Horse-Powering the 19th Century Farm

A dog-powered butter churn?

By Russ Sherwin

Heavy work on the 19th Century farm made extensive use of animals, particularly horses. Hitch ol' Nellie to the plow, point her southwest; turn around at the fence and go back the other way. Repeat all day long and for days and days to come. Hitch ol' Nellie to a wagon to transport goods or people from one place to another. Ride Nellie to round up cattle, hunt for game, or take the kids to school. Oxen or mules could do much of the same work. Hundreds of machines were developed, some by farmers themselves, to plow, plant, harvest, winnow, stack, store or move stuff, all pushed, pulled or dragged by animals. No mystery to any of this, but these are all linear motions; something moves from point A to point B by means of an animal.

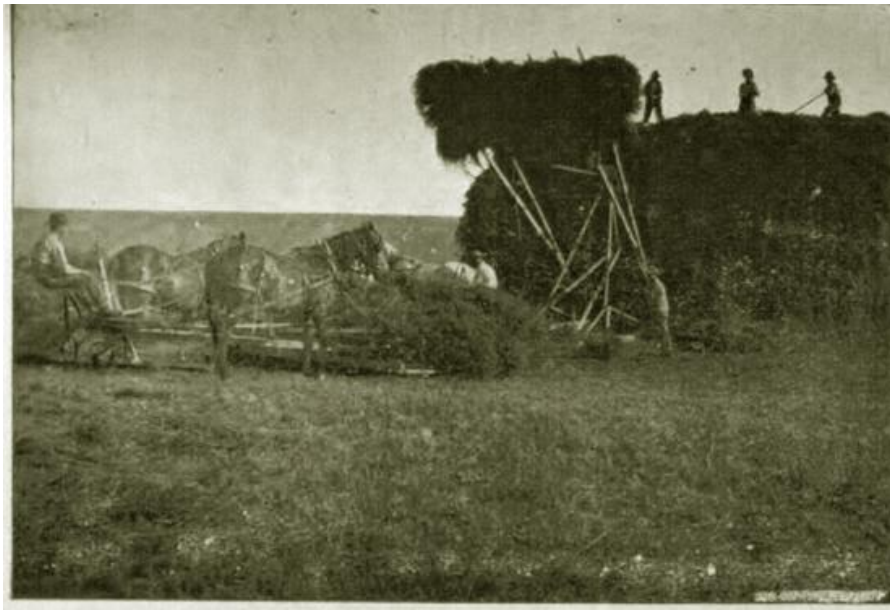


Photo: 1 - Horse powered buckrake and haystacker

A variation on this is the haystacking operation. A team of horses draws a rake to gather hay and push it onto the tines of a haystacking lift. The lift is powered by a horse or team of horses which pull a cable that raises the hay to the top of the stack and drops it. The horse(s) and their driver spend all day marching 50 feet or so along a prescribed path to lift the haystacker, then backing along the same path to lower it. The same kind of motion has been used for centuries in all countries to lift water in buckets for irrigation or to hoist things from one level to another. Linear motion, but restricted and repetitive.

In the latter half of the nineteenth century, because of advances in crop processing machinery, a need developed for stationary rotary power. Think of a threshing machine of early vintage; it needed a power source with a pulley and a belt to drive it. Well, from about the mid-1800s there were steam powered tractors that could pull things (sorry, Nellie) and also furnish belt-driven stationary power, but these were expensive, required copious amounts of water and a source of fuel like coal, oil or wood, and were not readily available to the small, generally isolated farmer in the West.

Photo: 2 - Steam tractor driving a threshing machine, late 1800s.

The best power source the small farmer had, or could readily obtain, was horses. If he didn't have his own, he could borrow or rent some for a short period of time. A horse just requires a little water and some hay for fuel and he's good to go. And it's generally scalable: Need more power? Get more horses. The problem is, how do you turn a walking horse into a rotating shaft?

One early solution was a treadmill; another was a sweep with one or more animals marching around in a circle. Power could be taken from these to drive other machinery, and a common name for all types, whether treadmill or sweep was "horse-power." We will also learn, later on, how the quantitative unit "horsepower" came to be developed.

Treadmill photos and the following italicized text is courtesy of *www.americanartifacts.com*

> *Horses were used to power machinery at least as early as the 16th century. Stationary sweeps are illustrated and described by Ramelli in 1588, and, in Germany, by Agricola in 1556. In the early 19th c. most horsepowers were still stationary and fitted with simple low speed gearing. By the 1830's, in America, both portable sweeps and railway treadmills had evolved to power the popular groundhog threshers. Many forms of gearing were developed to increase the speed of both sweeps and treadmills as required by the evolving threshing machines.*

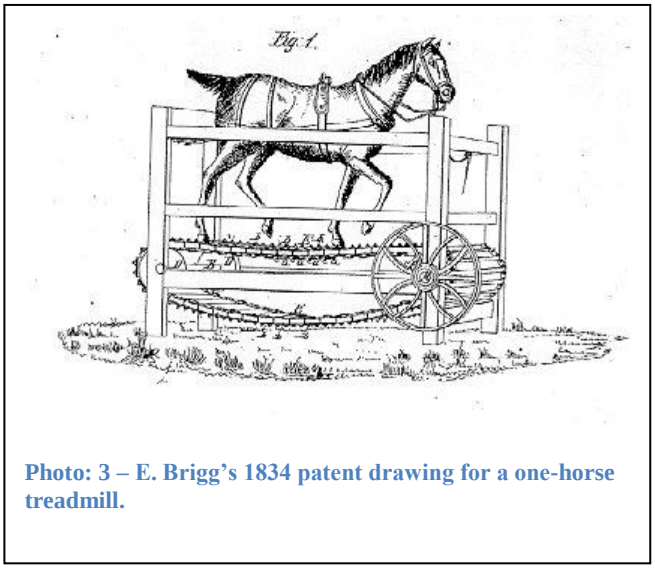


Photo: 3 – E. Brigg's 1834 patent drawing for a one-horse treadmill.

The animal treadmill for generating rotary power has two basic forms: One is shown in Photo 3, an 1834 patent by E. Briggs in which the moving platform is horizontal and the power is derived by the "draft" or pulling power of the horse.

The second form inclines the platform such that the horse is always walking "uphill." This utilizes both the pulling power and the weight of the horse and increases efficiency. Many people submitted patent designs for variations of these themes.

As treadmill development continued after the 1830's, one important improvement was the "level tread" design, where the treads remained horizontal, rather than sloped upward. This provided a surer footing for the horse, and less leg strain. The Heebners of Montgomery county, PA, first patented a level tread for their toothed chain treadmill in 1871. The triangular links allowed an inclined lower surface and a horizontal upper surface, resembling a mini-escalator. In 1883, the Heebners received another patent for an improved level tread, now using iron cross rods to secure the links on opposite sides of the track, rather than relying on the tenoned wooden treads to do this.

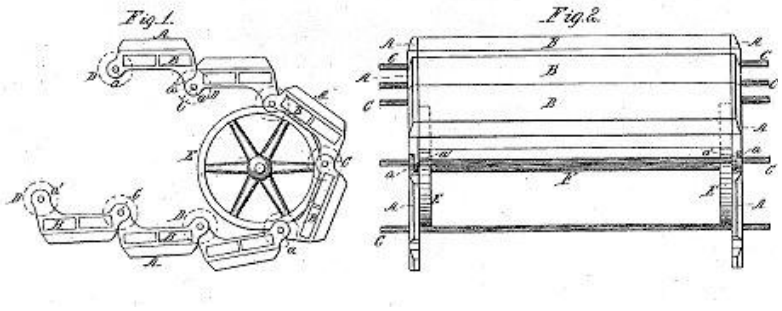


Photo: 4 - The 1871 patent drawing of a level-tread treadmill developed by Heebner.

Treadmills were designed for a wide variety of animals besides horses and mules, including dogs, sheep and goats.

Jefferson Wilson, of Beaver Falls PA, patented a treadmill churn power on Sept 21, 1880. Designed to fold into a small space, this machine also featured an inner ring gear on the track drum, which was geared to the flywheel for increased speed.

These small treadmills provided both rotary and reciprocating power to operate light machines like butter churns, grind stones, fanning mills, corn shellers, and later, cream separators. They generally use two India rubber or leather belts rather than iron links to form the chain of wood treads. The few surviving dog treadmills have become popular attractions at engine and farm shows across the country. And the dogs seem to love running the mills, much as a hamster in an exercise wheel.

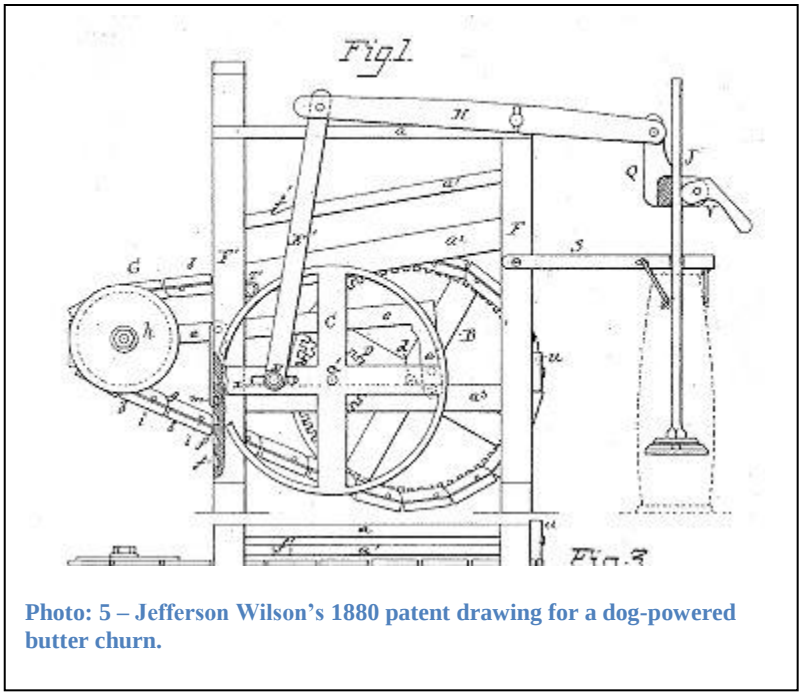


Photo: 5 – Jefferson Wilson's 1880 patent drawing for a dog-powered butter churn.

Although simple, compact and practical for small jobs requiring small amounts of power, treadmills were not easily scalable. Practical limitations constrained the designs to two horses at most.

With the ever increasing demands for power, a new machine came in the latter part of the 19th century in the form of the multi-horse sweep, a merry-go-round device that would, theoretically, accept as many horses as you had room to harness to the wheel. There were, of course, practical limitations to this as well.

They go by various names, and there were dozens of manufacturer each with variations on the theme, but one common term for the sweep or merry-go-round type of machine was, uniquely enough, a 'horse-power.' It was also called a 'sweep-power', or simply a 'power'. Wylie Sherwin, about 16 or 17 at the time, (around 1912) describes one such machine in his Journal:

> *Now, a "horse-power." It is a merry-go-round with real live horses, but they don't gallop, they plod around the ring. [There are] eight teams, sixteen horses, each team hitched to a pole called a sweep and their lead rope tied to the sweep in front of them. In the center there was a huge, horizontal log wheel called a bull wheel. This wheel was about six feet across. Then there was a pinion wheel of perhaps ten inches in diameter and a tumbling rod which ran along the ground and over which the horses had to step. In the center there was a platform over the bull wheel and here the driver stood and cracked a long whip over the horses' backs.*
>
> *This was the power we used for threshing. It was always my ambition to get to drive the horse-power, but I never got to, for this job was usually given to one of the older men who were less able to do the hard work and considered better with horses. This was an excellent place to break young horses. Once they were hitched in and tied to the sweep in front, they had to cooperate sooner or later. There was nothing they could do. They couldn't stop for they were pulled from in front, and pushed from behind. They couldn't run away without taking fifteen other horses with them and then no place but around the ring. However, I have seen it happen that the whole sixteen got excited and ran away at once. And that is a mess, for there is seldom any way to stop them until one horse*

stumbles over the tumbling rod and then there is a big pileup and considerable damage to be repaired.

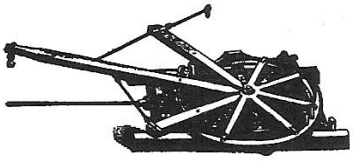
I can see that old horse-power yet in my memory. I can hear the whine of the pinion, the creak of leather and in warm weather there was the smell of the sweaty horses. In cold weather, the driver with a long sheepskin coat, fur cap and mitts, and all the clothes he could get, for he stood up there in the wind, frequently taking the dirt from the machine and only a four foot platform to stomp around on to keep from freezing.

To expand a bit, the large horizontal wheel that the horses turn drives the small vertical wheel as a gear. The 'tumbling rod' is the output shaft from the pinion gear that is the power take off point from the machine, used to drive whatever machinery you need to drive. It extends out beyond the circle in which the horses walk, so the horses had to step over this rod each time they came around. The power take off pulley on the end of the tumbling rod would turn about 7 or 8 times faster than the horses are turning the large wheel, based on the size ratios Wylie has described. Other versions produced higher RPM by means of more elaborate gearing. The original patents were held by Dingee and Woodbury, and a prominent manufacturer of those designs was J. I. Case Company.

A simple analog of the horse-power is a hand-crank eggbeater. If you lay the eggbeater horizontally and attach a miniature horse to the crank, as he walks around he will turn the beaters. Of course he has to jump over the beater shafts each time he comes around (and in the case of the eggbeater, he has to jump over the handle too). In place of one of the beaters you affix a pulley with a belt to a threshing machine. A very small threshing machine to be sure; but then, you have a very small horse.

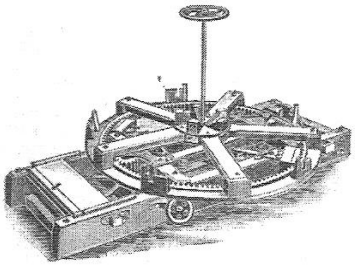
Photo: 6 - Eggbeater

Several variations of the horse-power machine and their manufacturers are illustrated in the photos below. These pictures only show the mechanisms. The arms that extend out from the center to which the horses are harnessed are not shown. All of them work fundamentally the same way. The differences are in the implementation. Some are designed to be easily movable on wheels. Some are designed to have a higher RPM output by means of sophisticated gearing. Some are expensive, some are cheap. Some worked quite well, others gave farmers a lot of trouble.

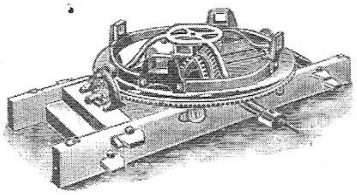


OLD STYLE, SINGLE GEAR POWER, USED BY PITTS.

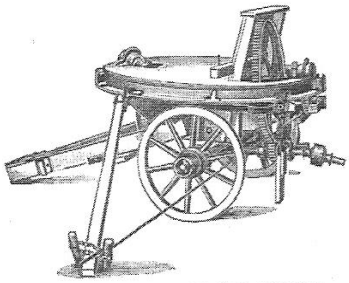
PITTS-CAREY POWER, MOUNTED.



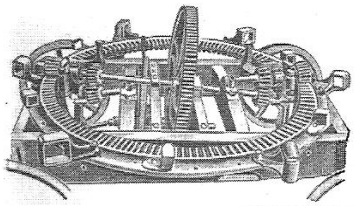
DOUBLE PINION PITTS-CAREY POWER.

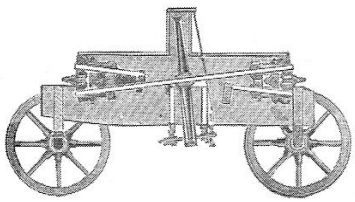


J. I. CASE'S CLIMAX POWER.



WOODBURY POWER ON TWO WHEELS.





THE DINGEE-WOODBURY POWER.

Photo: 7 - Several variations on the horse-power machine made by different manufacturers. From *American Agricultural Implements* by Robert L. Ardrey, 1894, now in the public domain through Google.

An interesting side note relating to the horse-power machines is how the quantitative unit of 'horsepower' was developed in the first place. We all understand that our car's engine is rated in horsepower, but few of us understand just what that means or how it came to be termed that. It has something to do with horses, probably, but what?

Well, in the sidebar, an excerpt from *300 Years of Farm Implements* by Ronald Stokes Barlow, describes what the numerical unit of 1 horsepower is based on.

The horse-power machine was a relatively short lived phenomenon due in part to the increasing power demands of the rapidly developing farm implement industry. After all, even a 12-horse horse-power can develop at most, well, 12 horsepower. And, a circular horse-power is a fixed source of power; what was increasingly needed was a mobile power source. Steam tractors, huge, heavy, wheezing, clanking monstrosities became the power source of choice before they themselves were replaced by petroleum based internal combustion tractors.

Wylie Sherwin recounts in his Journal their transition to steam power on the farm on Crooked Creek, Bighorn Canyon, Wyoming:

> *And I remember the first steam machine we had there. Jim Legg bought one. It wasn't new, but it was quite a thing out there and it replaced an outfit [the horse-power] that was probably the last of its kind to be used in this part of the country. The first time the steam rig was used on our place, we had an accident and some thought I was lucky not to have been killed or badly hurt, and I guess I was.*

How the quantitative unit of "horsepower" came to be defined

At some time in the past, farmers found that a tread mill could be used to capture animal power as a source of "brake" horsepower for stationary machines. The unit of measurement of force of strength necessary to operate these new stationary machines became known as "horsepower" based on the average pulling power of an average draft horse.

Typically, the average draft horse was considered as having the "tractive" power to pull 1/8 of its weight for 20 miles traveling at 2.5 miles per hour. (Ronald Stokes Barlow, *300 Years of Farm Implements* [Krause Pub.: Iola, Wisc., 2003] p. 24.) Thus, a typical 1,500 pound draft horse could develop 33,000 foot pounds per minute which became defined as one horsepower (hp.).

By changing the nature of the power of the average horse from tractive pulling power to a stationary source of power, the treadmill actually improved on the horse's ability. A 1000 pound horse on a treadmill inclined at a rate of 1 to 4 (an incline of one inch up for every four inches of length) could develop 1.33 hp. A 1600 pound horse on the same tread mill could develop 2.13 hp. (*Ibid*.)

We were threshing in the yard close to the house, for we wanted the straw to cover a new shed we had built. The machine was in place and steam was up ready to go, but there were one or two men who hadn't showed up yet, so we were waiting. I was to drive the grain wagon and I had the team and wagon backed up to the grain spout at the machine. I was driving "Barney and Chub", a team of bay geldings. There were well broke but nervous about the steam engine. It was early morning and very cold and everyone had gone to the kitchen to keep warm until the work started. That is everyone except Jim's dad who was tending the engine.

Photo: 8 - A steam tractor, early 1900s from which power could be taken to drive other machinery, like threshers.

I had wrapped the lines around the brake lever and I was standing by the kitchen door watching my team, for I knew they were on edge. Then things happened. The men showed up, and Mr. Legg, Sam, anxious to use the whistle, pulled the cord to signal "all ready." I happened to be where I could see Sam as well as the team and the instant he raised his hand I knew what was going to happen and I started for the team. No race horses ever got off to a faster or more perfect break than that team, but I was in time to grab Barney by the bit and away we went.

Directly in front was an ice house built of large logs. This was built in a bank several feet high so that the front was perhaps eight feet high and the back corner about five feet above ground. We were headed to just shave the side of this building with me between the horses and the house. I didn't have time to think, so I guess you just call it instinct that causes one to do the right thing in a case like that. Or else some higher power than our own takes over.

I couldn't have turned loose without being hurled into the corner of the ice house, and probably struck by the wagon. There wasn't room for me between the horse and the logs, so with one hand on Barney's neck and one on his [harness], I vaulted to his back and just in time. The right front wheel, my side of the wagon, missed the first corner of the ice house, scrubbed along the logs and caught on a log end at the back. This threw the wagon tongue with great violence against Barney's legs and at the same time brought us all to a sudden and violent stop. Barney was thrown flat with Chub on top and I went

sailing through the air. That was the first time Barney [had ever been] ridden! I don't think he ever remembered it though – it was too short a ride!

If you visit even a medium sized farm nowadays, you will find great green, blue, red, orange or yellow machines rolling across hundreds of acres of perfectly groomed and level farmland, planting, harvesting, bailing, threshing, packaging and delivering all manner of farm goods. They are fully enclosed and air conditioned, they follow paths determined by GPS, they are self-propelled by enormous diesel engines, they are equipped with stereo, am-fm receivers, radio communications, refrigerators for cold drinks and plush leather seats. They are also very likely commanded by 16-year old girls working their first summer jobs between high school classes.

It was not always so easy.

On Sun, Jun 20, 2010 at 7:34 PM, Richard Van Vleck <richard@americanartifacts.com> wrote:

> Hi Russ,

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> Yes. feel free to use the treadmill images in your publication. A credit to:

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> "americanartifacts.com" would be much appreciated.

>

> Richard Van Vleck

> American Artifacts