

Wagon and Carriage Jacks at ACM

A variety of vehicle lifting jacks,
several of local origin

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Industrial Survey Volunteer
November 2023

Amesbury Carriage Museum
Amesbury, MA

Wagon and Carriage Jacks

Nineteenth century vehicle manufacture was a local business of 10,000 wagon and carriage makers throughout America¹, and thus arose Amesbury's opportunity to become a carriage production center. Many vehicle jacks were similarly made by local carpenters and blacksmiths, most being unsigned and many a bit rustic. Another period aspect was a relatively high population of local iron foundries, making it more convenient than today for small businesses to obtain custom castings and forgings (Amesbury had two brass foundries until recently, and still has one). It is consequently common for many vehicle jacks to have cast components, especially "stairstep" castings for the stairstep style of jacks that were among the most common forms used. It may also be that some of these castings were commercially distributed hardware made available for craftsmen to use in locally made products.

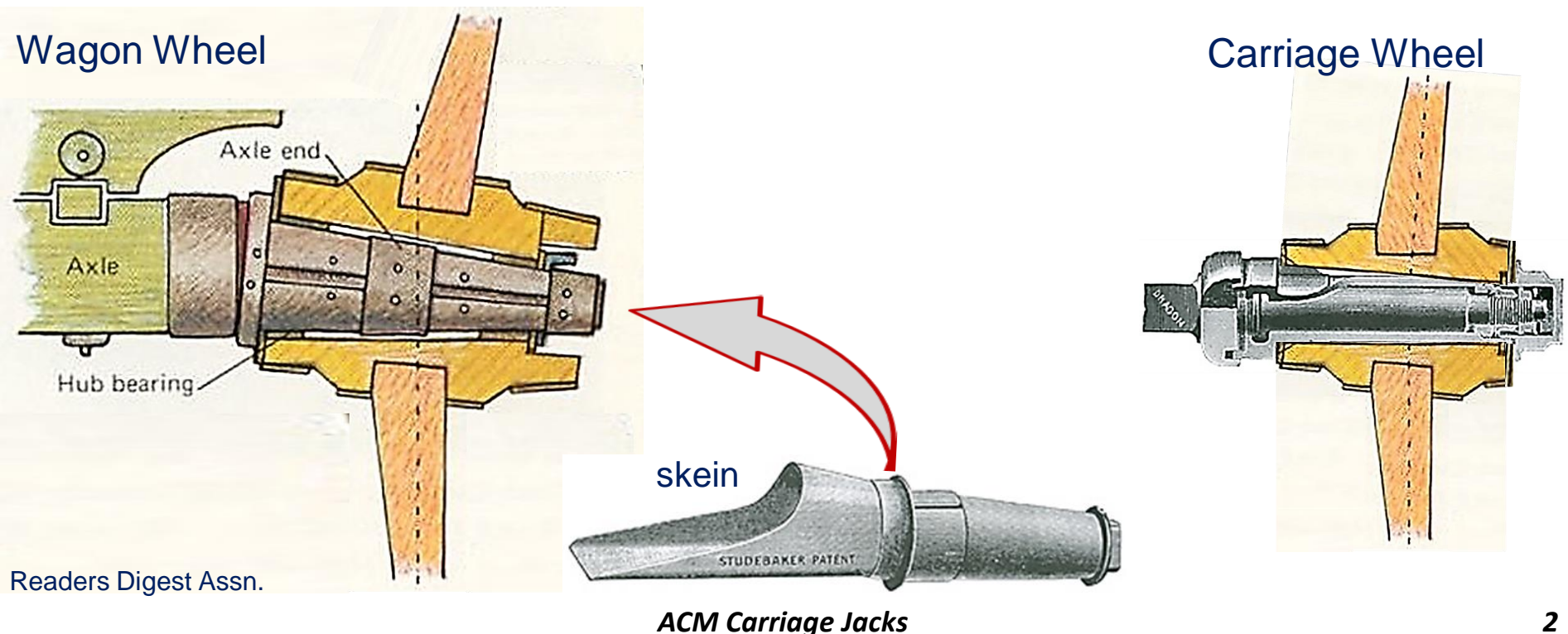
There is no particular distinction among jacks for their applicability to wagons as opposed to carriages, although carriage jacks could be of lighter weight capacity and sometimes had protective buffers to prevent scratches and damage to a finely painted carriage axle. But even wagon jacks became lightweight in the coming age of metal automobiles, so that wagon and carriage jacks were largely discarded during the 20th century. Being typically unmarked and anonymous, it is often difficult to determine what a particular jack is and whether to consider it a piece of local history. A convenient aid is the occasional ability to associate a patent with a device, although in many cases the patentee was elsewhere producing something that found its way here. Fortunately, a few ACM jacks are signed and several others can be clearly identified as of relatively local origin. Lastly, the world of mechanisms is so vast that there certainly are more carriage jack devices than have been presented in the following.

1) *American Carriage Directory*, 1891, Price, Lee & Co., New Haven

Wagon and Carriage Axles

New cars arrive with jacks that can lift a vehicle nearly a foot to allow for tire flatness and droop of wheel suspension. Nineteenth century vehicles had iron tires that never went flat, on wheels having no direct suspension, immediately implying that jacks were less often used and needed only to lift a wheel a few inches for removal and replacement. Occasional repairing might have required such, but a more frequent need would have been re-grease-packing of wheel journals.

Work wagons were generally heavy-duty wood vehicles having massive wood axles and journals to carry heavy loads. Wood journals were thus large in diameter, for strength, and sheathed in iron or steel skeins, as shown below. In contrast, carriages were intentionally light, having iron axles with slender journals. Journals on both had grease grooves for lubrication, but carriage journals could run much longer without servicing. Work wagons needed more frequent grease packing, and farmers would have maintained their own equipment. In either event, easily usable jacks were a relatively universal need, and a variety of mechanisms could perform the task.



Lever-Style Wagon & Carriage Jacks

examples shown here do not belong to ACM

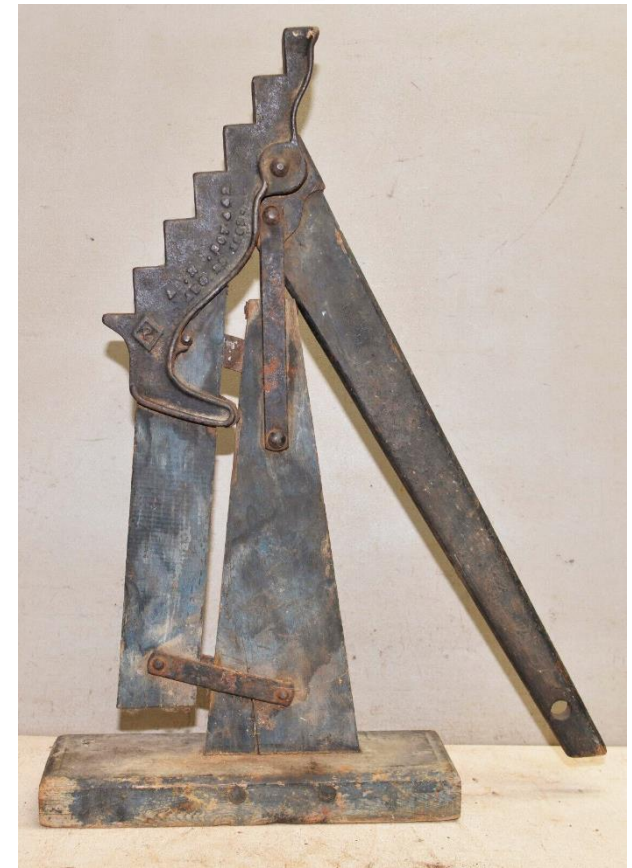
Not every ACM carriage jack is shown herein, but a variety of mechanisms is presented that yield a reasonable idea of what existed in the field. There were more complicated rack and pinion jacks, seen at right, but most jacks of the day were forms of lever jacks as shown below. That at left is of nearly all wood, likely made by a local carpenter and requiring no special metal parts. The middle version is mostly of hand forged iron with a wood base and post, and an iron latching rod holding the lever in its “down” position. At right is an all-metal industrial version ca. 1900. It has a conventional lever mechanism with a handle and linkage system, as with most ACM jacks.



Prices4antiques.com



ebay.com (3)

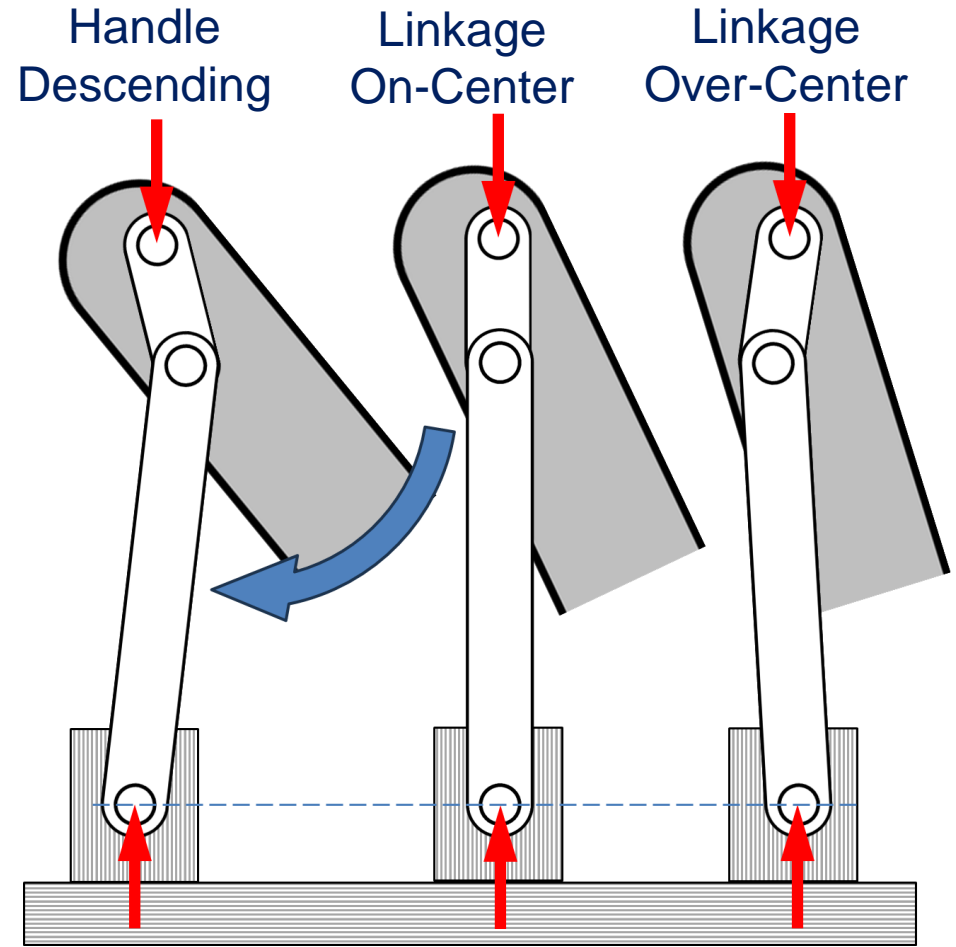


ACM Carriage Jacks

Lever-Jacks and Over-Center Locking Effect

Most jacks were of the stairstep style having a lever and linkage system. With the lever in its upward position, the jack is situated with a stairstep of correct height placed under the axle to be lifted (some jacks had an added adjustable step for lower heights). The lever was then pushed downward until stopping near the ground, where it should have remained in place, hands-free. If not designed to remain down, the lever must then be latched into place, as with the middle jack on the previous page.

The diagram at right shows a linkage in three different positions; the downward load being lifted is shown as downward red arrows. Bottom red arrows are the reaction force on the linkage of the ground supporting the load being lifted. In the left view the links are approaching their On-Center position in which the links align end-to-end. Prior to reaching On-Center, the pinching force of the two red loads tries to rotate the handle upward, which must be resisted by the operator pushing down the handle. Once Over-Center, pinching of the two red loads tries to rotate the handle down, so that the operator need not apply any force, and the handle will rotate downward until stopping against the ground or some part of the jack.



In practice, loads create friction in the linkage and the handle has weight, both tending to keep a jack locked in positions that are very near On-Center alignment. Also, at On-Center, the load stops rising, and then begins descending as it passes Over-Center. (Over-Center effect is commonly used to lock “toggle clamps” that operate exactly as shown here.)

Three Main Assemblies in a Jack

stationary structure, moving structure, lever & (usually) linkage

The base and a rigidly attached vertical piece form the stationary structure. The lever can be pinned (pivoted) to either structure: stationary below, or moving right (both).



ACM photos

One end of an intermediate link is pinned to the lever (handle) while the other link-end is pinned to the structure that the lever is not pinned to.



The moving structure is either pinned to, or captured by, the stationary structure: single pinned at left, double pinned at right, vertically sliding above.

Simple, Folksy, Latching Lever-Jack at ACM

This is among the simplest of jacks, made by local (somewhere) craftsmen with little likely production or distribution compared to industrial products. The lever is the only moving structure, with no additional linkage. It is essentially a crowbar. The horizontal hand-forged iron bar is attached to the lever (handle) outer end and passes through a slot in the vertical stationary wood structure. As the lever is pushed down, a set of ratchet teeth on the bottom of the iron bar ride over a transverse pin passing through the slot in the wood structure. Once totally down, the rod ratchet teeth prevent the handle from rising back upward. Having a fixed height, this jack would have to be elevated on a block to reach higher axles.



ACM photos



Lever-Jack with Linkage but no Over-Center Locking

This is not an ACM jack but is shown as another example of a device lacking over-center locking. The moving structure slides vertically in a track formed by the stationary structure. The lever has a swing link that accommodates the difference between the linearly sliding vertical motion and the rotary lever motion. However, the linkage never passes over-center, so that as the lever is pushed down, a ratcheting device on the right side (red arrow) prevents the lever from rising again when released.

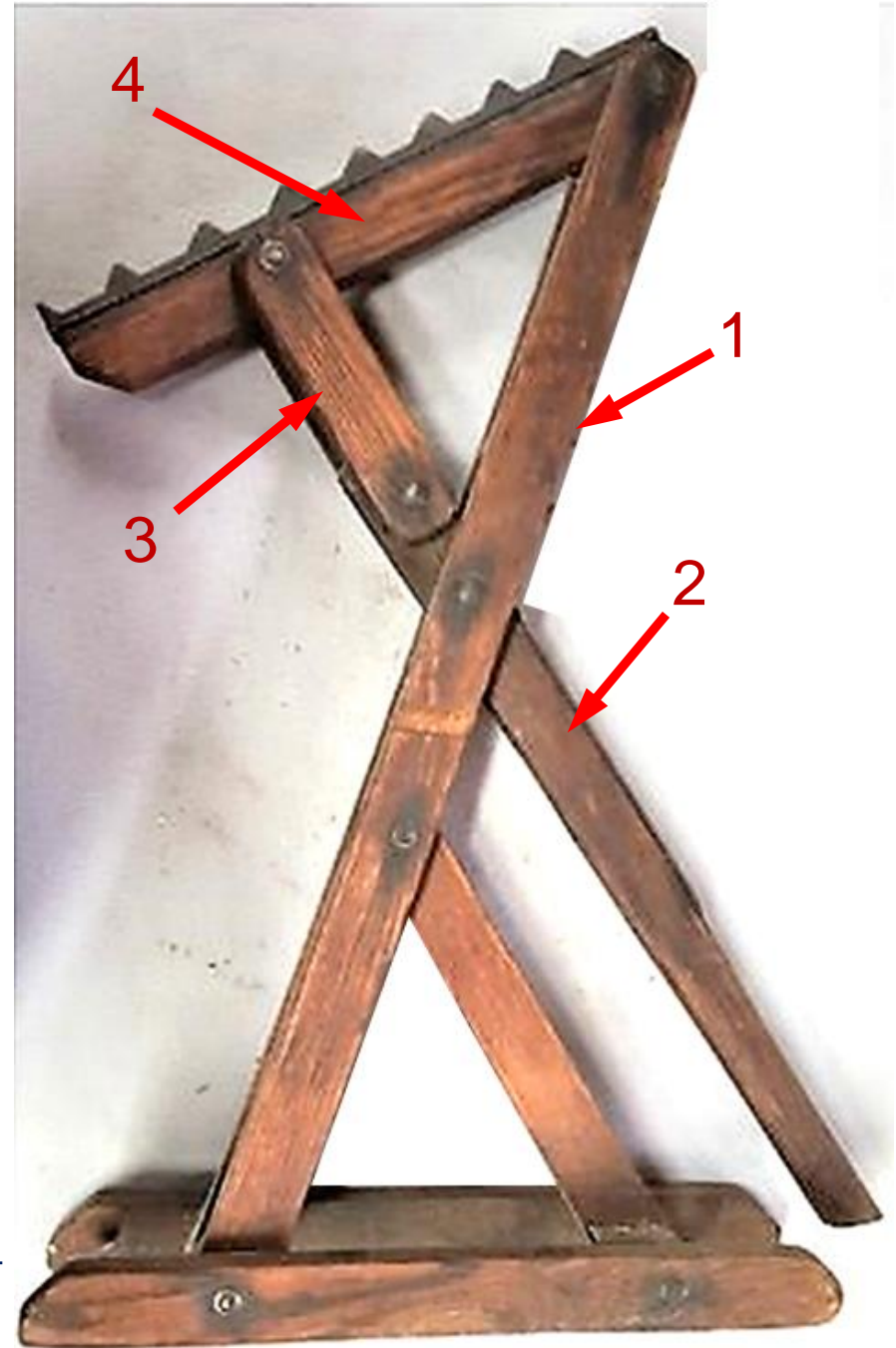
<https://www.quora.com/How-did-people-replace-wagon-wheels-before-the-hydraulic-or-scissor-jack-was-invented>



Simple, Folksy Lever-Jack with Over-Center Linkage

As with previous folksy ACM jacks, this appears to have been made by a local carpenter, with a cast iron set of steps attached. The stationary structure is shown below, to which the lever (handle) is pinned. The moving structure is simply a wood bar with the cast steps, which pivots about a pin at one end. The intermediate wood link (3) can be seen to be on-center (right), where the link stops against the stationary structure. This design seems to have been somewhat commonly used for light weight jacks.

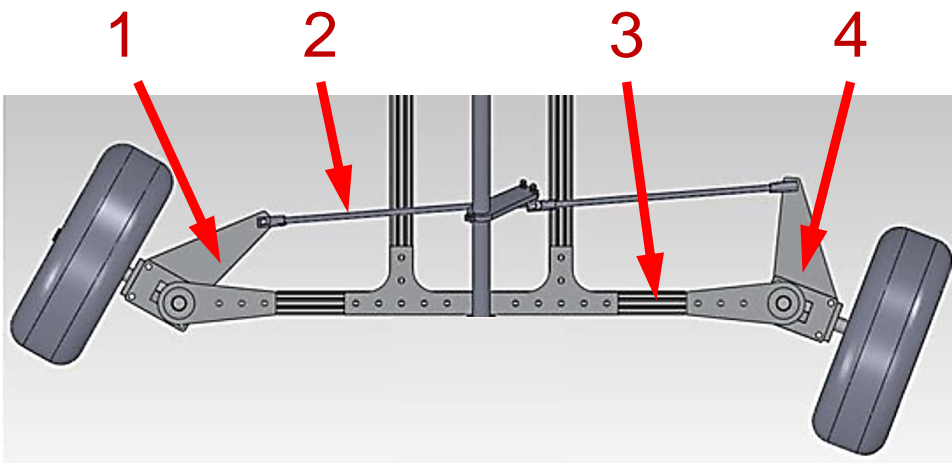
Also seen at right, the operating device is a four-bar linkage, several forms of which appear in carriage jack mechanisms (next page and elsewhere).



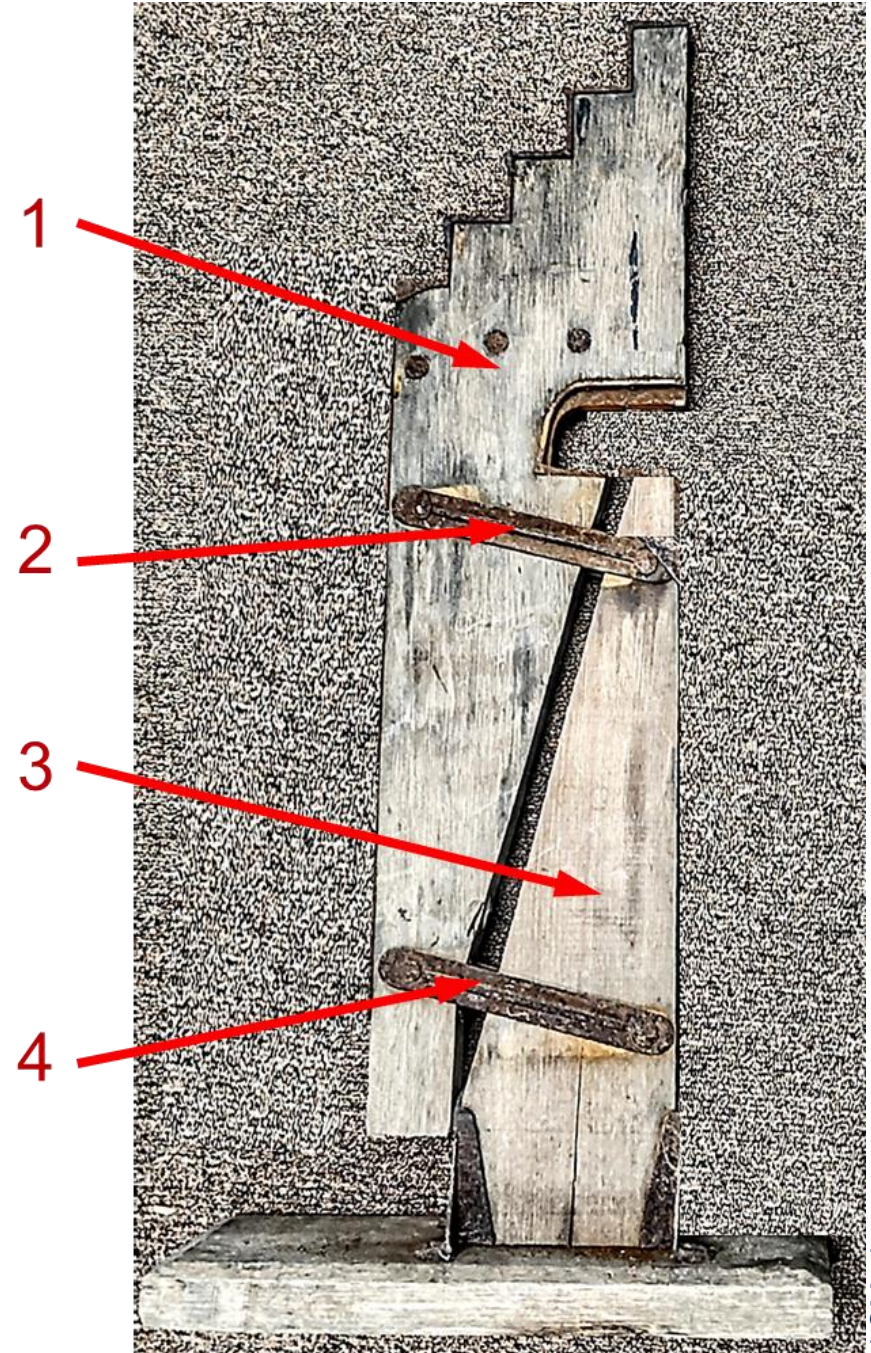
ACM photos

Four-Bar Mechanism of Stationary and Moving Structures

A very common style of assembly for wagon and carriage jacks is to join the stationary and moving structures into a four-bar mechanism using two links of equal length, as seen at right. (Equal length is not mandatory, but eases manufacture by demanding only one length of link to be made.) The example shown is by the Joy brothers of Newmarket, New Hampshire. Four-bar mechanisms are widely used in all manner of machinery, the example below being of a common steering system used for automobile front wheels. There is obviously wide latitude in mechanism shapes that constitute the four bars, even within carriage jacks, but the concept remains fundamentally unchanged.



Infinity Mfg. YouTube



ACM photo

ACM Prescott Standard Jacks (2) and Patent Markings

Edwin A. Prescott (1841-1931) was born to old families in Hampton Falls, New Hampshire, both parents being of the Prescott surname. These were all farmers, a nearby farming family being Lane, of which one branch sent to Amesbury T. W. Lane and three of his brothers who all entered the carriage business. Prescott's father died when Edwin was twelve, but by age twenty he had his own farm. He married in 1873, at which time he was listed as in the lumber business. With the improving economy of 1878 he was awarded U. S. patent 207442 for a wagon/carriage jack of the design seen on following pages. By 1880 he was living in Arlington, MA where he manufactured jacks and other products, mainly of wood construction but some of metal. He was thereafter listed as an inventor or manufacturer, his family remaining in and being buried in Arlington.

The top picture at right is of an ACM Prescott jack that had remained unidentified until the signed example at bottom was found online. It can be seen that the casting pattern at top had deteriorated such the patent information had become un-interpretable. The information, in fact, relates to two patents: one being #207442 (original 1878 patent), the other being of patent date August 25, 1903 (patent 737,016).



ACM photo



Worthpoint.com

Prescott's Standard Jack, 4-Bar Mechanism

Over-Center locking jacks by Edwin Prescott of Hampton Falls, then Arlington, MA

Early Prescott jack at ACM

“Prescott Standard No. 1
Boston Mass.”



ACM photo

Two early examples to the 1878 patent 207,442 that is embossed on the iron step castings. On the ACM jack at left the wood handle has been shaped around the upright post so that the linkage can pass over-center. There has been wear of the wood where the two pieces come together.



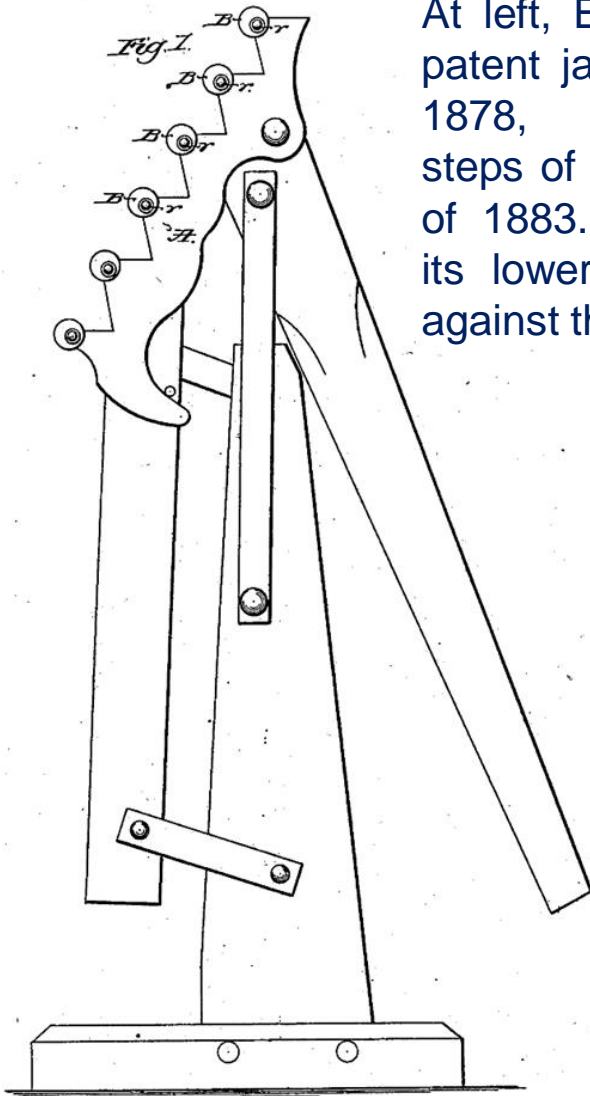
Example at right signed on vertical stationary structure

2010 Spring Auction, Ann Arbor, Mich. Icollector.com online auctions

Prescott's Jack with Front Wheel & Buffered Steps

with handle up, wheel is down and rolls forward under axle to be lifted

At right, an unusual Prescott jack mechanically rearranged into a different structural shape. The steps have rubber or leather buffers on their faces to avoid damage to nicely painted axles on fine carriages. David True of Amesbury patented (323,237 of 1885) a similar feature



At left, Edwin Prescott's patent jack (207,442) of 1878, with buffered steps of patent 272,899 of 1883. The handle in its lower position stops against the upright post.

At right, the handle is again shaped so as to reach over-center on the linkage, but then stops against the linkage rather than the wood upright. See next page.



Later Prescott Jack at ACM

step casting having un-interpretable patent marks previously shown

Embossed lettering on the step casting of the ACM Prescott jack at right refers to both the 1878 patent (number 207,442) and the patent of August 25, 1903 (number 737,016). The main feature of the latter patent is that, as the handle reaches its lowest position, the step casting stops against the linkage (red arrow) without wood-to-wood contact that could cause wear of the wood as seen on the second-previous page. Also in the patent, at the lever-up position the bottom of the movable structure stops against the horizontal wood base plate.

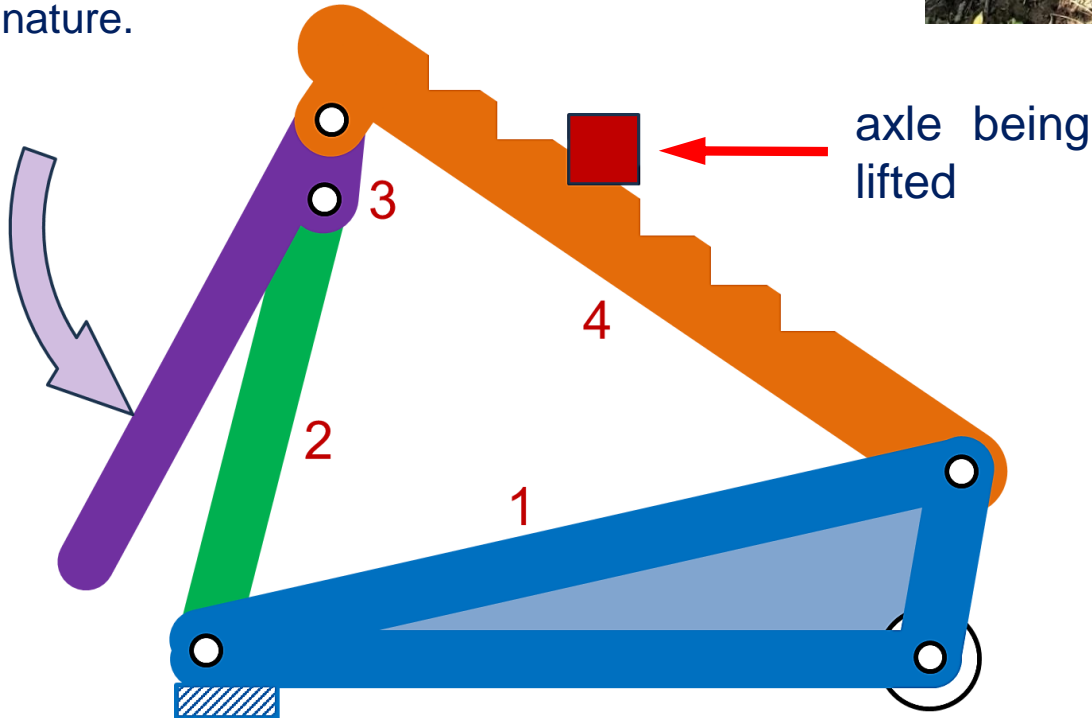
It is thus perhaps notable that neither of the above two patent intents are met on the ACM example. At handle-up the moving structure does not touch the base plate, and at handle-down, the handle stops against the wood upright rather than against the linkage.



ACM photo

Primitive Four-Bar Jack with Over-Center Locking

Shown here is a carpenter-made ACM jack that supports its load on two feet. The front foot is a roller so that the jack may be rolled in under a carriage and the axle to be lifted. The rear foot is a simple pedestal to stand the jack upright. The jack is a four-bar mechanism, one of the bars being the handle. The blue assembly at bottom functions as a single rigid structure. Such jacks are conveniently made from lumber and standardly available hardware, and are thus a bit common but are sometimes factory made. They are frequently of a rustic functional nature.



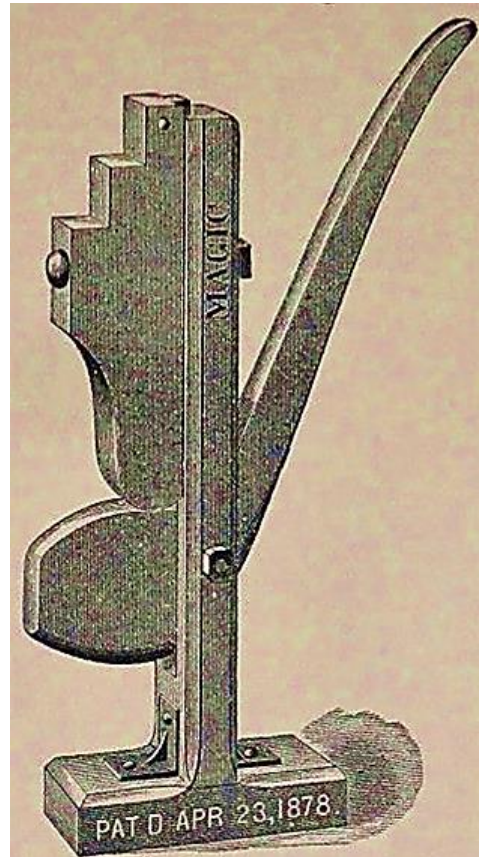
Circular Cam, Rather than Linkage

rollers are desirable but optional

These are elegantly simple devices having no links. Jacks at middle and right can incorporate a roller wheel (next page). The middle version is all of wood while working parts at right are of cast iron. Sliding action in both would require lubrication. Integral with the lever, in any case, is a shaped cam section that rotates around the lever pivot pin on the stationary structure (circular motion). While many circular cams in machinery rotate continuously in one direction, these oscillate in the limited range of handle motion to raise and lower the moving structure. In the example at left the roller is on the lever (handle) that is attached to the stationary structure. These cams function to achieve over-center operation that keeps the moving structure raised, hands-free.

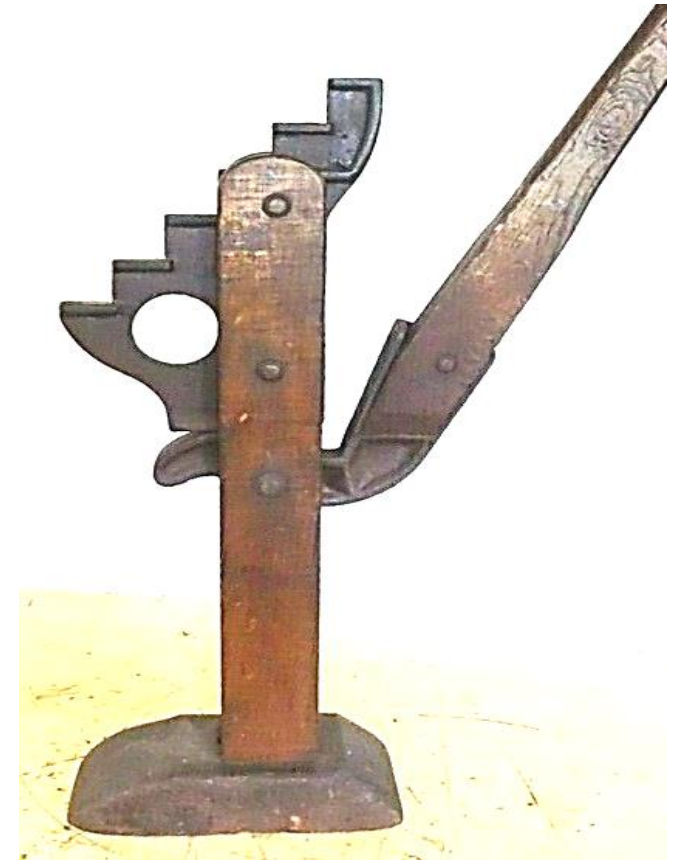


ACM photo, Joy Bros. jack



ebay.com

ACM Carriage Jacks



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Circular Roller Cam Jack at ACM

this cam action is capable of Over-Center locking, but does not function here

The roller is on the moving structure in this device. The moving structure slides slightly off-vertical directly against the sloping face of the stationary structure, captured by a bolt in each of the two structural pieces passing through a slot in the mating piece. The front edge of the moving structure has four holes for an adjustable step (missing). This example has been mis-assembled such that system motion stops just short of On-Center (at right), and load can thus raise the handle.

Slightly more system motion would solve the problem.



Vertically Sliding Moving Structure, Over-Center Linkage

captured moving structure slides freely up in a track on the stationary structure
 There are various versions of vertically (or near vertically) rising moving structures, including one in the Joy brothers section to follow, as well as this ACM device. The moving structure here also has a group of formed slots that accepted an added adjustable step that remains attached to the jack by a chain. The adjustable added step piece on front was a somewhat common concept that could be accomplished in several ways.

A now-missing adjustable front step, retained on the jack by a chain, can be set at different heights.



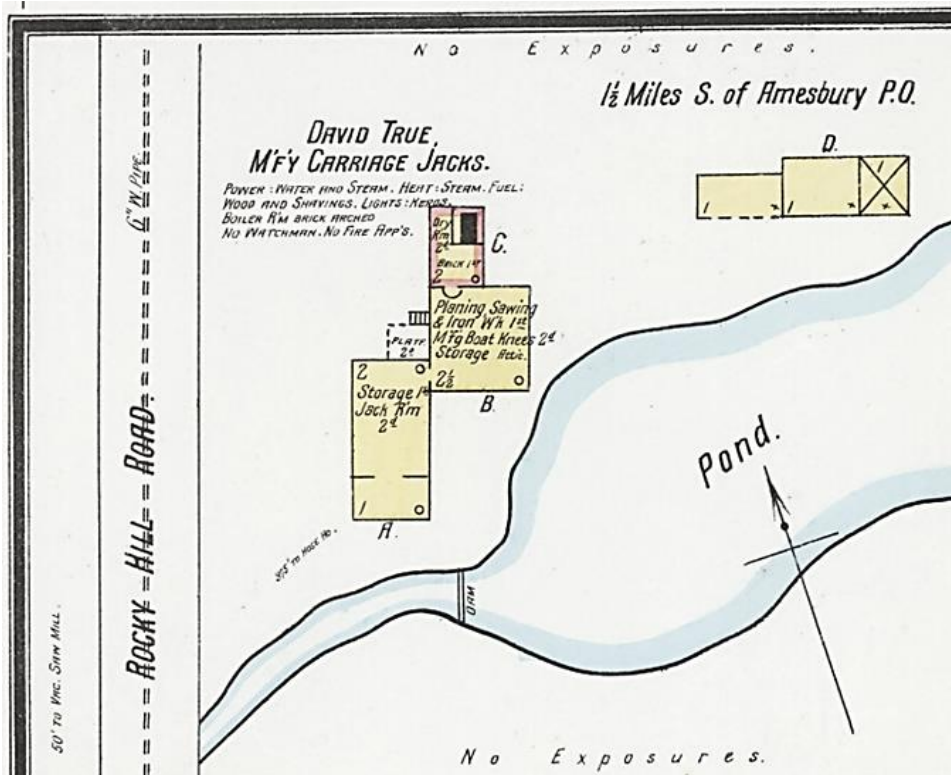
ACM Carriage Jacks



ACM Carriage Jacks (2) by David True of Amesbury

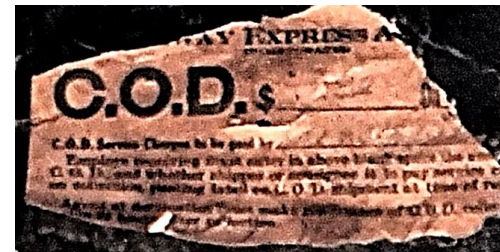
From about 1870 to 1905 David True was located on Rocky Hill Road where the first house below Rt. 110 is now located, across from the Irving gas station. Having both a small amount of waterpower and a small steam engine, he made carriage jacks of his own patented design, plus ships' knees and sometimes wheel hubs. Across Rocky Hill Road, directly behind the Irving station, was a separate small water powered wood mill performing sawing and planing.

David True's jack was designed to conveniently lift light vehicles (carriages). The jack would be placed between the wheel and carriage body with its step projecting in under the axle to be lifted. The operator stood outside the wheel without having to stoop or kneel¹. Because carriage wheels were 3-4 feet in diameter, the jack is tall enough that a person could reach over a wheel and work the jack.

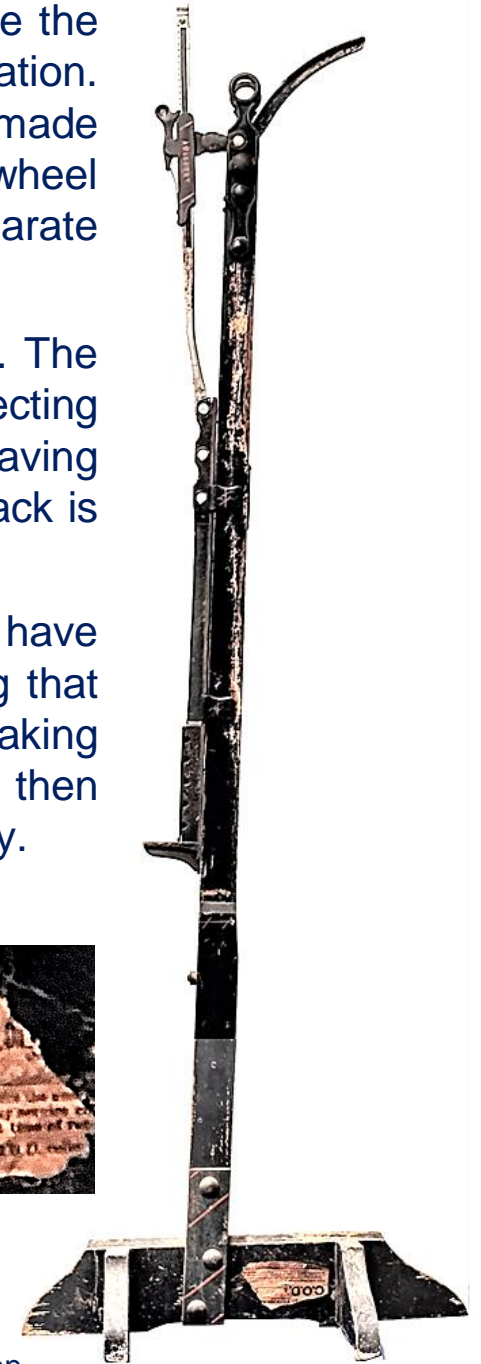


1904 Sanborn Insurance map, sht. 2

Several True jacks have COD labels, suggesting that he was advertising, taking mail orders, and then shipping FOB Amesbury.



1) Patent 308,643, description

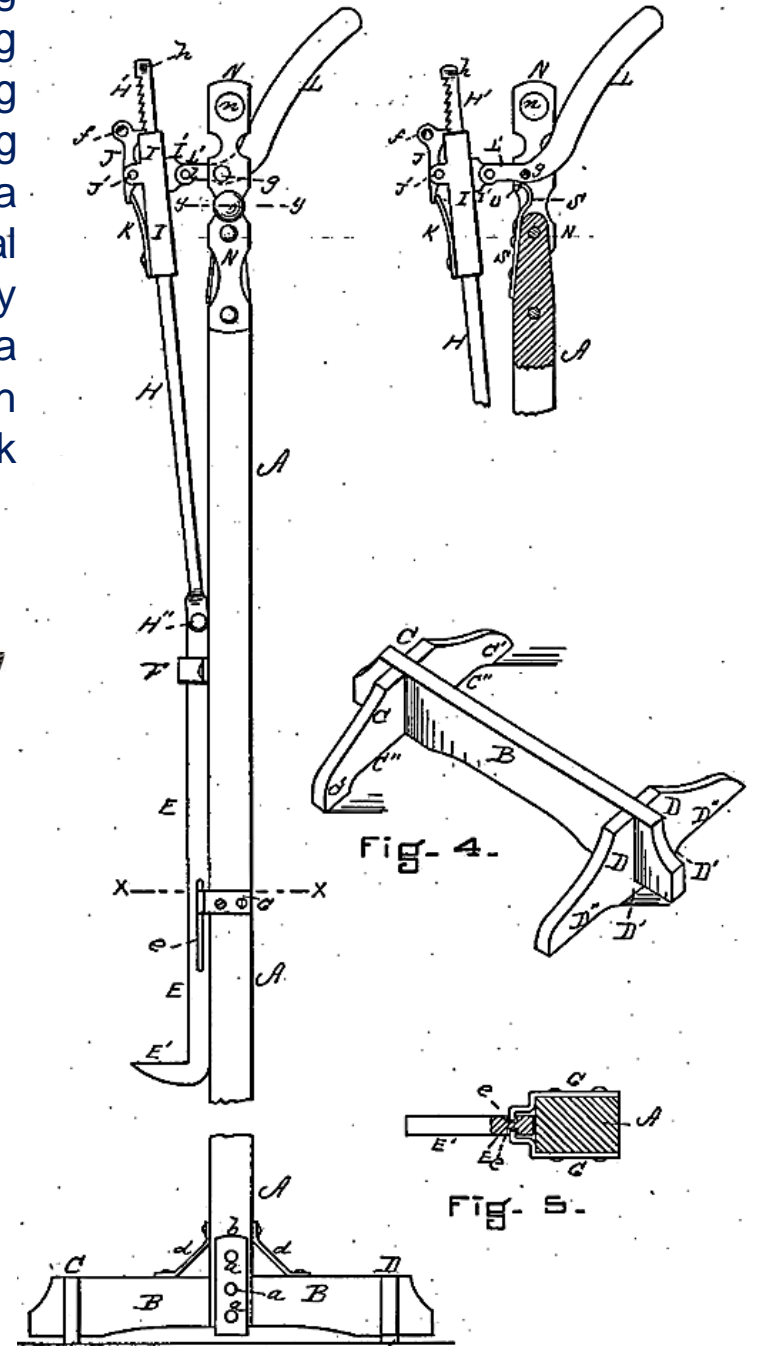


David True Carriage Jack Patent #308,643 - 12/2/1884

David True's 1884 patent regards a tall (4 ft. 4 inches) lifting jack having a wood stationary structure with a metal moving structure that slides vertically on the wood stand and having a forward projecting lifting step at its bottom. The moving structure is moved by a short metal lever at the top having a link to the moving structure. The wood stand has a metal assembly on top holding the lever, and has rings on top by which the jack may be lifted and moved. The lever lifts a rectangular collar (marked AMESBURY below) through which slides the link. Once placed into position, the top of the link may be pulled upward so its step is close under the axle.

The link upper portion, passing through the collar, has ratchet teeth that a pawl on the collar grips to hold the above adjusted link. Pushing down the handle then lifts the link and axle about 1½ inches. Raising the lever back to neutral and then slightly further drops the step a bit to allow the jack to be removed.

The wood base actually has only three feet, so will set firmly on uneven ground, and is designed to fall over only sideways, which will not harm the mechanism.

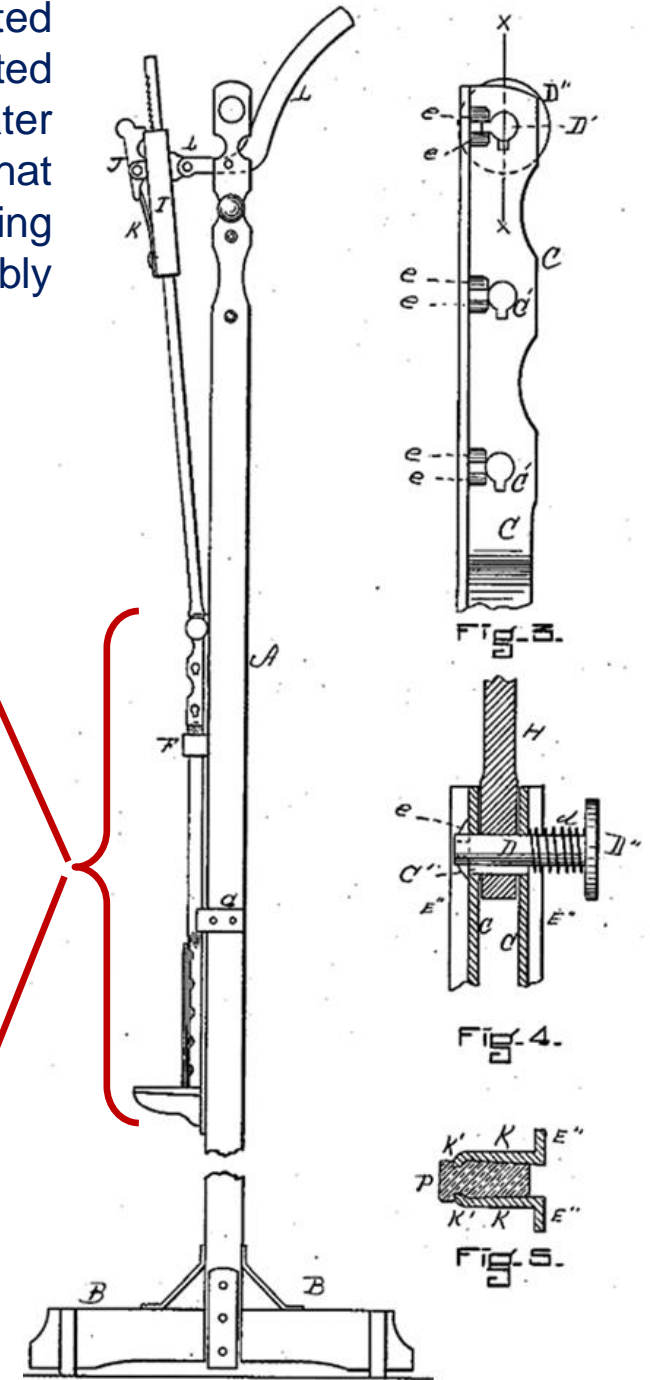
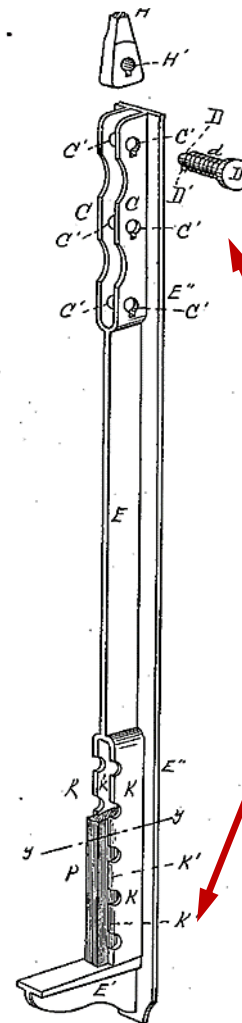


David True Carriage Jack Patent #323,237 - 7/28/1885

True's original 1884 patent describes a lifting step that may be adjusted up close to the axle being lifted so that there is very little wasted motion. However, it was found that the lifting step required a greater reach by which to accommodate a larger range of axle heights. To that end, his 1885 patent provides a moving lifting step assembly having three options for height of the step. At the top of the moving assembly are three "keyholes" for attaching the connecting link.

The key shape permits an attaching pin with a radial "key" such that the pin can be rotated a quarter-turn to become secured so that it cannot accidentally fall out. While a nut and bolt would perform the same task, the pin can quickly be removed and then secured into a different height keyhole.

An additional feature is a rubber pad on the face of the moving assembly, just above the lifting step, that protects a nicely painted and decorated axle (in keeping with fine carriages) from being scratched or chipped.



ACM Carriage Jacks

ACM Carriage Jacks (3) by Samuel S. & Adin P. Joy



1888 publication, Newmarket Historical Society

While most carriage jacks are unidentified, the following jacks were made relatively locally by Samuel Sumner Joy and Adin Phillip Joy of Newmarket, New Hampshire. Adin obtained their fundamental 1884 patent. The jacks are identified by either the Joy name being embossed on castings, by ink stamps on the wood structures, or simply by their patented designs. These have interesting features and their background has been researched with the help of the Newmarket Historical Society. The jacks are of relatively standard stair-stepped style and wood construction, but with unusual mechanisms and numerous cast iron enhancements.

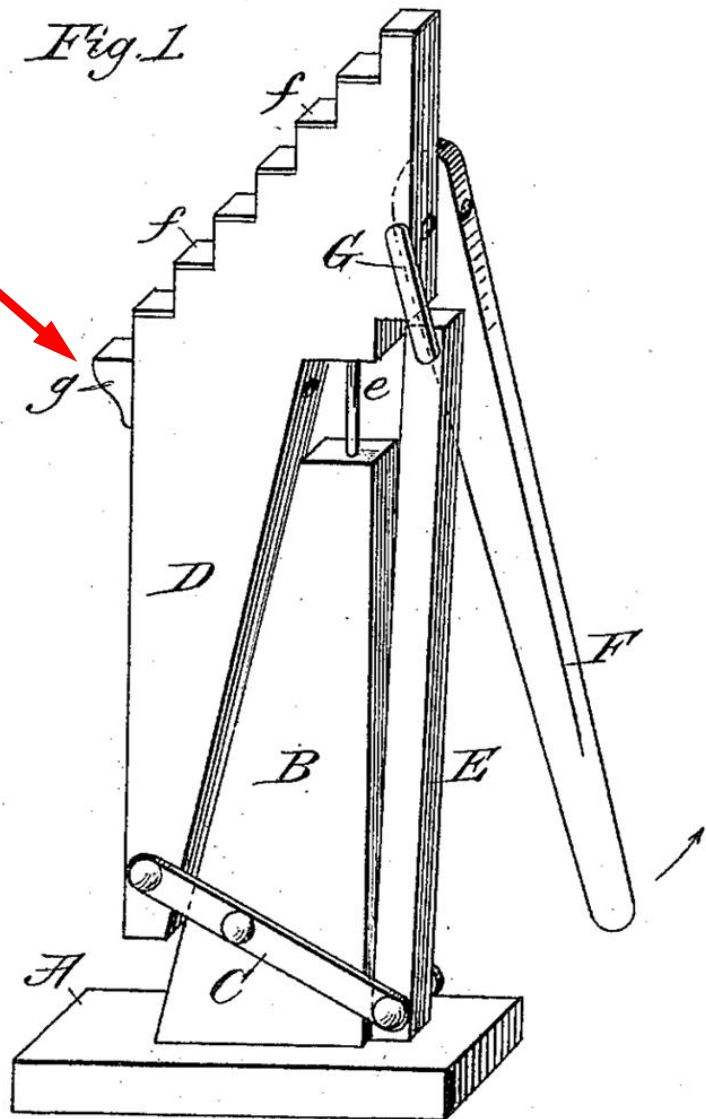
The inventive makers were primarily working farmers who joined in a part time woodworking shop on the farm. They are an excellent example of Yankee Ingenuity achieving productivity with modest circumstances. They advertised their jacks in newspapers around New England and along the eastern seaboard (input from family member Michael Provost). There is a Type 1 Joy jack in Missoula, Montana.

ACM Joy Brothers Type 1 Jack to Adin's 1884 Patent

The handle is attached to the nearly vertically rising moving structure and has over-center locking. There had been a chain on the step piece that held item "g" of their 1893 patent (red arrows), which was an insertable added front step that could be placed into one of four holes along the front edge. Such added adjustable front steps appear on a number of jacks by various makers.



ACM photo



Stamped Markings on Joy Brothers 1884 Patent Jack

This jack has three stamped legends. At right, the May 20, 1884 patent date is stamped on the base. Below bottom, the weight capacity appears to be stamped on the stationary structure but is not readable. The below top legend, on the moving structure appears to be a Joy signature of some fashion, but is not fully readable.



ACM photos



ACM Joy Brothers Type 2 Jack Having Roller Cam Lever

The Type 2 Joy design (left) has abandoned the Type 1 “compound lever” for a roller cam on the end of a simple “crowbar” lever. It has a standard four-bar mechanism guiding the moving structure, with the lever mechanism attached to the stationary structure and having over-center locking. There is seemingly has no associated patent. Similar to the previous example, this has stamped legends that have remained readable despite the weathered condition (2nd next page). This jack has the Joy Manufacturing nameplate plus all features of the 1893 and 1894 patents. At right is a similar roller cam lever jack from online, the only other example of this mechanism found.



ACM photo



ebay photo

Type 1 And Type 2 Joy Brothers' Jacks at ACM



ACM photos (2)



Stamped Legends on the ACM Joy Brothers Type 2 Jack

The stamped signature legend of the Type 1 has been replaced by the nicely signed cast nameplate on this jack. Near the top of the movable structure is stated in one stamp, “capacity 3000 lbs”, which seems a surprisingly large weight to place on this structure. It suggests that the jack could lift one wheel of a loaded farm wagon. The second legend declares, “castings malleable”, indicating the use of malleable iron alloys that would have less tendency for brittle cracking than with older “grey” casting alloys.



Another Type 2 Joy Mfg. Jack at ACM

The jack stands about two feet tall, with a wood structure having numerous cast iron enhancements. Items attached at edges are held with wood screws. All transverse pins and bolt-appearing fasteners passing through the flat wood pieces are riveted tightly into place. There are no threaded nuts to come loose, but the jack cannot readily be disassembled. All custom metalwork is cast, there are no hand-forged “blacksmith” pieces (the Joy facility was primarily a woodworking shop).



ACM photos

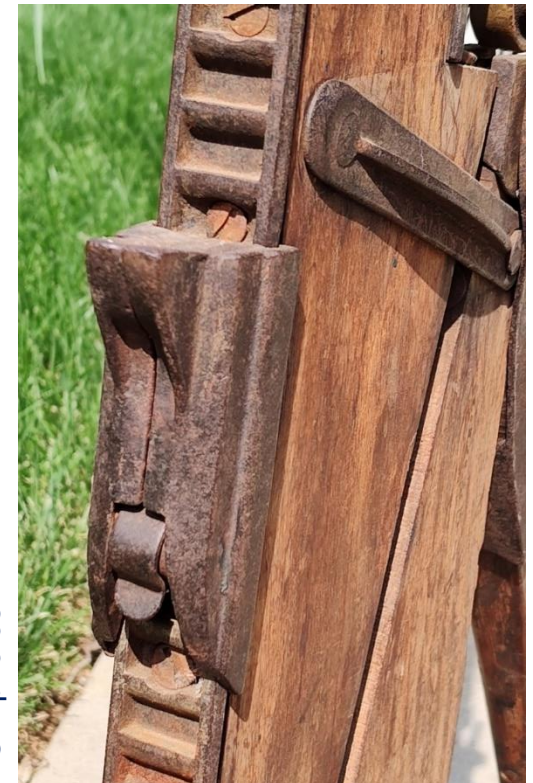


Joy Brothers Type 2 Wagon & Carriage Jack

The lever moves an iron roller at its inner end that rolls against a bottom surface of the cast iron name plate. It can be seen that the roller arm goes over center.

The jack's front edge has an assembly of cast parts for an adjustable-height lifting step that can fit under low features. If starting from a wagon body with no wheels, this would facilitate reaching under an axle held up slightly off the ground, and would also provide adaptability for other purposes.

The brothers had relatives in Lawrence, Mass., where they visited and also arranged for casting patterns to be made and the castings poured (input from family member Michael Provost).



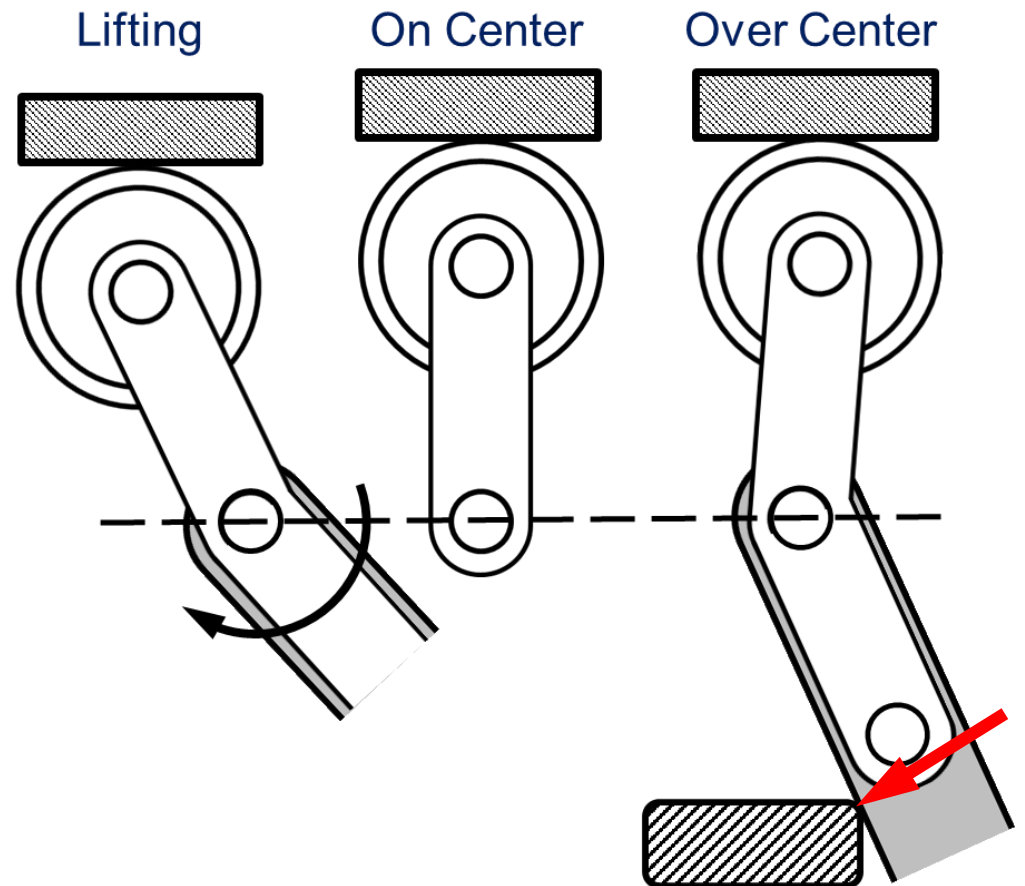
ACM photos

Over-Center Locking of the Joy Brothers' Type 2 Jack

The Joy brothers' jack at ACM is of the standard design for a stairstep lever jack mechanism. Starting from the handle-up position, the handle is rotated down, which lifts the load resting atop the lever-roller. As the lever approaches its top-dead-center position (on-center) lifting ceases and the handle has little tendency to move on its own, except perhaps from its own weight hanging out the side. As the roller passes over center, the lifted weight drives the handle down against its stop, where the jack remains self-locked in place, hands-free, while the load can be supported on blocks if needed.

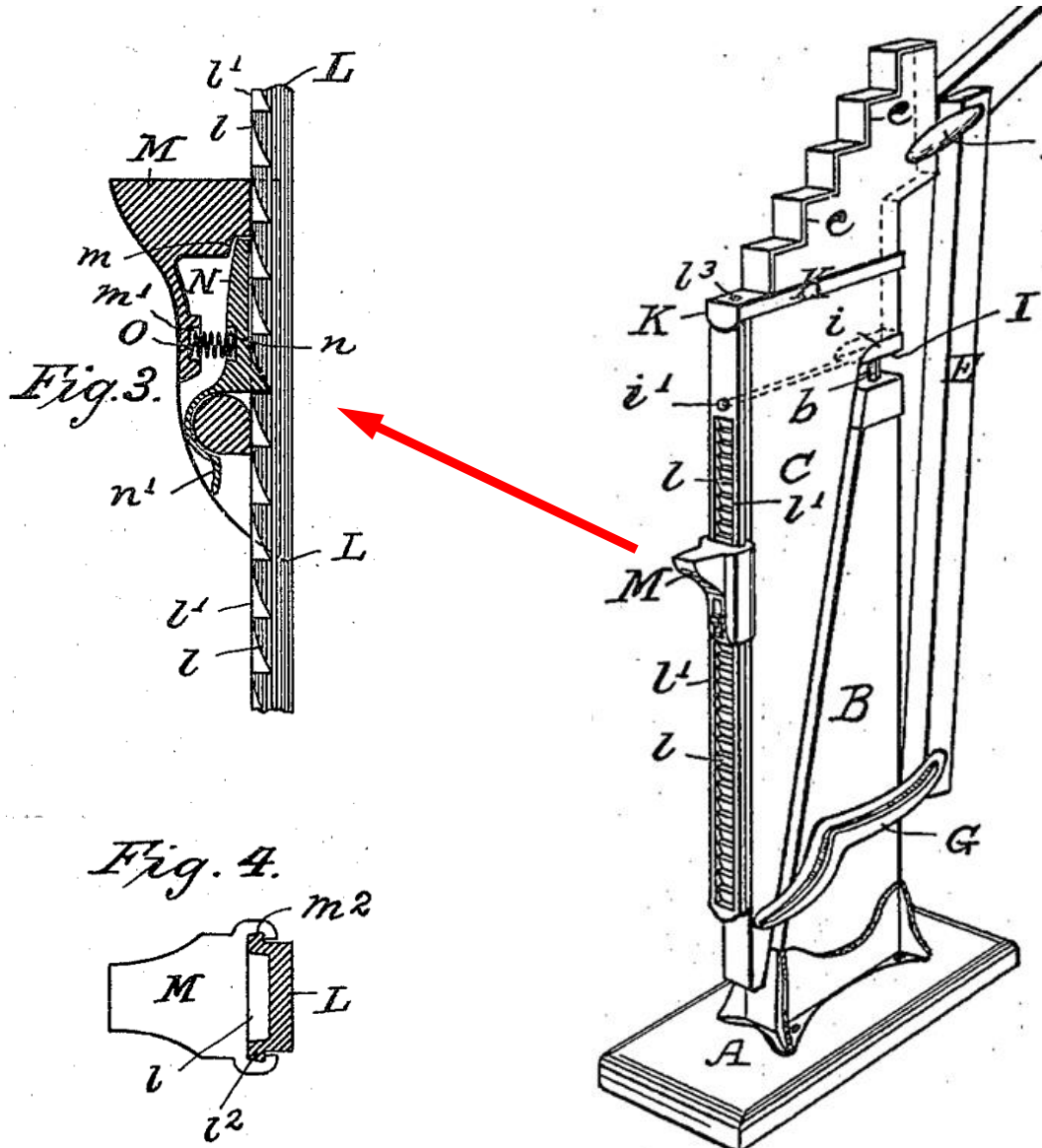


ACM photo

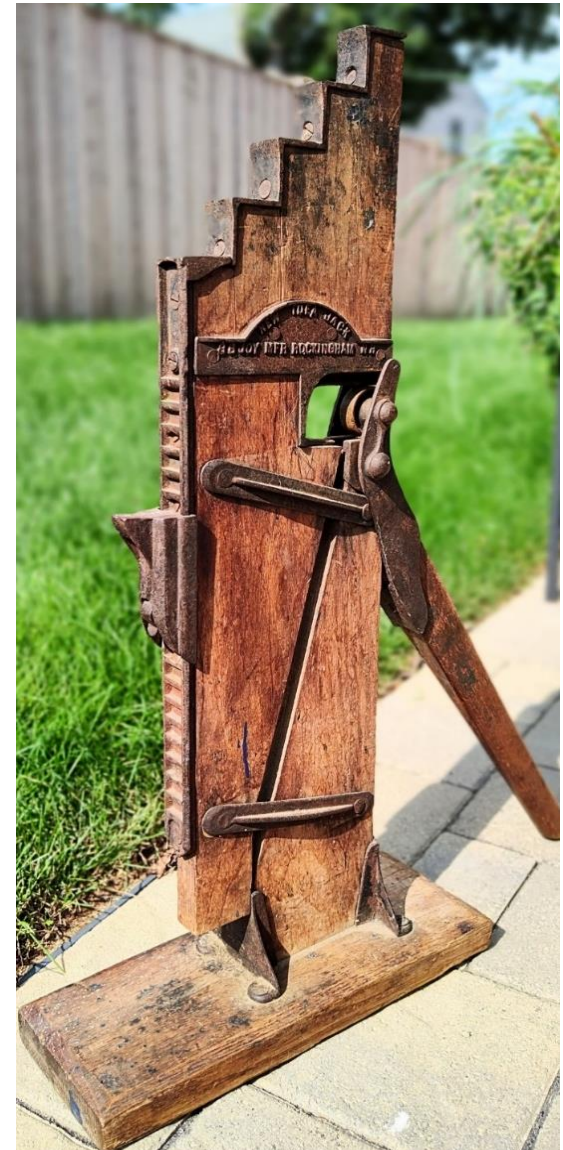


Adjustable Front Step of Patent #526,153 - Sept. 18, 1894

The finely adjustable added front step design is covered by the above patent of Samuel S. Joy. However, the four Joy brothers' patents all show the Type 1 lever operating mechanism, as seen here in patent drawing, compared to this example.



ACM Carriage Jacks



ACM photo

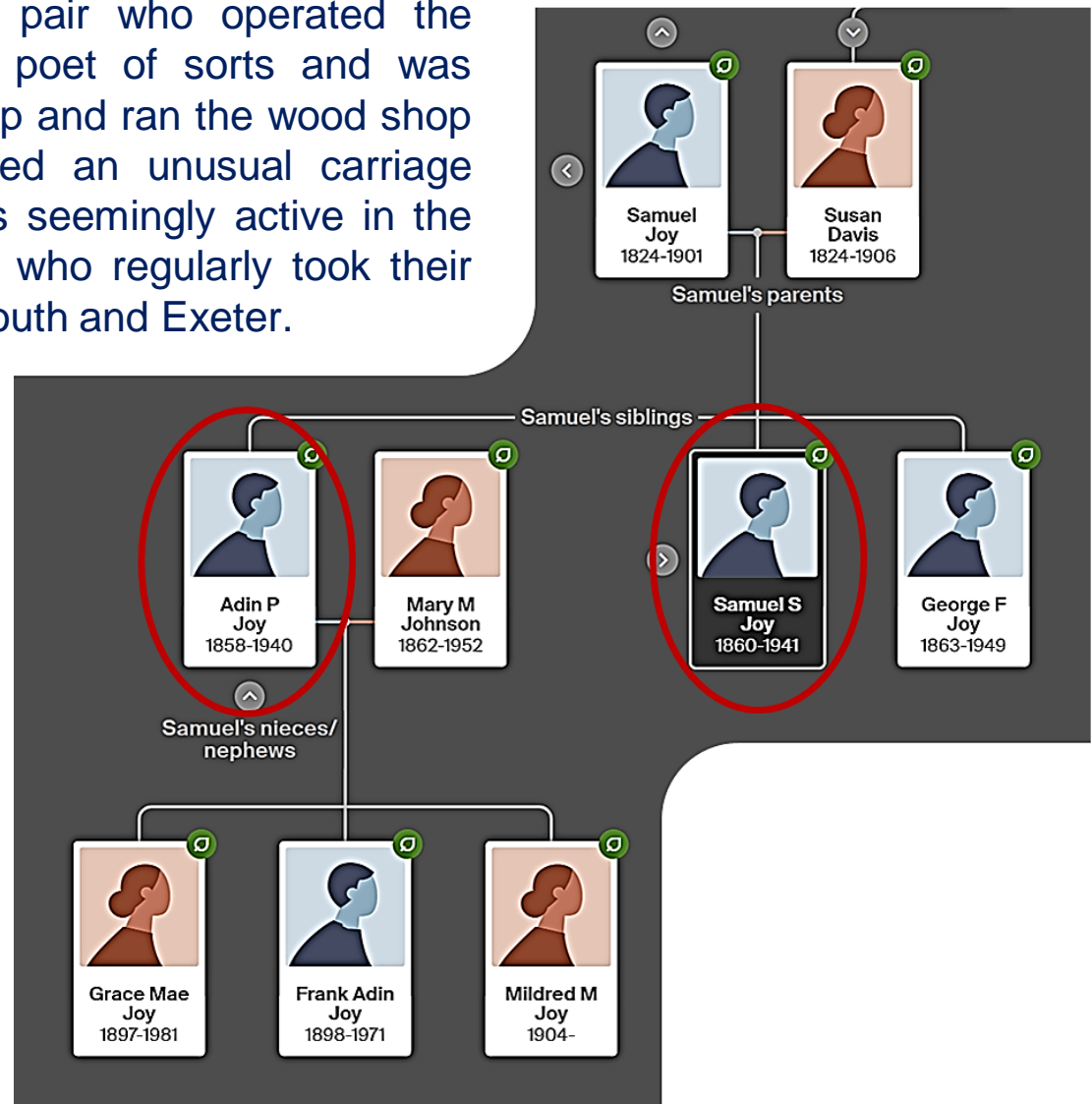
The Joy Family of Newmarket

The brothers Joy (Adin, Samuel, and George) were born and lived in Newmarket, NH, working mainly as farmers. Samuel and his brother, George, never married, and may have both continued living at and working the family farm. Adin eventually had a separate nearby farm, and all seem to have prospered reasonably in the lifestyle that they grew up in.

Samuel and Adin were the inventive pair who operated the business. Samuel was an occasional poet of sorts and was generally active in local affairs. He set up and ran the wood shop on the family farm. Adin also patented an unusual carriage wrench seen on the last page and was seemingly active in the shop. All along, they were still farmers who regularly took their produce by wagon to markets in Portsmouth and Exeter.

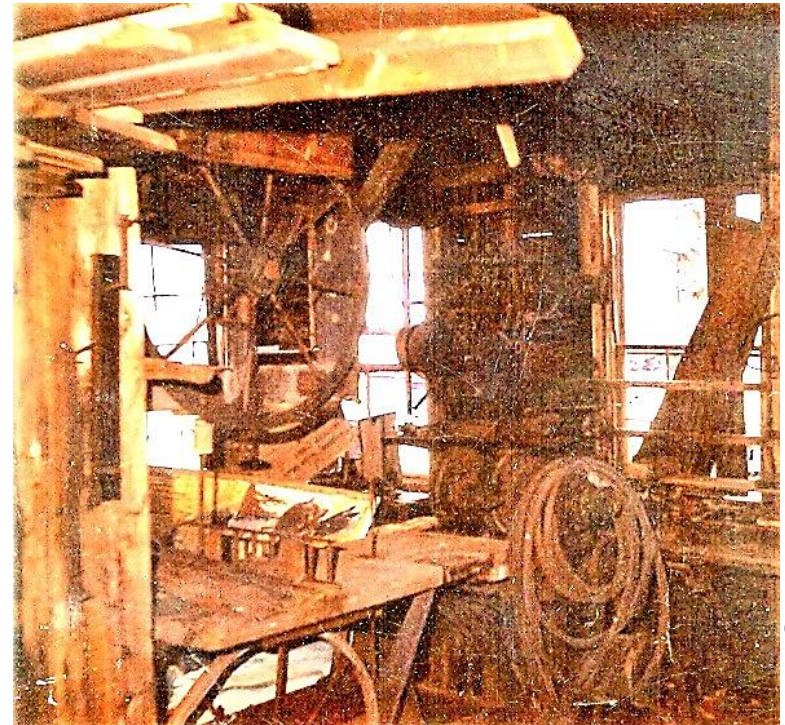
Their lifestyle continued with relatively little change up through the Great Depression. They continued traveling by horse and wagon, although the horseless age would have rendered carriage jacks and horse hitches obsolete as a business.

Adin proved a successful farmer whose three children all graduated from UNH and all had adult lives in Pennsylvania and Tennessee (Frank was an engineering professor in Pennsylvania). Adin's wife left her estate to UNH for the benefit it provided to young people.



S. S. Joy Manufacturing

The Joy Manufacturing facility was this approx. 25x18 ft shed on the family farm along Ash Swamp Road, Newmarket. Samuel Joy at one point powered this workshop with a windmill, and later with an actual horse (an early Beverly, MA textile mill was powered by a horse), before shifting to a gas engine. The shop seemingly had basic sawing, turning, and drilling capability where he performed primarily wood working, including job work for hire. In the picture at top-right, spoked wheels at left are on a foot treadle powered band saw by Betts Machine Co. of Wilmington, Delaware. Some tools are powered by rope belts over wood "barrel" pulleys.



Photos and information courtesy of Newmarket Historical Society

Joy Shop Residue at Newmarket Historical Society

The band saw is at left, with a wood foot treadle at bottom left side. To its right are two commercially made foot treadle scroll saws. Low at far right is a hand driven vertical drill that would have been on a bench. There is also a hand driven horizontal boring machine. On the band saw table are three wrenches invented by Adin Joy.

Three versions of the wagon jack are on the floor around the and band saw. Only one has the cast name plate. While the brothers termed these “wagon jacks”, especially useful on the farm, they certainly also used the jacks for their parents’ phaeton carriage (the carriage suggesting that they were successful farmers).

Not easily discerned at the front right corner of the band saw table is a rectangular cast iron horse hitch invented by the brothers (later page).



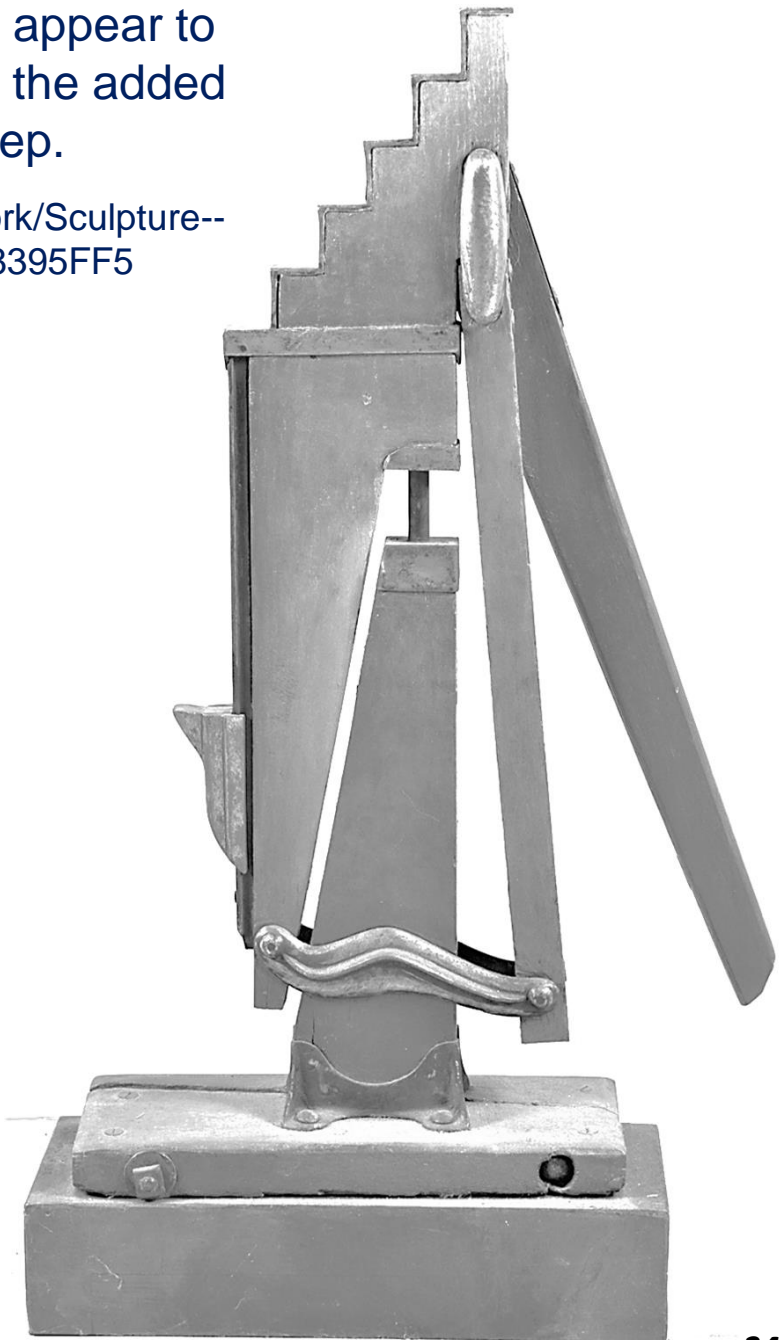
Photos and information courtesy of Newmarket Historical Society

Joy Brothers Type 1 Jack - 1884, 1893, & 1894 Patents

Vertical sliding jack, painted grey and on auction as a sculpture at MutualArt.com

Some metal components appear to be nickel plated. This has the added adjustable front step.

<https://www.mutualart.com/Artwork/Sculpture--Wagon-Jack-/84CE83CF88395FF5>



ACM Carriage Jacks

Joy Brothers' Horse Hitch (Reins Gripper)

This device would be screwed to a post or a sturdy rail where horses would be “parked”. Such would normally be a hitching rail where the reins would be wrapped around the rail and tied to secure the horse while its owner went about business.

This device has a T-handle pivoted at the bottom, with T extensions at mid-height. The top of the T-handle extends upward into a loop that passes over an arm coming forward. The T-handle is pulled forward and down, being spring loaded to return back up and latched when released.

With the T-handle pulled forward the reins are simply placed over it without the effort of looping and tying them. The handle then springs back up into its latched position, trapping the reins tightly in place until the handle is again pulled open to release them.

The Joy brothers apparently sold a number of these for public and home use. They again required casting patterns for multiple pieces, with finishing and assembly required. The back of this example suggests that these may have been nickel plated.



Photos and information courtesy of Newmarket Historical Society

Samuel S. Joy Patent Puzzle 1,050,141, Jan. 14, 1913

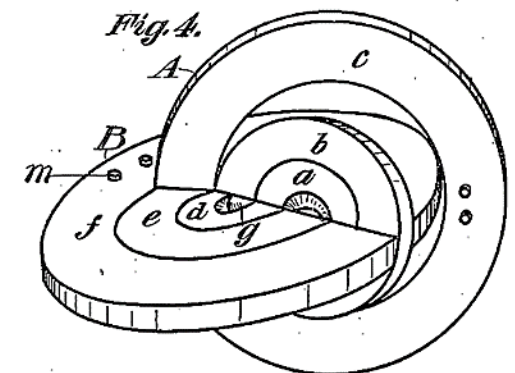
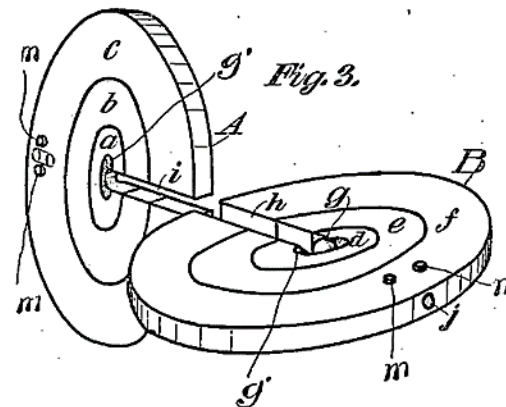
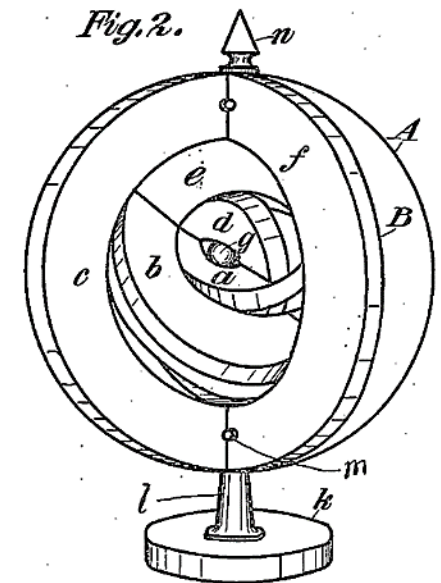
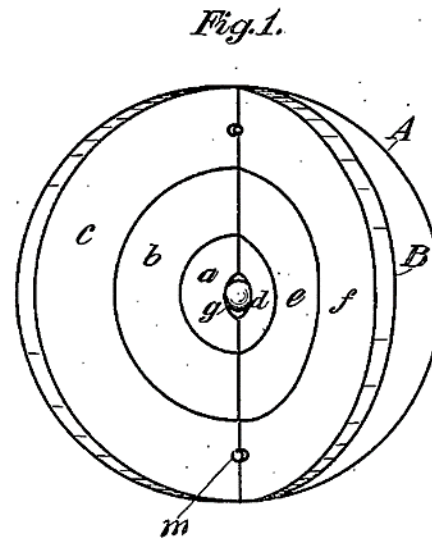
S. S. JOY.
PUZZLE.
APPLICATION FILED DEC. 9, 1911.

1,050,141.

Patented Jan. 14, 1913.

In an entirely different direction, Sam S. Joy (which is how he signed his patents) obtained a 1913 patent for a puzzle in which two flat disks are each composed of three concentric rings, each having a radial slot. These are manipulated into a 3D assembly having a ball in the middle. The result approximates three concentric spheres around the ball, each sphere being independently rotatable. Adding more spheres is limited only by the difficulty of holding and assembling all the pieces. The intent, at the least, was an entertainment for both adults and children.

These were apparently produced in a boxed set for a time. The one reported example is made of wood, which perhaps explains the two scroll saws in the Joy shop. With thin blades and some simple fixturing, the brothers could have sawn well formed circular puzzle pieces.

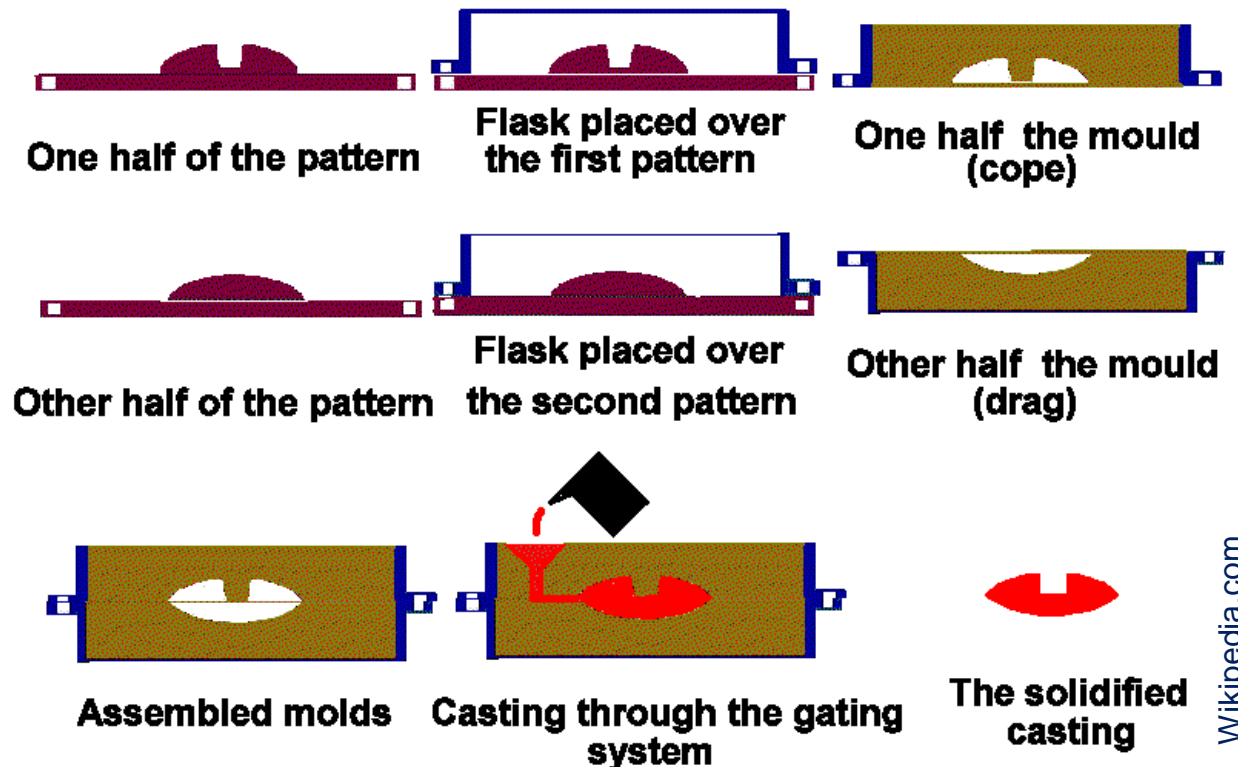


Iron Castings Used in Jacks and Elsewhere

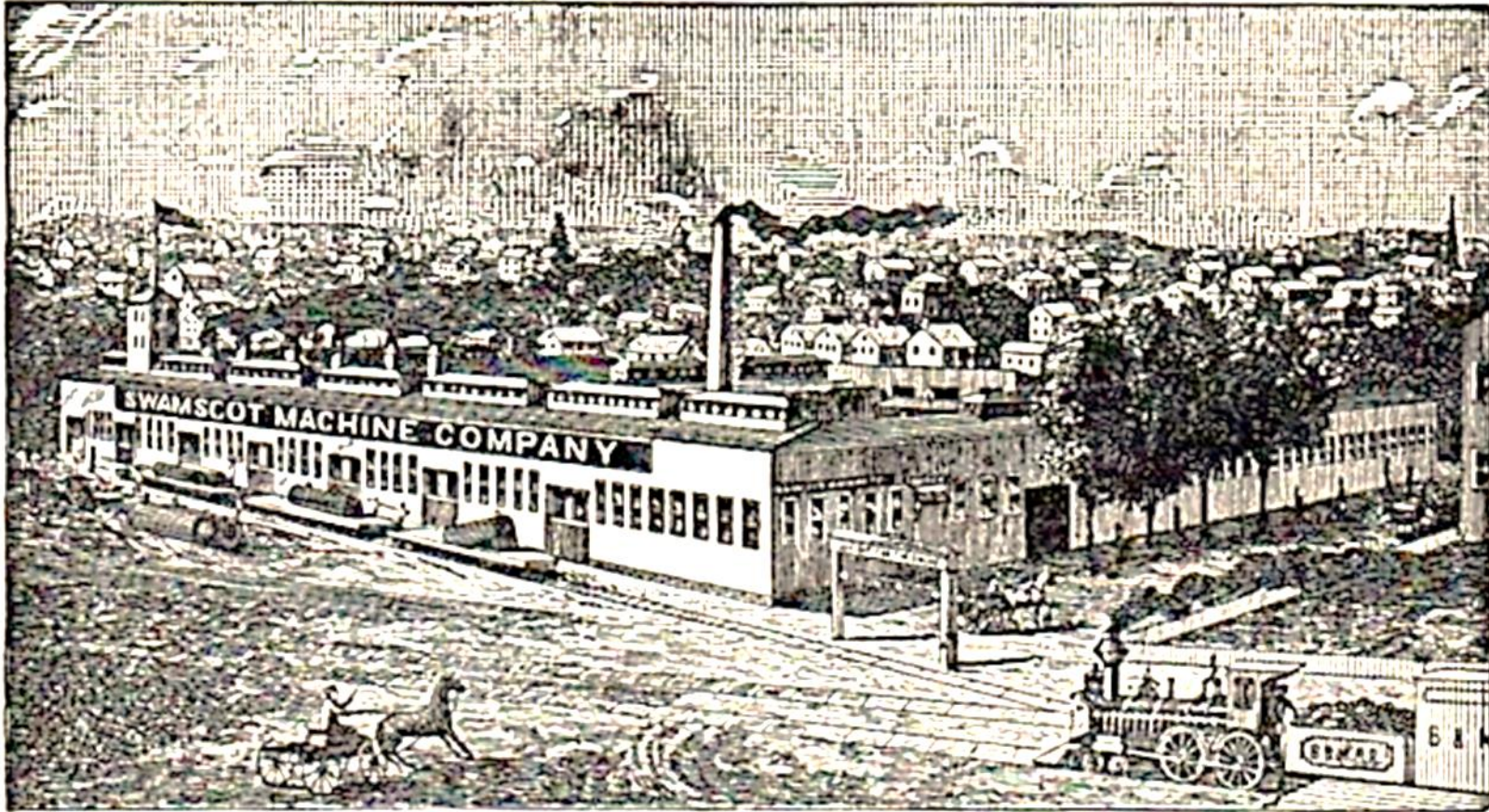
Use of iron castings elevates the Joy jack's level of quality and durability and alleviates much of the need for metalworking at the shop. On one hand castings involve effort and/or expense to make the wood patterns and then pour the castings. On the other hand, they can produce numerous and complex features in a single process, and several molds can be grouped into a single larger mold to produce multiple pieces in a single pour. Castings can thus enhance production in the long run. The Joy brothers and other small makers were frequently woodworking shops, so that castings minimized required metal work to mainly some grinding cleanup and then simply drilling holes.

These are sand castings made in roughly the eight steps shown. The flask is a metal frame in which a pattern is then packed in "green" casting sand that is stabilized to retain a negative form of the pattern shape after the pattern is removed. Top and bottom flasks are clamped together, with added features of a pouring "sprue", vents for escaping air, and perhaps a riser reservoir to fill shrinkage voids during cooling.

There were far more local metal foundries during that period where such castings could be made. The following page shows quite a large factory and foundry in Newfield, near the Joy farm, that did such work and much more. While the Joy brothers obtained castings elsewhere, it would be surprising if they did not occasionally use this nearby resource.



Swamscot Machine Company, ca. 1890



SWAMSCOT MACHINE COMPANY.

"Among the articles manufactured are wrought-iron, steam and gas pipe; brass, cast-iron and malleable iron fittings; radiators and steam boilers, stationary and portable engines, including the Swamscot Corliss Steam Engine; also the Fifield Tram Road Locomotive, gasometers and gas works, and mill work of all descriptions. Special attention is given to the making of locomotives, marine and tubular boilers, ship tanks, automatic sprinkler systems, and steam heating apparatus for public buildings, factories and dwelling houses; every detail of the work being skillfully carried out and selected material being used. The company are sole manufacturers of the famous "Hanlon's Petroleum Gas Works," and are prepared to make all kinds of plate iron work, and iron, and brass castings to order at short notice, employment being given to from 175 to 250 men."

<https://www.newmarketnhhistoricalsociety.org/docs/histories/1891-leading-business-men-of-newmarket-and-south-newmarket/>

Samuel S. Joy Obituary and an Interesting Event

Rural areas were decades merging 19th century lifestyle with slowly spreading electricity, automobiles, and central heat. Even now it is easy to be surprised by suddenly overtaking slow farm equipment, even on straight roads. As with semi-trailers and little red wagons, carriages and farm wagons had a horse-drawn front axle connected by a fifth wheel to a trailing body-and-rear-axle assembly. This all converged into the now amusing image of the Joy brothers' hit and run outcome.

Samuel Joy, Newmarket Inventor, Dies

Special to The Union.

NEWMARKET, April 8.—Samuel Sumner Joy, 80, inventor and manufacturer, died at his Ash Swamp road home late Tuesday afternoon, following several years of illness. He had not been confined to his bed until Monday.

Mr. Joy invented a number of ar-

ticles, including numerous devices for horse-drawn vehicles, kitchen gadgets and novelties. The best known of these was the wagon jack and a horse hitch which he produced and sold himself. At one time he had a factory operated by a wind-tower, devised by himself, later changed to horse-power and then to gasoline power.

He invented the "after-the-ball" puzzle, a novelty which caught the popular fancy in the '90's. He never married, but kept his own house where he introduced kitchen work savers used in advance of his day. He did considerable farming, wrote poetry and had been a close student of national and international politics. As a Republican, he has voted in every Presidential election since 1880.

Mr. Joy is survived by one brother, George Joy of Newmarket; one nephew and two nieces. Funeral services will be held Friday afternoon.

JOY BROTHERS VICTIMS OF HIT-AND-RUN DRIVER

Auto Crashes into Wagon in
Stratham Saturday Evening

Samuel and **George Joy** of Ash Swamp Road were the victims of a hit and run driver in Stratham while returning home from Exeter in their wagon at about 10 o'clock Saturday evening.

Near Emery's Filling Station in Stratham a car approaching at a high rate of speed from behind them turned out too late to avoid crashing into their vehicle. The left rear wheel and the perch of the wagon were smashed and **George Joy** was thrown to the road, receiving minor injuries to his arm and head.

The driver of the automobile did not stop after the collision. After leaving the remains of the wagon at Emery's Filling Station the Joy brothers mounted the front axle and drove their horse home

4/8/1941, The Union, Manchester, NH, Newmarket Historical Society

How Many of What Joy Jacks Were Made?

With few known examples it is impossible to estimate either how many total jacks were produced by the Joy brothers, or what subvariants were made, in what quantities, during what periods. The few known examples suggest several variants and combinations. Understanding the trends at least requires more data. The following page presents the known Joy brothers' patents. Four jack patents over thirteen years should provide partial answers to subvariant distribution, but that does not always hold. Technically, subvariant introduction should follow the patent chronology, because, technically, unpatented features are freely available once introduced into the public domain (the horse is already out of the barn). However, the patentees may well apply for patents only after sensing commercial success, i.e. sales income finances the patents. In another possibility (the dreaded *chaos* scenario) the brothers might typically have had on hand a range of components that they could assemble in various combinations either for convenience or at various prices. Such opportunistic mixing defies systematic tracking.

A main area of inquiry is the mechanism involved in translating pushing down the handle into raising the load. All four patents show the Type 1 linkage mechanism introduced in Adin's 1884 patent, that linkage appearing in five of about ten known examples. The linkage is likely the "compound lever" described in their 1888 advert. Joy jacks having the cast nameplates also incorporate all of the patented features, except that linkage. These are thus presumed to be later examples having a simpler and more robust lifting mechanism, incorporated precisely because it is simpler and more robust. The last of the four jack patents (1897) involves solely a further complication of the compound lever system, suggesting that the concept had not been abandoned. Neither history nor artifacts provide much guidance for dating examples.

Four Joy Brothers' Patents for Stairstep Lever Jack

Raisable wood step-piece activated by a wood lever on a wood upright and base

Adin P. Joy Patent 298,980 May 20, 1884 - wood jack structure & iron features

Compound over-center lever system with walking-beam transfer arm

Vertical step-piece action via vertical guidepost

Metal lined step faces

Added front step having tie bolt reinforcement for wood step-piece

Sam S. Joy Patent 493,031 March 7, 1893 - Added metal liners & sleeves

Features of first patent, modified with:

Single-piece screwed-on cast iron liner for step faces

Cast collar reinforcement for wood step-piece

Metal liners for critical bolt and guidepost holes

Adjustable added front step insert on chain having four available locations

Cast iron bracket(s) for connecting wood upright to wood base

Sam S. Joy Patent 526,153 Sept. 18, 1894 - Fine-adjust added front step

Features of first two patents, modified with:

Finely adjustable added front step on cast iron front track

Cast iron faces where raisable step-piece bottoms on wood upright

Sam S. Joy Patent 578,519 March 9, 1897 - Low-load or Hi-load leverage option

Features of first three patents, modified with:

Walking-beam arm having option of two arm lengths for two load ranges

Adin P. Joy Buggy Wrench

Adin patented and the brothers produced this axle nut wrench for wagons and carriages.
See ACM publication regarding buggy wrenches.

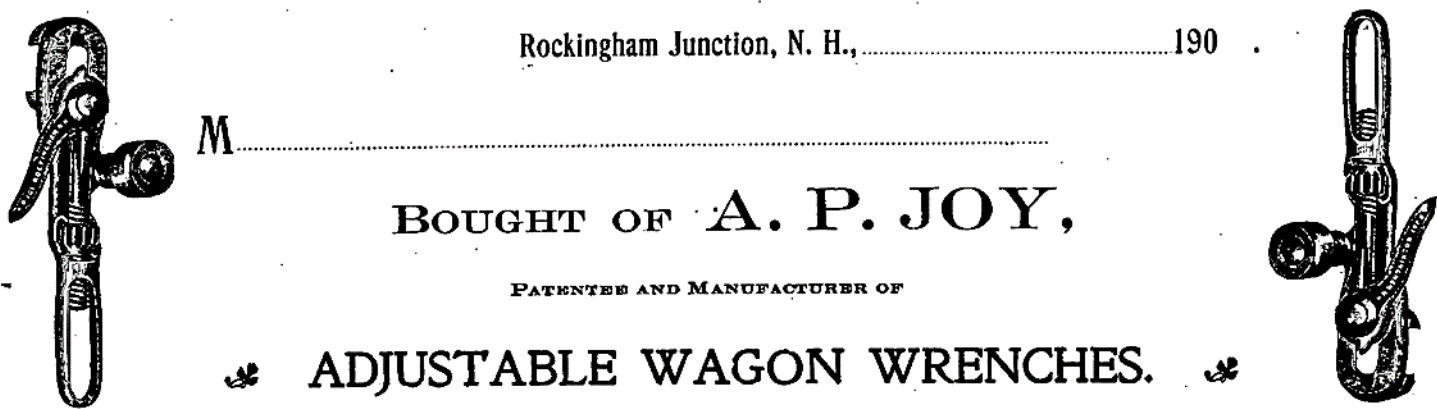
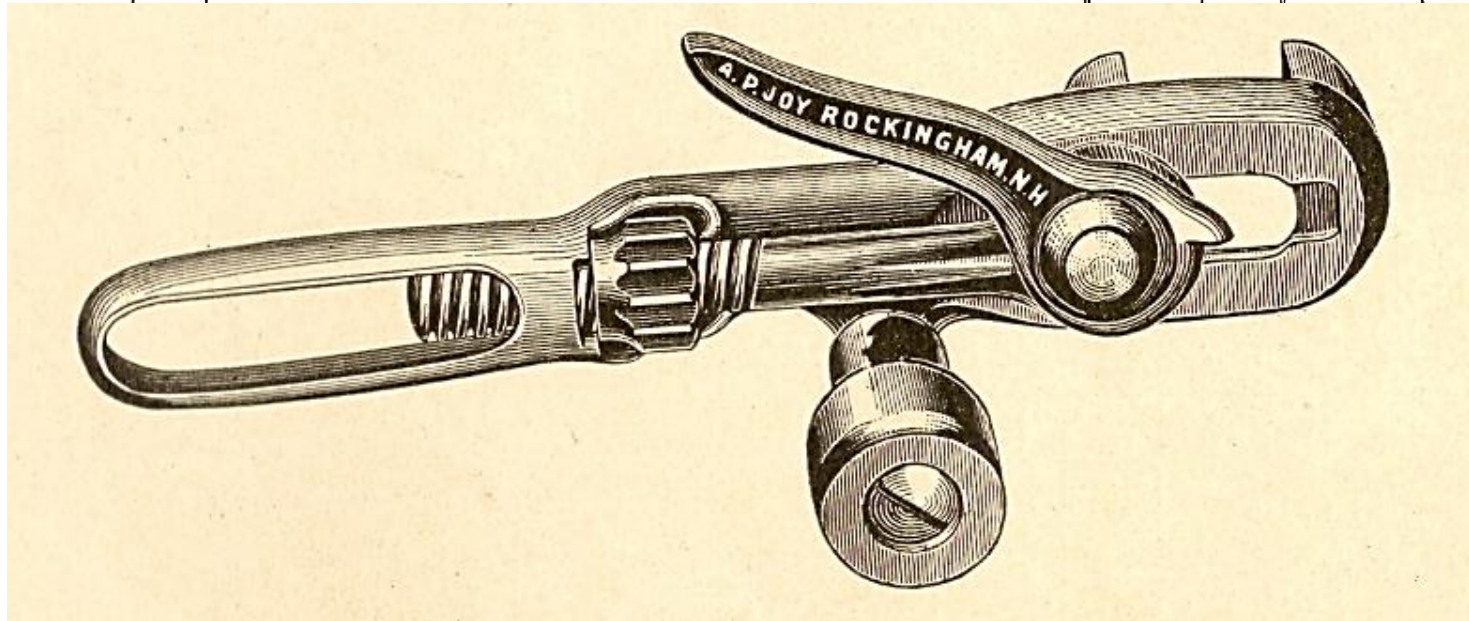
Rockingham Junction, N. H., 190 .

M.....

BOUGHT OF **A. P. JOY,**

PATENTEE AND MANUFACTURER OF

ADJUSTABLE WAGON WRENCHES.

Order slip and illustration courtesy of Newmarket Historical Society