FULCRUM

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Fulcrum is a newsletter for people interested in the history of weighing and measuring. It is published in February, May, August and November. Contributions are always welcome and can be sent to editor, John Knights

Hide and Seek

In the last edition there was a photograph of a leather measuring instrument in use in a tannery in the 1960's. These instruments were a peculiarity in the field of legal metrology which I thought merited a little further attention.

The measuring of area was only really an issue in one trade; the leather industry. Most fabric products were manufactured in regular rectangular forms so could be traded simply by length. Leather on the other hand comes in irregular shapes and the 'quantity' of material in a hide cannot easily be ascertained by simple mensuration.

To assess the area of an irregular shape manually, is a fiddly business so at the end of the 19th century machines were developed to carry out the calculation. At this time, technology was analogue, mechanical and comparatively clunky. We were yet to see the likes of photoelectric cells and electronic scanning which now render the measuring of an irregular area a straightforward process.

The technology, in this case seems to have come from the USA where leather production was clearly a major business.

A weighty tome entitled 'The Manufacture of Leather' by Charles Thomas Davis appeared in the USA at the end of the 19th century. This covered all aspects of leather manufacture and included a section on the measurement of hides. Judging by the illustrations and descriptions in the book all aspects of leather production were highly mechanised by this time and the measuring section describes powered mechanical devices then in use within the industry.

The market leader at this time was a device known as 'Sawyer's Leather Measuring Machine'. This was a device with an array of measuring wheels which totalised the area of a hide as it passed through the machine on a powered roller.

We see therefore, that by the time Regulators got round to considering what controls should be placed on these devices, what levels of accuracy were appropriate, what tests should be applied etc, such machines were already well established and would be in countless manufacturers' premises. Indeed, the Sawyer machine had won awards at trade fairs and by the end of the 19th century was regarded as the standard device for measurement within the industry. In the UK the regulation of this class of equipment was not attempted for another 20 years, bearing in mind of course, that there was a little thing called the First World War which might have occasioned a slight distraction.

By the 1920's it can be surmised that the tanning industry in the UK would have been highly mechanised. It is unlikely that the hidesmiths of Britain were banging bits of leather on the rocks down by the river. Britain was a technically advanced nation and would have been fully 'tooled up' with the latest technology. This probably meant that they would have taken advantage of all the latest developments from the USA, including the Sawyer Measuring Machine, the market leader and recognised industry standard device.

UK legislation of 1919 sought to apply standards to leather measuring equipment, to ensure that trade was conducted equitably. As part of the process there was an expectation that measuring machines used in the leather trade should be approved by the Board of Trade Standards Department. Going back to the turn of the century when the Sawyer machine was seen as the epitome of all that was fine and good in leather measuring, there were whisperings of the existence of another machine, not as yet fully developed. This was similar in appearance to the Sawyer device, in that it used an array of measuring wheels to detect the area of the hide, but differed in the method of detection. In the Sawyer or 'Roller Machine' as it became known in the UK, the individual measuring wheels were mounted on pivoted arms so that each wheel was initially in contact with the powered roller. When a hide was introduced into the machine any wheel which touched the leather was lifted up. This in turn, caused a pinion to engage with overhead gearing that turned and began to operate the machine's totalising mechanism. If there was no leather present beneath a wheel, that wheel dropped and disengaged from the totaliser.

The alternative device, not fully developed until the 1920's, also had measuring wheels, but these were not pivoted as with the Sawyer machine. Instead there was a series of holes around the circumference of each wheel, into which sliding pins were inserted. As the leather was drawn into the machine by the powered roller, it passed beneath the measuring wheels and lifted the pins in turn. The other end of the lifted pin engaged with gearing that operated the totaliser. If there was no leather beneath a wheel, the pins would drop and disengage from the gearing.

In both devices therefore, each of the wheels in the array operated to measure the length of a strip of leather in the hide. Each strip was of known width and thus the area was ascertained by adding the lengths together and multiplying by the width of the strip.

It subsequently transpired that the Roller machine was not quite the epitome of accuracy that had previously been averred. It was found, in particular to have difficulty in dealing with measurements when leather of varying thickness was being passed through the machine. The 'Pin Wheel' machine on the other hand performed better and was fully accepted by the Board of Trade for pattern approval in 1922. It appears that the roller pattern was never submitted for approval and it was certainly never approved, under the UK Legislation.

Thus, the only 'wheel' machine approved in the UK was the 'Pin Wheel' device. This is despite the fact that the schedule in the legislation, that set out procedures for testing etc, was actually based on the earlier roller machine. This is because it was written at a time when the roller pattern was still seen as the standard model. The 'Pin Wheel' machine was manufactured in the UK by the Turner Tanning Machinery Co. of Bramley, Leeds who produced a range of machinery used in the tanning industry. This company had its origins in the USA but had set up factories abroad to develop its markets. The 'Pin Wheel' device was something of a 'new kid on the block' by the 1920's and I would surmise that the UK industry was already pretty well furnished with the Sawyer machine that had been around for so much longer.

I would imagine therefore, that by the time Weights and Measures officials ventured into the malodorous tanning halls of the UK they would have been confronted with many measuring devices, which had been long in use but which could never be verified in accordance with the Regulations.

The whole legal framework regarding these machines was a bit of a dog's breakfast and I can well believe that effective enforcement never really got off the ground. The Regulations were worded in such a way that they appeared to only apply to machines that had been approved, so other devices were probably just ignored. Eventually four devices received the Board of Trade accolade, ie. the Turner Pin Wheel machine and a later version which used pneumatic pressure to operate the mechanism, a photo electric cell machine and the hand operated 'areameter' based on the Polar Planimeter; a simple but mystifying device still to be found in modern drawing offices etc.

This gave rise to the nonsensical situation that any other device would not be subject to any statutory control even though it was clearly in use for trade.

Using an approved measuring instrument in accordance with the Regulations was a fairly onerous business for the owner. Each machine had to have a set of templates, with which to calibrate it and check the accuracy. These were sheets of a suitable material (not leather, which was not stable enough) of either modified rectangular or circular

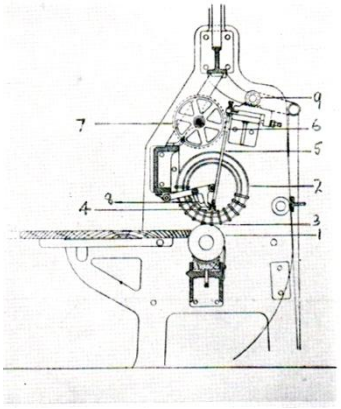
A Pin Wheel device with a stack of hides being passed through

A ‘roller’ machine in the Tannery Museum at Chateau-Renault in the Loire Valley in France. Made by Turner of Paris. Presumably pre-dating the ‘Pin wheel’ machine

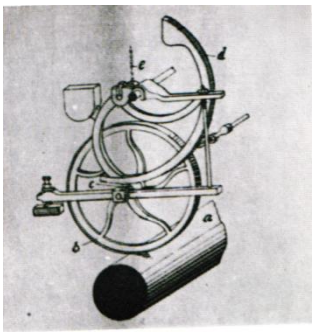
form of known area. The templates had to be correct to a very fine tolerance and had to be verified as such by the National Physical Laboratory. Weights and Measures Authorities, that had leather measuring instruments within their jurisdiction, also had to possess suitable templates, approved by the Standards Department of the Board of Trade. Keeping these templates in good condition was not easy and called for controlled storage conditions that were probably not readily available at that time. Certainly not in the average tannery!

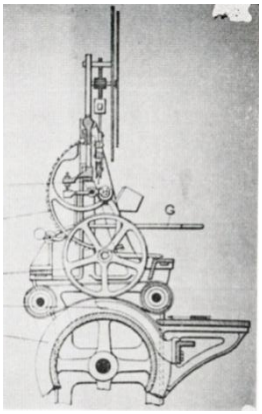
Maintaining the machines in a proper state of accuracy also involved a lot of ‘in service’ tinkering and adjustment by the user. This went very much against the normal principals of legal metrology where weighing and measuring devices were adjusted at the time of verification on the understanding that any subsequent interference would immediately require re-testing and re-verification.

All in all it appears that these machines were deemed problematical at best and there is evidence that not many enforcement authorities ever really carried out the regime of testing envisaged back in the 1920’s. By the 1950’s there were some who dismissed, even the pin wheel devices as little better than an ‘approximate’ measuring machines, whose results could be readily manipulated by the operator. It is therefore not altogether surprising that area measurement was put in the ‘too difficult box’ in the 1960’s and regulation was abandoned. The fact remains however that these devices stayed in use in the industry and were the means by which the price of leather was calculated. Whilst today there are more reliable electronic devices the mechanical machines have not entirely gone away and examples may even still be found in use.



The ‘Pin Wheel’ measuring wheels, showing the sliding pins around the circumference. As each pin lifts it engages the cog on the shaft which operates the totaliser





The mechanism of the ‘Roller Machine’. The whole‘measuring wheel’ lifts as the hide passes underneath and the cog engages the quadrant attached to the totaliser

This photograph was featured in the last Edition and shows someone using a leather measuring machine in the UK, probably in the 1950's or 60's. This appears to be a 'Roller' type machine rather than a 'Pin Wheel' so we see that unapproved machines continued in use right up until the Regulations were discontinued.

'The Sweet Smell of Success?' - Testing an Area Measuring Instrument in the field, circa 1983

John Knights' excellent 'Area 51' photo (left) and text in the last issue of Fulcrum (no 65) took me back to my days training to be a UK Inspector of Weights and Measures.

This took 3 years, and was a mixture of book-learning and practical experience. Hence several colleagues and I rolled up at a fellmonger's in the industrial hinterland of Birkenhead Docks one bright morning to 'complete section II 1 (a)' of our required workbooks. To wit, the examination and testing of a leather measuring machine (!).

Cameras and film in the 1980s were at an undeveloped stage compared to the present digital days. So we went to exercise our Mark I eyeball techniques and write (in longhand, with pencil diagrams) on:

- **the Regulations appertaining,**
- **our Examination *in situ* of the principles and operation of the mechanical wonder,**
- **the Denomination of the measuring units,**
- **the Stamping arrangements,**
- **the Inspection procedure and**
- **the Testing procedure.**

The mnemonic 'REDSIT' may have no resonance with more than about a couple of thousand of an ageing British population, but I'm amazed it's stuck in my mind after 41 years, when these days I can't for the life of me remember where I've put my glasses, cup of tea, or copy of 'A Treatise on Measuring Instruments Volumes I to IV' *(1968, published by the Institute of Weights and Measures Administration).*

This was our textbook for these machines. It contained an intricately worded technical description impenetrable for us Merseyside youngsters weighed down as we were, by steel-toecap boots, wearing ill-fitting suits and kipper ties, and smoking Woodbine cigarettes.

What the book didn't mention was the distinctive smell of the world in which the few remaining machines assessing leather sizes were to be found – a semi-sweet castor-oil top note, with hints of bovine ordure, decaying *oesophagi,* and pools of limpid rankness laid down like a good vintage from Victorian times.

The seasoned Inspector who was conducting this wondrous training session seemed in his element. He wore an ill-fitting suit, smoked Embassy Filter Tips and drove a Ford

Capri – our role model! He had also brought the 'standard templates' (usually kept carefully wrapped in tissue paper, in the Standards press at the office).

The machine was 'set to zero', the leatherworking staff stood respectfully by, and the regularly- shaped cowhide substitutes were introduced to the maw of the pinwheel machine.

Like most things in life, the spectacle was disappointingly brief, and proved very little.

Three square foot, four square foot, seven square foot – all the combinations of the templates whizzed through the mechanism in a flash, were indicated exactly on the 'clock' dial, and honour was satisfied. The templates were rolled up and returned to their long tubular, surveyors' map cases. I can't recall anyone volunteering to clean them back at the District Office, but it must have been done.

We four trainees probably spent five times as long as the visit lasted in writing up our reports, on technology which was already being replaced by a photoelectric table, with no moving parts.

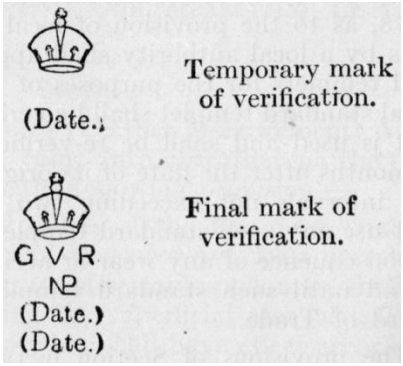
If we didn't complete the workbooks and have them 'signed off' we couldn't 'get our ticket'. But the original Weights & Measures (Leather Measurement) Act 1919 had been messed about with in 1921, then in 1926, and the whole kit and caboodle became'de-prescribed' in 1965. The marvellously accurate and resilient embodiments of engineering practice that were the pin-wheel machines occupied a regulatory dimension orthogonal to everything else.

The templates had to be made of rubberised fabric, in precise thicknesses according to their area in square feet. They were required to be of circular shape or "with semi-circular ends and an intermediate rectangular part". The diameter of the 30 square foot modified shape was to be 5 ft. 6 ins.

The machine had permissible limits of error in excess or deficiency of ⅛ of a square foot up to and including 8 square feet and proportionately greater for larger areas tested. Up until 1965 the factory had to keep their own set of 'stamped' templates, that the Inspector was required to double-check every six months.

A very few pin-wheel machines still exist, but it's hard to envisage them being preserved in museums or private collections because they're so difficult to explain, as well as transport and reassemble.

I'm rather glad I got to see one 'in the wild' in a fast-changing world. And if anyone comes across a strangely-shaped rubberised sheet with a GR crown, verification number and date(s) marked on it, I'd be pleased to hear of it! (M Sharpe)



httpsvideos://www.facebook.com/hewitonline//leather-measuring-machine/1149514671908127

If you Ctrl-click on this link you will see a short video of a Turner pin wheel machine in operation