that brings the ice to it, and the door-sill should be just half-way between the bottom of the ice and its top when the house is full. Thus one-half of the ice is lowered in filling, and one half is raised. The same is true of taking it out for use. The door is $3\frac{1}{2}$ feet wide, and reaches to the rafters. The earth inside the house was given a slant from the walls towards the well in the centre. This well is 6 or 7 feet deep, stoned up like any ordinary well, and covered with wide stones, and over them the spalls made in constructing the walls were laid loosely; this leveled up the bottom even with the walls. Then hemlock boughs were laid over the spalls in sufficient quantity to secure one foot in depth when pressed down by the full weight of the ice. On the hemlock boughs narrow strips of boards were laid, leaving wide cracks between them; this made the bottom, through which drainage passes freely, and which has never been moved or disturbed, remaining good to this day.

"On this bottom the ice is laid, in cakes 2 feet wide and 3 feet long, leaving a space next the walls one foot wide. The space is filled with sawdust well compacted. When the ice is raised 2 or 3 feet, the sawdust is put in place around it, and usually tramped down by the feet of a person walking around as it is put in. Having raised the sawdust to the top of the last course of ice that has been laid, it is swept off clean, and the process is repeated until the house is filled, and the ice covered 2 feet deep with sawdust. The doorway has cleats in the jambs, against which short boards are placed to hold the sawdust at the doorway. As the ice is used, these short boards are taken down as may be convenient. We have a cube of ice 12 feet on all its sides, giving in all $13\frac{1}{2}$ cords—a supply ample for all uses, and a considerable left over every year. Over the door is a triangular space of lattice work, and a corresponding lattice-work in the rear gable. Through the spaces in these lattices the air passes freely, and carries off all vapor rising from the ice, but the spaces being small, no bird or other unwelcome visitor can pass in.

"The roof is shingled, and is not shaded by any tree. Sawdust is used in preference to any other material that we can readily procure to insulate the ice, and the same dust is used year after year, less the waste, which is provided for by going to a sawmill for about one large sleigh load.

"An ice-house should be opened but once in each day during the summer season, and then a competent man should remove the necessary amount of covering, and take out a full supply for all purposes; then restore the covering, carefully packing it about the opening, and close the house for the day. Much waste follows frequent visits to the ice-house, especially by unskilled persons, who dig down to the ice and, by much tugging, perhaps succeed in getting some irregular fragments, and then throw into the place from which they took them some loose sawdust, through which the air penetrates, and melts perhaps ten times as much ice as has been taken away in this very irregular manner of proceeding.

"There are many places where it is most convenient to construct ice-houses all above ground, and such houses have many advantages; and if constructed of wood, last much longer than if partly under ground."

Milk-House Connected with Ice-House.

Another correspondent of the Country Gentleman, residing in Virginia, gives the following description:

"My ice-house is built above ground, and I have a good concrete floor, with a fall of 6 inches to one point, to conduct the waste water by a lead pipe to the dairy on the outside. The dairy room is 8 by 16 feet. The water trough is 2 feet wide, 16 feet long, and 16 inches deep, also made of concrete, and has been in use for years, never failing to keep milk sweet from 60 to 70 hours. I use the deep cans holding 4 gallons. I have tried the shallow pans, but the water is too cold, and I find the deep cans pay best, yielding 25 per cent. of cream.

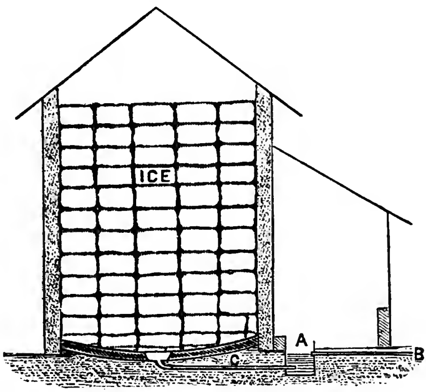


Fig. 57.

"I get from 20 to 30 gallons of milk daily, during the summer, which we strain into the cans and put directly into the water, which stands at a temperature of from 45 to 50 degrees. We never had any occasion to put ice in the tank, the water always being cold enough. The ice-house is 16 by 20 feet, and 14 feet to the plates, and will hold about 100 tons of ice, which will afford 30 tons for family use, and also supply the milk-house during the season, or until the first of December.

"I give a sketch of the ice-house and dairy (fig. 57.) The letter *A* in the dairy is the water tank; *B*, the waste pipe: *C*, the conduit or pipe to convey the water to the dairy. This pipe should be muzzled or come into the tank just below the surface of the water, to prevent air from passing to the ice. This plan has given entire satisfaction."

George Kingsland's Ice-House.

A convenient structure, possessing some special advantages, was built about the year 1864, by George Kingsland of New-Jersey, a description of which has been furnished by J. L. Douglass of Belleville, N. J. It is

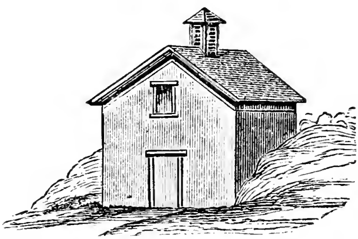


Fig. 58.

13 feet square outside, and 13 feet high, and stands against sloping ground, so as to be filled from above. Fig. 58 is an imperfect representation of its outside appearance. The sides are vertically boarded, and are coated with coal tar against the bank. Although in use fourteen years, it has needed no repairs. A space of one foot in the walls is filled with sawdust, and the roof has a 6-inch stratum of the same.* Fig. 59 is a vertical section, and gives a general illustration of the construction. The floor is of plank. Fig. 60 is a ground plan, showing the entrance above for the admission of ice, and the "cool

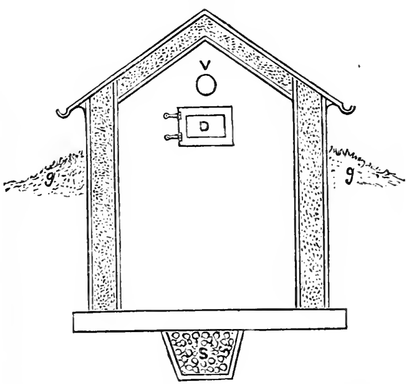


Fig. 59—*Vertical Section*—V, *Eight-inch Ventilator*; D, *Filling Door*; g g, *Ground Surface on upper side*; S, *Stone under centre for drainage.*

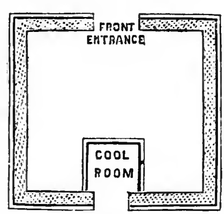


Fig. 60.

*This sawdust in the roof appears hardly necessary, the ice being covered with a stratum of the same.

room" below, lined with shelves, for a refrigerator. This room is 4 by 5 feet, and 6½ feet high, which admits of the ice being packed on the three sides, and on the top. During summer it melts away a few inches, A plank partition of yellow pine separates the ice from the cool room. This room is ventilated by an inch and a half iron pipe through the roof of the ice-house. It is so effectual in summer that meat, milk, butter, &c., remain cold in the hottest weather. The ventilation of the ice-house is effected by two 8-inch openings in each end of the upper portion. The ventilator on the roof, shown in fig. 58, is not employed, although it would doubtless be useful. The cost of this ice-house was $175 complete.

In newly settled wooded countries it might be made of chestnut or other durable logs, put up like a log-house. When vertical boards are used, they might be rendered very durable by two or three coats of coal tar when below ground, and crude petroleum above.

Ice-House and Workshop Combined.

J. L. Douglass has furnished us sketches of his combined ice-house, tool-room and workshop, and to the whole building is given a handsome

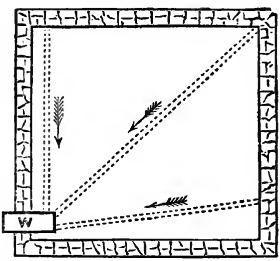


Fig 61.—*Plan of Underground Ice Vault—W, Well under wall; dotted lines, Drains to Well.*

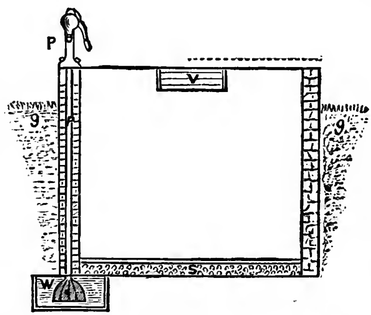


Fig. 62.—*Vertical Section of Ice apartment or Basement—P, Blunt's Pump; P, Pump Pipe, 3 inches diameter; V, Ventilator on each of four sides; S, small stones for drainage; g g, Surface of Ground; W, Well under wall.*

ornamental finish. The ice vault is mostly underground, with stone walls a foot and a half thick. It is about twelve feet deep, and two feet above ground. Each side has a ventilator, and the whole has a large ventilator at the roof. A well under the wall is reached by a Blunt's Universal pump, the pipe of which is three inches in diameter, and encased in the stone wall. The lower end, in the well, is covered with brass wire gauze. The bottom of the cellar is covered with eight inches of small stones for drainage, and this is covered with an inch and a half of gravel. The wall is laid wholly in water-lime cement, made of one part water-lime and three parts of sand. There are two doors on the north side of the ice vault for the admission of the ice. The tool-room is on the first floor; the work shop above. Fig. 61 is a plan of the ice vault. Fig. 62 is a vertical section. Fig. 63 is an elevation of the exterior.

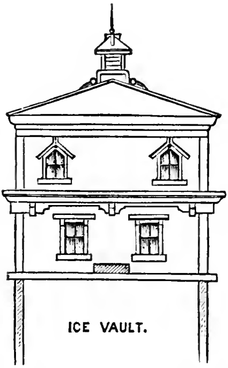


Fig. 63.—*Elevation of Combined Ice-house, Tool-room and Repair Shop.*

ICE-HOUSE AND REFRIGERATOR.

JOHN TAYLOR, of Mercer county, N. J., who has had much experience with the use of ice for preserving fresh meats, &c., in summer, says:

"Having spent considerable money in experimenting with the use of ice for curing meats in summer, I have some decided opinions on this subject. Ice of any thickness will keep better above ground than below, if properly protected from air, moisture and heat. My brother, who is in the wholesale butter and cheese trade, has an ice-house about 25 feet square. The cold chamber is on a level with his cellar floor, and is partitioned off from it. The ice chamber is on a level with the upper or ground floor, the space corresponds in size with the chamber below, and when filled has a mass of ice 23 feet square and 12 feet high. This ice wastes about one-half during the season. With the refrigerating room in constant use, the temperature is usually about 35°. This room is lighted by two windows, each having three sets of sash tightly cemented in place. The drainage from the ice is well cared for, and the condensing of the moisture of the room is so perfect that sweeping of the floor at any time will raise a dust. The success of this plan is secured by the absolute protection the builder gave the interior from outside influences, and the simple yet perfect plan of condensing the moisture of the cold chamber.

"I have studied most of the various plans of refrigerating now in use, and am fully satisfied that this is the best for fruit preserving, dairy or curing purposes. I am about arranging one in my pork-packing house on a large scale, and one on my farm for dairy purposes. It is not a patented arrangement."

Mr. Taylor furnishes the following more detailed description of this refrigerator, illustrated with an engraving:

"The drainage of the ice is carried off by a series of **V**-shaped tin or iron troughs, which run between the joists, all of which carry the water to one point, where it is conveyed outside by a trap pipe. These troughs reach over to the centre of the top of the joists, and are soldered together, so that no water will drip on the floor below. It will be seen that in this plan there is no sawdust or other preservative in contact with the ice, and the air of the room cicrulates around and over the ice. As long as the temperature of the goods stored is above the temperature of the room, there will be a gentle draft around the mass of ice, and of course all the moisture in the air, vapors and odors from the goods, will condense on the ice and pass off, so that you can keep milk, cream, butter, fruits and meats all in the same chamber without danger of injuring the flavor of either. The atmosphere of the room is always dry, sweet and pure.

"I should have explained before that the ice does not rest directly on the joists; but there is a bed of oak lath, about 1½ by 3 inches, laid across the joists, about 4 or 5 inches apart, on which the ice is laid. I would farther suggest that another cold chamber can as well be had by making a cellar under the one shown, with a lattice floor between them. It would be necessary to finish the sides and bottom of this cellar in the

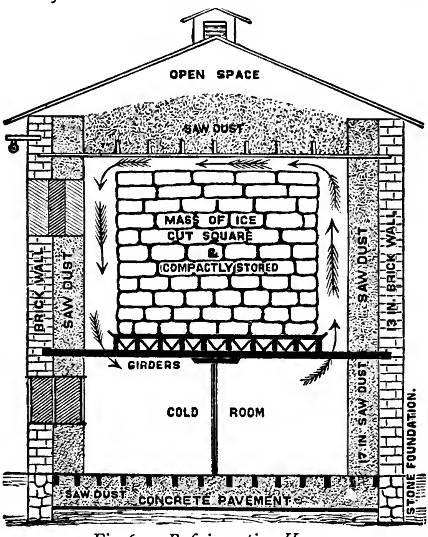


Fig. 64.—*Refrigerating House.*

most complete manner, as above described. At the entrance to the store-room there must be a vestibule, either inside or outside, as space or circumstances may direct. If outside, the walls should be thick and the door very heavy. The doors, both inside and outside, should be fitted with rubber, so as to close perfectly tight, and both doors must never be opened at the same time. This vestibule should be large enough to contain a fair wagon load of goods, so that if you are receiving a load of stuff, you are not required to stop until all is in the vestibule and ready to store. This house only needs filling once a year. The temperature will range from 34° in winter, to 36° in summer, and will preserve fruit perfectly from season to season. The opening for putting in the ice, shown just under the pulley in the cut, (fig. 64,) has two doors, with a space between; each door a foot thick. The window in the cold room has three sets of sash, well packed or cemented. The walls are 13 inches thick, lined with 17 inches of sawdust. Thirty-six inches of sawdust are put on the floor over the ice. The building shown is 25 feet square, inside measure, and 22 feet from floor of cold room to ceiling over the ice. The ice-room is 12 feet high, and the cold room 9 feet. Pillars are required under the centre of the ice."

In writing to us subsequently, Mr. Taylor makes the following additional remarks:

"The important principles in its construction are *ample* protection from the outside influences (heat, air and moisture) and the ice so arranged that the air of the chill room can circulate *around and over it*, and the floor of the ice loft so tight that no water can possibly drop below. The advantage of condensing the *heat*, *moisture* and *flavors* of the chill room directly on the ice, as in this plan, instead of on an iron floor, as in nearly all ofher plans, is that the ice (four sides and top) furnishes a larger condensing space, and the ice will do it more rapidly and completely than the iron floor—consequently you have a dry, sweet room. There are two houses built here that have iron floors, made in shape of one large trough. The moisture condenses on the iron, runs down, and is carried off by the small underhanging trough. There is no communication between the store-room and the ice above. They put the sawdust immediately on the ice—say about 3 feet of it—and have a circulation of air over the sawdust, as the sides of the house are about 3 feet thick.* They keep ice very well, but they do not get quite as low a temperature, nor as good, dry, sweet air in the chill room."

A Gate which Cannot be Left Open.—A gate which is frequently passed by one person is often left open by the careless, to the annoyance of the farmer—such for example as the small gate to his cattle yard. The accompanying plan (fig. 65) shows how such a gate may be made, which cannot be left open, and which never needs fastening: *a a* is the fence; *b*, the gate post, in which the hinges are inserted; *c c c*, three posts set so that the fence has a **V** shaped opening; *d*, the gate, which will swing in this **V**. When any one wishes to pass through, all he has to do is to push the gate, step into the **V**, throw the gate back, and pass on. This is done with no trouble, in less than a second. No farm animal can pass it, and no latching or fastening is necessary. We find it exceedingly convenient.

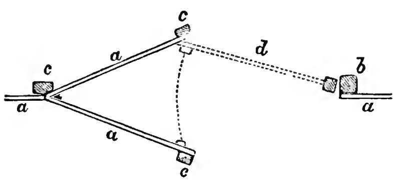
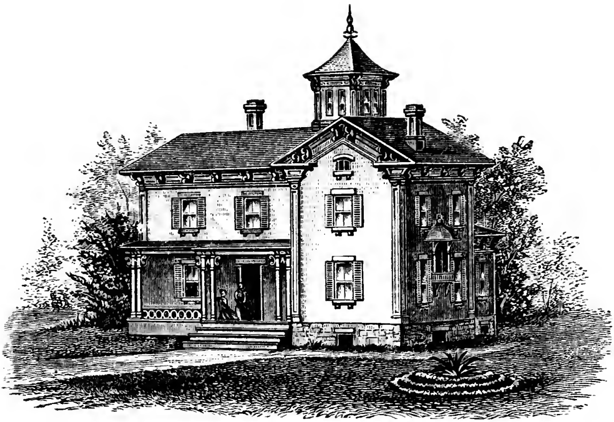


Fig. 65.

*We think so thick a stratum as three feet or thirty inches unnecessary, and that half that thickness will answer as well.



A COMPLETE FARM RESIDENCE.

WE HAVE FREQUENTLY GIVEN DESIGNS for the cheaper class of farm houses in former volumes of RURAL AFFAIRS, and now furnish a more perfect country dwelling in the plan of the residence of DAVIS COSSITT of Onondaga, N. Y., constructed during the summer and winter of 1877. The house was constructed under the immediate supervision of Mr. Cossitt, the mechanics working by the day, and every detail was carefully worked out and put upon the plans, and hardly a change was made during the construction. Wood was selected in preference to either brick or stone, though either could have been procured at moderate prices, and of excellent quality, in the immediate vicinity. But wood was thought to be the best for health. The studs, joists, and all timber two inches thick and over, had been seasoned four years, and most of the other lumber had a like seasoning. The outer inch boarding was so closely matched that when forced together, the joints were tight, and an intermediate lathing and plastering divided the six-inch space between the outside boarding and the inner faces of the studs into two air-chambers; the inside face of the studs being covered with inch boards, edge to edge. On this close boarding, vertical strips of one inch thickness were nailed, and on these strips the lathing was placed.

This wall, so divided into air-chambers, closed at top and bottom, that there may be *no change* of air, bringing in moisture and cold, is expected to give the warmest house in winter, and the coolest in summer, that can be made at any reasonable cost. Diagonal bracing between the studding of the main partitions and bridging was extensively resorted to in order to make the frame solid.

The house is warmed by a furnace of full capacity to give pure air from outside the house, heating and sending it wherever wanted on both floors- Ventilation is secured by having flues in the walls, extending from the base boards near the floor to the top of the house, and in the large parlor used as the family living room, a grate not only gives ventilation, but a fire to look at when wanted.

Drainage of the house and cellar is secured by tiles that go around the outside of the cellar walls, some inches below their foundations. Under the cellar bottom, drains of 2-inch tile concentrate any water that might rise, and by proper descent carry it all far away from the house.

There are two cesspools—one for the drainage of the kitchen refuse, the other for the water-closets. The cellar is eight feet between joists, Its floor is covered by cement; its ceiling is matched boards, nailed on the joists, and several inches of mortar on this ceiling, between the joists, not only *deaden* the floor of the rooms above, but cut off any possible exhalations from the cellar. Division walls of bricks divide the cellar into convenient rooms, and windows hung on hinges light and ventilate it.

The accompanying plans, figs. 67 and 68, need but little explanation. The visitor on entering through the vestibule sees a spacious entrance hall, the large panel mirror at *M*, fig. 66, giving the appearance of its full breadth throughout.

The side entrance is under a veranda, and is used for a waiting and business room, at the same time furnishing conveniences for washing, for umbrellas, overcoats, overshoes, &c. The adjoining closets, for robes, brooms, &c., are readily accessible from this entrance. These closets, taken from the space otherwise allotted to the pantry, without abridging the space for pantry shelves, actually improve them by bringing them nearer the centre, and making them therefore more convenient for use.

There are no winding stairs in this house. When corners are to be turned, they are turned on square platforms. The main flight, standing in a recess between the front room and the dining-room, rises about eight feet, then a platform about eight feet long by three and a half feet wide, makes the half turn to the remainder of the flight. Over this platform is an oriel window that lights the stairs, as well as the back end of the lower hall, and the upper hall, and gives facilities for admitting air and sunshine. Under this main flight are stairs that lead to the cellar, and under the stair platform is the store-room opening into the dining-room.

The outside finish is adapted in some degree to the present prevailing architectural tastes, having an observatory, some more gables than were really necessary for anything but appearances, but which give a high and well lighted garret. The roof is of tin; the cornices wide, and the house set three feet above the ground. Water from a large tank in the garret is carried, hot and cold, wherever wanted in the house, for all purposes

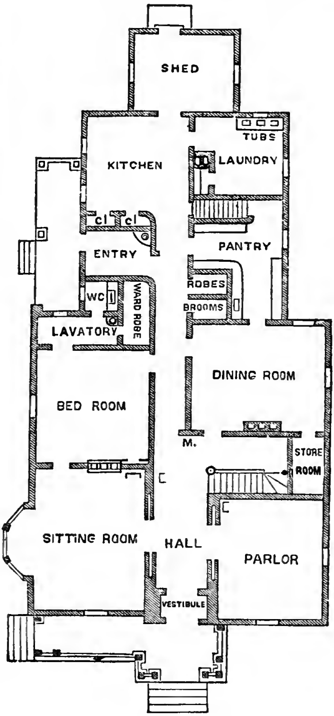


Fig. 67.—*Principal Floor.*

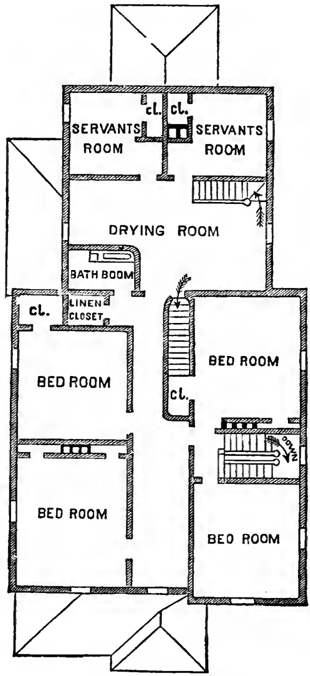


Fig. 68.—*Chamber Floor.*

except drinking and cooking. For these purposes a cistern under the room used for fuel, having a brick filter, gives a supply.

This house cost $8,000, besides the services of the owner, he giving most of his time to gathering materials and supervising the work for about a year.

LOSING SCRATCH-AWLS.—Every carpenter has had to hunt among chips or shavings for his scratch-awl. He may be saved much time by attaching to the end of the handle a small piece of bright red cloth, which will render it quickly visible anywhere. The same thing may be adopted by the farmer for any of his small tools, likely to be lost among straw or elsewhere.

SUGGESTIONS IN RURAL ECONOMY.

Culture of Indian Corn.

A CONDENSED REPORT was given in the Country Gentleman of a lecture on the culture of Indian corn by Prof. I. P. Roberts of Cornell University, at a Farmers' Meeting in Ithaca, in March, 1877, from which we make the following extracts:

Prof. Roberts gave an extended and valuable discourse on this crop, which he regarded as one of great importance, taking the place of turnips, so essential in British husbandry, and yielding annually in this country a billion bushels, worth half a billion dollars. In culture it is valuable as a hoed crop in rotation for clearing out weeds. A serious loss and drawback has resulted from the common error that it is a crop requiring little skill, and from this cause there has been a diminution in quantity in some localities, and the product per acre is much less than might be easily reached under proper management.

Very early planting is not to be recommended, as the seeds fail to grow if after planting they are kept for a considerable length of time at a temperature below 55°, but the temperature may be much lower for a short time. In the preparation of the soil, autumn and spring plowing each have their special advantages. Fall plowing admits of greater depth of working, and of more thorough pulverization before planting. Spring plowing, which should be shallow, allows the grass and clover to continue growing till near planting time, and to permit a larger quantity of vegetable food for the plants. If the plowing is done early in September or late in May, the cut-worm is partly eluded. Prof. R. urged the importance of thorough mechanical division or pulverization of the soil. If clods are broken into small fragments, these present a much greater surface to the action of the roots in withdrawing nourishment from the soil. To illustrate this truth, he cut an apple into a 2-inch cube, when it presented 24 square inches of surface. Cutting it into 8-inch cubes, the surface is doubled, and its surfaces are 48 square inches. Reducing the cubes to quarter inch, and we have 96 square inches of surface. In the same way the pulverization of clods increases the chances for the fibrous roots to receive supplies from all parts of the soil.

Planting.—If early, it should be shallow, and deeper for later planting and in drier soil. Surface harrowing, before the plants are up, destroys the starting weeds, saves labor and advances the crop. The roller is sometimes used in preparing the soil, but much care is needed, as more injury than benefit is often done when the soil is not in proper condition. No implement, said Prof. R., requires so much judgment in its use as the roller. For cultivating the rows, the two-horse cultivator should be be used for saving labor; a one-horse implement is too slow in its work where the labor of a man is so valuable. A very common mistake is made in not cultivating at nearly equal intervals of time. Oftener than once a week is not desirable, and is liable to do injury, and it should not be deferred longer than ten days. The accompanying diagram (fig. 69) will show how these unequal periods occur. The square may represent a forty-acre lot; the cultivation is commenced at the side *a*, in the rows represented by the dotted lines. In the course of a week or two the cultivation is completed to *b*. The cross-cultivation is then begun on the side *c*, as shown by the continuous lines. A part of the field, as at *d*, is thus cultivated within a day or two of the previous work, and it thus goes on until that part of the field at *e* does not receive a second stirring till the entire interval of time has elapsed during the whole of the two dressings—half a month or more.

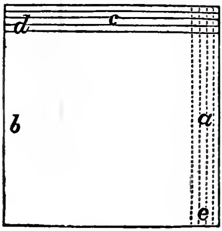


Fig. 69.

Protecting the Seed.—The old remedy of coating with tar was recommended as the best and easiest remedy for the wire-worm and crow. The seed is first made warm, not hot, with water, the tar applied and stirred, and it is then rolled in plaster and ashes. This treatment will slightly retard the germination. It should not be used when the soil is very dry. It does not kill the wire worm, but only repels it. The wire worm lives five years, and changes its skin three times during this period. It then retires from business for a short time, and comes out a snap-beetle to propagate its species. Good enriching culture, in connection with rotation, tends to reduce its numbers.

The brown cut worm (sometimes confounded with the white grub) is strictly a caterpillar, and after it has completed the usual transformations under ground, comes out a moth or miller. The only effectual remedy for it is to dig out and destroy it by hand.

A mistaken mode of plowing or cultivating corn to the injury of the roots was pointed out by diagrams on the blackboard. It is common to begin the cultivating at a distance from the small plants in the row, and go nearer afterwards as the stalks become larger and better able to withstand the banking of the earth. The young roots are not touched at the first cultivating, as shown in fig. 70. At the second dressing, a number of them are cut, and the plant is still more mutilated the third time, fig. 71. A better way would be to begin near the row, (which should be perfectly straight to permit it,) when little injury would be done while the roots were small and short,


Fig. 70.


Fig. 71.

and which would induce a more downward growth (fig. 72.) The subsequent dressings should be farther off, and would not reach or tear the roots (fig. 73.)

Prof. R. furnished the results of some of the experiments made on the grounds of the university, with different modes of treatment and different fertilizers. With three, four and five stalks to the hill, the following results were obtained: Three stalks gave 5,146 pounds per acre; four stalks gave 5,946 pounds per acre, and five stalks gave 6,160 pounds per acre. That is, with the four stalks to the hill the field yielded 800 pounds more to the acre than with three; and with five stalks, there was an increase of only 214 pounds per acre, showing that at four stalks the proper number was nearly, but not quite reached. The weight was taken at husking time, and seventy pounds of ears were reckoned as equal to a bushel of shelled grain. After several months of drying, it would of course be much reduced.

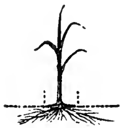


Fig. 72.

Fig. 73.

Burying Fodder.

Much inquiry having been made for information on the mode of preserving green fodder, known as *ensilage*, we give in condensed form the statement of Prof. Caldwell of Cornell University, which comprises the essential requisites for this mode of preservation:

This mode of packing green fodder in pits or trenches, requires that it may be made as solid as possible, and then covered with earth. It undergoes a fermentation, is softened in texture, so that the hard stalks become capable of being easily eaten; and, in fact, the process is not unlike that by which sourkrout is made. It is absolutely essential that the ground selected for the trenches has a perfect drainage, as water would spoil the result. The covering with compact earth should be a foot and a half to two feet thick, and packed solid to exclude air. The usual mode is to dig trenches two or three feet deep; but if there is any fear that the subsoil will be wet, the fodder is placed on the surface, and covered somewhat like a potato heap, but is oblong instead of circular. Fig. 74 is a cross section of such a heap, showing the chopped fodder within, and the earth covering over it. If well secured, this sourkrout fodder will continue uninjured for months, or even for a year. The fodder is cut rather short, so as to favor solid packing, and mixed with a portion of straw. The heaps may

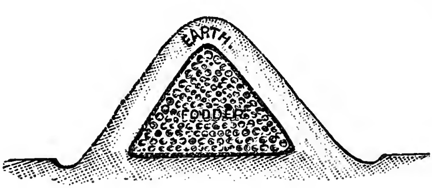


Fig. 74.

be made six feet high, and fifteen feet, more or less, in length, according to the quantity to be preserved. Straw is then placed over the heap, and the earth is added. This, if properly spaded up, will leave a trench all around the heap to facilitate drainage. Trenches are better, in that they require less labor to cover. A section of one of these is shown by fig. 75, and may be two and a half to three feet below the surface, six to eight feet wide, and about the same in entire height. Some persons use no straw, in which case it is necessary that the fodder be allowed to become partly dried. Others do not cut the fodder short, but in this case it is more difficult to tread it down compactly. Some add salt. It is important in any case to press or tread the fodder as compactly as possible, without leaving any interstices or air-spaces.

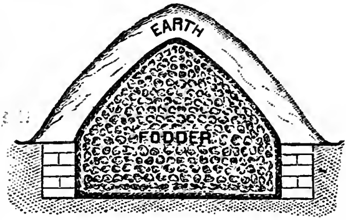


Fig. 75.

The total cost of the entire operation is reported not to exceed 24 to 30 cents per ton; or, including fodder and all, with one-fifth straw, $3.20 per ton, except covering

Fermentation always sets in; it could not be otherwise; but this is kept within bounds by the moderate bulk of the heaps, its coolness by contact with earth, and by the entire exclusion of external air.

The changes that take place are that the fodder becomes more digestible and slightly acrid, and if cattle dislike it at first, they soon learn to eat it greedily. If fed at the rate of 20 pounds to 1,000 pounds of live weight of animal, it does not affect the flavor of the milk in the least; 40 pounds of ensilage fodder and 10 pounds of meal are good feed for such an animal for a day, and 50 pounds have been given without any harm. The practice is especially recommended for adoption in this country, where cornfodder is more easily raised than roots.

When used, an opening is made at one end of the heap, and it is gradually used, working towards the other end. It spoils in a day or two when exposed to the air, and for this reason no more should be shoveled out than is needed for a feeding, when the hole should be covered with a thick layer of straw trodden down.

No attempt should be made to imitate this process by packing green hay in tight barns. There could not be exclusion from air, the fodder would not be kept cool by proximity to the earth, and the mass would be too large for safety.

Removing Large Trees.

G. W. Farlee describes in the Country Gentleman the following mode he successfully adopted in removing large trees: A heavily built ox-cart had been constructed of wide tread, say 7 feet, and on the axle was built a gallows or bench 3 feet high and 4 feet long (of oak), about 8 inches square. On the top of this was strapped a stout canvas cushion, to protect the bark of the tree that was to lie on it (fig. 76.) Two men supplied all the manual aid required. Could machinery be more simple? Yet we find its work effective. The time selected is the early spring, when the frost is out of the ground and the buds begin to swell, but before the bark will readily peel. If left till the bark is fit for peeling, it is difficult to handle the trees without bursting the bark, and thus defacing and injuring them.

A circular trench is first dug around the tree, a foot or eighteen inches in depth, and six to nine feet in diameter, depending upon the size of the tree. The object of this is not only to get a ball of earth to accompany the tree with the intertwining roots it contains, but also to

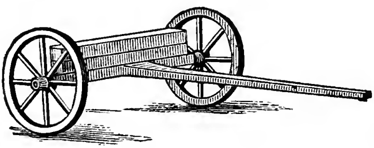


Fig. 76.

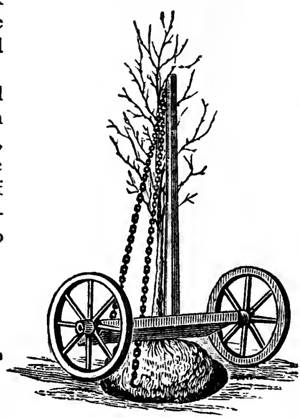


Fig. 77.

reach and cut off the four or five large lateral roots which now serve but little purpose other than keep the tree erect. These found and cut, removal is comparatively easy. To the end of the pole of the cart are attached two ox-chains, somewhat longer than the pole, and with hooks at the ends. The cart is now backed up to the tree, the pole elevated and carried up the tree, and the end lashed securely to the trunk, taking care to protect against rubbing, by the use of pieces of old carpet or canvas. The saddle or cross-piece of the bench now rests against the base of the trunk (fig. 77); the ox-chains suspended from the pole are then attached by their hooks to two large roots, and the tree is ready for the application of the power necessary to its removal. The block and fall, consisting of a long, stout rope, with two double pulleys, are now brought into requisition. One of the pulleys is attached to the end of the pole, and the other to a tree, or some other firm object, at a distance, to get sufficient leverage; the oxen are hitched to the end of the rope, and pulling steadily, the tree is lifted bodily, the action at the same time bringing the pole of the cart to its proper level, and the tree lies with its trunk upon the bench, and its top in a line with and on the pole. The top is now compressed into a small compass, by being bound tightly with a half-inch rope, and securely fastened to the cart, (fig. 78.) The oxen resume their proper place at the pole, and walk off with the top of the tree extending beyond their heads, like a long, slender pyramid. The tree is balanced into position by the removal of earth from the roots if

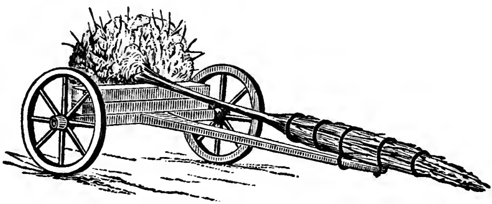


Fig. 78.

necessary. The hole for the reception of the tree is prepared beforehand, being about one foot in depth, and one foot wider than the ball of earth, that there may be space for filling with good soil, sods or well decomposed compost, *not* fresh manure, around the edge, that the broken roots may find good food for forming new rootlets. The cart is backed up to the hole, the oxen removed, and by the aid of ropes to guide it, the pole with the tree attached is once more elevated, and the tree brought to an erect position. It is then unbound and released from the cart, and with the aid of the oxen and chains hooked to the large roots, adjusted to its place. The trees should be supported or guyed with wires fastened to stout stakes driven into the ground, since if allowed to be rocked by the winds, the new roots that are forming will be broken, and recovery of vigor be delayed. My trees, the year of removal, developed leaves of about one-half the natural size; the next year they showed a new growth of about four inches on the smaller limbs, with the foliage nearly full, and the third year burst forth in full bloom, with, if possible, greater luxuriance than they had ever known before, and have since flourished with uninterrupted growth. Trees of six to seven inches in diameter could be readily removed by the use of the common ox cart with two hewn logs eight inches square lashed one above the other, to the axle, to serve as a bench on which to carry the tree.

Lubricating Gates.—Every gate on the farm should have the hinges and latches oiled or greased as often as once a month, varying with its use. Bore a hole in the gate post, insert a piece of lard or tallow, and plug it up. Whenever the hinges need it, the grease is always at hand. Without this provision, the work will be sure to be neglected. Within the house, as often as once a week, touch every door latch or bolt with a drop of kerosene, or with lard or tallow, and they will work freely.

IMPROVED FARM MACHINERY.

THE PAST TWENTY-FIVE YEARS have witnessed extraordinary improvements in the implements and machines for performing farm labor. The magnitude and importance of the results which have sprung from these improvements, have had no parallel in the history of man. A single machine—the mower and reaper—furnishes a remarkable example. During the three years preceding the late civil war, their manufacture had increased so much in numbers that when the war broke out there were enough in the field to save or do the work of nine hundred thousand men. Had the war occurred three years sooner, the withdrawal of nearly a million laborers from the farms of the north to fill the ranks of the armies, must have resulted in extensive ruin among the farmers. Since that period the number and efficiency of mowers and reapers have greatly increased, and there are now manufactured about one hundred and fifty thousand annually, which sell for more than twelve million dollars.

Among other improved machines, are the steel and hardened cast-iron plows, seed drills, pulverizing harrows, seed planters, steel-tooth rakes, horse-forks, hay-loaders, hay-carriers, self-rakers and self-binders on reaping machines; threshers, separators and stackers driven by tread powers, lever powers and farm steam engines; feed cutters and feed grinders, and farm wind-mills. We have not the data to furnish an estimate of the number of these machines in use, or of the amount of manual labor which they save; but if farmers generally could be thrown back for a moment on the use of wooden mould-board plows for inverting their soil, or the hand planting of seed, the scythe and cradle for cutting crops, tbe hand-flail for threshing grain, and on the other slow operations of former years, the impression would become vivid that a great revolution had been effected in the saving of hard work on the farm. But the saving of labor merely is by no means the whole benefit that results from these facilities. The farmer is enabled to perform his work so much more rapidly that heavy losses are often prevented. The mower and reaper enable him to cut his crops promptly in their right season; the hay tedder dries his hay, and the horse-rake, hay loader and horse-fork may save it in the best condition in the face of advancing storms. The ready preparation of his grain for market may enable him to take advantage of prices, or to place his crops in the purchaser's hands at the best or most convenient season of the year.

Importance of Good Workmanship.

The *form* in the construction of mowers, reapers, and other farm machines, important in itself, would be of little avail unless made in the best manner, and of the best materials. Two different manufacturers have worked on the same invention; one has succeeded in making a perfect and durable piece of workmanship; the other machine, externally the same, by the use of bad iron, poor wood, and not being adjusted and fitted in all the parts, runs with difficulty, performs poor work, and soon wears out. The most successful manufacturers are those who have not only secured the best inventions, but have shown skill in construction, and made machines which have lasted and done heavy work for a long series of years.

Care of Machines.

The farmer must not only secure a good machine, but take proper care of it as long as he uses it. Protecting from rain and weather is of vital importance. With the wood cracked by exposure, or the metal rusted with rains, no machine can run easily or do good work, or last long. Dust and dirt cause the boxes to wear rapidly, and early repairs are required. Leaving bolts loose or unscrewed, occasions breakages. The man who has charge of a mower or reaper should frequently examine it, wrench in hand. He should keep all parts properly oiled which need it, taking care to apply a very small quantity at a time. If journals become "gummed," clean them with a rag dipped in kerosene, after taking them apart.

All machines not in actual use should be kept under cover. The wooden portions, if not thoroughly painted, should receive a coat of crude petroleum, which enters the pores and makes the wood durable. Machines which have not received the care required in the different ways mentioned, have been destroyed in a single year. With proper management they have lasted twenty years, with little repair.

Smooth Fields Necessary.—The more general introduction of farm machinery renders an important service to successful farming by compelling owners to remove the stones, stumps, and other obstructions to free working, and to drain the wet portions of their fields, that all may be alike subjected to easy tillage.

The Best Machines to be Chosen.

The great importance and advantages of using the best and most improved implements and machines, will be seen when an enumeration is made of the requirements on every well managed farm, even if only a hundred acres in extent. For such a farm the cost of the plows, subsoilers, cultivators, harrows, seed planters, grain drill, mower and reaper, horse-rake, fanning mills, farm wagons, forks, ladders, &c., will amount to many hundred dollars; and the aggregate for the six million farmers of the Union, ought not to be less than a thousand million dollars, if they are properly furnished. To obtain the best success in farm management, the farmer could not engage in a more profitable inquiry than to ascertain which of the various machines and tools are among the best that are to be obtained.

To assist this inquiry is the object of this article. Where a number of manufacturers make the same machine, it often happens that each one possesses some particular point of superiority over the others; but it is interesting to know that for general use there is much less difference in their merits, taken as a whole, than a limited trial may induce owners and purchasers to suppose. Throughout various portions of the Union, there are manufacturers of excellent implements and machines; and as a general practice it is better for farmers to procure them near home, when equally good, either directly of the makers or of their established agencies, where repairs can be more easily obtained. For the same reason, well established manufacturers are to be preferred to transient ones.

This article, while aiming to offer much useful information, does not claim to be a complete treatise, or to describe all the valuable labor-saving machines of the farm, or to enumerate all the reliable manufacturers. This would occupy more space than we could devote to the subject. Nor does it aim to state which is best among the many competing machines offered in market. Much depends on the excellence of the material used and on the skill employed in the manufacture, and often still more on experience and care on the part of the farmer who uses them.

It is hoped that a more general introduction of valuable labor-saving inventions through the information given in this article, will benefit alike the farmer and the manufacturer.

Improved Implements for Tillage.

The simplicity of the plow in construction and in working has placed it at the head of all implements for inverting and pulverizing the soil. More complex and more costly spading or digging machines have been made, but their compound character has rendered them liable to get out of order, and their expense has prevented their introduction. On soils free from obstructions, some of them succeeded for a time; but when one out of their many parts becomes deranged or bent by striking a stone, they cease to work freely and are thrown aside.

The form of the plow has not been much improved of late years, but important advantages have been secured by the use of hardened iron and steel for the cutting edge and for the mould-board. The two principal sources of resistance as the plow moves through the soil are the friction of the bottom and sides, and the resistance against the cutting edge. Experiments in this country and in England have shown the friction to be about 35 per cent. of the whole force of draught, and 55 per cent., or over one-half, is consumed in cutting the earth. The remaining 10 per cent. is required for lifting and turning the furrow-slice. Hence it will be seen that for reducing the draught these two great requisites are best secured by employing a metal that will maintain a sharp edge, and that will occasion little friction on the mould-board and sole. For this purpose steel was at first used, and the steel plows have the advantages of lightness, and of scouring in adhesive soils. They are still made and used, but have been replaced to a considerable extent by the *chilled* plows and those made of other hardened preparations of cast-iron.

It is proper to remark that in estimating the relative force required in a team to overcome the friction of the plow and the resistance to the cutting edge, the results will vary much with the friable or the plastic character of the soil, the sharpness at the time, and the hardness and polish of the share and mould-board. A fair average is given in the preceding estimate.

CHILLED PLOWS.—The practice of hardening the points of cast shares by chilling has long been known to manufacturers. More recently it has been applied, with important modifications and improvements, to the mould-boards. The well known process of chilling consisted in running the melted metal against a surface of cold iron. This process, while it greatly increased the hardness, rendered the metal correspondingly brittle. Various means for annealing have been employed to prevent this defect. Later improvements secure entire hardness to the metal throughout, as in the "carbon," "diamond" and "adamant" plows. The New York Plow Company inform us that the result of long experiment has taught them that "steel in a certain condition will mix with melted pig-iron, and with the addition of certain chemicals will make a homogeneous casting, by pouring into moulds, uniformly at the right time by means of its color when melted. This color line is very important, and is perfectly reliable. In this way we get hardness, uniformity and strength."

In former years, plows made of common cast-iron were sold rough, and the farmer employed all his skill in making them scour bright. Now, all plows are ground and sufficiently polished before being placed in market. Farmers who use them should take pains to keep them bright when not in use, with tallow, wax or paint.

MANUFACTURERS OF PLOWS.

The New-York Plow Company (55 Beekman Street) make what they term "adamant plows," using for this purpose cast-iron rendered extremely hard by a process of their own, the mould-board being equally hard throughout. These plows have a reversible, self-sharpening slip point, which is easily changed, at little expense, as it becomes worn, fig. 79.

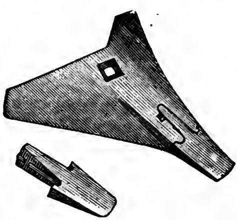


Fig. 79.—*Point of Adamant Plow.*

The Oliver Chilled Plow Works at South Bend, Indiana, are among the most extensive manufacturers in the country. The larger buildings which they occupy are the foundry, 165 by 300 feet; the grinding and polishing shops, each 50 by 200 feet;

the wood and paint shops, each of the same dimensions; and the store-house, 40 by 900 feet. There are several other smaller buildings. A six-hundred horse-power engine drives the machinery, and several hundred men are employed. Over 70,000 plows are made in a year. The process by which the chilling is effected gives a uniform hardness through the whole of the mould-board. The beam is placed in the centre of work, removing side draught. The mould-board throws the furrow-slice upward and pulverizes it well before it is laid.

The chilled plow made by the Gale Manufacturing Company of Albion, Michigan, has a wide reputation for its good qualities.

The Remington Works, Ilion, N. Y., make many thousands annually of their "carbon plow," the share and mould-board of which are made of a cast metal of extreme hardness. This metal, they inform us, is made by melting a portion of cast-steel with common cast-iron and some other metals, the result by a particular process being a material not exceeded in hardness by any chilled process, while it has the advantage of uniform hardness throughout. The mould-boards receive a high polish.

The Wiard plow has been manufactured for seventy years, and during that time important improvements have been made. It has always given much satisfaction in the manner with which the furrow-slice is inverted, and by its durability. It is now made of chilled cast-iron, of several forms and sizes. The malleable beam is so constructed as to secure lightness, strength and durability—see cut, p. 132.

The Syracuse Chilled Plow Company make a plow not unlike the Wiard plow, which has a high reputation, and their manufacture is largely increasing.

SULKY PLOWS.—The Osborn Plow-Sulky, made by Gregg & Co., Trumansburgh, N. Y., is furnished with two wheels and a seat, (fig. 80,) on which the plowman rides, and, by the use of levers, readily controls the depth of the furrow and the width of the slice, the work being completely under his control. An important advantage is in lessening the friction on the sole in the furrow bottom. Any right-hand plow may be attached to the sulky. It has proved very successful in work, after several years' trial.

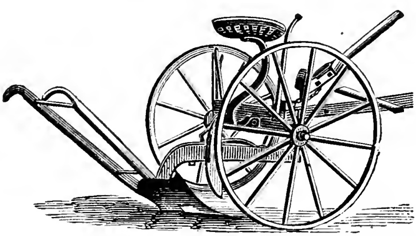


Fig. 80.—*Osborn Sulky Plow.*

The Casaday Sulky plow, similar in general principle, but differing in its details of construction, is made by the South Bend Iron Works, South Bend, Indiana.

An efficient sulky plow is made by Furst & Bradley of Chicago, which has all the appliances for controlling the direction and depth of furrow by the man who rides or drives, and has some special advantages.

Another valuable one is manufactured by the Deere Company of Moline, Ill.

Form of Plows.

The brief space allotted to this article will not permit a discussion of the form of mould-boards and the other details necessary for good draught and efficient work. We give a few cuts of some of the best plows made in the country. Fig. 81 shows the form of the "carbon plow" made by the Remington Works at Ilion, N. Y. The mould-board and share possess extreme hardness, and the plow is a very durable one. Fig. 82 represents "Gregg's No. 3," made by Gregg & Co., Trumansburgh, N. Y., which, like the preceding, possesses hardness and durability. Fig. 83 is the "adamant plow" made by the New-York Plow Company, already mentioned.

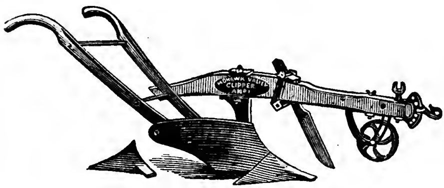


Fig. 81.—*Remington Carbon Plow.*

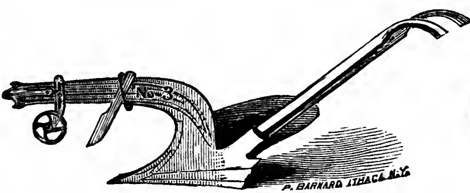


Fig. 82.—*Gregg's No. 3 Chilled Plow.*

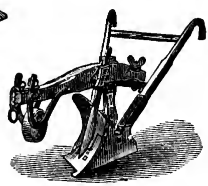


Fig. 83.—*Adamant Plow.*

Swivel Plows.—Plows so constructed as to turn the mould-board readily from one side to the other, termed side-hill, reversible or swivel plows, are of great convenience in plowing hill-sides, for throwing the furrow-slice always down hill, in passing horizontally backwards and forwards. Several inventions have been made for this purpose, having their several advantages.

Among the manufacturers of swivel plows are Belcher & Taylor of Chicopee Falls, Mass., who make three modifications or forms, as well as varying sizes. The Hubbel swivel plow is so constructed that the stationary cutter is always in a line with the point and landside, on whichever side the mould-board is thrown, and the clevis is always kept in the right position. The change is made at the end of each furrow with a slight movement by the plowman. Another form is the Hodge reversible plow, which has the advantage of being adjusted in different positions for varying depth or width of furrow-slice. The change at the end of the furrow is made by a single touch of the foot. Another form is the "Oneonta Clipper," in which the shifting handles, moving on the centre of the beam, bring the coulter into position at each turn of the mould-board, and enable the plowman to walk in the furrow directly behind the plow. A touch of the foot changes the plow without taking the hands from the handles. Simpler and cheaper swivel plows, made by this firm, require more attention in effecting the change.

Swivel plows are often recommended for level land, to prevent dead furrows, the slice always being turned the same way. But after trial, most farmers prefer the lighter and simpler common plow for level fields.

Weed Hooks.—In plowing in green crops, it is common to attach a heavy chain in such a position that it sweeps over the tops of the growth, and brings the green mass under the mould-board. A hook is sometimes employed for the same purpose—see Rural Afeairs, vol. vi, page 250. One of the best is Ballard's "weed tucker," represented in the annexed cut, (fig. 84,) and which is screwed to the beam of the plow. Where weeds are permitted to reach a heavy growth on badly managed farms, this contrivance turns them completely beneath the plow, and where luxuriant crops of clover or cornstalks are inverted for enriching the land, the weed hook assists in making perfect work. It is manufactured by Scott Bro., Jay & Co., Fairmount, Ind., and sold for $3.50.

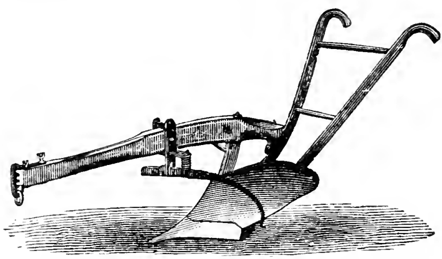


Fig. 84.—*Ballard's Weed Tucker.*

Harrows.

Spring-tooth Harrows.—These are made of the best steel teeth, about two inches wide, bent in a curve of the shape of the steel teeth of a hay-rake. When they strike a stone or other obstruction, they bend backwards and pass it, and immediately resume their former position, without checking the horses. They pulverize efficiently. Their constant motion prevents clogging. The teeth point forward and enter the ground easily. These harrows are intended to take the place of two-horse broadcast cultivators. They are made by G. B. Olin & Co. of Perry, N. Y.; the price varies from $25 to $37, according to size, for two or for three horses.

A spring-tooth harrow is also made by H. W. Luetkemeyer of Cleveland, Ohio.

Disc Harrows.—These consist of several wheels or discs made of steel plate, set on common axles, and running with slight obliquity to the line of draft. They sink some inches into the soil, and moving it sidewise, produce pulverization. They have one important advantage over other harrows, in that these wheel-teeth roll through the soil without the the friction consequent on rubbing or scraping through it. They roll over obstructions without being caught by them. Their drawback is the want of the simplicity or oneness of other harrows, as they are composed of several parts. The lightest form of the disc harrow is La Dow's (fig. 85), which has also a flexible axle, and adapts itself to uneven ground, the wheel gangs being united by means of a series of joint boxes; the journals are protected from dirt and provided with self-feeding oil-cups, and the whole harrow is iron except the seat and pole. The weight of the driver, who rides, imparts efficiency to its work. These harrows are manufactured by Everett & Small of Boston, and by the Wheeler & Melick Company of Albany, N. Y., at $25. The last named firm makes one for cultivating corn, the wheels running in two spaces following the two horses which draw it. The discs may be set so as to throw the earth towards the corn or from it.

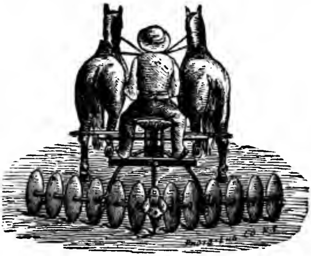


Fig. 85.—*La Dow's Harrow.*

Another form, known as the Randall harrow, has a stout timber frame, and possesses some advantages over the preceding in general efficiency in working, from its stiffness and weight. It is made by Belcher & Taylor of Chicopee Falls, Mass., and by the Warrior Mower Company of Little Falls, N. Y.

Shares' harrow operates in a manner similar to the disc harrows, and has the advantage of being all in one solid piece. The teeth slice the upper surface of the soil, and partly invert it like the mould-board of a plow. They press down at the same time the inverted surface of the sod, and do not tear it up. They pass over roots in an orchard without disturbing them. This harrow will pulverize about four inches of the surface. The steel teeth are much better than of cast-iron, but more expensive. It is made and sold by the Ilion Agricultural Works, New-York, and by Belcher & Taylor, Chicopee Falls, Mass.

The Thomas Smoothing harrow differs from all harrows previously made, in its numerous teeth, and in their backward slope at an angle of about forty degrees. The slope of the teeth causes them to clear obstructions, never to clog, and to pulverize finely the surface of plowed ground, destroying all small weeds at the surface. Larger weeds or plants are not injured by the passing teeth. Hence it is largely used for cultivating corn broadcast, destroying the small weeds, the teeth passing without injury among the young corn. The harrow being nine feet wide, many acres are harrowed in a day. But in its use the precaution is indispensable, to harrow as often as once a week, till the plants are a foot high, so as to take the weeds before they are up an inch, grinding them to powder with the crumbled soil. A few days later they would escape. The frequent harrowing accelerates the growth of the corn. This implement may be used in the cultivation of potatoes while the plants are only a few inches high; but it cannot be adopted for turnips or carrots until they have grown several inches.

The greatest advantage is derived from its use in harrowing wheat in spring. The English practice of cultivating drilled wheat has been found to increase the product largely. The use of this harrow accomplishes the same end, with far less expense, for it may be used with a broadcast sweep of eight or nine feet at each passing, without any care to follow the drills. The first harrowing may be performed as early in spring as the ground will bear the horses; and it may be continued every few days till the wheat is a foot high. The increase in the wheat crop resulting from this harrowing has been found after many experiments to be from five to ten bushels per acre. At the last harrowing clover seed may be sown and lightly covered with the harrow. Timothy seed sown with the wheat the previous autumn will usually be several inches high in spring, and may be harrowed with positive benefit.

This harrow is used as an important labor-saver in pulverizing spread manure, the sloping teeth cutting downwards and grinding the manure, instead of pushing it forward, as with common vertical-tooth harrows.

Since its introduction several imitations have been made by adopting the slanting tooth; but as these are not set solid in the frame, they are liable to become soon deranged.* An engraving of this harrow may be seen on page 295 of vol. VI of RURAL AFFAIRS.

APPARATUS FOR PLANTING CROPS.

GRAIN DRILLS.—The general introduction of drills for sowing wheat and other seeds, throughout most of the northern States and portions of the southern, has resulted in great benefit to grain raising. They are more accurate in their work than hand-sowing, are more economical of seed, and give better crops than common broadcast sowing. They should be properly adjusted for use, for when the tubes have been set too deep, this has lessened the crop, and in a few instances caused a hasty rejection of the drill.

A great improvement has been made during late years in the accuracy and uniformity of the sowing. Instead of the old mode of allowing the seed to pass through the machine merely by its weight, the "*force feed*" is now employed, which carries it through with precision, and the amount per acre is accurately gauged. The prices of grain drills vary from $70 to $90.

* It is proper to inform the public that the inventor of this harrow and the writer of these remarks, has not been for many years in any way interested in their manufacture and sale, and does not make these remarks as an advertisement.

Among the many very excellent drills now mauufactured are the following:

The "Farmers' Friend" is the name of a drill made by the Farmers' Friend Manufacturing Company of Dayton, Ohio, which has been in operation nine years. It is adapted to sowing all grains and grass seed, and has an attachment for sowing fertilizers. Fig. 86 shows the "double force feed," by which an exact quantity of seed is carried down as it revolves. The quantity is regulated by the slower or more rapid motion

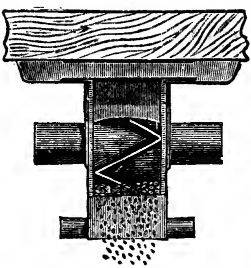


Fig. 86.—*Double Force Feed.*

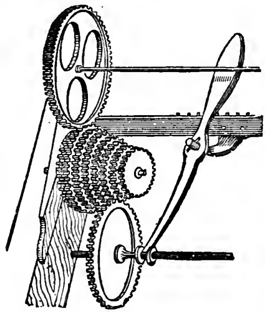


Fig. 87.—*Cone Gearing.*

of the feed shaft, which is effected by means of a cone of cog-wheels of different sizes for this purpose, (fig. 87,) and the amount discharged may be changed by a single movement of the driver, while the drill is in operation. An arrangement is connected with this drill by which the hoes are thrown backwards on striking a stone or stump and are immediately replaced, when the obstruction is passed, by means of a rubber spring.

Another seed-drill, made by J. W. Stoddard & Co., at Dayton, O., is termed the "Triumph." In this the quantity of seed is regulated by turning a screw at the end of the seed-hopper, which enlarges or diminishes the feed-wheels, the actual speed of these wheels always being the same. It has a grass-seeder, sowing any desired quantity per acre. It has also a land measurer, showing, by hands on a dial, the amount of land gone over, the large one making one revolution per acre, and the smaller one, the acres from one to twelve, only measuring while the drill is actually sowing. The hoes have a spring for throwing them again into position after passing an obstruction. This drill will sow fertilizers.

The well known "Buckeye" drill is made by P. P. Mast & Co. of Springfield, Ohio. It discharges seed in any desired quantity with accuracy, and has an arrangement for sowing fertilizers, the quantity of which is regulated the same whether dry, or damp and adhesive.

The "Farmer's Favorite" is one of the oldest and best seed-drills, and has been widely used throughout the Union. It is very successful in its accurate delivery of the same amount of seed on hillsides as on level ground. It sows guano, phosphates and other fertilizers with the grain, as may be desired, whether damp and adhesive, or dry. A change in the quantity sown is effected by a change of cog gear, increasing it by increasing the rapidity of the stream, and not by altering the aperture. An engraving of this drill is shown on page 293 of vol. VI of RURAL AFFAIRS.

The "Empire" drill, made by H. L. & C. P. Brown of Shortsville, N. Y., has a high reputation for excellence, Its fertilizing attachment is divided into compartments, and the fertilizers may be run down alternate tubes between the seed tubes, in sowing drilled crops with wide spaces.

Foster & Aldrich of Palmyra, N. Y., have manufactured for many years a valuable and efficient drill, with arrangements for sowing fertilizers and grass seed.

Williams Brothers of Ithaca, N. Y., manufacture a plaster and broadcast grain sower, which may be attached to their horse-rake, or be a separate machine. The sower complete in itself is offered for $30; or as an attachment to the horse-rake, for $20. It has a double crank motion, driven by bevel gearing, with two sets of agitators, which keep the plaster or other fertilizer always loose in the hopper, and the throat open. It is successfully used for sowing all kinds of grain broadcast.

Ewald Over of Indianapolis, Ind., manufactures a one-horse wheat drill for sowing wheat in standing corn, consisting of a seed-box with a force feed driven by gearing, placed on a one-horse cultivator. It is made of two sizes, with three and five tubes. It may be used for general purposes on small farms. The price for the smaller is $20; for the larger, $25.

PLANTING CORN.—In clean fields, corn may be planted in drills, and cultivated in one direction only. Repeated experiments show that drills will afford about 25 per cent. more grain per acre than hills, and a still larger proportion of fodder. Even in fields foul with the seeds of weeds, drilling will answer well if the soil of the field is smooth and mellow, so as to allow the weekly use of the smoothing harrow, which will destroy all the weeds at little expense, as elsewhere explained. Drilling the seed instead of planting in hills by hand, effects a large saving of labor in planting. A common grain drill is used for this purpose, by employing only such tubes for the rows of the corn as are at proper distances. Fertilizers may be sown at the same time with no additional labor. With a drill having seed tubes 8 inches apart, the rows may be 40 or 48 inches apart; or with 7-inch drills the rows may be 35, 42 or 49 inches apart. No previous marking is required for the planting; and the rows being parallel, are easily cultivated.

When it becomes desirable to plant corn in hills, or in rows both ways in large fields, the Champion corn-planter, made by Beedle & Kelly, Troy, Ohio, will plant two rows at once. It is drawn by two horses, and a man drives, while a boy seated on the machine controls the dropping as each marking is passed. This machine possesses the following advantages: By means of a lever, the depth in planting may be controlled while the machine is in operation; strict precision may be secured as well as ease in dropping, by the movement of the dropping lever; and accuracy in dropping is preserved, both in the line and in the number of grains. The price is $65.

TRUE'S POTATO PLANTER.—This is a useful machine where fields of several acres are to be planted. The seed potatoes are to be assorted, and those of nearly equal size put into the hopper at each operation. One at a time comes in contact with the slicing knife, which cuts the pieces, and they drop one by one through a tube, which at its lower end opens a furrow, into which each piece is dropped at a regular distance, visible to the eye of the operator. The earth falls on them, and the coverers bury them at a proper depth. The hopper holds about a bushel of potatoes. The knife cuts them at random, of equal sizes, and of such size and shape that it is nearly impossible for any piece to be without eyes. Gauge rings are provided next to the knife, by which potatoes of different sizes are planted separately. If the soil is uniformly mellow, from six to eight acres may be planted in a day with one horse, and a man to drive, the machine cutting, dropping and covering at one operation. An appendage may be attached for dropping fertilizers with the seed. These machines are made by Nash & Brothers, No. 7 College Place, New-York, and the cost varies from $30 to $40.

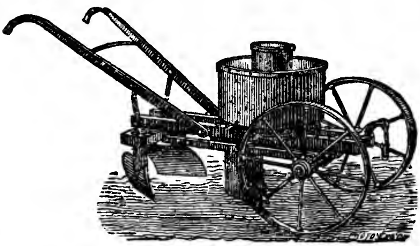


Fig. 88.—*True's Potato Planter.*

HAND PLANTERS.—Everett & Small of Boston offer in market an efficient and useful planter of garden and other seeds which are sown in drills. It opens the furrow, drops the seed evenly at the required depth, covers, and rolls the soil; at the same time marking the next row parallel to the one planted. Among the seeds to which this drill is fitted are beets, carrots, peas, beans, corn, sorghum, onion, parsnep, turnip, &c. An indicator has the names of these different seeds, and it is necessary only to turn the hopper to the name. There are no cams,

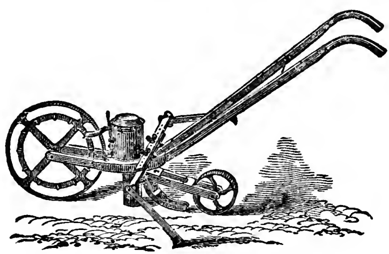


Fig. 89.—*Everett & Small's Planter.*

gears, springs or belts to get out of order, and yet the quantity of seed is accurately gauged. The price is $12.

Allen's "Planet Drill" has a cylindrical brass seed-hopper, which revolves with the wheels, insuring regular dropping, and is readily adapted to seeds of various sizes. It never clogs, and sows perfectly and evenly. It is made by S. L. Allen & Co., 119 South 4th Street, Philadelphia.

Cultivators.

Furst & Bradley of Chicago have carried on an extensive business for many years in the manufacture of agricultural machinery. During the busy season they employ from 450 to 500 hands, and can turn out each day 200 plows, 100 sulky rakes, 100 sulky cultivators, 50 sulky plows, besides hand barrows, field rollers, road scrapers, harrows, &c. The daily production is equal to that of 500 plows. They manufacture largely the riding and walking cultivators for working among corn and other crops in rows. These cultivators are drawn by two horses, which walk in contiguous rows, and two spaces are cultivated at a time. This gives an important advantage over the use of one-horse cultivators. which equally require the labor of a man, with only half the amount of work accomplished. These machines are provided with reversible shovels, and they are easily controlled.

The Sandwich Manufacturing Company of Sandwich, Ill., makes an efficient walking cultivator, which works in two spaces, and is furnished with means for controlling the depth, or the right or left motion. It is readily changed to a riding cultivator.

Among the extensive manufacturers of farm machinery are P. P. Mast & Co. of Springfield, Ohio. This manufacturing company has a paid up capital of half a million dollars, and gives constant employment to 350 men. Among the machines made are the Buckeye grain drill, of which there are 50,000 in use; the Buckeye walking cultivator; the combined walking and riding cultivator, the sulky plow, and broadcast seeder.

Mowers and Reapers.

When, about twenty or thirty years ago, mowers and reapers began to be largely demanded and introduced, many persons commenced their manufacture, mostly on a moderate or small scale. Numerous defects were found in a large number of these, new difficulties occurred, and most of the manufacturers gave up the business. We have been furnished a list of one hundred and ninety of these unsuccessful manufacturers, in different parts of the country! The fact became established that to make the best machines, great skill and experience are required, with ability to procure the best material, to secure skilled workmen in the several departments, to make a systematic division of labor, and to provide, without regard to cost, the best machinery for forming the multifarious parts required for a complete mower and reaper. As a consequence, there are fewer manufacturers at the present time, while their works are mostly conducted on a vast scale, and with systematic accuracy. The importance which this part of farm machinery holds at the present time in farm economy, calls for a somewhat detailed account of this interest, and for a notice of some of the more prominent manufactories employed in the construction of mowers and reapers.

Mowers and reapers are now made at much lower prices than ten or twelve years ago, partly because labor and material are cheaper, and partly because the patents on the many parts which make up a machine have mostly run out. An extensive and experienced manufacturer stated to the writer that he and a few companies with whom he had been associated in purchasing patent rights, had paid first and last over one million dollars for the privilege of using the many patented parts with which every machine was encumbered.*

Manufacturers incur much risk by the breakages to which their machines are liable when not made of full strength in every part. Long experience is required to meet all the requirements of a perfect mower or reaper. In one case the use of bars of iron slightly too small in making a certain part, cost an extensive manufacturer no less than $30,000 in broken, damaged and returned machines. Even careless handling by the farmer, the want of protection from the weather, or neglect in oiling the journals or in screwing up the bolts, may seriously injure the reputation of the best machine.

Good machines will reap about one acre per hour, for ordinary, everyday work, and ten acres a day may be regarded as a fair estimate, although with powerful teams and hard driving, nearly double that amount has been reached. Mowers cut nearly the same amount.

Adriance, Platt & Co. of Poughkeepsie, N. Y., have manufactured, for more than twenty years, the machine known as the Buckeye mower and reaper, which has proved, by long and extensive trial, both excellent and durable. They have made recent improvements, among which is a simple contrivance by which the driver throws the work in and out of gear by simply turning a button. The cog-work is simple, and is carried high above the ground. Side-draught is obviated by balancing the cutter on one side, with the weight of the gearing on the other. As with all machines which have the cutter-bar in front of the driving-wheel, with the driver's seat behind, an equilibrium is effected by which no weight rests on the horses' necks, and the driver has a full view of every part. The leading wheel in front of the knives prevents loose grass from being pushed along and clogging the knives, and prevents the finger guards from catching the ground when passing small elevations. The double-jointed coupling between the gearing and the cutter-bar, leaves the weight of this

* This would show that at least some inventors had been remunerated for their toil and hard thinking, were it not for the fact that most inventions of value are bought up cheaply by shrewd or scheming adventurers, or by good and reliable manufacturers who know how to make profitable bargains.

bar to its own support; all the rest of the machine rests on the driving-wheels, thus imparting efficiency to the motion of the knives. The cutting apparatus folds squarely over the machine, which is thus readily driven to any distance on the road (fig. 90.) A special contrivance gives to the cutter-bar its full length of cutting. These machines are strongly and neatly made, the mower weighing 600 lbs., the reaper between 700 and 800 lbs. Experiments have been made with lighter machines, but it is found that the weight here given is required for full and reliable strength. As now made they perform excellent work with little draught.

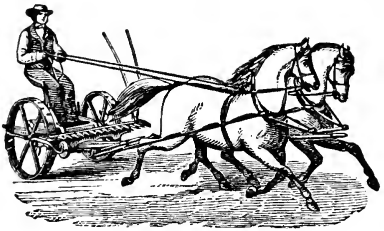


Fig. 90.—*Buckeye on the Road.*

Adriance, Platt & Co. have recently constructed a reaper which appears to possess important merits. The self-raker resembles the Johnston self-raker, with improvements. The ease with which the rakes operate enables the driver to control their operation with great ease, and like other rakes, the size of the gavel is regularly fixed, or its size determined every time by the driver by a pressure of the toe. A light touch of the heel causes the rake to pass without gathering. It is put in and out of gear by turning a button near the driver's hand. The platform of the reaper may be compactly folded for driving on the road. This reaper, as now made, proves one of the best in use (fig. 91.)

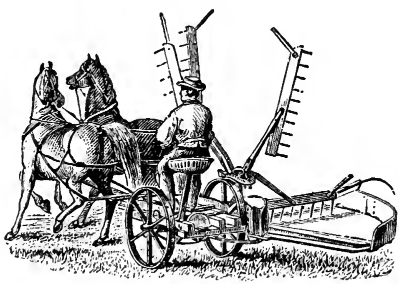


Fig. 91.—*Buckeye at Work.*

The machines of Messrs. Adriance, Platt & Co. have made successful trials in Germany, France, Holland, Sweden, Belgium, Russia, Italy and other countries.

Their manufactory is beautifully situated on the banks of the Hudson River, half a mile south of Poughkeepsie. Their main building is 50 by 300 feet, the interior of which is neatly and systematically arranged. The foundry is 50 by 200 feet, and there are several smaller buildings. They make from 7,000 to 9,000 mowers and reapers annually. The first four years they lost money while perfecting their work and introducing their machines, but have since been eminently successful. They informed us that some of their machines have been in use for twenty years, and are not yet worn out, having received the best care from the owners.

The distinctive characteristics of the Buckeye machines, made by this and other firms, consist in placing the cutter-bar forward of the two driving-wheels; in the double-jointed coupling between the gearing and the knives, giving a flexible cutter-bar; and in the lifting lever. The driving-wheels contain no cogs, but motion is imparted to the knives by fixing the driving wheels fast to the axle, which in revolving gives motion to the cutter. When not cutting, in driving from one field to another, or on the road, the wheels move independently of the axle, which, with the gearing, remains at rest. A similar contrivance is adopted in other mowers and reapers.

C. Aultman & Co. of Canton, Ohio, manufacture annually about 15,000 of the Buckeye mower and reaper, and have made it for twenty-two years. They turn out from 1,000 to 2,000 threshers, and have made them for twenty-five years. They commenced the manufacture of the Monitor engine in 1877 with one hundred, and made in 1878 two hundred and sixty.

The mowing machine which they term the "New Buckeye," is all iron or steel, except the tongue, and has the qualities of the Buckeye in the forward cut, insuring safety to the driver; in the lifting lever to raise the cutter-bar over obstructions; in the tilting lever to raise or depress the points of the guards; and in the perfect protection of the gearing. The Buckeye "dropper" is easily attached to this machine for reaping.

They manufactured 1,000 of their self-binders for the harvest of 1878. This is similar in its general form to other self-binders, and appears to have been very successful in its work.

Bradley & Co. of Syracuse, N. Y., manufacture yearly about 900 of the Buckeye mower and reaper, which have the reputation of being among the best.

The Champion reapers and mowers have a high reputation, and 35,000 and upwards are made by three firms at Springfield, Ohio. The manufacture was begun by Wm. H. Whiteley, the inventor, and the demand increased to such an extent that ultimately three companies engaged in the work, namely, the Champion Machine Company, whose territory for sales is the Southwestern and Southern States; Whiteley, Fassler & Kelly, who have the Eastern and a portion of the Middle States, and South America; and Warder, Mitchell & Co., who have the entire Northwest, the northern portion of Ohio, Indiana and Illinois, the western portion of New-York and Pennsylvania, the Pacific States and Europe. Their combined

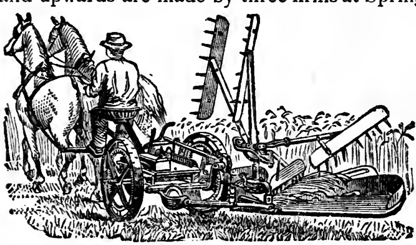


Fig. 92.—*New Champion Reaper.*

capital, with two appended companies, is two million dollars; they employ 1,500 men, and one-fifth of the city of Springfield depends on this business for a living. They all manufacture the same machine, interchangeable in all its parts. They employ malleable iron largely in the construction of their mowers and reapers, and the three firms have united in establishing the Champion Malleable Iron Company, which turns out annually upwards of two hundred tons of malleable castings, used exclusively on these machines. On the same basis the Champion Bar and Knife Company was organized, the product being entirely consumed by the three manufactories. Their machines formerly had a rear cut, but in 1876 they commenced making the New Champion mower, with a front cut, which has been much approved.

Wilbur's Eureka mower is quite unlike all the others, in having the draught pole in the centre of the machine, and the cutting-bar between the two wheels directly following the team. One of the horses, as a consequence, walks on the uncut hay or grain. This is found in practice to be of little detriment, while the cut grass or grain is out of the reach of the horses' feet at the next passing. The peculiar form of the mower gives it some decided advantages, in lightness of draught, steadiness of operation, and broad swath. It also has the advantage of returning along the same line without going around the piece of grass. It is made by the Eureka Mower Company, Towanda, Pa., who manufacture about 600 yearly at the present time.

Among the best machines made in the Union are the mowers and reapers of D. M. Osborne & Co. of Auburn. N. Y. They manufacture over 12,000 annually, and employ, when at work, about 600 men, making themselves some of the parts usually purchased by other reaper makers. The self-raking attachment, partly an invention of their own, operates with much success. Among the several forms of mowers and reapers made by them is the new "Wheeler No. 6," a combined mower and reaper, which is remarkable for the perfect control it gives the driver in its work. For farms of moderate size, a combined mower and reaper is made, furnished with a "dropper," or simple apparatus for forming the cut grain into gavels without the use of the broad raking platform. Among the special

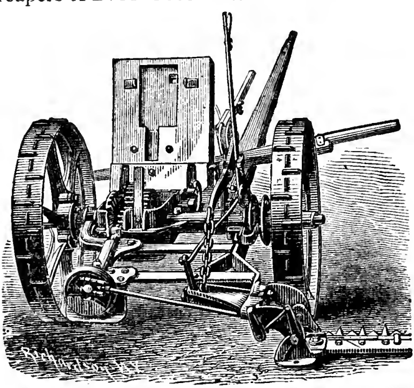


Fig. 93.—*Osborne Mower with Box turned up to show Gearing.*

merits of the No. 6 are named the following: A frame of wrought iron bars, strong enough to resist, as long as the machine lasts, all the pressure against the cutter-bar; an arrangement by which the knives are readily raised or lowered in passing over uneven ground, independently of the main frame; the perfect control of the position of the knives in cutting lodged grain; and the position of the self-raker for the most effective work.

The Osborne self-binder has been so perfected that it is one of the best now made, and the demand has been so great for it that 2,000 were sold for the harvest of 1878. In this self-binder, six rollers give motion to a carrying and elevating canvas, and a comparatively simple contrivance does the work of binding, twisting the wire, and discharging rapidly each successive sheaf.

D. M. Osborne & Co. have constructed their reapers so that for traveling on the road, or from field to field, the whole may be folded into a neat, compact shape only four feet wide, passing readily through narrow spaces. They have branch offices at Chicago, St. Louis, Dallas, Cleveland, Philadelphia, San Francisco, Liverpool, Paris and Bremen.

Wm. Anson Wood's mowers and reapers are made by the Eagle Mower and Reaper Company, at Albany, N. Y. This company has manufactured the Eagle mower and reaper for about four years, and during this time has secured a large business. They make about 8,000 machines in a year, and employ 250 men. Their main building is 75 by 200 feet. Their mowers weigh 625 pounds; their reapers 800 to 1,000 pounds. Among the special improvements which they have made is the patent chilled iron box for a bearing, and each being an exact duplicate of all the others, every machine works exactly alike, and these bearings do not wear out, The two wheels of the Eagle mower are separated by a rather long axle, giving steadiness to its motion. A pitman protector prevents injury to it on rough ground. A one-horse mower is made with thills. Their reapers, of two sizes, have modified self-rakers of nearly the usual form. Like most other reapers now made, their platform is folded for driving on the road. The cutter-bar is on a line with the axle. They make a combined mower and reaper. Trials of their machines with the dynamometer show a light draught.

The Remington Agricultural Works, at Ilion, Herkimer Co., N. Y., manufacture a large number of various agricultural implements and machines. Their main building is 300 feet long, 50 feet wide, and four stories high; their shovel manufactory is 200 feet long; their foundry 150 feet, and they employ here about 300 men. They turn out yearly 2,000 of the Crawford mower, and many thousands of their "carbon plow." They make annually 100 tons of cultivator teeth, and a large number of shovels. spades, steel-rakes, hay-forks, &c. They largely manufacture iron bridges. The spades and shovels are made of one piece of steel, without rivet or welding, the sheet being rolled back so as to form a socket for receiving the wooden handle. They are thus strong, durable and simple in form. Their needle cotton gin is one of the best made in this country, and having witnessed its operation, we can speak with confidence of its perfect work in cleaning, the large quantity of lint obtained, and its rapid working. From the report of trials, it appears capable of ginning a 500-pound bale in less than an hour.

The Crawford mower is among the best made in the country, and the following merits are claimed for it by the makers:

"The gearing is so securely boxed as to keep it entirely free from dust, dirt and grit. The shafting is all firmly held by the frame, and consequently must always work in line, with equal friction on the bearings, until the machine is worn out. The machine is accurately balanced upon the driving-wheels, so that the horses' necks are entirely relieved from a heavy weight. By means of the lifting lever the cutter-bar can be folded or raised to pass any obstruction. With the tilting lever the height of cut can be changed either for cutting lodged grass (the way it is lodged) or over rough and stony ground. The draught-rod connecting the evener with the cutting apparatus, overcomes the side-draught, and lessens the draught of the machine. The seat for the driver answers a double purpose—as a tool-box and a seat combined. The gearing is changed by means of a lever worked by the foot of the driver, thus leaving his hands free. The driver can fold the bar, regulate the height of cut, shift the gearing, and oil the machine in all its parts, without getting off his seat."

The manufactory of the Walter A. Wood Mower and Reaper Company, at Hoosick Falls, N. Y., is the largest single reaper factory in the world. The visitor on approaching the buildings, is struck with their colossal size. The principal one is 150 feet wide and 400 feet long, with an addition of 150 by 70 feet. The foundry is 70 by 400 feet, and 40 tons of cast-iron are melted daily and cast into parts of machines; or 6,000 tons yearly. The blacksmith shop is 70 by 90 feet. From 700 to 1,100 men are employed to do the necessary work in making 25,000 mowers and reapers, the number manufactured the past year. Nearly all the work is done on one floor.

The large number sold annually proves the excellence of the machines. Among the various modifications are the improved iron mower for two horses, the mower for one horse, two sizes of the sweep-rake reaper, the mowing attachment for the reaper, the chain-rake reaper, and the self-binding harvester. The self-binder, in which wire is used for the bundles, has been so successful that 5,000 were made and sold for the harvest of 1878. A western farmer* used ten of these in 1876, and harvested with them, 1280 acres. In 1877 he bought thirty-one more, and harvested 7,500 acres of heavy grain. He states that the saving in clean work over hand-binding more than pays for the cost of the wire. The manufacturers give the following as among the leading points of excellence in this machine:

* Oliver Dalrymple of Minnesota.

"The machine is so balanced that when the driver is in his seat all weight is taken from the horses, and side-draught is entirely removed. The line of cut is nearly on a line with the axle of the main wheel—an important feature, and most desirable for crossing furrows or following irregularities of surface. The height of cut, by a very simple arrangement, can be quickly and easily changed. The driver, on a good, comfortable seat, has entire control of the machine. By the use of levers, conveniently located, the points of the guards can be elevated or depressed, and the knife and rakes thrown out of or into gear while in motion. All the gearing is where it can be reached, yet covered to protect from straws and dirt. The patent spring oilers are applied to all bearings. The sweep of the rakes is most perfect, delivering the cut grain well out of the way of the machine and horses. The balance of the machine is perfect, and the draught light and easy for two ordinary farm horses. The platform and cutting apparatus are so hinged to the main frame that they can be turned up for transport, and when so arranged the machine will pass through a gateway *five* feet in width."

The following are the merits of the self-binder: 1. A free separation of the bundles from the unbound straw in lodged or tangled grain. 2. Compressing the bundles with iron arms before binding, instead of drawing it together by the wire itself. 3. Tight binding in consequence of this compression. 4. Ready regulation by the driver of the size of the bundles, and the saving of wire in the use of large ones. 5. In the cleanness of the work, the horse-rake collecting no scatterings after the binder.

About one-third of all the machines made by this company, are sent to different countries in Europe.

The Johnston reaper, manufactured by the Johnston Harvester Company of Brockport, N. Y., at the rate of 2,000 or 3,000 annually, has within a few years acquired a high reputation, not only in this country, but in Europe, where it has had many successful trials. Among other points of merit, the following are mentioned: 1. Driver's seat balancing the pole. 2. Pitman rod attached to knife by ball and socket, giving elasticity. 3. Patent key-nuts, easily adjustable. 4. Speed of knife changed by reversible gear; and 5. General strength, durability and finish. The self-raking attachment on the reapers, consisting of the cam movement of the rakes, operates on the same general principle as those of most reaping machines. Fig. 94 represents this reaper. Mowers and reapers are made as separate machines,

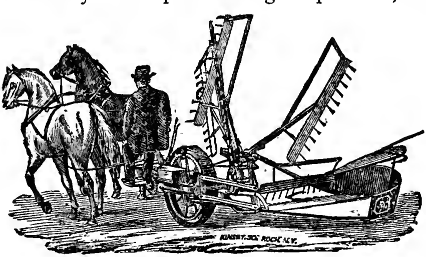


Fig. 94.—*Johnston Reaper.*

or the two combined in one. The separate reaper, as with most other manufacturers, has but one large or driving-wheel; the combined machine, as well as the mower, has two.

The Marsh harvester, as made many years ago, had a platform on which two men stood and were carried along with the machine. The cut grain was delivered on a platform before them. As they expended no time or strength in stooping and in passing from gavel to gavel, they could bind twice as fast as otherwise. This harvester, with some modification, is still manufactured, and among others as the Adams & French harvester, by the Sandwich Manufacturing Company, Sandwich, DeKalb Co., Ill. The only drawback with this contrivance is the increased weight of the binders. The same manufacturers also make a self-binder, which uses wire.

Gregg & Co. of Trumansburgh, N. Y., build annually about 1,500 mowing machines, 200 to 300 plow sulkies, about 500 chilled plows; and 700 lawn mowers in 1878, with the prospect of making 3,000 in 1879, as these lawn mowers are simple, cheap and efficient. The mower termed the "Meadow King" (fig. 95) has for several years proved itself one of the best. It is simple in construction, and is afforded to purchasers for $70. The manufactory employs over 100 men for these and some other machinery.

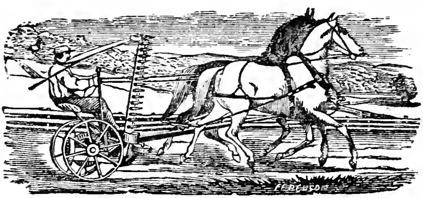


Fig. 95.—*Meadow King Mower on the Road.*

The Warrior Mower Company of Little Falls, N. Y., manufactures an excellent mowing machine, the cutter-bar of which, like that of many or most other machines, is in front of the wheels, where it is easily seen by the driver, and, like many others, has no cogs in the driving-wheels. The same company makes a one-horse mower with thills.

The Victor mower, made by the Cortland Foundry and Machine Company of Cortland, N. Y., has been much improved, and is highly esteemed by those who have used it, as a good and efficient machine.

SELF-BINDERS.

It has been many years since the first attempts were made to bind the wheat cut by a self-raking reaper, by the use of wire. It is more recently that these efforts have proved practically successful. Among those who have succeeded, and who have, on the basis of this success, manufactured them largely, are D. M. Osborne & Co. of Auburn, N. Y.; the Walter A. Wood Company of Hoosick Falls, N. Y.; McCormick & Co. of Chicago; the Sandwich Manufacturing Company of DeKalb, Ill., and the Johnston Harvester Company of Brockport, N. Y.

The accompanying cut (fig. 96) represents the self-binder of D. M. Osborne & Co. in operation. The grain on the platform at the left being carried up and over to the right, where it is bound and discharged, only one man is required, as driver.

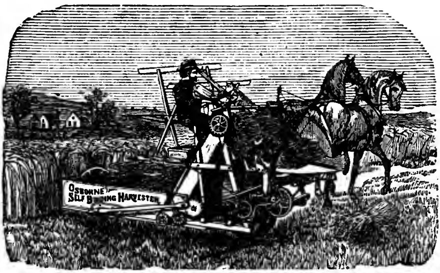


Fig. 96.—*Osborne Self-Binder in Operation.*

The Johnston Harvester Company have recently completed a contrivance by which strong hemp cord is used instead of wire, obviating the objection of the wire becoming mixed with the straw at threshing, and injuring cattle. This self-binder forms and compresses the bundle, passes the cord around it, ties a secure knot, cuts it off, and drops the bundle behind on the ground. The cost of the cord is about the same as that of wire.

The Walter A. Wood Company manufacture a pair of shears, by which, at a single stroke, the wire is cut, held fast and jerked from the bundle, before passing into the thresher.

Making, Gathering and Storing Hay.

Hay Tedders are valuable in large meadows with heavy crops, drying the hay more rapidly, and often effecting a large saving by eluding storms. The first effective one used in this country was Bullard's, represented in vol. VI, page 286 of Rural Affairs. It is manufactured by Belcher & Taylor, Chicopee Falls, Mass.

Collins' tedder is similar in construction, and is sold by Everett & Small of Boston, at $65.

Hay Rakes.—The earliest made hay-rake drawn by a horse, was the single solid rake, about 12 feet long, with the draught ropes attached to short teeth at each end, and held by the driver with a pair of handles near the middle. The driver lifted it to discharge the hay at each windrow, the horse stopping each time. The revolving hay-rake, made of wood, was an improvement, requiring no stopping, and on account of its greater cheapness than the steel-tooth rakes, is still used in some places.

The steel-tooth rakes are however, widely adopted, and are all made on the same general principle, the teeth having a large curve backwards to hold the accumulating hay, the rake running between two light wheels, and the driver occupying a seat above. The various manufacturers differ in the devices by which the teeth are raised at each windrow for dropping the hay, and all those made in this country are alike important labor-savers. Some of more complex construction, with higher prices, operate with more ease to the driver than others of simpler form and of cheaper construction.

The average price is about $30. Among the many manufacturers are the following: B. C. Taylor, Dayton, Ohio, who makes ten thousand annually; the Buffalo Agricultural Works; the Ithaca Agricultural Works; Williams Brothers of Ithaca, N. Y.; the Wheeler & Melick Company, Albany, N. Y.; J. H. Thomas & Sons, Springfield, O.; J. W. Stoddard & Co. (the Wisner rake), Dayton, Ohio; Lane, Field & Co., Millbrook, N. Y.; Remington Agricultural Works, Ilion, N. Y.; Wilson & Halsey, Ithaca, N. Y.; Belcher & Taylor, Chicopee Falls, Mass.

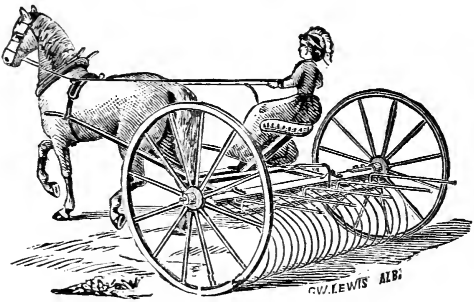


Fig. 97.—*Steel Tooth Hay-Rake.*

Furst & Bradley of Chicago, manufacture a spring-tooth hay-rake, the dumping of which is accomplished by friction bands around the cast hub of each wheel. The friction is applied equally to both wheels, with no side-draught.

Foust's Hay-Loader.—This is attached to the rear of a hay-wagon,


Fig. 98.—*Foust's Hay-Loader.*

(fig. 98,) is drawn by the same team that draws the load, and saves the labor of pitching by hand. The wagon is driven astride the windrow, and the motion of the wheels of the loader carries the hay upward and drops it on the load, where one man is required to place it in position. With a boy to drive, two men on the wagon have loaded a ton in five minutes. If the hay is heavy, it may be used without previous raking. It pitches barley and unbound grain rapidly. It is attached to and removed from the wagon in a few seconds.

This machine requires smooth meadows for its successful operation, and proves valuable on large farms; and in connection with the hay-tedder and the horse-fork and horizontal carrier, enables the farmer to secure large quantities rapidly, and to avoid the loss by storms. The weight of this machine is 500 pounds; the cost, $75. It is manufactured by Stratton & Cullum, Meadville, Pa.

Hay Carriers.—Horse-forks are connected with a contrivance so that the load of hay which they carry up by the draught of the horse, as soon as it reaches the required height, begins to run horizontally by the continued traction of the horse, and the hay is dropped at any desired spot on the mow. This horizontal motion is obtained by a wheel or pulley running on a track under the rafters of the barn, made of an iron rod about five-eighths of an inch in diameter, properly supported. It not only proves a great saver of labor, but admits of wider bays. With this contrivance a man on the load of hay, with a boy to drive the horse, may unload a ton of hay in five minutes. The carrier may be used outside the barn if desired.

Among the few manufacturers of efficient hay elevators and carriers which are now sold, are the following: Clark & Scott, Bridgewater, N. Y.; E. V. R. Gardner & Co., Johnson's, Orange Co., N. Y.; U. S. Wind Engine Company, Batavia, Ill.; and G. B. Weeks, Syracuse, N. Y.

Hay Presses.—P. K. Dederick & Co. of Albany, N. Y., have been long and extensively engaged in the manufacture of hay presses, and have reached a high degree of perfection in their machines. They have besides an extensive manufactory of farm engines, hoisting machines, dumping carts and horse-powers. They occupy four large brick buildings and several smaller ones, and their works may be seen from the N. Y. Central cars, in the valley below, just before running into Albany from the west.

Their perpetual horizontal press, driven by horse or steam power, operates continuously, and forms successive bales as fast as the hay is thrown in. One man is required to pitch in the hay, and another to bind and store the bales; and when the press is run rapidly, a boy in addition is required to assist with the bales. Important facilities have been afforded farmers who market hay, by this rapid mode of reducing it into a shape to be easily handled and cheaply conveyed to market. It gives economy in room, neatness and cleanliness, and is safer against fire.

With the perpetual press, the bales may be made of any desired length or size, but the owners find that a moderate sized bale, weighing about 100 pounds, is the most convenient to handle, as it may be carried, or thrown up, in storing. They remark that "such bales may be sold at grocery stores, like bread or tea, and a customer may take a bale or two along in his buggy if desired." The bales being in folded sections, a single section may be taken out and fed at a time, and experience has proved that horses will pull the hay from the bales no faster than it is consumed, and loose portions are not trodden under foot.

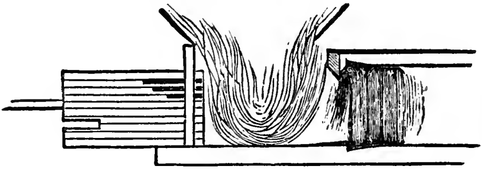


Fig. 99.

With the small bales, fifteen tons of hay may be stored in a grain car. The most rapid working machines give from twelve to twenty strokes of the traverser per minute.

The accompanying figures show the process of bailing. Fig. 99 shows

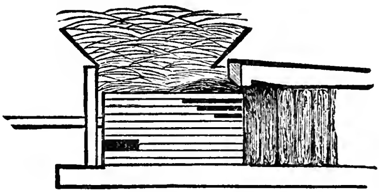


Fig. 100.

Fig. 101.

the traverser drawn back, and a mass of hay thrust into the space for pressure. In fig. 100 the hay is pressed by the traverser into the narrow space, forming the sections of the bale. Fig. 101 shows the form of one of these sections. In fig. 100 the hopper is seen filled with hay for the next section. The bales are secured by stout

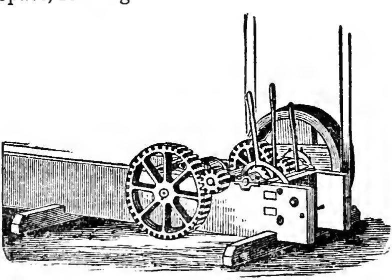


Fig. 102.

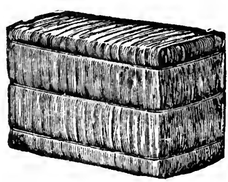


Fig. 103.

steel wires made for the purpose. Fig. 102 represents the gearing by which the powerful pressure is secured. Fig. 103 shows one of the perpetual bales, with the sections of which it is composed.

These presses are sold at prices varying from $300 to $500 each. They may be used for pressing hay, straw, cotton, moss, wool or rags.

Threshers and Separators.

Among the earliest to introduce the large machines which contain as a whole the thresher, cleaner and straw carrier, was H. A. Pitts, and his extensive works for their manufacture are still in operation in Buffalo, N. Y., with many modern improvements. More recently there are a large number engaged in making similar machines, with various modifications, but all possessing peculiar advantages, and all performing good work.

The threshers now made in this country employ two modes for separating the straw from the grain. The endless aprons were adopted many years ago by the Pitts Brothers, and have since been extensively used by other manufacturers. Important improvements have been made in the endless aprons, and when the machines are not threshing too rapidly, they answer an excellent purpose and make clean work. Another form, known as the "Vibrator," (fig. 104,) is manufactured by Nichols, Shepard & Co. of Battle Creek, Michigan, which appears to be

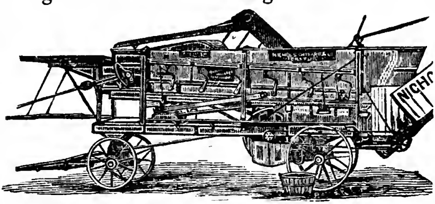


Fig. 104.—*Nichols & Shepard's Vibrator.*

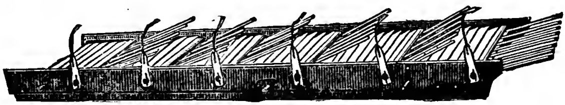


Fig. 105.—*Upper Shaker.*

a perfect cleaner, and a rapid thresher. Fig. 105 represents the shaker, with its series of fingers, the motion of which tosses up the straw and shakes out the grain, which falls to the screen below (fig. 106) through

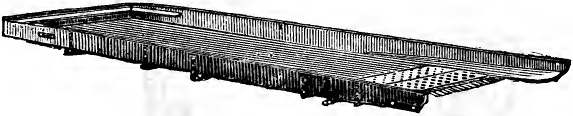


Fig. 106.—*Lower Shaker, or Conveyor.*

the slat work. These fingers do not revolve, but merely rise and fall. Their motion sends the straw onward.

The concaves of the threshing machine are in three parts, two containing rows of teeth, and the third blank. These are movable, and may be placed in different positions. When the blank is placed in *front* (as shown in the cut, (fig. 107,) the machine draws or takes grain faster; when placed between the two with teeth, it favors clean threshing; but if at the rear, clogging is prevented when the straw is wet or in bad condition.

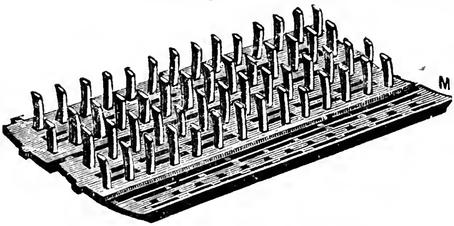


Fig. 107.—*Concaves of Threshing Machine.*

Other forms of the vibrator, effecting a similar end, have been invented, among which are those of Westinghouse & Co. of Schenectady, N. Y., and the Wheeler & Melick Company of Albany, N. Y.

B. Gill & Son of Trenton, N. J., manufacture a thresher and cleaner which, in addition to its separation of grain and straw, is supplied with a *duster*, which carries the dust from the front of the machine, away from the feeder, and out with the straw. They also manufacture a rye thresher, which removes the grain and sends the straw over a carrier, keeping it straight and parallel for binding in bundles. These threshers may be driven by tread or lever power, both of which are made by these manufacturers.

A. B. Farquhar of York, Pa., has an extensive manufactory of threshing machines, horse-powers and farm engines, employing over 200 men. The thresher and separator combines strength and simplicity; the vibrating carrier is composed of ribbed sheet-iron, with projections and open spaces, and agitators shaking the grain from the straw. A measuring hopper shows the quantity of grain.

The horse-powers made by Mr. Farquhar are of three kinds—tread, lever and steam. The steam engines are made with both vertical and horizontal boilers.

A strong coil-spring (fig. 108) is used on the geared threshers, for equalizing the irregular power of horses, or the irregular feeding of the machine, making both more uniform, and lessening the fatigue of the animals and the danger of breakage.

Fig. 108.—*Coil Spring.*

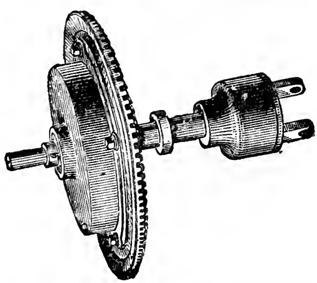


Fig. 109.—*Gearing containing Coil Spring.*

The manufactory of G. Westinghouse & Co. of Schenectady, N. Y., is one of the oldest in the country, and has long been distinguished for the excellence of its tread-powers, as well as its threshing machines. It employs from seventy to eighty men. This firm has increased its manufacture of lever-powers, which are noted for their efficiency and neatness of construction. Their thresher and separator stands among the best made in the country; and a contrivance is attached by which it is altered to a clover huller. The vibrating rods, which toss and shake the straw for separating it from the grain, act with efficiency in cleaning it in a thorough manner. The accompanying cut (fig. 110) shows the external appearance of this machine.

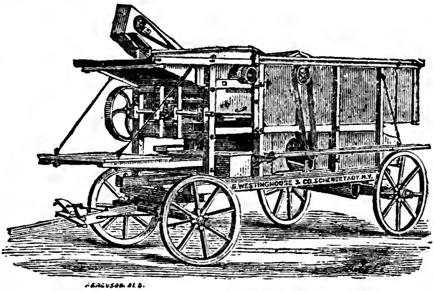


Fig. 110.—*Westinghouse's Thresher & Cleaner.*

The "Fearless Railway" tread-powers, threshers and cleaners made by Minard Harder, Cobleskill, N. Y., have been long known as among the best in the United States.

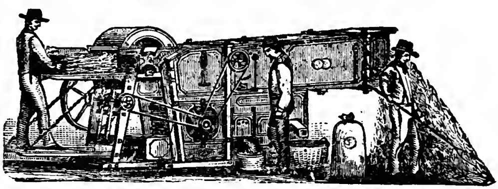


Fig. 111.—*Harder's Fearless Thresher and Cleaner.*

Russell & Co. of Massillon, Ohio, have very extensive works for the manufacture of threshing machines, which possess some important improvements for efficient work.

The Pitts Agricultural Works, Buffalo, N. Y., successors of James Braley, Braley & Pitts, and of John A. Pitts originally, manufacture extensively the Pitts grain threshers and cleaners, and lever horse-powers. These machines have long had a high reputation, and their introduction has led to a general use of the valuable labor-savers now so commonly employed.

An extensive manufactory of excellent horse-powers and threshers is carried on by A. W. Gray & Sons, at Middletown Springs, Vermont. The business was commenced in 1840, in a small way, by A. W. Gray, but after gradual increase he took his two sons into the business, and in

1875 they assumed entire control. It has increased rapidly of late years, and 1,200 tread-power machines are made annually, and 400 com-

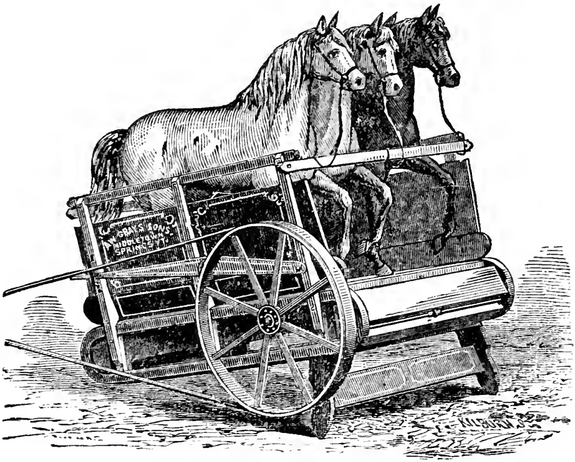


Fig. 112.—*Gray & Sons' Three-horse Tread Power.*

plete sets of threshers and separators. The annexed cut, (fig. 112,) representing their three-horse tread-power, exhibits its appearance when in operation.

The Silver & Deming Company of Salem, Ohio, make endless chain horse-powers, having steel track-rods and wrought-iron track links. These are supplied with governors for regulating motion, and to control speed even if the belt should break or slip off. Connected with this, they manufacture an efficient threshing machine, and a separator with a succession of beaters, which raise and shake the straw at the same time that they carry it forward.

The Wheeler & Melick Company of Albany, N. Y., have for many years manufactured efficient railway or tread horse-powers, for one, two and three horses. Their combined thresher and cleaner is furnished with a vibrator for separating the straw and grain, consisting of a series of forks, which toss up the straw and carry it forward, and effect a complete separation

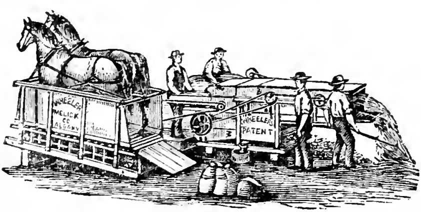


Fig. 113.—*Wheeler & Melick Thresher and Cleaner.*

Their prices, which are about the same as those of other manufacturers, are the following:

One-horse Tread-power, with all appliances,			$140
Two-horse	do.	do.	170
Three-horse	do.	do.	215
Thresher and Cleaner	additional, smaller size,		220
Thresher and Cleaner	do.	largest size,	260

They make a threshing machine for rye, which carries the straw through unbroken, for binding in bundles. The unthreshed straw is fed sidewise to a long cylinder, and passes between two corrugated surfaces, which remove all the grain, and the straw is deposited even and parallel, from an endless apron. It will thresh 2,500 to 4,500 sheaves in a day. The price is $150.

The threshing and separating machine of C. Aultman & Co., Canton, Ohio, possesses, as they inform us, the following valuable qualities: 1. There is no friction on the beater-shaft, the belts pulling in opposite directions. 2. It threshes wheat, rye, oats, barley and buckwheat without changing the riddles. 3. It has steel spikes. 4. It has double fan-boards to centre the blast on the riddles.

The following are the prices of some of their machines: Threshers and carriers, $250 to $350; stackers, $55; lever-powers, $155 to $235; monitor steam engines, six to sixteen horse-power, $800 to $1,400; mowers, $85 to $95; mower and dropper, $145; Buckeye harvester, $180.

J. O. Spencer of Union Springs, N. Y., makes an excellent threshing machine and separator, known as the McFarland. It has threshed 650 bushels of wheat in less than six hours, with steam power.

The Stevens thresher and separator, made by A. W. Stevens & Co. of Auburn, N. Y., has a reputation of doing efficient work.

M. Williams & Co. of St. Johnsville, N. Y., manufacture a railway horse-power, and a thresher and cleaner which has received high commendation, and they state that with it eleven hundred bushels of oats have been threshed and cleaned in a day.

Among other manufacturers of good grain thresners and separators are E. M. Birdsall & Co., Penn Yan, N. Y.; Joseph Hall Works, Rochester, N. Y., and C. Aultman & Co., Canton, Ohio.

Tread and other Powers.

Tread-powers possess an important advantage for the moderate farmer. He may do his threshing at any time in winter, without securing the large force of laborers required to man a large machine; and he may employ his horse-power for the various other purposes of grinding, cutting straw or stalks, sawing wood, &c. With lever-powers from six to ten horses may be employed at a time, and more rapid work performed. Of late years, portable farm steam engines have come rapidly into use, and they will perform more work than can be accomplished with horses on a lever-power, and they may be run without cessation from morning till night, no seasons of resting being required, as with horses. They possess another important advantage, in leaving the horses of the farm at liberty to draw the unthreshed grain to the thresher, or to convey the straw and grain away after the operation.

SMALL TREAD-POWERS.—The Wheeler & Melick Company manufacture what is termed a "pony power," or a tread-power which may be worked by a yearling calf, or a pony weighing 400 or 500 pounds. It is intended for churning in large dairies, pumping water, &c. Its price is $50. Their "dog-power" has been extensively used for churning in small dairies. A sheep of large breed is much better than a dog for working this power, as the work is less irksome to the sheep, it is easier to keep, and is always at hand in its yard or pasture. The price of this tread-power varies from $15 to $25.

HUSKING AND SHELLING CORN.

CORN SHELLERS.—For shelling large quantities of corn on large farms or in warehouses, the Adams self-feeding machines made by the Sandwich Manufacturing Company of Sandwich, DeKalb Co., Ill., have proved durable and efficient. They may be run with several horses, or with steam power, and the three different sizes will shell and clean from 600 to 3,000 bushels per day. A smaller machine, called the Farmer's sheller, is run with one or two horses, shelling 300 or more bushels per day. These shellers operate as "pickers" or spring shellers, and take the corn from the cob whether dry or soft, leaving the cob unbroken and entire. The Farmers' shellers cost from $50 to $75; the larger ones from $130 to $540. These sums do not include the driving powers.

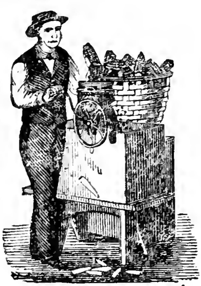


Fig. 114.—*Livingston's Corn Sheller.*

SMALL CORN SHELLERS.—Livingston & Co. of Pittsburgh, Penn., manufacture a small and efficient sheller, (fig. 114,) well adapted to farms of moderate size. It is attached to any large box or plank on edge, and will shell from five to eight bushels in an hour. It adapts itself to large and small ears. The price is $5; a smaller one at $2.50 is used for shelling seed corn, grain for poultry, &c.

CORN HUSKERS.—Philip's corn husker, manufactured by C. H. Malleson of Hudson, N. Y., strips the husks from the ears on a bed of rollers, which revolve in contact, the ears having been snapped off a moment previously by the machine in running the stalks between rollers.

Jones' corn husker, made by J. Van Zandt, Schenectady, N. Y., is similar in its general principle to the preceding, with some variation in its details of construction. Like the Philip husker, the ears are broken from the stalks by passing between rollers; and the husks are stripped off by a series of rapidly revolving rollers in contact. A part of the rollers in the Jones husker are longitudinally corrugated; in the Philip machine they have teeth and holes. These machines will husk corn green or dry, taking it from the stalks as they are thrown upon the platform, passing the stalks out at one side, the ears at the other, while the husks are deposited beneath. They are driven by two horses, and will husk from forty to fifty bushels per hour. The cost of each is $125. The only drawback in their use appears to be their leaving the stalks in irregular heaps, instead of parallel for binding; at the same time they are crushed, improved and softened for the cattle.

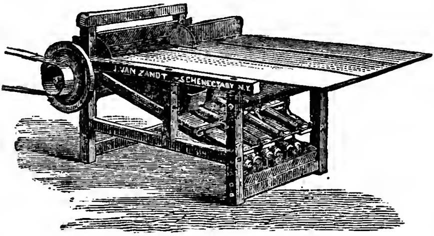


Fig. 115.—*Jones Corn Husker.*

Clover Hullers.

Many years ago, J. C. Birdsell, a large farmer of Monroe County, N. Y., who was much interested in the growth of the clover crop, made many and long continued experiments, and produced a machine of which over 5000 have since been sold. This invention has contributed largely to increase the growth of this enriching crop. The machines, as now made, thresh, separate and clean the clover seed at one operation, and as their price is about $400, it is common for purchasers to traverse neighborhoods with one machine, and do the work for many farmers at moderate rates. The average of one machine is about 600 bushels for a season.

The Wheeler & Melick Company of Albany, N. Y., make a cheaper clover huller and cleaner, somewhat resembling their grain thresher, but with a hopper for feeding placed over the cylinder. The cleaned seed is discharged into a large drawer beneath. It may be run with a two-horse tread power, or a larger sweep power. It will clean from ten to twenty bushels of seed in a day, and its cost is $125. A smaller machine, for one-horse power, will clean from five to


Fig. 116.—*Wheeler & Melick Clover Huller.*

fifteen bushels of clover seed in a day, and is sold for $50. This does not winnow the chaff from the seed, which is effected separately by the use of a fanning-mill. It is specially adapted to moderate farms, which are not accessible to the larger machines.

An excellent clover-seed machine known as the "Victor," is made by the Agricultural Implement Company at Hagerstown, Maryland, and has proved itself a rapid and perfect huller. It has been found capable of threshing and cleaning from thirty to fifty bushels of seed in a day. Its cost is about $400. It is sold by H. B. White, South Barre, Orleans Co., N. Y.

Grain Cleaners.

The best fanning-mills must not only winnow out all the chaff, but remove every foul seed which may have found its way among the grain. Cockle and chess must be all taken from winter wheat, oats from spring wheat and from barley, and most important of all, grass seed must be thoroughly cleaned—clover separated from timothy, sorrel or plantain seed; and timothy from other small seeds. The best separators now accomplish all these purposes by means of sieves of various sizes and forms of meshes, and by the aid of wind currents.

Denison, Fredericks & Co. of Syracuse, N. Y., manufacture an excellent grain cleaner, known as Osborne's patent. It separates oats, cockle, wild buckwheat and other seeds from spring wheat; rye and chess from winter wheat; oats from barley; and mustard and other seeds of weeds from flaxseed. It separates and cleans from clover and from grass seed the various small seeds which become mixed with them. It owes its efficiency to the size and form of the meshes in the sieves, to the direction of the wind current from the fan, but more particularly to the jar or vibration produced in the sieves by a special contrivance for this purpose.

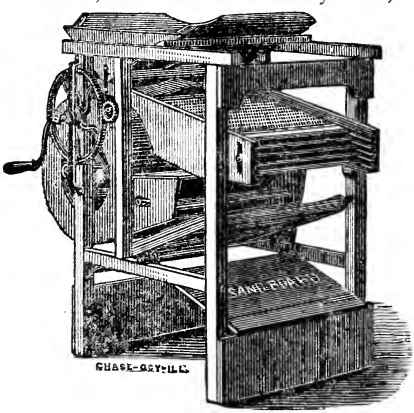


Fig. 117.—*Osborne's Grain Cleaner.*

Belcher & Taylor, Chicopee Falls, Mass., make an excellent fanning-mill and grain separator.

A separator which performs excellent work, made by J. J. Brander of Barrington, Yates Co., N. Y., is shown in the accompanying cut (fig. 118.)

It separates, oats, chess, cockle and grass seed from wheat, clover from timothy, sorrel, plantain seed and timothy from red-top, each at a single operation. It is furnished with a bagger, (seen at the rear of the machine in fig. 118,) carrying the cleaned seed to the bag suspended from it. The price of the separator alone is $30; the bagger $10; additional for warehouse work, $60 and $75.

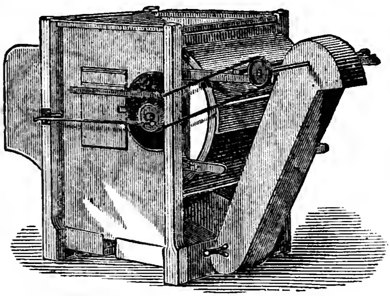


Fig. 118.—*Bradner's Separator.*

A. W. Gray & Sons, Middletown Springs, Vt., make, in connection with their horse-power and thresher, a separator, by which the cleaning process is thoroughly completed. This cleaner may be readily detached and used as a hand fanning-mill.

Feed Cutters.

Belcher & Taylor of Chicopee Falls, Mass., have made over 40,000 of their "self-sharpening feed-cutter," which appears to be an efficient machine. The knives are so accurately adjusted that every one is required to be tested by passing a single strip of thin paper through it, and if the paper is cut in the same manner as with sharp scissors, it is ready for sale. The knives play past each other like shears. The prices range from $10 upwards, varying with size. The largest size is used for large stables, and for paper mills; the balance-wheel weighs 100 pounds, and with steam or water power it will cut two tons an hour; the cost of the machine is about $75. The intermediate machines, costing from $30 to $40, run with horse-power, cut a ton an hour.

Among other feed cutters, the same firm manufactures the "junior cutter," with capped knives. If required, it will cut straw for bedding, from two to six inches long, making manure short without rotting. Another excellent machine made by them is known as the "Lion cutter," which cuts all lengths from a third of an inch to two inches, the change for which can be made in the machine in less than a minute. The feed roller is so constructed that crooked and tangled feed is presented straight to the knives. The relative position of the stationary knife to the revolving knives gives an easy and efficient shearing cut. The prices of these cutters are $18 and upwards.

There are many other manufacturers of feed cutters. Efficient machines are made by Silver & Deming of Salem, Ohio, and are run by horse or steam power. An arrangement in them is a safety flywheel, which continues to revolve if any obstruction stops the knives.

A hand machine called the "pony cutter," is one of the best of its kind. The cutters, run by horse or steam power, make about four hundred revolutions per minute. They have four knives, and cut all desired lengths. The prices vary from $32 to $97; the hand cutters from $20 to $27.

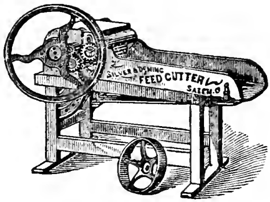


Fig. 119.—*Silver & Deming Feed Cutter.*

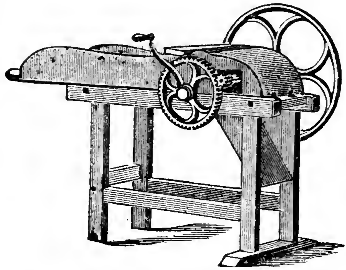


Fig. 120.—*Wheeler & Melick Feed Cutter.*

Fig. 120 represents a cutter made by the Wheeler & Melick Company of Albany, N. Y., and called the "National cutter." These cutters are strong, durable and efficient. They are of six sizes, the smaller for hand, and the larger for steam power, varying from $18 to $50 in price.

Feed Mills.

An efficient mill for grinding corn, corn and cob, oats and barley, is made by Thomas Roberts of Springfield, Ohio, (fig. 121.) It is made wholly of iron and steel. It sharpens itself by reversing the motion. It may be run with a four-horse or eight-horse power, and will grind from ten to twenty bushels of feed in an hour. It is said to answer well for grinding bones. A boy large enough to shovel in grain may attend it. It will grind from 6,000 to 10,000 bushels before the plates are worn out, when they are replaced at a small expense. The prices of this mill vary from $75 to $135,

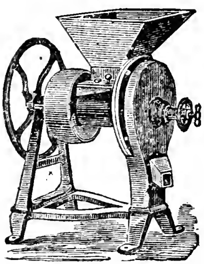


Fig. 121.—*Roberts & Bro. Feed Mill.*

Wm. L. Boyer & Bro. of Germantown, Penn., manufacture a farm grist mill, which has been in use twenty years, the grinding edges made of cast-steel, and the edges kept sharp by contact. A bolting attachment is added, for preparing family flour. The prices vary from $50 to $80. The mill may be driven by horse-power varying from one to four horses, or by steam, and will grind from eight to twelve bushels per hour.

J. A. Field & Son, 922 North Second Street, St. Louis, manufacture an efficient farm grinder, known as the "Big Giant corn mill," made of cast-iron, with chilled iron grinders, which are replaced with new ones when worn, at a cost of from $3 to $8, according to size. They inform us that one mill with steam power has ground 6,000 bushels, and still the grinders are not worn out. The mill is actually improved by wearing, by means of a special arrangement, the wear being taken up by a set of screws. It grinds corn in the cob and husk, or corn and cob alone, or small grain, the mill being varied by turning a nut. No separate horse-power is required, the animals being attached directly to the lever. The price is $25 and upward.

BUHR STONE MILL.—The Straub Mill Co., Cincinnati, Ohio, manufacture very extensively portable mills for wheat flouring, and for corn meal. of which they inform us they have sold 7,000 during the past thirty-four years. The under stone is the running stone, which admits grain with a very small eye, and any desired speed may be given to this stone for rapid grinding, Choking is prevented, and if the mill happens to be empty, no harm is done, as the stones do not press together. The speed may vary from 100 to 600 revolutions in a minute. For horse-power, a fair average for fine flour is 2½ bushels per hour for every horse. Good threshing powers may be used to drive them. For such powers, 18 and 22-inch mills are used.

STEAM POWER ON FARMS.

The past few years have been conspicuously marked by the great increase in the use of steam power on farms, and numerous manufactories of farm engines have sprung up throughout the country. Their superiority to horse-power for many purposes is becoming well understood. Steam is cheaper and more steady and uniform in operation, and is applied with great advantage to stationary work at such times in the year as team work is crowded. The introduction of steam engines has been much facilitated by their cheaper and simpler form, and the greater ease in their management.

The smaller and low priced engines, of two or three horse power, may be employed for cutting or grinding feed, pumping water, sawing wood, driving small threshers, and churning in large dairies. The larger ones are extensively employed for large threshing machines for itinerant work, or for extensive farms.

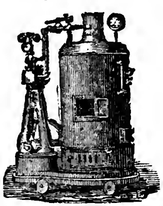


Fig. 122.—*Payne Farm Engine.*

MANUFACTURERS OF ENGINES.—B. W. Payne & Sons, Corning, N. Y., manufacture a neat and efficient vertical engine for doing farm work (fig. 122,) the smallest size being 2-horse power and sold for $125. This size consumes less than a bushel of coal in a day. From the sectional construction of the boiler, the makers insist that there can be no danger from explosion. The firm employs sixty workmen, and nearly all their manufactures are engines.

Wood, Taber & Morse, Eaton, Madison Co., N. Y., are widely known for the excellence of their farm engines, which have been largely introduced and successfully used.

James Leffel & Co. of Springfield, Ohio, make the celebrated Bookwalter engine, (fig. 123,) which is an upright tubular, made with a view to economy in fuel and safety in operation; the boiler is durable and free from leakage. Every boiler is tested by hydraulic pressure to over twice its working pressure, and steamed up and run before leaving the works. The 3-horse power boiler is sold for $165, and the engine for $75; 6½-horse power at $225 for the boiler, and $115 for engine.

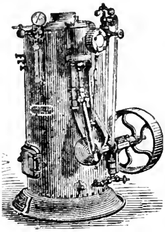


Fig. 123.—*Bookwalter Engine.*

Among the manufacturers of good farm engines, are: J. O. Spencer, Union Springs, N. Y.; C. Aultman & Co., Canton, Ohio; B. W. Payne & Sons, Corning, N. Y.; Oneida Steam Engine Co., Oneida, N. Y.; Frick & Co., Waynesboro, Penn.; Fishkill Landing Machine Company, Fishkill-on-the-Hudson, N. Y.; Watertown Steam Engine Company, Watertown, N. Y.; P. K. Dederick & Co., Albany, N. Y.; James Leffel & Co., Springfield, Ohio; Russell & Co., Massillon, Ohio; G. Westinghouse & Co., Schenectady, N. Y.; Porter Manufacturing Company, Syracuse, N. Y.; Mansfield Machine Works, Mansfield, Ohio; E. M. Birdsall & Co., Penn Yan, N. Y.; the Wheeler & Melick Company, Albany, N. Y; Wood, Taber & Morse, Eaton, N. Y.; A. B. Farquhar, York, Penn.; Whitman & Burrell, Little Falls, N. Y,; Skinner & Wood, Erie, Penn.; Blymyer & Co., Cincinnati, Ohio; F. & A. B. Landis, Lancaster, Penn.; and Williams Brothers, Ithaca, N. Y.

Wind Power.

The wind which sweeps overhead in every part of the country, possesses in the aggregate an immense amount of power, a force equal to many thousand horses being exerted everywhere without being brought into practical use. Wind power has some special advantages. Water power exists in certain localities only; wind blows over the whole face of the earth. Wind may be employed in places where other kinds of power are not to be had, and more especially on broad level plains. In the Western States it has proved of great value. Its only drawback is the extreme irregularity of its currents. Hence the ingenuity of inventors in providing means to meet this difficulty by self-regulating contrivances.

Windmills have been known for many centuries, but their simple and rude construction has required constant care in regulating to perform their required work, or prevent disasters from storms. Small windmills with fixed sails, if not more than four feet in diameter, and strongly made, may be used for pumping water on farms, without any self-regulating contrivance. If much larger, they should be supplied with a self-governor, and a simple arrangement to make them so, is to counterpoise by a weight the force employed to bring the sails against the wind. When the wind is moderate, the weight bears down and forces the windmill into a position to receive its full force; when it becomes more violent, the weight is lifted by it, and the windmill swings around with its edge against the wind, and its motion is thus lessened, or entirely arrested. Of this construction is the Eclipse windmill. In a third class, of which the Halladay mill is a prominent representative, the circle of fans remains facing the wind at all times, but their degree of angle to the wind is regulated by centrifugal force, and the greater the velocity of wind, the more nearly the fans are turned edgewise to the current.

The most useful wind is one that moves at the rate of about fifteen miles per hour, and at any velocity between eight and twenty miles it does good work.

MAKERS OF WINDMILLS.—Mast, Foos & Co., Springfield, Ohio, manufacture the "Iron Turbine Wind Engine," the wheel and vanes of which are made of sheet-iron, secured and braced with bar iron, and so strongly put together that the manufacturers warrant it to withstand the force of any wind that will leave the neighboring buildings standing. It has what is termed a "solid wheel." Although wholly of iron, it is no heavier than windmills made of wood. It is, of course, self-regulating, turning edgewise to hard gales. It is made from 8 to 14 feet in diameter, at prices ranging from $85 to $225 respectively.

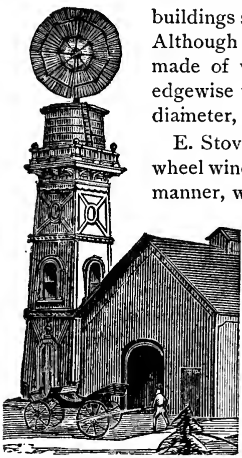


Fig. 124.—*Eclipse Windmill.*

E. Stover & Brother, Freeport, Ill., make another solid-wheel wind engine, operating as a self-regulator in a simllar manner, with details of construction to give it efficiency.

The Eclipse Windmill Company of Beloit, Wisconsin, manufacture extensively, with an experience of twelve years, their solid-wheel windmill, (fig. 124,) which is regulated by turning the whole wheel edgewise to the wind in strong gales. It is substantially made of malleable and wrought iron. There are several sizes, from 8 to 45 feet in diameter; the latter size, with wind 15 miles an hour, possesses a force of about 25 horsepower. They will moreover build mills, at the owner's risk, up to 40 horsepower. All parts of each size are made perfect duplicates of all the others, allowing any part to be readily replaced. The company makes over 100 of these mills each month, and they are not only used in this country, but are exported to nearly all the countries of Europe, and to several in Asia and South America.

This company claims the following advantages for their solid wheels for windmills over sectional wheels: "The fans being rigid and fixed, do not tilt or move in any way; while the sectional wheels have numerous joints and pivots, which are continually wearing loose. The solid wheel may be constructed of heavier and stronger material, and all the wind surface is utilized, and lighter winds employed."

This windmill has not only been largely employed for pumping water into the tanks of the many railroads which use it, but it may be employed to advantage for all the purposes of steam, horse or water-power on farms, in grinding feed, pumping water, cutting straw, sawing, and other work.

Halladay's windmill has been in use more than twenty years, and during this time important improvements have been made in its construction. It is one of the most steady running self-regulating windmills that have been made, admitting of a diameter of 60 feet, which, with a wind of 15 miles an hour, has 40-horse power. Of this size it is well adapted to grist-mills, and in localities of steady and uniform currents has proved a much cheaper power than steam engines. It has likewise been used in pumping water into large frost-proof tanks for the use of locomotives on railways; and in the absence of running streams may be employed for supplying water for towns and villages, for daily use and protection against fires. The United States Wind Engine Company of Batavia, Illinois, who manufacture these windmills, with pumps and tanks to accompany them, inform us that they make from 1,600 to 2,000 windmills annually, which at retail prices amount to half a million dollars a year, in which they employ upwards of a hundred men. Their price for the smallest size, or 8 feet in diameter, is \$90; for 12 feet, \$130; for 20 feet, \$400; for 40 feet, \$1500; and for 60 feet, \$3,500. The power varies from one-half-horse power for the smallest, to forty-horse power for the largest, with wind 15 miles an hour. The accompanying cut (fig. 125) represents a Halladay mill mounted for pumping water, with substantial tower and pump below. Or it may be placed on the top of any farm building either for pumping or for other farm work.

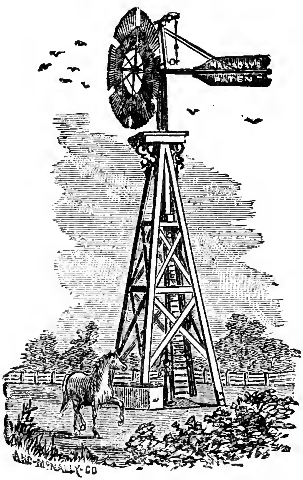


Fig. 125.—*Halladay's Windmill.*

The Challenge Mill Company of Batavia, Ill., construct an efficient windmill, which is made self-regulating by the combined action of centrifugal force and of the pressure of the wind. A movable weight on a regulating lever (within reach of a person on the ground) can be adjusted to hold the mill against a resistance effecting from 10 to 40 revolutions in a minute, and no increased velocity of the wind will change the speed of the mill. When the wind increases, the sails open to the wind, and present only enough surface for the desired velocity. As the weighted lever holds the faces of the sails to the wind, any accident causing a break in connection between them at once stops the mill, bringing the edges of the sails to the wind. Hence the safety of this arrangement, even in the most violent gales. By moving the weight on the lever, any desired number of revolutions per minute are given, and this number is not changed, whether the wind blows ten or forty miles an hour.

Water Power.

Among important improvements which have been largely introduced of late years, is the turbine water wheel. The large wooden overshot wheels have to hold and carry all the water while its force is acting. Turbine wheels do not hold the water, but merely act from its pressure in the flume above. Hence a turbine wheel of quite small size, receiving all the force of a high column of water, may impart great force to machinery. Turbine wheels are horizontal, and the water acts at once on the whole ptrcumference. Being under water, they do not freeze. They are not stopped by the back water of a flood.

The annexed cut (fig. 126) represents the turbine wheel made by the Cortland

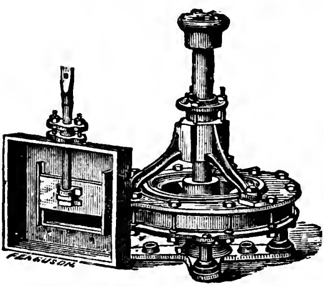


Fig. 126.—*Carley's Turbine Wheel.*

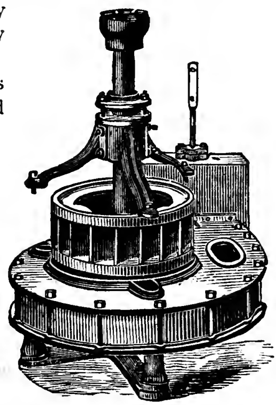


Fig. 127.—*Wheel Lifted out of Case.*

Foundry and Machine Company, Cortland, N. Y., and known as Carley's turbine. It represents the orifice through which the water is admitted to the whole circumference of the wheel. Fig. 127 shows the wheel lifted out of the case, and the form and arrangement of the buckets, which are made of steel or wrought iron, cast into the rims of the wheel, imparting to it the great strength required to sustain the heavy weight of water in the flume above.

Among the largest turbine wheels which have ever been made are those manufactured by James Leffel & Co. of Springfield, Ohio, the wheel proper being 8 feet in diameter, with a head over 10 feet. Higher heads usually require less size of wheel. In one instance they made an exceedingly strong 9-inch wheel, for 300 feet head, and with 80-horse power. One of the most powerful wheels which they have in operation is a 35-inch wheel, under a head of 64 feet, giving 400-horse power. It was made in the best, strongest and most substantial manner, mostly of steel and bronze, and the shaft was of solid forged steel. They have put four wheels in one mill, each 7 feet in diameter, each of which possesses, when run at full capacity, 460-horse power. We mention these instances to show the great power possessed by turbine wheels. J. Leffel & Co. are extensive manufacturers of turbine wheels of all sizes, and have now 7,000 in operation in different parts of the United States, from their establishment.

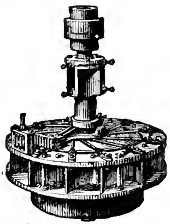


Fig. 128.—*Leffel's Turbine Wheel.*

As turbine wheels do not lose more than one-seventh or one-eighth of the whole descending force of the water, the power of any stream may be determined beforehand with much accuracy. For example, a stream which falls 10 feet, and discharges 53 cubic feet per minute, has an inherent force of one-horse power. For, as a single horse power is equal to lifting 33,000 pounds per minute, or 530 cubic feet of water to the same height, it will be the same as raising 53 cubic feet 10 feet high. Add one-seventh for waste, and it will give 60 cubic feet as required for active power. Larger streams, or higher fall, may be accurately computed on this basis.

Water may be thus employed occasionally for driving farm machinery, for threshing, grinding feed, shelling corn, and sawing wood. A wheel 8 inches in diameter, with 40 feet head, and a stream large enough to fill it, will have 8-horse power.

Farm Scales.

As every good farmer requires platform scales for weighing what he raises and what he sells by the load, as well as for ascertaining the increase in the growth of his animals upon the feed given them, it often becomes important for him to know where he can procure suitable scales possessing sufficient accuracy at moderate prices.

Edward F. Jones, commonly known as "Jones of Binghamton," N. Y., makes platform scales specially for farm use, and by not employing traveling agents, furnishes them directly to farmers at moderate prices. Portable machines, which will give the weight of from 400 to 2,500 pounds, are sold at $15 to $35. Wagon scales, with the freight paid, are sold for $50, and are capable of weighing five tons. To prove their excellence the manufacturer furnishes them on trial.

Osgood & Co. of Binghamton, N. Y., who have manufactured scales for forty years, furnish all the metal parts, including the cast-steel bearings, scale beam, &c., with freight paid, for scales weighing five tons, for $25. Timbers for the wood levers are furnished by the purchaser, and may be finished and set up by a carpenter in two days. They give rubber bearings to prevent sudden jar, for $10 additional. The price is not paid until their accuracy has been tested. Illustrated directions are furnished for setting up. Or the manufacturers will set them up for $40 and $50 respectively, and warrant them equal to the best iron lever scales.

CHURNS.

The old simple dasher churn possesses some important advantages over the newer churns worked by rotary motion, more particularly in the completeness with which the butter is separated from the wood with which it comes in contact. The Bullard churn appears to possess all the advantages of the vertical dasher churn, with great ease in working. It consists of a box without floats or paddles; and the motion backwards and forwards is rendered easy by two balance wheels. It is thus easily kept clean. Experiments show that it secures from a given quantity of cream more butter than is obtained from most of the churns in use. It is made by Bullard & Ellsworth, Barre, Mass., and Moseley & Stoddard, Poultney, Vt. The prices are $15 and $20.

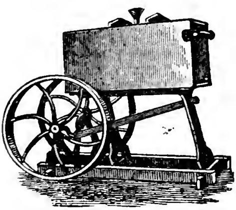


Fig. 129.—*Bullard Churn.*

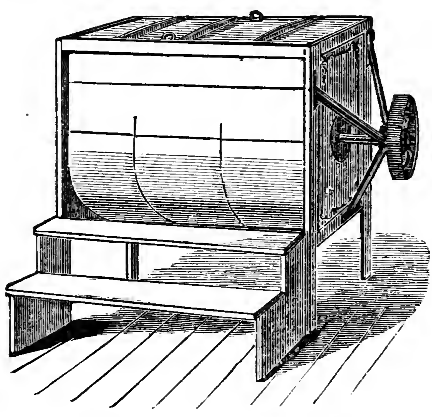


Fig. 130.—*Blanchard Factory Churn.*

The Blanchard churn (manufactured by Porter Blanchard's Sons, Concord, N. H.,) is also highly esteemed by the best dairymen for its convenience, efficiency and durability, combining as it does simplicity of design with excellence of materials and workmanship. Fig. 130 represents a large size, intended to be driven by power.

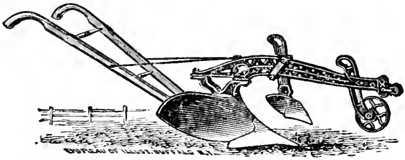


Fig. 131.—*The Wiard Chilled Cast-Iron Plow.*

THE WIARD PLOW.—The above cut (fig. 131) represents the Wiard chilled cast-iron plow, with malleable beam, referred to on page 94, and was not received in season for insertion in its proper place.

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MORE'S PYRAMIDAL STRAINER.

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THE MOST PERFECT MILK STRAINER EVER OFFERED TO DAIRYMEN,

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2d. AN ATTRACTIVE FINISH, being highly polished, and made from metal that will not rust.

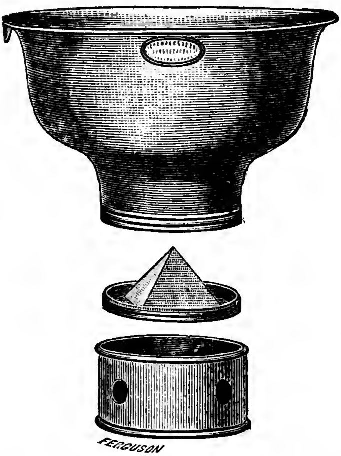
3d. A PERFECT ARRANGEMENT for detaching the Strainer for cleaning, it being attached by a coarse screw spun on the bottom of the bowl and the strainer attachment.

4th. IT WILL NOT CLOG, (if properly cleaned after using.) Being in the form of a pyramid, the milk falls on the point, and the sediment is washed off and settles at the base, leaving a clean surface.

5th. IT CLEANS MILK PERFECTLY, the wire cloth being finer than can be used on strainers of shape other than conical or pyramidal. The wire cloth used is 100 threads to the inch, making 10,000 perforations in a square inch, or as fine as the finest linen used in shirt fronts.

6th. IT CLEANS MILK RAPIDLY, it being impossible to pour milk into the largest size Strainer fast enough to overflow it.

7th. IT IS THE ONLY STRAINER that is adapted to all and every use for which a milk strainer is required. It is especially adapted, by its shape, to be used on railroad cans. For small pans the metallic rest is used, as shown in cut; and to complete its adaptability for factory carrying cans, large, broad pans, and pails for deep setting, we furnish at slight additional expense, a wire attachment adapted to the several requirements, in which to rest the strainer.



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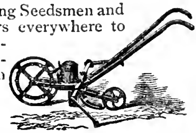

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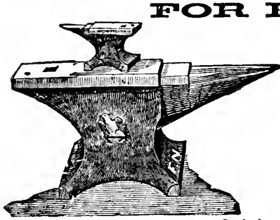

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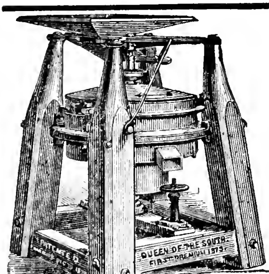

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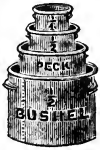

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