The Pyrenees Heritage Preservation Magazine

Goldsmith

No 144 October 2017

Lake Goldsmith Steam Preservation Association Inc

Registration No:- A0032895

Rally Grounds:-
1234 Lake Goldsmith-Carngham Road
Lake Goldsmith Vic.3373

Next Rally

GOLDSMITH AUTUMN RALLY

No 110 Nov 4 & 5 2017

Rally Theme:-

JOHN DEERE

Special Pre Rally event:- Pyrenees Tractor Trek see page 11

Shades of Green and Yellow will mark the 110th Lake Goldsmith Rally

John Deere has ploughed its way through history for around 180 years. Their tractors started out under the name of Waterloo Boy and went on to include Chamberlain and Lanz. John Deere is well established in Western Victoria and their Ballarat Centre is a familiar sight on the Western Highway.

Editors Overview

Hello Readers, The 2017 Autumn Rally is nearly with us and the highlight theme for this rally is John Deere, Tractors Ploughs farm machinery graders etc. anything made by John Deere, including some changeover Chamberlain and Lanz Bulldogs are welcome.

The lead John Deere story more or less follows on from edition 143 (August) (you will have to download it from www.lakegoldsmithsteamrally.com.au as it only came out as an electronic edition) and covers some background on the letter series and early number series of these popular tractors. This edition 144 will still be on our Web site in high definition print quality.

The email edition is, in most cases to large in print quality to email, and many addresses have further limitations which reduce the common 10meg limit, which in turn kicks back a lot of emails as undeliverable. Where possible I try and catch these, but at times it is not possible and often very time consuming, which means that without a phone contact no, many returns are not corrected.

To minimise these problems the email that accompanies each Newsletter will have a direct link to the website in the text. This will give the reader the option to download the pdf, or go directly to the website with Ctrl+click on the blue address in the text. The pdf copy will eventually be dispensed with and the direct link will become the only source for download. Downloads are not limited in size, so there is then no limit on the size of the magazine, and far less problem with email rejects as the cover email is relatively small.

The cover pictures included some JD tractors and a picture of the Ballarat based John Deere Agricultural distributors, CERVUS on the Corner of Brewery Tap Road and the Western Highway on the Eastern entry to Ballarat. Cervus will be demonstrating some modern John Deere Tractors and a Gator runabout will be seen running errands around the site.

In addition to the John Deere introduction, the Harry Ferguson Tractor Club of Australia, who are organising the Tractor Trek, have just completed the enlargement of their shed, so it may be worth your while to drop in and have a look around. The second story is about Harry Fergusons other major innovation that largely goes unnoticed. The Ferguson Formulae for continuous four wheel drive.

The last story looks at some background for the Tuxford engine in the Boiler House, and the Company that built it. William Tuxford and Sons closed the shop over 130 years ago, so information is pretty thin, but it seems that they were the first manufacturer to make a portable Steam Engine, and if they were not the first to make one self-propelled they were very close.

This story was expected to be in last month's edition but it did not get completed in time.

I am keen to get any information on this manufacturer, pictures, articles brochures and the whereabouts of the survivors. Just email or ring the editor. Thanks. Ed.

Our next event is the pre-rally Tractor Trek and the Autumn Rally

Mission Statement

To foster, nurture, encourage and demonstrate technical, agricultural and life skills associated with the Industrial Era.

To provide a quality environment where these skills may be used to educate and entertain members and visitors.

To run two weekend rallies each year, and be available at convenient time for other interested groups or individuals.

To conserve and develop a heritage collection.

Find us on the net at:-www.lakegoldsmithsteamrally.org.au
Or contact us by email info@lakegoldsmithsteamrally.org.au
Or write to: The Secretary:- P.O. Box 21 Beaufort 3373
Or contact the editor:-goldsmithgazet@optusnet.com.au

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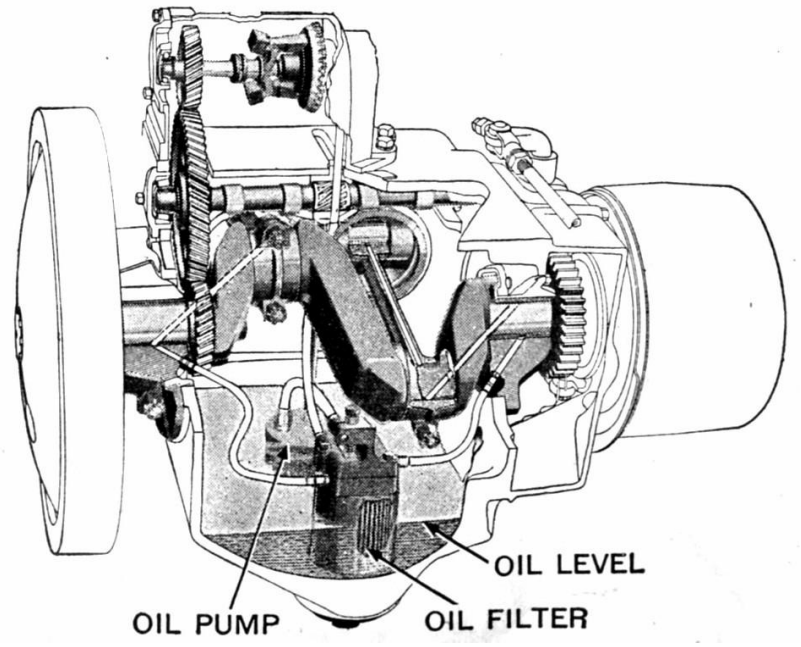
John Deere

In the previous edition of GOLDSMITH there was an outline of John Deere before they became involved in producing Tractors of their own design when they introduced the Model D in 1923.

The model D retained the twin cylinder configuration of the earlier Waterloo boy, although the cylinder heads were now at the front.



These twin cylinder 4 stroke engines had the big end journals 180° apart, which meant that when one cylinder was at top dead centre the other was at bottom dead centre and the pistons were always moving in opposite directions which helped balance without the need for large counterweights.

The trade-off is that the cylinders do not fire at regular intervals. If cylinder 1 fires at 0°, then no 2 fires 180° later.

As each cylinder fires every 720° (ie every second revolution) there is 540° of rotation before no 1 fires again.

This results in a distinct note, hence the nickname Puffing or Popping Johnnies.

(Flat twin 4 stroke engines can use the same crank shaft with equal firing intervals. Inline Twin cylinder motorbike engines had both journals in line so that both pistons were at Top Dead Centre at the same time, they had even firing intervals but needed a large counterbalance on the crankshaft to help balance the reciprocating mass.)

The Model D Tractor was in production until 1953, which is an incredible achievement for a 1920's design. The engine produced about 30HP at 900RPM, and had a bore of 6 ¾" and Stroke of 7" for a displacement of 465ci

The picture on the left (above right) is an early 1924 Model, and on the right is the last model D in 1953, by which time about 160 000 had been built.

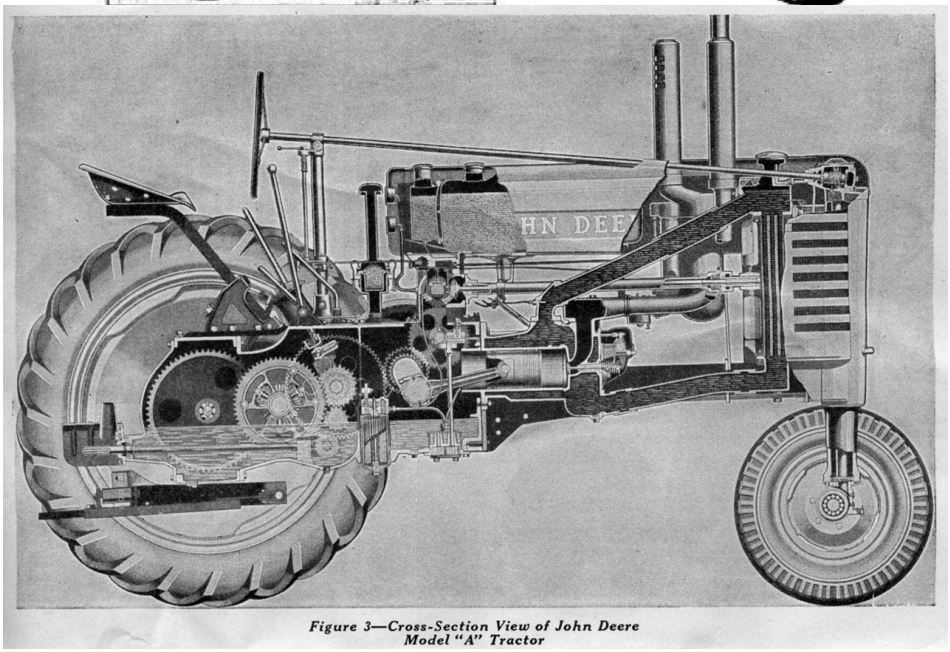


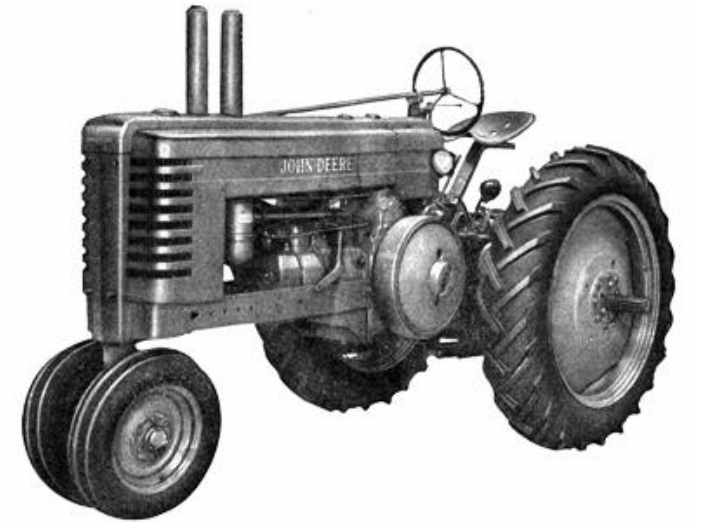
Figure 3—Cross-Section View of John Deere Model "A" Tractor

The cross section on the right shows the major component layout of a model A Tractor.

The twin cylinder East West engine arrangement allowed a compact layout for the engine and 3 speed Gearbox and a good rise for the thermosiphon cooling System. Similarly the overhead valves had neat manifolding.

The A model arrived in 1934 and stayed there until 1952 when it was superseded by the model 60 which continued until 1956.

The model A was a row crop tractor with a pair of centre mounted front wheels. Other versions appeared in 1936, an AI industrial, an AO orchard and an AR with a front axle, each with various modifications for high crops, variable widths, and an AN with a single front wheel. The engine had 2 cylinders of 5.5" bore and 6.5" stroke which gave it a 309ci displacement. There were 24 hp available on the belt and 18 on the drawbar, and the engine revved at 975 RPM with a compression ratio of 4.45:1.

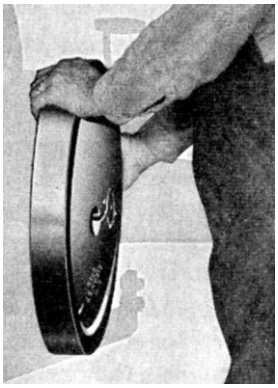


About 300 000 of this model was built. The Model A was the first John Deere Tractor offered on Rubber tyres.

The C/GP , pictured on the right,came into production in 1927 and continued until 1935. This tractor had a 312cid engine, and produced 24hp on the belt, about 36000 were produced in various configurations.

The B Model was introduced in 1935 as a smaller version of the A. Again it came out in various versions and continued in production until 1952 by which time around 110 000 units had been sold.

The engine had 149cid with a bore of 4.25" and a stroke of 5.25". The tractor produced 12hp at the drawbar and 16 on the belt.



The early Model B's (as with others) were started by rotating the Flywheel slowly forward over TDC.

In 1939 the B was upgraded with styled sheet metal and electric starting and lights were offered as options. The engine was enlarged to 161 cid with extra power available, and 140 000 were built.

In 1947 the engine was enlarged to 190cid (30hp on the belt) and the frame was made of pressed metal. Electric starting was standard.

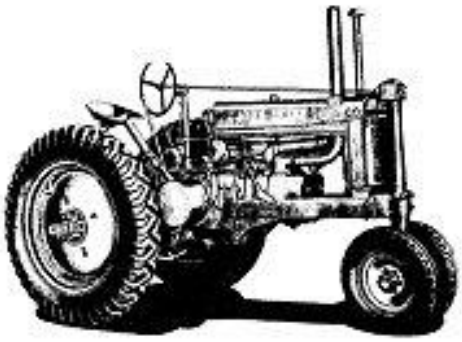
110 000 late models were built in the last series before the Model 50 was introduced in 1952.

The small Row Crop Model H arrived in 1939 and went through to 1947 by which time over 58000 had been built The 100 CID 2 cylinder engine had a bore of 3.5" and a stroke of 5". It produced 14hp on the Belt and 12 at the drawbar at 1400 RPM, and ran on Petrol/Kero. Electric start and lights were an option.

The very small Model L arrived in 1937 and stayed in production until 1946. The L was again a twin cylinder, but it used a 56cid Hercules vertical engine mounted in line and in front of a conventional 3 speed gearbox. Later a 66 cid engine was used, which produced 9hp at the drawbar and 10 on the belt. A model LA was available with Cast Iron rear wheels with removable rims.

It has a twin tube chassis and about 13000 were built.

1937 saw the introduction of the Model G Row Crop Tractor with a 412 cid (cubic ´inch displacement) engine with a 6.125" bore and 7" stroke which produced 38hp on the belt and 34 at the drawbar at 975 RPM running on Kerosene 64 000 were built by 1953 when the G was replaced by the Model 70, and later the 720 and 730.



The G was the largest row crop tractor, and the side frames had a noticeable bulge to accommodate the larger engine. The tractor could pull 3 14" ploughs, and hydraulic lift was available as an option.

In 1942 styled sheet metal was added and the 4 speed gearbox gained 2 more. Electric start was standard as were rubber tyres.

Model G's had an overheating problem under severe service, and various retrofit adaptions appeared from the factory, and eventually a high radiator was fitted.

During the Korean War copper was not allowed to be used in radiators. The Steel alternative brought the problem back, and in 1952 a water pump was fitted to all new tractors, and a retrofit pack was available for older tractors.

Later petrol only kits were offered for the model G which boosted power by around 25% which was a massive increase over the 38hp available on Kerosene.

Late model G's weighed in at around 2.5 Tons which gave them a lot more traction than the similar powered model A.

During WW2 the President of John Deere was commissioned as a Colonel and headed the Farm Machinery and equipment division of the War Production Board. The company continued to produce farm machinery during the war. It also produced aircraft parts, tank gearboxes, ammunition, and laundry machinery.

Two experimental Armoured Tractor Tanks were built as prototypes as an attempt to produce a very cheap protected vehicle which was armed with machine guns. The originals were destroyed, but replicas have been rebuilt from information supplied by those involved at the time. Neither went into production. They had a 3 man crew with 3 Browning Machine guns in rotatable turrets.

Over 4500 John Deere employees served with the military services,

The end of the war saw a return to tractor and farm machinery production.

The Letter series of tractors continued into the 1950's.

New in 1947 was the M, which replaced the B, L, & H Models. This was the first tractor produced at John Deere's plant at the Dubuque Factory in Iowa.

The Engine was a vertical twin cylinder with a 4" bore and stroke giving a displacement of 100 ci. It produced 18 hp at the drawbar and 20 on the belt at 1650 rpm. There were 4 forward speeds and electric start was standard, a PTO was fitted and the "Touch-O-Matic" hydraulic system was introduced on the Model. A kit to convert to a 3 point linkage was available.

The M was produced in Industrial, rowcrop and 4 wheel versions and a Crawler version was also produced, Nearly 46000 were produced by the time the production finished in 1952 when the Model 40 replaced it.

The last letter series, the R came on line in 1949 and stayed there until 1954 when the 80 was introduced.

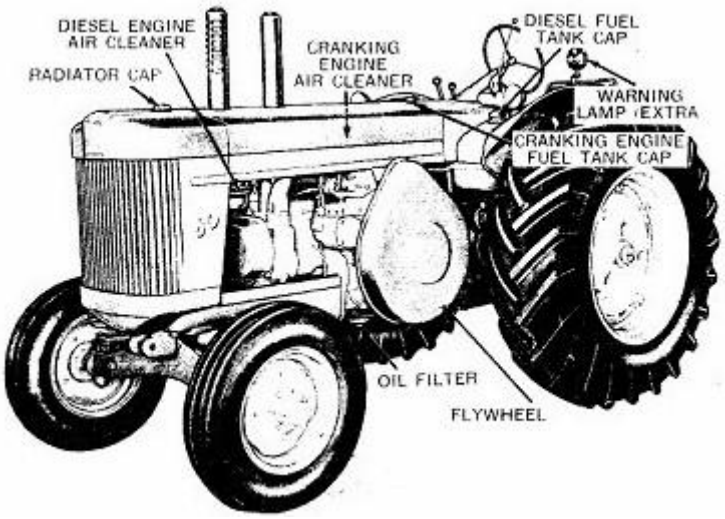
The R was the last letter series and John Deere's first Diesel tractor. The twin cylinder, horizontal 415 CID motor had a bore of 5.75" and a stroke of 8". It had a compression ratio of 16:1 and ran at 1000 RPM. The 9 hp starter was an opposed 2 cylinder petrol Pony motor which was used to warm the jacket water of the main engine for cold starts before it started the motor via its own clutch. The pony motor had its own 6 volt starter motor. The R was the first John Deere tractor offered with a cabin.

The R above is the standard form and the Cab version is shown above on the right. These tractors weighed about 3.5 Tons, had 5 forward speeds and could travel at11mph

In the mid 1930's John Deere had experimented with a diesel version of the Model D but the idea was not put into production. The R could plough a 40 acre paddock in half the time and use half the fuel required for the Model D which was kept in production until 1953 when the future of the big diesel was assured. About 21000 R's were built.

In 1955 the R was upgraded as a Model 80. The gearbox got a sixth speed, the engine bore was increased to 6 1/8 "ϕ taking the displacement up to 472 cubic inches, and the driver got an option of power steering.

The 2 cylinder starter motor was replaced by a V4 with its own electric start. Drawbar horsepower went from 43 to 60 as tested and the belt went from 48 to 65. Engine revs went up from 1000 to 1125. The teardrop shape of the flywheel cover is an easy way to identify the 80 from the R. About 3500 were built before the Model 830 came on the market to replace it.



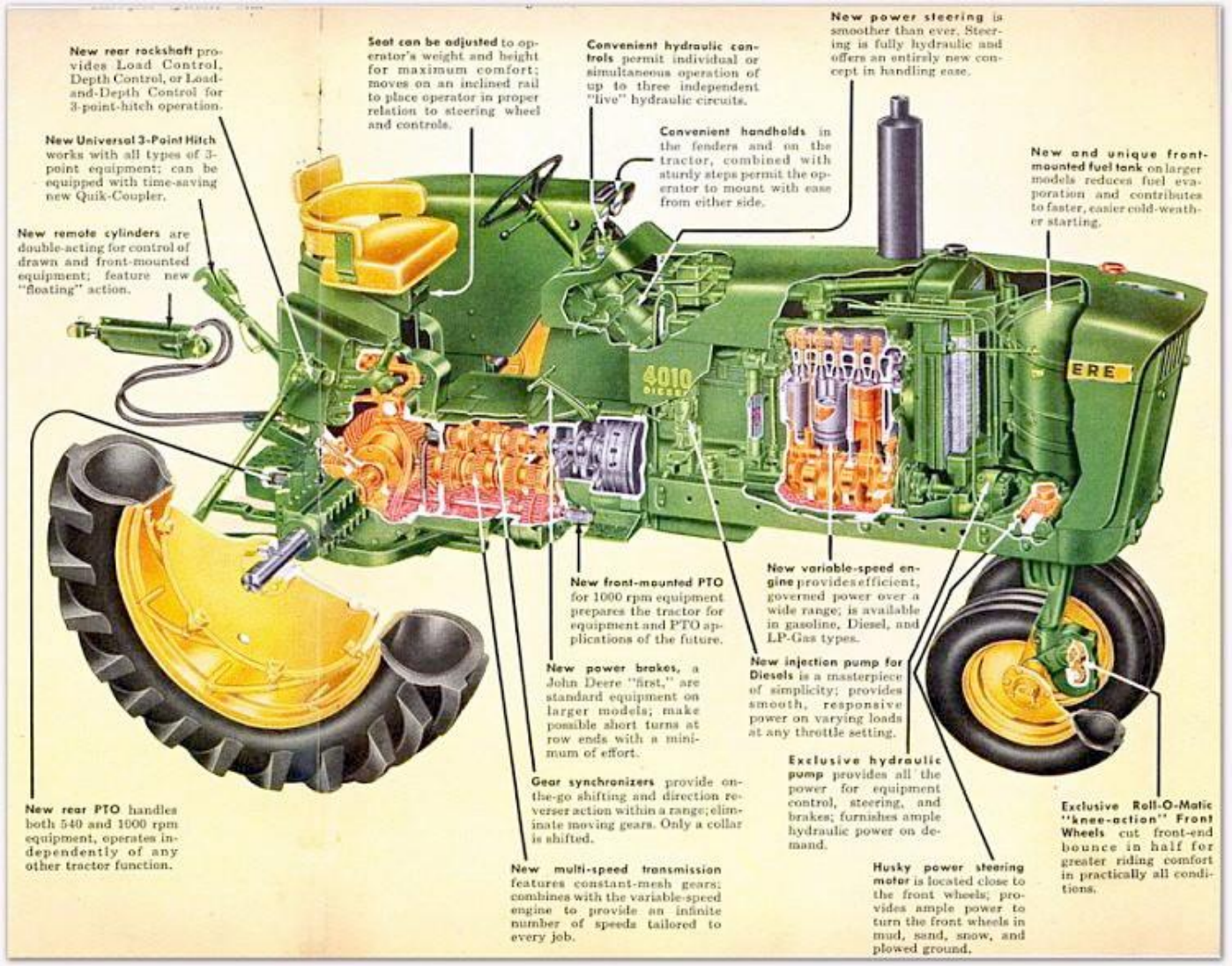
The Model 830 was the last refinement of the Model R. The V4 starter motor was standard, but for $140 less than the $5000 price tag you could have a 24 volt electric starter. Just under 7000 were made over half of which had the pony engine start. The distinctive yellow side panels made this tractor easily recognisable from its predecessors.

It was the most powerful of the 2 cylinder horizontal engine tractots, and it was at the practical limit for what could be achieved with the twin cylinder engine layout. Production finished in 1961.

In 1960 the "new generation" "10" series of tractors was introduced, almost all at once, on August 30 in Dallas Texas. The ten series all had vertical 4 and six cylinder diesel engines and the 2 cylinder tractors were phased out.

Following in the 830's horsepower range was the 4010 which was produced until 1963 when the 4020 replaced it. The 4010 was a popular tractor and 58000 were sold over 3 years. John Deere's market share increased from 23% to 34% from 1959 to 1964 The tractor weighed approximately 3.5 Tons and produced 84 drawbar horsepower with its 6 cylinder engine. The Tractor was available with Petrol and LPG fuelled motors.

The sectioned view of a rowcrop 4010 gives a good idea of the models main features.



The Model 4020 was an upgrade of the 4010 which remained in production until 1972 by which time 184 000 had been sold.

The 8 speed transmission had a "Power Shift" option which allowed clutchless changes on the go. The clutch pedal was now an inching control. A pedal operated diff lock was standard, and a Hydrostatic front wheel drive was an option which had settings to assist steering or traction. For its time the 4020 offered excellent value for money and it went a long way towards making John Deere become the major tractor manufacturer.

From 1961 to 1964 John Deere produced 100 4WD articulated Tractors with 150 drawbar horsepower. A GM 6/71 Diesel with 215HP available was fitted which made it a massive tractor in its day. It was the first 4WD tractor made by a major tractor manufacturer.

This Model 8010/20 was priced at around $30000 which was nearly 6 times the price of a Model 830 so there were not a lot of buyers and only 100 were made. One sold in Canada in 2010 for $90 000 which was a good return on a 1960's tractor. It certainly was an early look at what might arrive in the future!

The Model 9620 R (left) and RX (right) share some common overall layout features with the earlier generation tractor. They are powered by a Cummins 6 Cylinder 912 CID Diesel motor with an output of 620 hp in front of an 18 speed Power Shift transmission. They weigh between 24 and 30Tons depending on how they are set up.

At the other end of the weight scale is the Gator, a utility All Terrain Vehicle that started out as the John Deere AMT, a 5 wheeled utility vehicle in 1987.

Another wheel was added in 1992 and the gator 6*4 had arrived. With a payload of 1000 pounds these were a versatile vehicle with uses in agriculture, industry and recreation. These vehicles have now morphed into the Gator XUV Crossover Utility Vehicle series with various options available to optimise them for different purposes.

Cervus, (see bottom photo on the front page), the John Deere distributer in Ballarat will have the Gator on display at the rally, where it should have a high profile organising various events. The company also expect to have some modern tractors on display. This will depend on what is available at the time but it is expected that they will be the 6000 series

This pretty much brings us to the end of this write up on some early JOHN DEERE tractors that you might expect to see at a John Deere Rally.

There has been no attempt to include any other agricultural, Industrial or Forestry equipment made by John Deere, but that does not mean they will not be at the Rally in November.

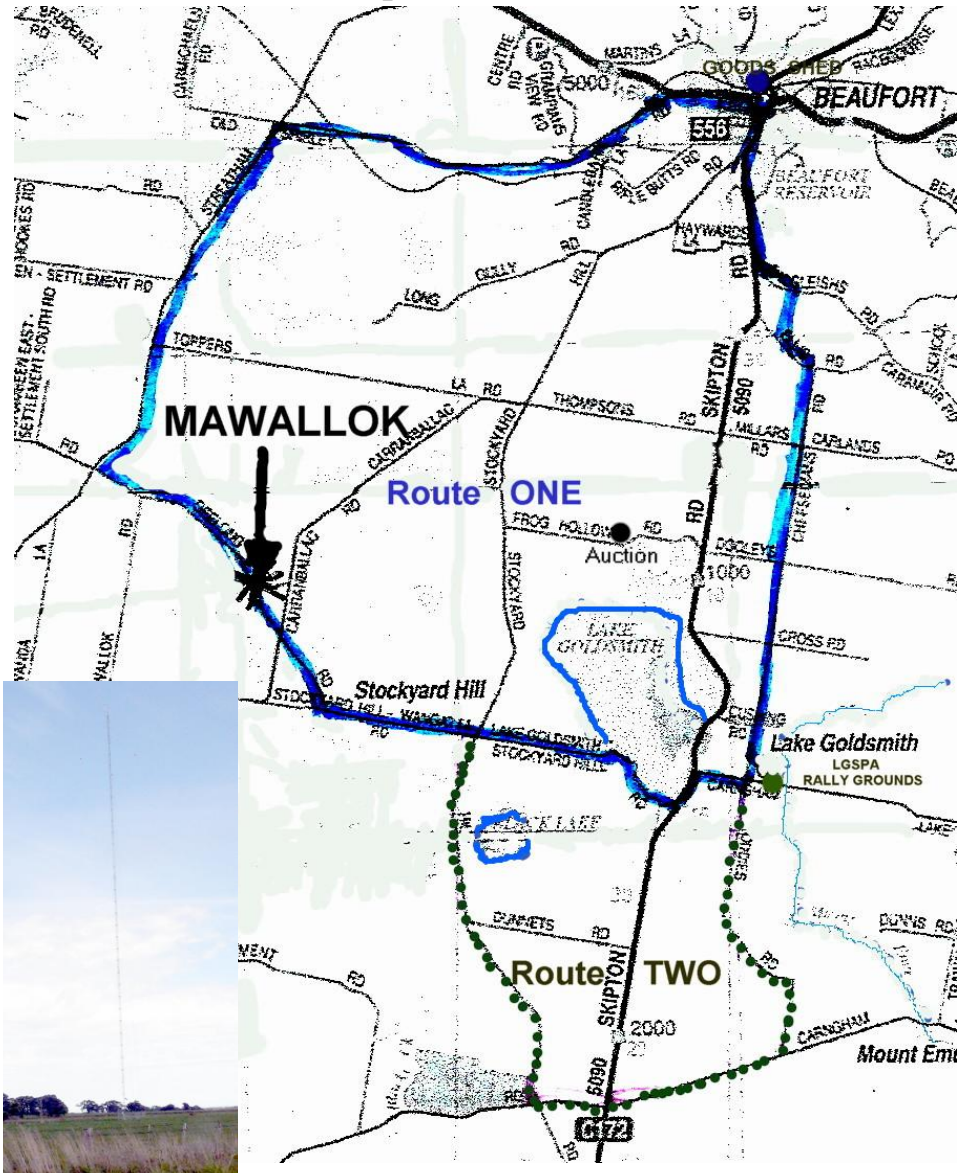
Come along and enjoy the Day.

The Pyrenees Tractor Trek Update.

In the last edition we outlined the route for this event which starts in the Rally Ground Carpark at 8.45AM. on Friday the 3rd of November, the day before the November Rally The last edition did not go out in print, but it can be downloaded from the clubs website at www.lakegoldsmithsteamrally.org.au as edition 143 under the magazine tab. The Map has been repeated here for those who missed it.

Briefly the route follows the blue line until you get to Stockyard Hill. At that point you can take the short run back to the Rally Grounds along the South side of Lake Goldsmith, which provides some good high views across the Lake (last weekend there was enough water for some good views and pictures). The other option is to continue along route 2 (the green dotted line) and return to the Rally Ground via Oddies Road.

Route 1 is a round trip of around 53KM and the Route 1+2 is 64KM.



The first stop is in Beaufort at the Clubs Goods Shed where morning tea will be served while you look around the display inside.

Toilets and Hot water are available inside

BYO lunch will be at the Mawallok Station Shearing Shed yards.

Again Toilets are available.

There will be lead and follow up vehicles along the way.

Picture on the left is a wind test tower near Mawallok Station.

For information, contact Ron on 0418 514 990 or Phil on 0418 399 341

The Harry Ferguson Tractor Club Of Australia Inc.

The Tractor Trek is being organised by the Harry Ferguson Tractor Club who have there substantial headquarters pavilion at the Lake Goldsmith Rally Grounds.

Harry Fergusons role in agricultural history has been well recorded. TOMM magazine recently outlined his history, and the Rally program entry for shed 4 has a brief outline.

Harry Ferguson had another interest which impacted road safety by developing the first vehicle with full time four wheel drive and anti-skid braking.

Following a successful court case for patent infringement, and the sale of his interests in Massey Ferguson Tractors, he had funds to further this dream and develop a series of prototype cars which incorporated these features which had been considered by Fredie Dixon and Tony Rolt. For good measure they also introduced the first hatchback and electric windows.

Harry Ferguson Research Ltd. was formed in 1950 in Coventry England. Various prototypes were built until the R5 (3 built) shown on the last page made a public debut in 1965 when it was tested by motor magazine Autocar. The earlier R4 arrived in 1952 (see picture on the right). Post WW2 was a difficult time to manufacture or sell new expensive concepts.

The R5 was an advanced design for its time, full time 4WD, 4 wheel disc brakes with Dunlop Maxaret antilock brakes, and a flat 4 engine.

A formula 1 car was planned to demonstrate the effectiveness of the Ferguson four wheel drive system and promote its advantages to industry.

Tony Rolt was a racing driver who had won at Le Mans in 1953 driving a C Type Jaguar. Claude Hill who had been Aston Martins designer and Technical Manager was engaged to design the space frame chassis.

The P99 was designed while the 2.5 litre engine limit for F1 cars was current. As fortune would have it, the rules were to change for 1961 and limited the engine size to 1.5 Litres. This would put the car (there was only one) at a disadvantage, as the transmission and body were built for the heavier Climax engine and the new V8 1.5 L Climax engine would not be developed properly until the end of 1961. The only engine available was an old 4 cylinder FPF Climax engine.

The project was completed within a year, bur unfortunately Harry Ferguson passed away I October 1960, before he could see the car in action.

The cars first successful race, (it had been in 2 earlier races, an accident put it out of the first, and it was black flagged for a push start in the second) was the International Gold Cup at Oulton Park, a hilly circuit on a wet day. The car was entered by the Rob Walker Racing Team (his family made whisky in Scotland) in the Blue and White team colours.

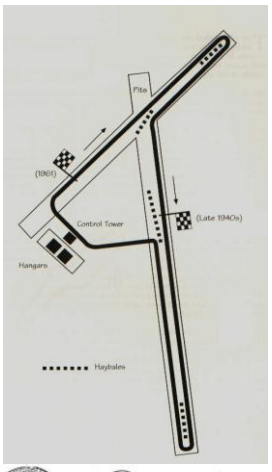
The car was driven by Stirling Moss. In practice he qualified 2nd on the grid next to Jack Brabbam in his Cooper Climax. By the end of the race he was 46 seconds in front of Brabbam and the P99 won its only Formula One race.

The P99 was the last front engined and the only 4WD to win a Formula 1 race.

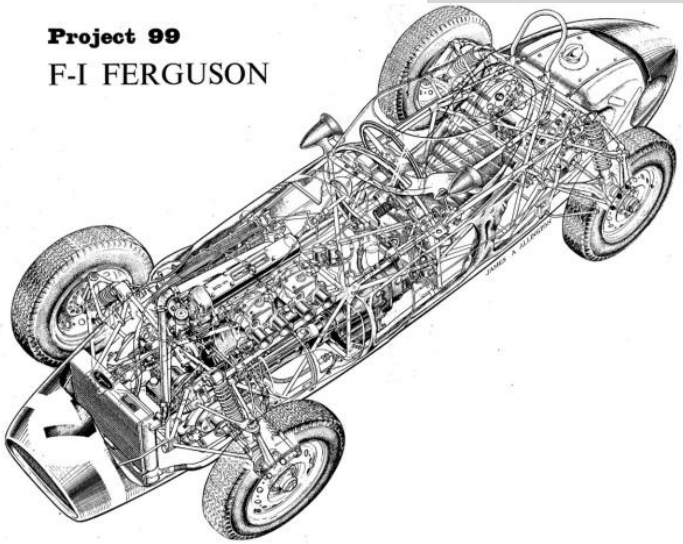
The picture on the right is Moss in the P99 at a Goodwood revival race after it was restored by the

Ferguson Family.

After the race at Oulton Park, the car had the original 2.5l Climax engine fitted for a tour to Australia where the Formula Libra was still for 2.5L cars. I recollect seeing pictures of the car on display at the Ballarat Airfield International race when Dan Gurney and Graham Hill brought their 2.5 Litre BRM's in 1st & 2nd in the Victoria Trophy race. Those magazines are on a high shelf, and unfortunately, I cannot confirm it.



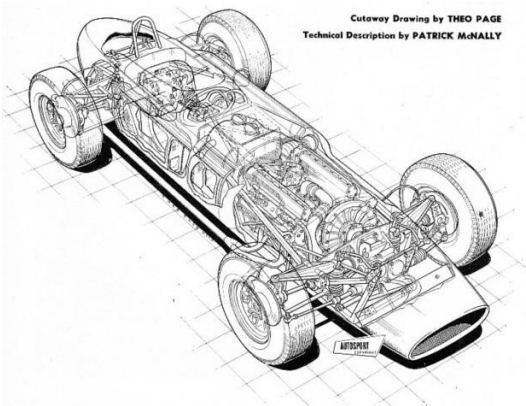
The Car was sent to New Zealand for Four NZ GP races at Pukukohe, Levin, Wigram and Teretonga in Jan 1963 with Rob Walker Racing, driven by Graham Hill and Innes Ireland driving. It then came to Australia and raced at Lakeside in Queensland where it took 2nd place (It won an earlier race in the wet) and Warwick Farm in NSW.



The P99 then returned to the UK and in 1964 won the British Hill Climb Championship.

The P99 was an incredible effort. A one car team built by a manufacturer with no F1 experience, built for a formula that finished before it raced and driven by drivers who were now driving rear engined cars.

Stirling Moss practiced enough to develop a driving style to maximise the advantages of the 4wd system, later remarked that"" in its day, when it was wet that car was unbeatable, absolutely unbeatable", and much later said that "it was one of his favourite cars from that era", and he had driven most of the best.



The P99 was used as a basis for the 500hp+ V8 Novie engined 4 wheel drive car for the Indianapolis 500. The Car qualified well but was put out of the race in a multi car accident on lap 2.

The first road car to use the Ferguson System was the Jensen FF Interceptor in 1965. This was a large car powered by a Chrysler 361 cid engine with an automatic transmission. The FF was a low (318) production version of the 2WD car. It was also fitted with the Maxaret Anti lock braking system. Again from memory, a magazine review of the day said that you could drive with 2 wheels in the gravel and 2 on asphalt at 100mph and hit the brakes and pull up in a straight line, a pretty amazing feat at that time.

The Mazaret Brake was developed by Dunlop in the late 1940's for use with Aeroplane brakes. The system mechanically detected when a wheel locked while the vehicle was moving. If this happened it dropped the brake pressure briefly to release the wheel and then reapply the brake. This devise improved the safety of Aeroplane landings markedly by reducing skids, flat spots on tyres and blowouts, and reduced landing distances on wet and icy runways. They worked well at high landing speeds when the effect of a lock up was at its worst.

The released fluid was transferred to a reservoir, and each burst could last 10 seconds while the system could pulse about 10 times a second. if there was no lockup there was no pulsing. In a plane the brakes are only used for a short time while landing.

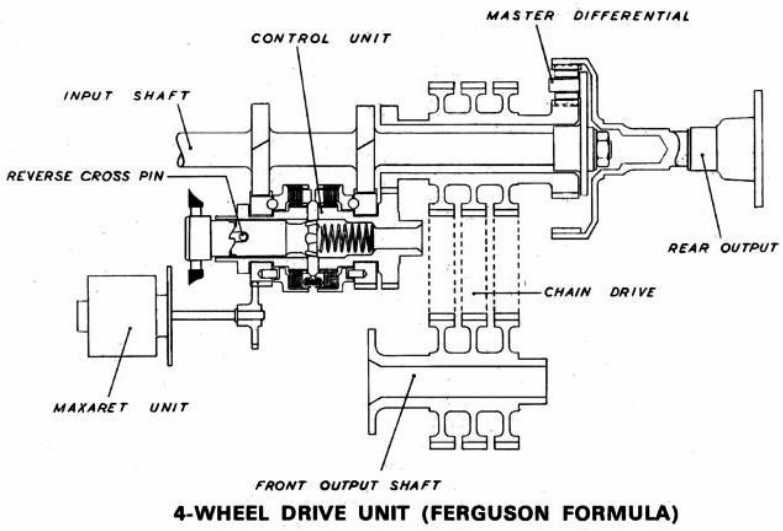
In a car the brakes are used frequently, so it is not practical to keep bleeding fluid off, so the Ferguson bled the high pressure pulse back into the master cylinder which pulsed the pedal back against the drivers foot. Some racing drivers did not like the loss of sensitivity as they had developed good pedal control anyway. Moss turned it off.

In later days ABS development simplified the design and reduced the cost to allow its common use in cars today. In 1950 this adaption of aircraft technology to road vehicles was a Ferguson first and its success paved the way for the future.

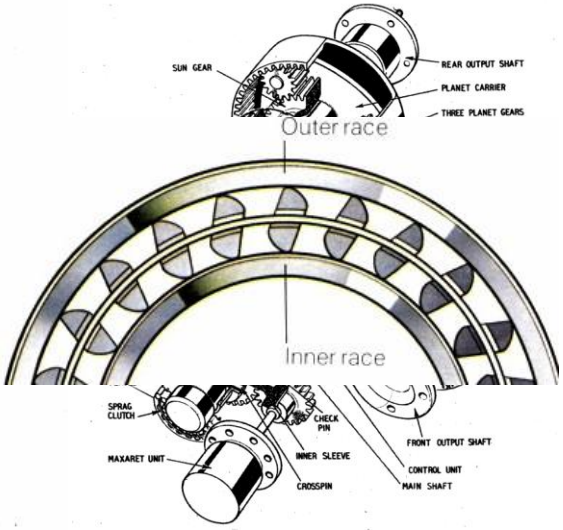
Four wheel drive vehicles had been around for a long time but its use had generally been limited to off road vehicles. Where off road use was intermittent, the drive to the front wheels could generally be disengaged, particularly when driving on hard pavements. The fixed rotation to the front and rear axle required that average surface speed of the front tyres was identical to the rear. The front and rear differential could accommodate side to side variations, and in principle a differential in the centre at the gearbox could accommodate a difference front to rear, but it is not that simple.

When a vehicle accelerates weight is transferred from the front to the rear which effects the tyre slip, rolling radius and the tractive effort. Combined with variations

from steering and undulating ground, tyre wear and pressure there is always the chance that one wheel will lose traction and spin with a loss of traction to all wheels.



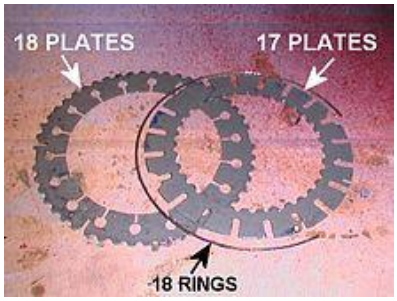
4-WHEEL DRIVE UNIT (FERGUSON FORMULA)



The FF system detects wheel spin and allows a sprag clutch to lock which then closes a clutch and transfers the torque to the non spinning axle which releases the drive to the spinning axle which stops the wheel spin and the drive is returned when the sprag releases. Similarly if a wheel locks under brakes, the torque is transferred to the spinning wheels until the wheel is unlocked and the braking torque is returned.

The drawing on the right shows the arrangement of the small cam like elements that slide freely when rotated in one direction, or rotate and jam when one shell rotates in the opposite direction, a small spring maintains contact for minimum backlash.

The Ferguson system was again used on F1 in the late 60's when BRM in 1964 and Lotus, Matra and McLaren in 1969 brought it back to life. It did not find a lot of success with rear engined cars as wide wheels and aerodynamic effects were able to get the power on the road without the extra weight, and driver discomfort of 4WD in rear engined cars. Williams produced a 6 wheeled car, 4 of which drove showed promise, but later 4WD and 6 wheel cars were permanently banned from Formula 1.



In 1971 Tony Rolt formed FF Developments to pursue applications for the Ferguson Formula. He is credited with developing the idea of the viscous coupling and applying it to FF 4WD technology simplifying the manufacture and reducing the cost of full time 4WD. In 1971 the Subaru FF-1300g Station Wagon arrived in limited quantities. (picture above)

Audi Quattro Group B dominated when it introduced AWD

Rally cars were the next stage when Audi developed the Quattro 4WD and the fabulous Group B Rally cars with their spectacular back road performance.

FFD provided support for many of these teams and cars. The company had an office in Detroit USA where it work with General Motors and others on AWD development.

In the UK they designed and developed the Jaguar XJ220 AWD transmission and manufactured the McLaren F1 transmission.

FFD was acquired by Ricardo in 1994 and formed the basis of their Driveline division in the UK. The company was now FFD Ricardo, and Tony Rolt's son Stuart who joined the company in 1981, stayed on with the group until 1996 when it was absorbed into Ricardo. Ricardo has a worldwide Driveline and Transmission division

Ultimately the viscous coupling morphed into transmissions with electronic control which further enhanced the advantages of AWD on road cars, and this still goes on with designs for electric and hybrid vehicles.

Next time you marvel at the success of Harry Fergusons tractors and the Linkage that became a world standard, give a thought to the next AWD car that you see on the highway, its roots, directly or indirectly go right back to Harry Ferguson and the company that he formed to develop an all-wheel drive and brake system that would improve the safety of road cars.

Harry Ferguson did not live to see the success of the Ferguson Formula. Tony Rolt carried on the work with intuition and resourcefulness and made it a practical system that is with us every day. Harry Ferguson's genius was in recognising the advantages of 4WD and developing a system that would overcome the limiting factors. Beyond that it was a matter of incorporating upcoming technological improvements.

There is a lot of information available on this driveline system. For anyone with an interest in Ferguson you can spent a lot of time filling in on (and correcting!) the loose string of details that are collected here. As an aside, Harry Ferguson was the first person to design, build & fly a plane in Ireland and Tony Rolt spent WW2 in Colditz.

Notice to Members:- COLLECTORS CLEARING SALE
NEAR LAKE GOLDSMITH
at "ARCOONA' 182 Frog Hollow Road Lake Goldsmith
(See centre of Map on Page 11)
FRIDAY NOV 3 2017 at 10AM
Pre-auction inspection:- Wednesday Nov 1 & Thursday Nov 2 on site.
Contact Shirley Boyle 03 5349 8227
Agent:- ELDERS Julian 0428 937 694
www.eldersrural.com.au/clearingsales

This clearing Sale is being held by Shirley Boyle at her home. The items include many from the Boyle family who arrived at Lake Goldsmith in the 1800's, and include many items acquired by David Boyle to make the model collection which is now on display at Science-works in Spotswood, just SW of Melbourne.

1906 Lennon Double Furrow Plough
1912 Lennon Potato Scuffler
1880 Walk behind Hay Rake
1906 M.H Spring Tooth Harrow
1908 Grain Grinder
1909 Bag Loader
1940 McKay Separator

Sunshine HST Header Harvester
IH Steerable Harrow Cart
Wheelwrights Tyre Shrinker
Steelyard Scale
Southern Cross Petrol Engine
R & T (N), Bamford & Lister D engine Parts
Clayton & Shuttleworth Threshing Machine (for Parts)
Ballarat Made Vertical Bellow set
Ballarat Jail Cell door

3 Hay Trucks & 2 * 4 Furrow Ploughs
2 Double Furrow Ploughs
4 Single Furrow Ploughs
4 McKay Sunshine Gates
2 Corrugated Iron Rollers
Hand Chaff Cutters
Rope making items
Hand Well Pump
Small Anvil, swageblock & vice.
Blacksmith Toools
Furphy Tank End
Assorted Oil Drums and Enamel Signs

Treated Pine Poles, Fence Wire weldmesh panels bullnosed veranda sheets
Watch the "For sale Column" at www.lakegoldsmithsteamrally.org.au
The Boyle Family have a long history with the District & Rally.

Tuxford

The Company behind our oldest working engine

Some background history of the Tuxford Company was made available from a booklet on the history of the Heckington Windmill. This booklet was provided by Lynda Sergeant who attended our 108th Rally with Felicity Tuxford who is a descendant of the Tuxford family. Felicity and Lynda visited the rally to gather information on the clubs twin cylinder engine and other survivors around the state. (see page 8 Edition 139 for more background).

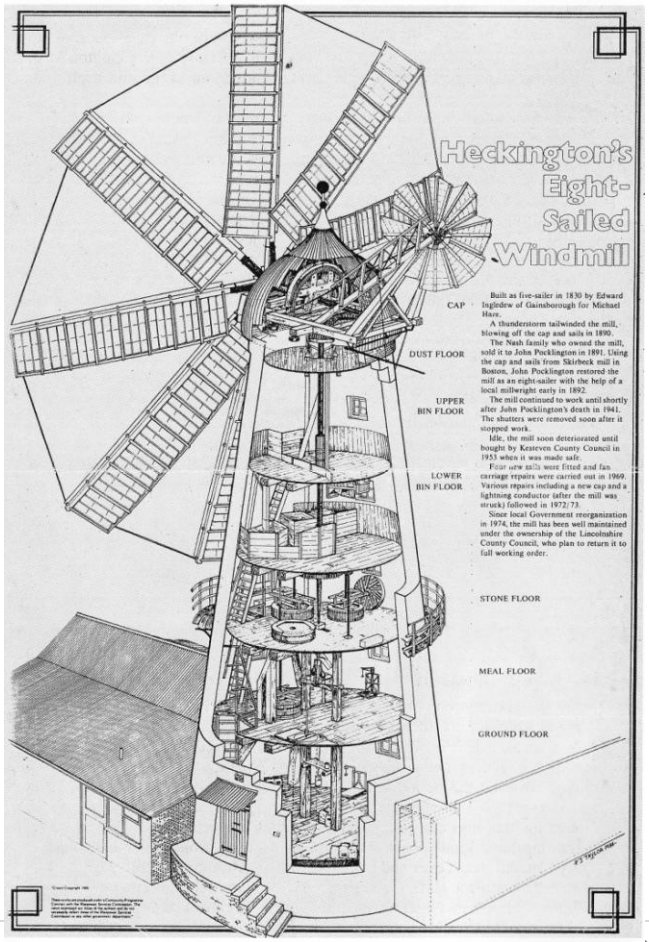
Lynda is involved with this preserved Windmill which although located about 12KM West of Boston & Skirbeck which was the home of Tuxford, has a direct link as the rotating windmill head powered the original windmill used by the Tuxford family to grind flour.

The Heckington Mill was built in 1830 with a five armed sail using patented adjustable louvered sails which could be adjusted to maximise the power available, or feathered to minimise it. The six storey tower was made of brick which was painted with black bituminous paint to stop moisture penetration.

This mill functioned for 60 years until lightning struck the direction controlling fan in 1890. With the loss of control the sail rotated and spun out of control until it disintegrated, along with much of the top of the tower. The damaged mill and property were sold, and by good fortune were acquired by a new owner, who at an earlier date had purchased the Tuxford 8 arm mill head with cap gear and control fan to go with it.

The new owner was John Pocklington. The repair of the mill tower and fitting of the mill head and sail were completed in 1892 and the mill ran until 1946 when the shutters were removed from the sails. In addition to the flour milling a line shaft provided a drive for a timber mill in an adjacent building at ground level.

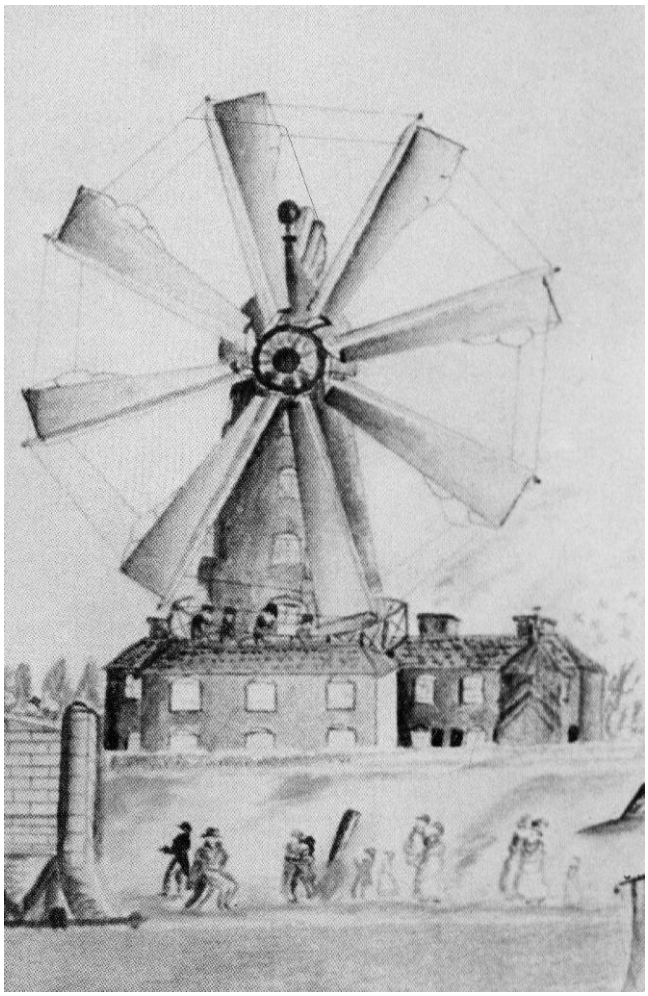
The 8 arm mill was powerful enough to run 4 sets of stones and an elevator to lift the grain to the top floor from where it descended through the various processes until it left the ground floor in bags.



The mill was initially preserved and repaired by the Friends of Heckington Mill and later in 1986 it was opened and operated by The Heckington Mill

Trust. Later restoration in 2014 saw the mill fitted with new sails. This mill is the last of 12 eight arm wind mills built in the UK, and the last of four which were in Lincolnshire.

Of interest to us is the source of the mill head which was used for the reconstruction of the Heckington Mill in the early 1890's.

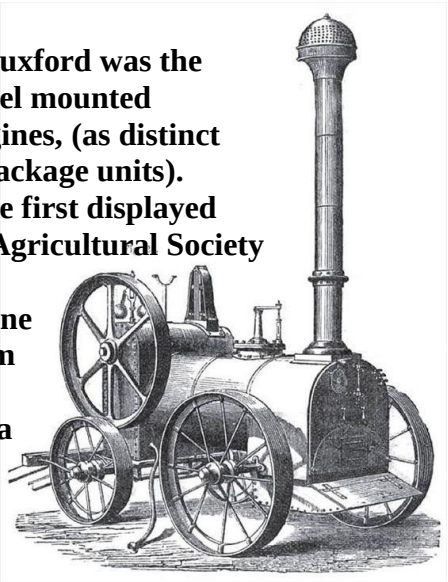


John Pocklington had purchased the remains of the Tuxford Family's milling enterprise at Skirbeck, a Borough of Boston in Lincolnshire.

This mill was built in 1813. In 1838 William Tuxford, (who had patented a corn screening machine in 1830) formed a company, William Tuxford and Sons at the Boston and Skirbeck Ironworks which was built alongside the existing Milling and Baking business depicted in the 1822 watercolour on the left. Weston Tuxford later joined the company

By 1839 William Tuxford was the forerunner of wheel mounted portable steam engines, (as distinct from relocatable package units).

These engines were first displayed at the 1842 Royal Agricultural Society Show in Bristol.



The portable engine on the right is from about 1861.

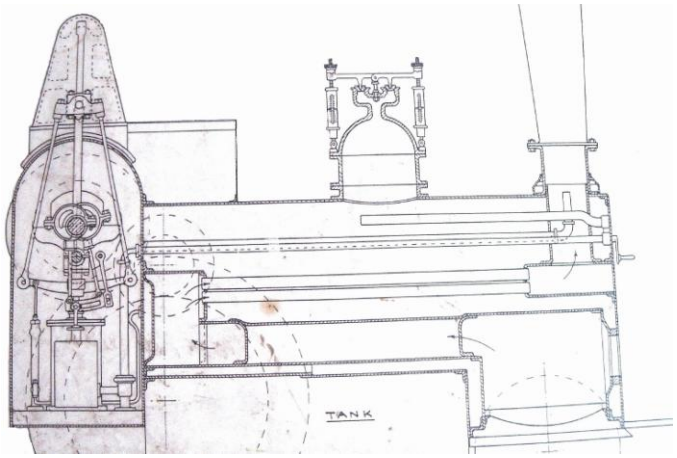
It appears to have a single vertical cylinder Steeple engine.

Felicity Tuxford has provided a copy of the Royal Agricultural Society of England's records of Tuxford exhibits from 1850 to 1882. Unfortunately these records do not include pictures

For 1850, at Exeter, Tuxfords's exhibited 4 new implements, a wheel mounted straw shaker, to separate grain and straw, a 1 ½Ton 30" diameter load distributing self-cleaning clod busting roller with road wheels and shafts for 3 horses.

The primary exhibit was a 6 nhp Portable Steam Engine, invented and exhibitors:

Tuxford and Sons, of Boston and Skirbeck Ironworks, Boston, Lincolnshire.



A scan of the entry is reproduced on the next page, and the description is well worth a read.

The drawing on the right, although depicting a later traction engine boiler, is typical of the portable engines.

The firebox is fully jacketed on all sides and the hot air moves to the front smokebox via a single Cornish boiler large tube low in the water. From the front fire box the hot gas returns to the rear smokebox and leaves by the chimney through the water/steam space.

As can be seen on the engraving of the portable above, the safety valve is a single dead weight and a governor is fitted over the engine.

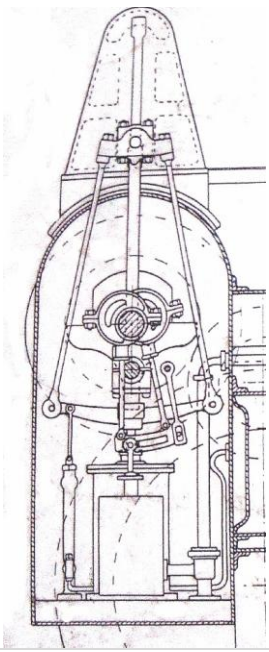
Stand No. 94.—*Tuxford and Sons, of Boston and Skirbeck Ironworks, Boston, Lincolnshire.*

Article No. 1.—(*New Implement.*)—A Portable Steam Engine of Six-horse Power; invented and manufactured by the exhibiters. This steam engine is simple, and from its small size very portable; two horses, upon ordinary roads, being sufficient to transport it from farm to farm. The principle of the upright cylinder has been preferred by the inventors, their experience in the manufacture of portable steam engines, dating as far back as 1842, having proved the horizontal cylinder liable to wear oval from the rubbing of the piston upon the lower part, greatly assisted by priming occasioned by bad water. The engine is effectually protected from the weather, and from dirt or grit while working, a matter of the first consideration, as the grit is more injurious to the wearing parts than the work to be performed; it is also locked from interference when not in use. Its construction has allowed the side rods to be of sufficient length to prevent injury by the angle they assume, yet keeping the length of the engine within three feet to the fly wheel shaft. The governors, and the method of attaching them, are also novel and simple. The boiler is made entirely from low moor iron, the best and most costly in the kingdom. It has a fire-box and water-space bottom flue, returning through lap-welded tubes over it. The chimney is furnished with a spark-trap, and the furnace with an ash-pan containing water, and a quadrant front. The consumption of water and fuel is very small. Boiler plates of low moor iron, $\frac{1}{4}$ in. thick, with the exception of the tube plates, which are $\frac{1}{2}$ in. thick; cylinder, 7 in. in diameter; length of stroke, 12 in.; revolutions per minute, 150; diameter of crank shaft, $2\frac{1}{8}$ in. of wrought iron; diameter of fly-wheel, 4 ft. 6 in.; weight of do., 5 cwt.; diam. of driving pulleys, 4 ft. 6 in. and 1 ft. 6 in.; power of engine, six-horse; time to generate steam at working pressure, 25 minutes; fuel to get up steam, wood 8lbs., hard coal 36lbs.; consumption of fuel when at work 45lbs. per hour. Price of engine with governors, the boiler felted and cased, £190.

Interestingly, there is no mention of working pressure, image of a pressure gauge or sight glass.

The picture on the left was taken at the Swan Hill Pioneer Museum. It has the same Bore (7") and Stroke (12") as the machine on stand No 94 at the Exeter described above, which makes it 6nhp. It is no 501 and is thought to date from the early to mid 1850's. The drawing enlargement on the right provides an outline of the mechanism. The A frame sliding connecting rod, shown at bottom dead centre, drives the crankshaft with a connecting rod from the top pin, and the water pump from the lower cross beam.

The valves are driven from eccentrics on the Crankshaft. And the valve chests fill and exhaust from their lower ends. Everything is easily accessible from the operator at ground level.



For 1851, the exhibition was in the Agricultural and Horticultural section of the Great Exhibition at Hyde Park. Tuxford displayed 4 and 6 nhp portable engines, and received an award medal.
The extract of the award winners is shown by product category, Maker and Country.
Tuxford, Clayton and Shuttleworth, received medals for Steam engines.

CLASS IX.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded
United Kingdom	15	Busby, W.	Two or four horse plough, horse ribbing corn drill, and cart.
——	135	Crosskill, W.	Norwegian harrow, meal mill, and gorse-bruiser.
——	142	Garrett and Sons	Horse-hoe, general purpose drill drill on the flat, improved h for grass seeds, steam engin machine.
——	233	Hornsby and Sons	Corn and seed drill, drop drill drill on the ridge, oil-cake b gine.
United States	73	M'Cormick, C. H.	Reaping machine.

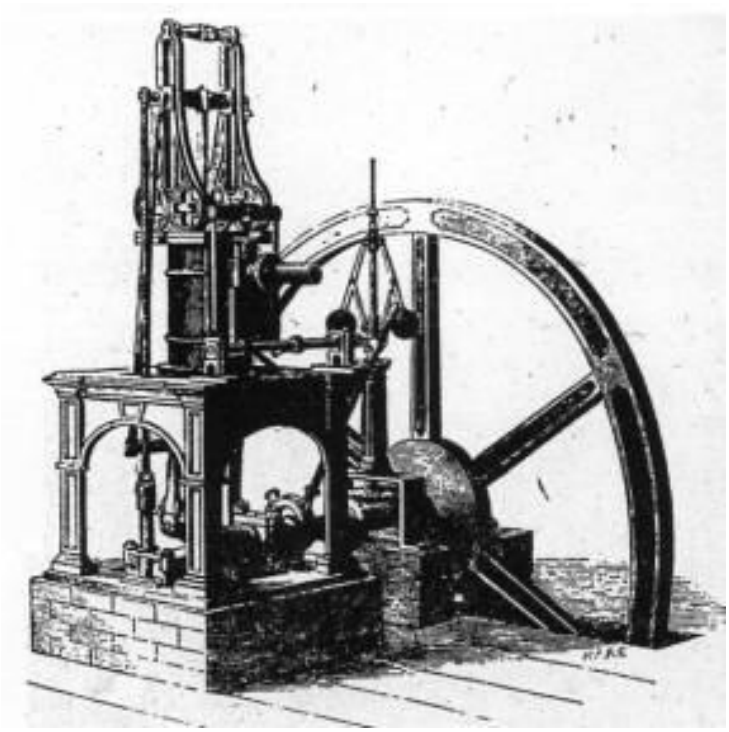
PRIZE MEDAL.

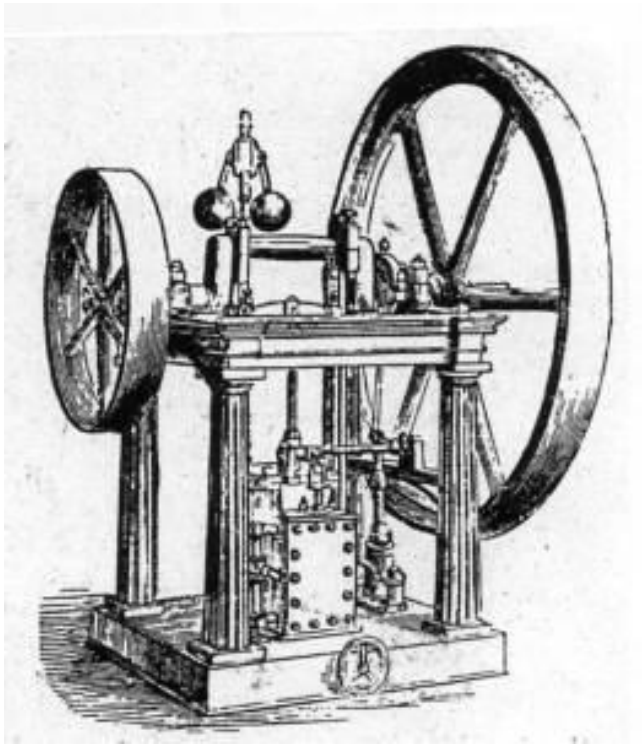
United Kingdom	132	Ball, W.	Two-horse plough.
——	128	Barrett, Exall, and Andrews	Steam-engine and linseed and co
——	217	Bentall, E. H.	Cultivator dynamometer.
——	237	Burgess and Key	Improved American churn and
——	37	Burrell, C.	Gorse bruiser.
Belgium	163	Claes, P.	Corn drill and roller.
United Kingdom	242	Clayton, Shuttleworth, and Co.	Steam engine.
——	47	Clayton, H.	Tile machine.
——	216	Coleman, R.	Cultivator expanding harrow.
——	143	Comins, J.	Horse-hoe.
——	205	Cornes, James	Chaff cutter.
——	96	Crowley and Sons	Cart.
Belgium	510	Delstanche, P.	Plough.
——	166	Duchene, J. J.	Churn.
United Kingdom	129	Gibson, M.	Clod crusher.
——	150	Gray and Sons	Cart.
——	149	Hensman and Son	Thrashing machine, four-horse p
——	241	Holmes and Sons	Thrashing machine.
——	240	Howard, J. and F.	Two-horse XX plough, four-hor rake.
——	414	Hurwood, G. (Cl. VI.)	Meal mill.
Netherlands	74	Jenken, W.	Plough.
France	1299	Lavoisy, A. D.	Churn.
United Kingdom	124A	Newington, Dr. S. (as Inventor)	Top-dressing machine.
——	50	Nicholson, W. N.	Oil-cake bruiser.
Belgium	169	Odeurs, J. M.	Plough.
United States	404	Prouty and Mears	Plough.
United Kingdom	124	Ransomes and May	Drop drill.
——	108	Reeves, T. R. and J.	Water drill and liquid-manure d
——	185	Samuelson, B.	Turnip cutter.
——	228	Scragg, T.	Tile machine.
——	234	Smith and Co.	Haymaker, chaff cutter, horse ra
——	1	Stanley, W. P.	Linseed and barley crusher.
France	1028	Talbot Brothers	Plough.
United Kingdom	271	Tuxford and Sons	Steam engine.
——	220	Wilkinson, T.	Churn.
——	151	Williams, W.	Light and heavy harrows.
——	239	Whitehead, J.	Tile machine.
France	705	Vachon, Son, and Co.	A seed and corn separator.

HONOURABLE MENTION.

United Kingdom	28A	Fowler, J.	Draining plough.

In a different Section (No 5) of the exhibition Tuxford displayed some stationary engines





On the left is what was described as a "Table Engine". On the right is a "Portable". With the Flywheel above the floor and no brick base, the engine could be moved as a self-contained unit.

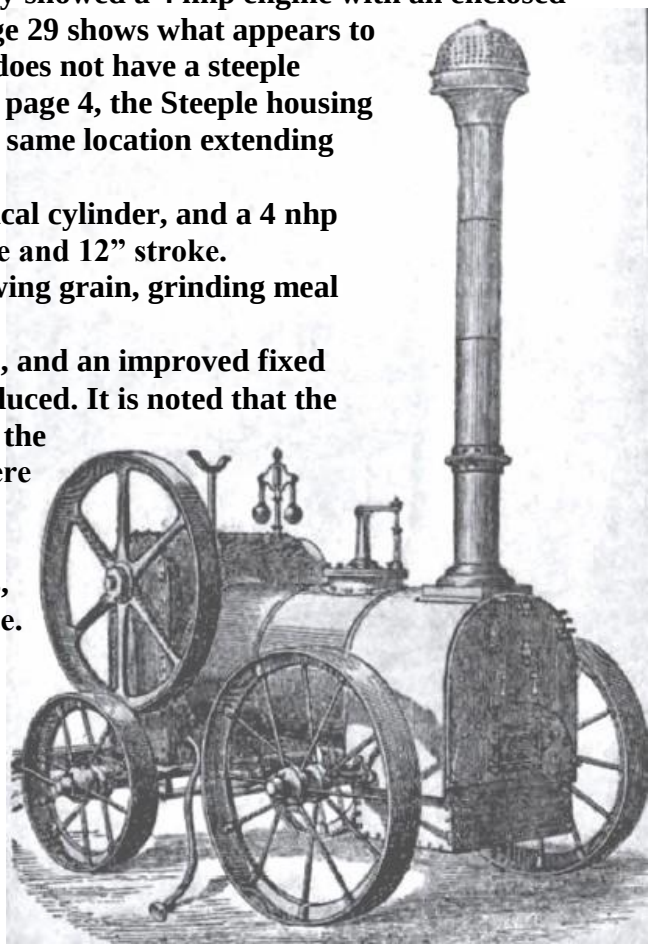
For 1852 the Agricultural show was at Lewes , and Tuxford had their 4 and 6 nhp fixed vertical cylinder portable enclosed engine again. This year they showed a 4 nhp engine with an enclosed oscillating cylinder engine. The drawing Fig 23 on page 29 shows what appears to be one of these engines, and the drawing on the right does not have a steeple

When compared with the vertical cylinder engine on page 4, the Steeple housing is missing and the Governor fly balls are shown in the same location extending through the top of the engine housing.

They also exhibited a 6 nhp fixed engine with a vertical cylinder, and a 4 nhp fixed engine with an oscillating cylinder with a 6" bore and 12" stroke.

Five other machines for threshing, shaking and blowing grain, grinding meal and a 26" diameter circular saw bench were on show.

Similar engines were displayed at Gloucester in 1853, and an improved fixed Engine with an 8 1/2" ϕ bore by 12' Stroke was introduced. It is noted that the Boiler was made of Best Butterley Crown plates, with the shell using 3/8" plates and the flues ¼". 5/8" rivets were 2" apart. There were 2 internal flues with fire ways within them. They were fitted with a blow off cock, improved glass water gauge and common gauge cocks, steelyard, and safety valve with Salter's spring balance.



The crankshaft was a 2 ¾" ϕ wrought iron "faggoted up from Lowmoor scrap"

The previous boiler shells had been made from ¼" "Lowmoor iron, the best and most costly in the Kingdom"

Again grain and straw handling machinery were Displayed, as was a "Kibbling and Crushing mill invented by the makers.

For 1854 the show was at Lincoln, and some improved equipment was introduced. A 4 nhp patent portable housed engine, invented by Weston Tuxford had steam jacketed vertical cylinders. Three other portables of 5, 6 and 8 HP were also shown, as was a 4nhp fixed engine with an oscillating cylinder on a cast iron sole plate with Doric framing and entablature for supporting the crank end of the shaft, the other end being supported by a plummer block fixed in the wall. The engine was furnished with a Cornish Boiler made of Butterley BB Crown plates.

The engine had a 6" bore and 12" stroke and ran at 135 RPM

A 6HP engine on 4 Doric columns, arranged for power to be taken of either or both ends of the Flywheel shaft. This engine had a Bore and stroke of 8 ½ * 12 inches and ran at 120 rpm. A similar engine with jacketed cylinders was also displayed.

Other grain working machines were on display, as was a 30" circular saw with powered self-feeding support horses on rails.

The 14 items on display were for the first time listed as invented by Weston Tuxford, and one engine was listed as patented. Today we tend to use the term designer for non-patented designs and inventors for patented designs. There is a degree of inventing in design as different concepts are combined, but these may not be patentable.

Some other names have different meanings today. Wrought iron is currently used to describe ornamental steelwork, or steel wrought (or worked) hot or cold by a Blacksmith. Before steel came into common use in the late 1800's wrought iron was a term for low carbon iron (as distinct from cast iron which had a high carbon content which made it brittle). Wrought iron could be forge welded at high temperatures, but required working to distribute it evenly in the iron. The stretched impurities left grain lines on the surface. These impurities, or "slag inclusions" were about 2% by weight. Wrought iron was corrosion resistant, malleable and tough. The low carbon content was achieved by adding iron oxide in the furnace using a puddling technique. If the amount of iron oxide was restricted, it was found that enough carbon would survive to form steel which could be used for edged tools and springs. Unlike iron, steel could be heat treated to enhance properties.

Low Moore was a large manufacturer of wrought iron in the early 1800's. Their works at "Low Moore" in West Yorkshire, had access to good quality iron ore and low sulphur coal providing good quality wrought iron. They produced wrought iron from 1801 to the mid 1950's. The view on the right is from the mid 1850's

Faggoting is a process where scraps of iron are bundled to resemble a faggot of sticks used for firewood. These scraps are heated to welding temperature (near white hot) and hammered into large ingots which are flattened and folded and hammered again until they are fused. The block, still hot is then hammered to stretch the "grain" in one direction. This alignment increases the tensile strength in the stretched direction, as required in a shaft. If the ingot is re-faggoted it is described as Best, if faggoted a third time it is Best Best. The tensile strength increases with each rework.

Some of these terms sound like advertising spin when we read them today. In their day they were used to demonstrate the use of quality material.

My apologies for the crude and oversimplified descriptions, but hopefully they help interpret the terms used in a time when technology was evolving to produce the processes and materials familiar to us today.

It is not the intention to write a history of Tuxford products, the hope is to try and follow the evolution of their steam engines and provide some sort of context for where our engine is this line.

Butterley was established in 1790 in Ripley Derbyshire (and still going). In 1856 they adopted the Bessemer Process, which removed impurities by direct injection of oxygen gas into a furnace lined with selected refractory lining. The impurities formed a light slag which floated. This process produced high quality steel at a low price which gave superior performance to wrought iron.

By the dates it seems that Tuxford was quick to take up the advantages of new materials.

The move from Best Laymoore to Butterley B.B. Crown plate (I presume B,B to be Best Best which had a higher tensile strength) was to build boilers which could work at higher pressures even before the arrival of cheaper steel.

Now back to the engines.

1855 notes another improvement, in addition to the jacked steam cylinders, was the incorporation of an expansive valve (see page 32) on their 8 nhp vertical cylinder portable which had a 9" bore and 12" stroke, and ran at 125rpm. The style and type of expansive valve is not explained. It implies that only the regulator and governor were used in earlier models with no form of early cut off available. Expansion valves seem to have been used on early stationary or marine engines prior to more complex link valve gear.

It claimed "a boiler built on a new principle, effectively obviating the troublesome leakage so common in ordinary tubular boilers"!!

This engine had a 3"ϕ Crankshaft and was priced at £250.

A similar 6 hp was on offer for £190 and a 4 nhp "having the simple cap valve without the expansion gear" was £190. This engine took first prize.

The expansion valve was also fitted to a 6hp fixed steam engine which was" felted and lagged" , And the 4hp fixed engine with oscillating cylinder could be yours for £110.

A 24" and 42" circular saw and a "Thrashing" machine was also shown at this Show in Carlisle.

At Chelmsford in 1856, the show entry made strong mention of the advantage of low leakage of water into the firebox offered by their design which combined flues and tubes.

They state that these advantages led to sales to the French and Prussian Government for the Museum of Arts and Trades in Paris, and the Agricultural Museum in Magdeburg respectively.

I understand that the engine in Paris has been restored and is currently on display.

Nine engines and two saws and a Thrashing machine were again on display.

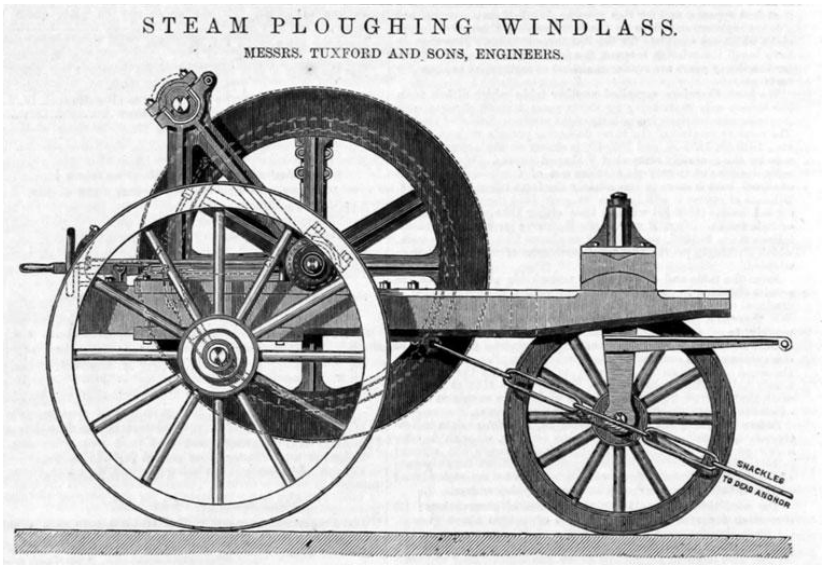
For 1857 there were 8 engines on display a Salisbury, plus the Saws and Thrashing machine.

Of interest to us is the first mention of a twin vertical portable steam engine on display. No mention is made of any form of self-propulsion, although they mention its usefulness for steam ploughing, and other general purposes.

This Patent engine was 10 nhp, and the maker stated that all of their engines over 8 nhp would have 2 vertical cylinders. The cylinders were still in the iron house at the end of the improved boiler.

A Tuxford engine won first Prize.

It does not say how they used it to plough, but this Tuxford Steam Ploughing Windlass may be an indication of how a plough and portable engine may have been combined. The image was in the "Engineer" in 1871



In 1858 the show moved to Chester, and Tuxford had 15 entries on display, 9 of which were steam engines. Boiler plates were still wrought iron from Low Moore and a new supplier Lord Ward who had set up in 1857 to produce high quality wrought iron.

A 6 and 8 nhp engine with horizontal cylinders were introduced with 8" and 9 ¼" bore cylinders and a 12" stroke. A 12hp portable with twin jacketed cylinders and expansive valves suitable for ploughing and fixed works or for "exportation to distant colonies", was on offer for £355 on wooden wheels, or £350 on iron.

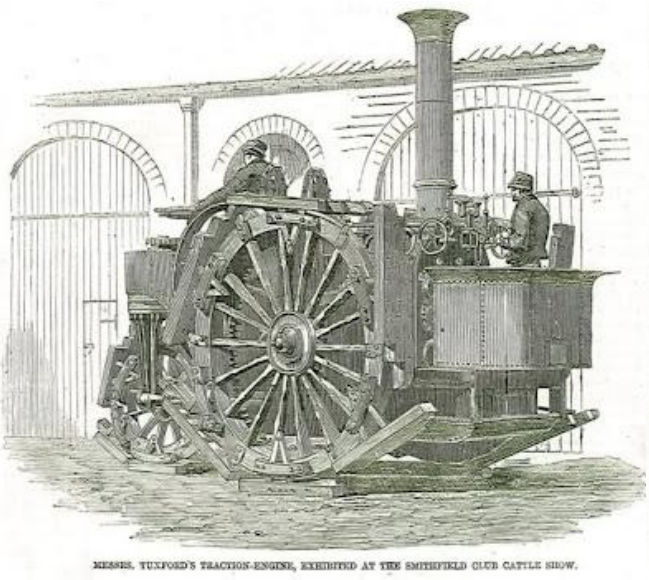
No mention is made of oscillating cylinders.

A 7nhp Patent Portable Steam Steeple engine, with vertical cylinders, Governors, Force pump and suction hose. This was the first mention of a "Steeple" to describe the engine.

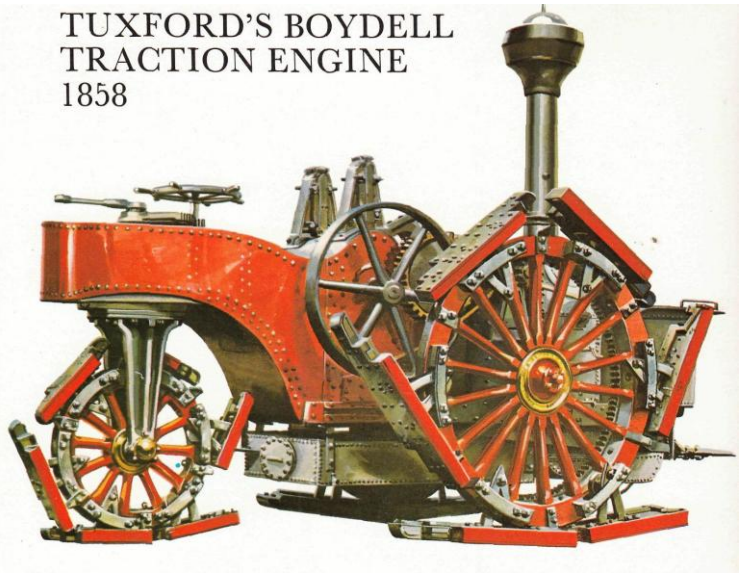
Item 15, listed as a (New Implement) was:-
Tuxford and Son's Steam Traction Engine
With Boydell's Endless Railway
Known as the "Walking Engine" or The Steam Horse"
Invented by Weston Tuxford

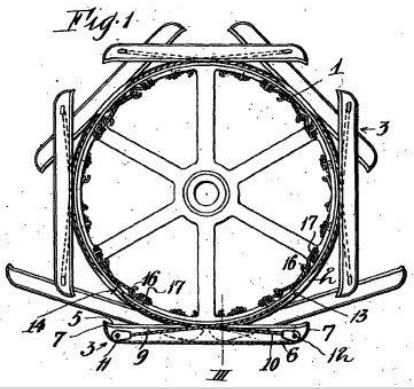
"This engine overcomes the difficulty in making turns to either side: each impelling wheel is furnished with driving gear complete, to which the power from the two cylinders can be given off equally, or a greater power to one, and less to the other, or either of the wheels can be detached from the power instantaneously, and without the least shock or jar."

Price, 20 horsepower £550. 24 horsepower £750, 28 horsepower £900, 32 horsepower £1020, exclusive of the patentee's royalty for the "Endless Railway:" if driven from one wheel only, £100 less



MESSRS. TUXFORD'S TRACTION-ENGINE, EXHIBITED AT THE SMITHFIELD CLUB CATTLE SHOW.





James Boydell (who worked with Charles Burrell & Sons) received patents for his invention described as "endless Rails" or "endless railway wheel", later variations of which were known as "Dreadnaught Wheels". These wheels were first used on wagons and artillery guns drawn by draught animals to reduce ground pressure under the narrow wheels of the day. They provided the first practical means of travelling over soft ground, and they went through various iterations which led to the development of the linked tracks that we know today. Traction engines and later tractors moved to simple and reliable wide wheels. The picture above right, was taken from Ken

Rush's book "Fantastic Machines" 1974 ISBN 0-7064-0341. The top left was from a post card.

The driver and fireman were well separated. The "Steeple Guide " covers are clearly visible. The drive wheels have an internally geared ring driven by a pinion, but there is no hint of the mechanism used to achieve the implied differential action or clutch system used to drive the wheels.

Tuxfords received a prize of 25 Sovereigns for their 8hp Portable steam engine and "commendations" for their 12nhp Portable.

TABLE I.—EIGHT-HORSE PORTABLE STEAM-ENGINES.

Results of Performances.

Makers' Name.	Horse Power.	Stand.	Article.	Price.	Coals.		Time getting up Steam.	Actual time Running.		Mechanical time Running.		Weight on Break, inclusive of Constant.	Revolutions.		Coals per Horse-power per Hour consumed.	Remarks.
					1st Exp.	2nd Exp.		1st Exp.	2nd Exp.	1st Exp.	2nd Exp.		1st Trial.	2nd Trial.		
		No.	No.	£.	lbs.	lbs.	Min.	Min.	Min.	Min.	Min.	lbs.	No.	No.	lbs.	
Tuxford and Sons	8	159	1	245	39	112	60	10·	215	8·694	214·6	140·32	1220	30,120	3·914	1st Prize of 25*l*.
Clayton, Shuttleworth, and Co.	8	54	4	235	20·5	112	41·5	8·5	187·75	8·00	182·22	135	1079	24,600	4·611	2nd Prize of 10*l*.
Hornsby and Sons	8	47	2	225	19·5	112	46	10	153	7·853	159·87	140·32	1102	22,432	5·235	Highly commended.
Brown and May	8	82	1	230	41·5	112	45	15	154	14·42	159·45	134·71	1921	21,480	5·269	Commended.
Ransomes and Sims	8	6	2	235	37	112	42	8	162	5·295	154·815	150·89	799	23,360	5·426	Ditto.
James Haywood, jun.	7	1	1	215	32	98	63	10	120	9·76	118·96	138·21	1350	16,443	7·063	
Fowler and M'Collin	7	86	1	180	35·5	98	48	7	110	6·56	104·45	132·85	872	13,879	8·04	
William Foster	7	137	1	210	40·5	98	55	4	87	3·045	94·50	142·50	494	13,473	8·88	
William Clay	7	132	1	220	35·5	98	48	6	83	5·712	87·847	121·13	692	10,641	9·56	
Oliver Maggs	8	118	1	200	41·5	112	43	6·5	108	4·95	87·368	147·41	730	12,879	9·615	
William Butlin	6	18	1	210	46	98	64	7	82	5·236	74·75	129·28	677	9,664	11·245	

at the Chester Meeting, 1858.

The results of the 8 hp portables steam engines are shown above. The Tuxford vertical cylinder engine showed a considerable lead in efficiency, using coal at about 1/3rd of the rate of the 11th contender in the trial.

TABLE II.—EIGHT-HORSE PORTABLE STEAM-ENGINES.

Results of Second Trial with Common Coal.

Makers' Name.	Horse Power.	Stand.	Article.	Price.	Coals.		Time getting up Steam.	Actual time Running.		Mechanical time Running.	Weight on Break, inclusive of Constant.	Revolutions.		Coal per Horse-power per Hour consumed.
					1st Exp.	2nd Exp.		1st Exp.	2nd Exp.	2nd Exp.		1st Trial.	2nd Trial.	
		No.	No.	£.	lbs.	lbs.	Min.	Min.	Min.	Min.	lbs.	No.	No.	lbs.
Tuxford & Sons	8	159	1	245	56	112	67	17	178	206·841	140·32	2406	29,024	4·061
Clayton, Shuttleworth, & Co.	8	54	4	235	34·5	112	31·5	12	169·5	169·2	135	1556	22,842	4·964
Hornsby & Sons	8	47	2	225	52	112	37	25	136	128·278	140·32	2645	18,000	6·548
Ransomes & Sims	8	6	2	235	37·5	112	46	11	139·5	143·004	150·89	1410	21,578	5·875

TABLE III.—TWELVE-HORSE PORTABLE STEAM-ENGINES.

Results of Performances.

Makers' Name.	Horse Power.	Stand.	Article.	Price.	Coals.		Time getting up Steam.	Actual time Running.		Mechanical time Running.		Weight on Break, inclusive of Constant.	Revolutions.		Coals per Horse-power per Hour consumed.	Remarks.
					1st Exp.	2nd Exp.		1st Exp.	2nd Exp.	1st Exp.	2nd Exp.		1st Trial.	2nd Trial.		
		No.	No.	£.	lbs.	lbs.	Min.	Min.	Min.	Min.	Min.	lbs.	No.	No.	lbs.	
R. Hornsby & Sons	12	47	1	360	49·5	168	37	8	137·5	7·247	144·733	155·5	1127	22,5.6	5·803	Prize of 25*l*.
Tuxford & Sons	12	159	3	350	53·5	168	57	8	174	7·136	175·03	139·88	1001	24,590	4·780	Highly commended.
Ransomes & Sims	12	6	1	300	34·5	168	63	11·5	153	9·929	149·128	152·68	1516	22,769	5·633	Ditto.
Clayton, Shuttleworth, & Co.	12	54	1	340	43	168	32	14	162	13·25	161·49	148·23	2653	23,947	5·200	Ditto.

Similar results were achieved using "Common Coal" with the 8hp engines and their new 12 hp twin vertical cylinder engine. All up it seems that 1858 was a good year for Tuxford and sons.

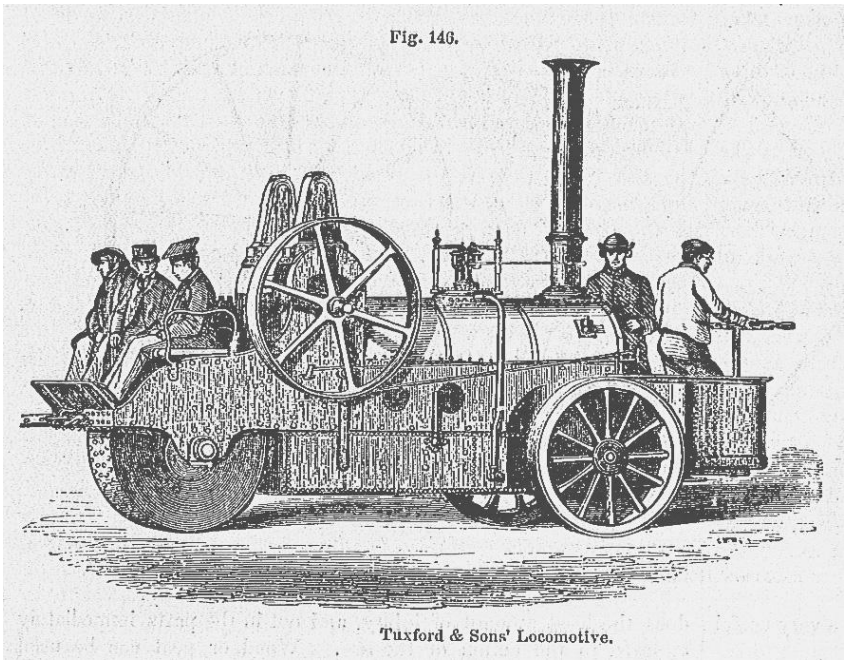
For 1859 the show moved to Warwick. Most of the steam engines at Chester reappeared.. New for the show were 1, 2 and 3 hp Portable steam engines. A grain grinding mill, thrashing machinery and circular saws were displayed, but the Traction engine was not mentioned.

There was no show in 1860 due a to Cattle Plague,. The Show was at Leeds in 1861 and again Tuxfords were back in force with 18 different portable and fixed engines from 2 to 20hp on show.

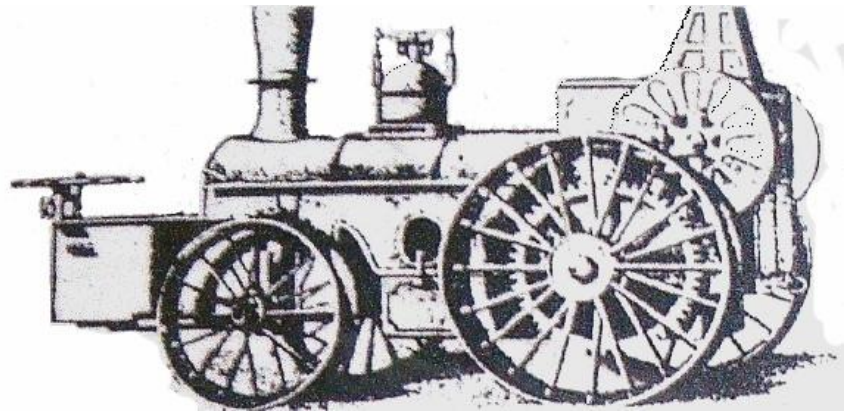
A new implement, Tuxford's No1 Patent Steam Road Locomotive with 2 vertical cylinders, and capable of drawing 8 Tons, was an addition to the range. Whilst it can be used on the highway, it is intended for drawing a combined machine to the farm, and then to act as a portable engine. It steers readily, and is managed easily. Price £400. I am not sure what this machine looked like, the only images that I have are shown below, can anyone help?

The Steeple name did not appear, apparently replaced by the term inverted vertical cylinders.

Four different models of 8 hp engine were listed, the first was a vertical cylinder model with the expansive valve within a steam jacket. The engine was similar to the engine which had won first prize at Carlisle and Chester and cost £250.



Tuxford & Sons' Locomotive.



The second 8 nhp engine had twin vertical cylinders in a housing for £250, and the 3rd had a single vertical cylinder for £235 on iron wheels.

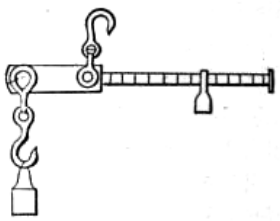
The 4th offering had a horizontal cylinder and tubular boiler " In every respect it takes its place in first class horizontal engines. The workmanship and quality of materials are in every respect equal to that of the exhibitor's patent engines with vertical cylinders which have obtained worldwide celebrity" Price £230.

An interesting note attached to their 3 hp entry (with horizontal cylinder and tubular boiler) reads "The engineering judges of the Royal Agricultural Society refused to test various small engines as being…….. mechanically and very inferior in workmanship, but dangerous ….. inferiority"

Weston Tuxford is no longer noted as the inventor, and engines are only referred to by Horsepower and type. All mention of dimension and material type has been eliminated.

A 12 nhp fixed engine with vertical cylinder on a cast base plate, with handsome Doric frame furnished with a tubular or improved cylindrical boiler, with 2 internal flues having fire ways within them; and with improved glass water gauge, steelyard, safety valve, with Salters spring balance, force pump, steam exhaust and feed pipes. Price with boiler and fittings, £280.

The steelyard would seem an odd addition for a boiler. I can only imagine that it may have been used to check the safety valve or some other devise. Can anyone help with information on what the steel yard was used for?



The sketch on the right is typical of a 19th century Steelyard, which we would describe as a portable weighing scale.

There is still no mention of a pressure gauge.

1862 saw an International Show at Battersea with a similar line up of engines. Of interest there were 2 12hp engines exhibited. The first had 2 inverted vertical cylinders, similar to the 12 horse engine

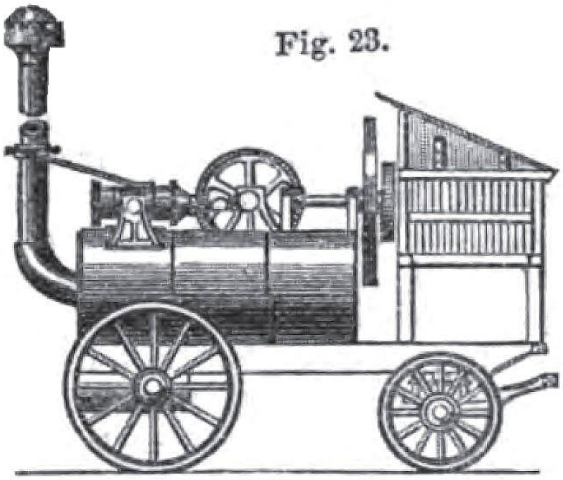
which had "eclipsed the other 12hp competing engine at Chester". The society had not had any subsequent trials. The "inverted" is not described!

Their other 12hp portable entry" Steeple engine" had 2 enclosed vertical cylinders with parts under lock and key. The engine is intended for working, cultivating, pile driving, mills, barn work and brick machinery, and for working steam boats, etc Cost £350.

The No 1 Road locomotive continued, and a centrifugal pump was added to the product range with the grain working and grinding machinery, and circular saws.

For 1863 the show was similar, although the Road Locomotive was missing, and the Inverted Vertical of 8 and 12 hp had move to the top of the entry list with the Steeple engines below ranging from 1 hp engines for chaff cutting to 12 hp.

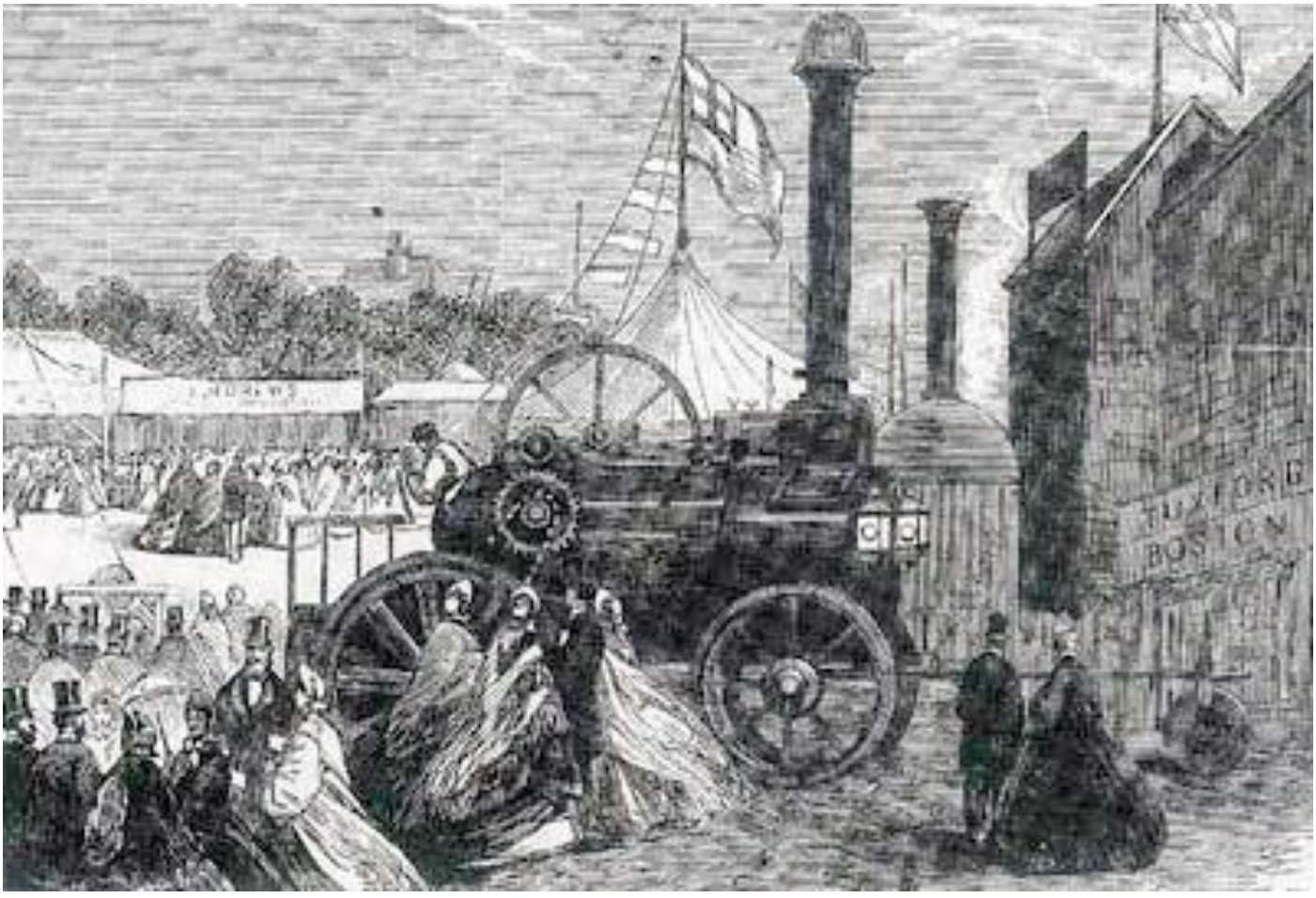
Fig. 23.



The 1864 event was at Newcastle and Tuxford's appeared in force with 25 exhibits Engines with Inverted vertical, Steeple vertical, and Horizontal cylinder engines of 1 to 10 horsepower were offered, as were an array of grain, straw handling gear, saws and pumps.

A 10hp Farmers Locomotive, self-propelling, for cultivating and farm yard purposes. Price £360.

A Road Locomotive for Drawing Trains as well as for farm purposes, will work up to 24hp but termed nominally of 12hp Price £500.



Tuxford Traction Engine at the Newcastle Agricultural show 1864 appears to be chain driven.

To support cultivation, a Patent Windlass for steam cultivation (see page 25) was priced at £90. A double action Five tined steam cultivator was £21, and a double action Three Furrow Steam Plough could be yours for £50. If you needed a lift you could have an iron lifting Jack for £1 10s. The picture (fig 23 page 25) shows a Tuxford combined implement with an oscillating cylinder engine. It does not seem to appear on any of the show entry lists.

Nine steam engines were on show at Plymouth in 1865. Their 8hp "First Prize" engine with twin jacketed inverted cylinders was on top of the list at £250, followed by their 1 nhp horizontal cylinder engine for £60.

The 10hp Farmers Locomotive, self-propelled for cultivating and farm-yard work could be yours for £400. "All parts are of extra strength so that the engine can work up to double its nominal power."

The 10 nhp Prize Portable Steam Steeple engine with 2 vertical cylinders and boiler of extra strength, celebrated for its strength, economy and durability was priced at £285. The grain working and grinding gear, pumps, saws and jacks were joined be circular saw blades from 30" to 40" diameter of "Best Cast Steel, Engine turned, sharpened and set" sold for £2 10s to £9.

1866 saw another period of Cattle Plague, where all movement of Cattle by Road and Rail was prohibited. The show was cancelled until 1867 when it was held at Bury St Edmunds.

Nine steam engines were on display, including a 14 hp twin cylinder Horizontal engine, extra expansive valves and jacketed cylinders with Extra Strength Boiler was listed at £355. The Grain handling and Grinding gear, pumps and saws were there too.

The Prize winning 8 nhp twin Inverted and an 8 nhp Steeple twin Vertical engine were the only engines without horizontal cylinders on show in 1867 at Leicester. The Farmers Locomotive was not shown, although the grain working and grinding, pump and circular saw made an appearance.

1869 saw the show move to Manchester where 10 portable engines with horizontal cylinders were on show from 1 to 12 hp. Three Steeple engines of 6, 8 & 10hp portable engines and a 10 nhp Traction engine, or Farm Locomotive, able to work to double the nominal hp could be had with 2 cylinders for £420 or £390 with one. The improved cultivating windlass had expanding friction couplings, and automatic friction brakes. The drums could be thrown in and out of gear without shock or jar. Price £90.The brakes prevent slack in the rope. The double action cultivator with 5 rows of tines is described as "a truly mechanical, strongly made, very effective, and easily managed implement."

The Pump and saws joined grinding mills and Thrashing machines.

The traction engine is described amongst the thrashing equipment and is not grouped with the portable engines.

A similar turnout was seen at Oxford for 1870. With Steeple engines and 6 horizontal cylinder engines from 1 to 10hp. The Traction engine or farm Locomotive was now 8nhp and could be worked to more than double the nhp. The same windlass was there with the thrashing and grinding gear,

Wolverhampton was the site of the show in 1871 and the improved cultivating windlass won a £20 prize as the best detached windlass. The 10nhp traction and their self-feeding 48" circular were displayed with 5 engines with Horizontal cylinders and 1 each with inverted vertical and a vertical steeple engine

Five Appold's centrifugal pumps with discharges of from 150 to 1400 gallons per minute, a portable combined thrasher, shaking and winnower and a portable grinding mill were also on show.

Cardiff in 1872, saw the 10nhp traction and ploughing Windlass and the 1,2 & 3 nhp horizontal cylinder boilers on show. The entry includes a note attached to the entry for their 8nhp engine with

Horizontal cylinder and extra expansive valve, priced at £240 that "For 12 years successively the exhibitors' Portable engines held prizes of the Royal Agricultural Society. (*for trial*)

The Traction Engine or Farm Locomotive carried a note" This engine is made exceedingly strong, can work to double its nominal power, and is mounted on springs." Price £420

Traction engines headed the entry list in 1873 at Hull. The 10 nhp (now priced at £500 was accompanied by a similar sprung new 6 nhp machine for £395. An 8nhp Prize Steeple engine priced at £280 was joined by 5 Horizontal Portables, 5 pumps and grain working gear. The cultivating windlass was joined by a "Screw Pile, for Windlass, Holdfast etc" this is an admirable implement and can be used for a variety of purposes in place of ordinary anchors." Price 15s.

1875 at Taunton only had 1 entry, a "First Prize 8 Horse Power Horizontal Portable Steam engine with improved valves and Boiler.

1876 in Birmingham saw a 10-Horse Portable Coal Saving Engine. Price £270 and £30, extra for the coal saver. A 3nhp engine, a Thrasher,3 pumps a screw anchor and a jack completed the display. There was a 6nhp Improved Traction Engine with gear complete. Price £360.

1877 at Liverpool saw an 8 and a 16 nhp coal saving engine, a1,2 and 3 Horse portables and 4 pumps

1878 at Bristol saw an 8nhp Jacketed portable for £210, plus a 2,3 and 4 nhp engine, a thrasher,2 saws and 2 pumps.

1880 at Carlisle saw 3 Portable engines of 2, 5 and 8 nhp, plus a thrashing machine, 2 saw tables and a 12" Indian Centrifugal Pump made by the Exhibitors

1881 at Derby Tuxford's displayed 3 Portables of 2,5 and 8 nhp, a Thrashing Machine , 2 Saws and a 12" Indian Pump.

1882 saw the last entry for Tuxford and Sons at the Royal Agricultural Shows. They displayed Portable engines of 2, 8 and 10 nhp, a combined Threshing machine, 1 * 12" Indian Pump capable of 1900 Gallons per minute, and a No 27 Pump capable of 1400 Gallons per minute.

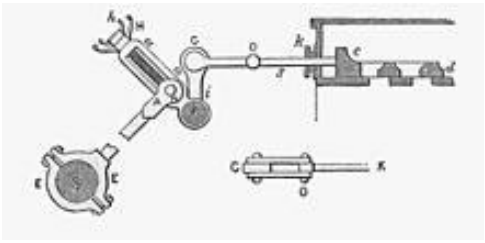
The Royal Agricultural Society of England held its first Show at Oxford in 1839, and it appears that Tuxford and Sons first appearance was at the Bristol Show in 1842. From comments in the show entry, it appears that the early portable engines had horizontal cylinders which wore the bottom of the bore and lost performance. The need to overcome this problem led the development of the vertical engine with its steeple guides, which allowed a low crankshaft height, which in turn allowed the engine to be locked in a steel "House" which was easily accessible from the ground, and protected the engine from the weather and pilfering.

This Steeple engine seems to have remained in production the period from 1850 to the end, giving it a 30 year lifespan. This seems a long time in a period when technology was changing fast.

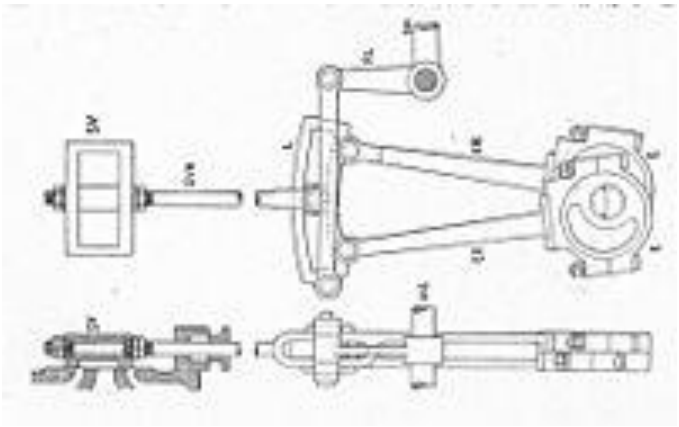
William Wedd Tuxford, the senior partner appears to have emigrated to Adelaide in South Australia in c1852 and with brother John (who had arrived in 1839) became agents for the families products and other agricultural machinery. William was a Committee member of the Agricultural and Horticultural Society. They also acted as agents for the "Mark Lane Express" the leading agricultural magazine of the time, owned and by printed by his brother George in England (William had been apprenticed as a printer). George Tuxford was a Life Governor of the Royal Agricultural Society of England.

William became a member of the South Australian Legislative Council in 1865 and retired in 1873. He was born in 1826 in Boston to Jack and Mary. This coincides with the time that Weston Tuxford became the designated "inventor", which was first mentioned in the 1854 Royal Agricultural Show entry. The business was located on property which ran between Grote and Gouger streets near Selby

Street. The business ceased trading in 1873. William passed away in 1878. Members of the family are still in Adelaide.



Expansive valves were typically a slide valve inserted before the inlet port of the cylinder steam chest which contained the simple inlet valve which left the cylinder open to the feed pipe pressure for the pressure stroke, which was OK for working at full load. The expansive valve cut the feed off before the piston reached full stroke. This let the steam in the cylinder expand, which dropped its pressure and temperature so that the energy could be recovered as useful work rather than be exhausted up the chimney. The gain was a saving in fuel and water consumption when running at less than full load.



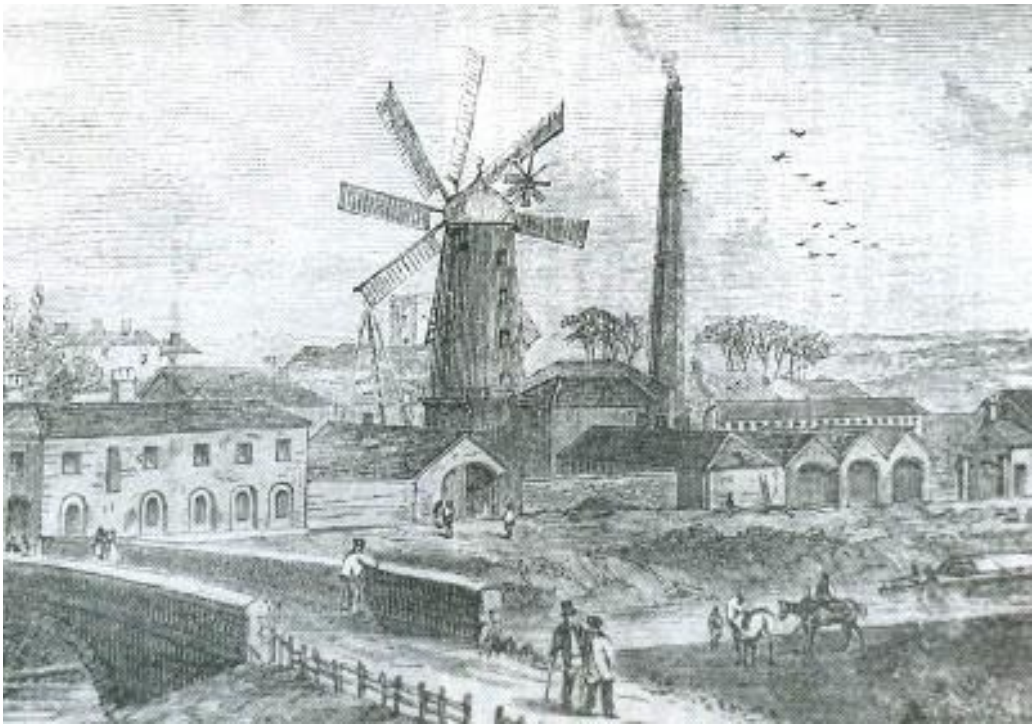
These were used on stationary engines where steady loads were common. For Trains and Traction engines the cut off mechanism was incorporated with the valve gear so that one inlet valve could be used for full and part load, Stephenson introduced his variable valve gear in the 1840's. This gear also controlled forward or reverse engine rotation. Many variations soon followed.

Later variants of the expansive valves were added to control the opening of the inlet for and achiever further gains in efficiency.

To date I have not found any information on the style of the separate expansive valves used by Tuxford, if anyone can help I would appreciate a copy or reference. Ed.

The top drawing on the right shows one type of expansion valve control linkage, the length of the adjustable arm is varied so that the arms of the rocker are equal for full throttle or unequal for cut of variation. The second drawing is Stephenson's valve gear shown for full cut-off, the curved link is raised or lowered using the bell crank for forward or reverse, with full opening being at either extreme.

On the right this early view of the Tuxford Windmill and Works appears to be taken looking from the top left corner to the bottom right corner of the Google Earth image on the next page



The property now seems to be being developed as a residential area. The square tower of the Skirbeck church can be seen to the left of the windmill. The Bridge crosses the Maude Foster drain.

The earlier painting on page 20, which dates from 1822, before the Chimney was built, appears to have been taken from the South side of THE HAVEN at the centre bottom of the Google Image.

The MAUD FOSTER DRAIN is on the West of the site and Skirbeck Road runs East West from the Northern Road Bridge. (The lower bridge /weir can just be seen on page 20).

A 5 Blade Windmill, The Maude Foster Mill still exists about 1600M to the North on the East bank of the drain, it can be seen on the Google Earth, but not in this image.

In 1851 Boston had a population of 15000 with 2400 more at Skirbeck.

A report from an 1856 "Gazetteer and Directory of Lincolnshire", recorded that!

"in Boston and Skirbeck, are six steam and 11 wind corn mills, an oil mill, several large breweries and malt kilns, some extensive curriers, a tannery and several iron Foundries and machine works. Near Skirbeck Church are "*Boston and Skirbeck Iron works*" belonging to Messrs. Tuxford and Son, who employ several hundred hands in the manufacture of portable steam engines, thrashing machines, mill work, iron bridges, patent slips, pile driving engines, etc These works extend over an area of 5 acres and were founded many years ago, on a much smaller scale; by the senior partner, Mt Wm Wedd Tuxford who was the first manufacturer of portable farm yard steam engines, and combined thrashing, shaking, and dressing machines, which are now extensively made here and at Lincoln,"

The size of Tuxford's business can be gauged to some extent by what was on offer when the plant was auctioned . Graces Guide have published an advertisement from an edition of the Stamford Mercury on Friday July 10 1885, which is repeated on the following page.

1885 Works for Sale

All those valuable and commodious engineering works, known as "Tuxford and Sons Boston and Skirbeck Ironworks" situated in close proximity to the Boston Docks and the Boston Dock Railway (GNR) are, owing to the recent decease Mr. Weston Tuxford, the last surviving partner of the firm of Messrs. Tuxford and Sons, now for disposal. The works, which have been established since 1830 and have commanded an extensive business, are as present arranged include convenient accountancy, drawing and private Offices fronting Skirbeck Road; also the iron foundry, with 3 cupolas and large pit for pipe casting, drying stoves and 3 powerful cranes; also a conveniently-arranged Brass Foundry, with three furnaces and pattern shop, together with Smiths shop 300 feet long and 36 feet wide fitted with modern smiths forges and blasts and appliances: Boiler shop with all necessary tools of good type for the department; Paint shop and finished engine Stores, Gas apparatus with two purifiers and holders, large casting stores, Stables, Coach-house, &c; also an excellent flour mill, with 5 pairs of stones, to work by wind or steam, the whole standing on an area of about 4 ½ Acres. The new Boston Dock and Boston Dock Railway (GNR) are within a few yards distance, and it is anticipated that no difficulty would be met with in connecting these works with both.. It is believed that the sale of these works offers an unusually fine opening for investment enterprise, besides space sufficient for engineering works, as now carried on, there would convenience for making a slipway directly connected with the Boston Haven and Docks for repairing of large vessels, and there also be convenience for other business requiring room and cheap water and railway carriage.

The works was taken over by Collitt and Co and continued to manufacture Tuxford products at the works until 1887. The site & plant were sold up 1891.

All of this brings us back to page 19 where the Tuxford Mill at Skirbeck was acquired by John Pocklington, dismantled and transported to Heckington where the mill head was adapted to the tower of the damaged mill. This 1815 mill head is the oldest surviving piece of theTuxford plant, and it is still in working order.

These mills with their rotating heads use a helicopter like tail fan to keep the shuttered sails aligned with the prevailing wind for optimum performance.

Their internal mechanism, and operation of the mill is a story in itself.

Tuxford ceased manufacturing over 130 years ago, and our engine is about 150 years old, and it is fortunate that it has survived and been restored by members.

Tuxford's had a major role in bringing steam power to agriculture.

Thanks to Felicity Tuxford and Lynda Sergeant for supplying the information, that got this story underway.

Download Edition 139 of this magazine for pictures and background of our Tuxford twin vertical engine at:-
www.lakegoldsmithsteamrally.org.au

LAKE GOLDSMITH 110TH STEAM AND VINTAGE RALLY

4TH & 5TH NOV, 2017

FEATURING JOHN DEERE PRODUCTS

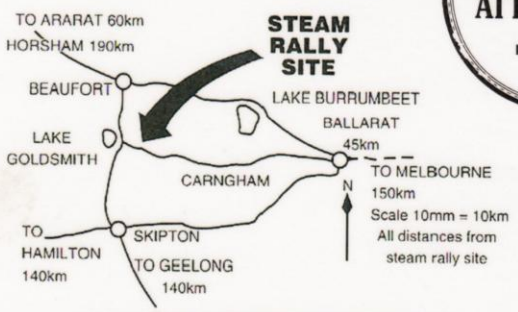
Regular attractions include:

- 65 Display Sheds
- Steam & Oil Engines
- Steam Powered Shovels & Saw Mill
- Displays of Earthmoving, Cars, Motorcycles, Tractors & Trucks
- Radio Controlled Model Boats
- Attractions for Ladies & Children
- Blacksmithing
- Threshing
- On-site Catering

CAMPING FOR EXHIBITORS ONLY
(free, non-powered)

ADDITIONAL ATTRACTION →

LAKE GOLDSMITH INAUGURAL ALL-MAKES TRACTOR TREK
Leaving Rally grounds on Friday 3rd November at 8:45am



VIC ROADS DIRECTORY MAP 75 G5 2.4

ADMISSION PRICE: • Adults $15.00 • Children aged 5-16 $5.00 • Exhibitors and Children under 5 free

For rally information contact:
Trevor 0407 539 041 or
Graeme (03) 9723 3310

For Tractor Trek information contact:
Ron 0418 514 990 or
Phil 0418 399 341

www.lakegoldsmithsteamrally.org.au • PO Box 21 Beaufort 3373

LAKE GOLDSMITH STEAM PRESERVATION ASSOCIATION RALLY GROUNDS

Google Earth updated the images of the Rally Grounds and surrounding area earlier in 2017. The image was taken "Between Rallys" so the carpark on the left is empty and the shed area is uncluttered and the arena area is recovering from the earthworks and getting ready for the next. Compared with the picture on the front cover taken at the 100th Rally, it is positively peaceful.

The Evans Family collection of vintage and early bicycles will be on display again in shed 76 and around the Parade ground. You can expect some more Flash & Bang from the Shenandoah's crew.

Then there are the John Deere's, and the Lake Goldsmith Sheds and Parades will be in action. Drop in and enjoy the day.

The President, committee and Members of the Lake Goldsmith Steam preservation Association hope to see you at our 110th Rally on November 4 and 5 2017. Ed.