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NOTES ON 19th CENTURY COAL MINING AT STAVELEY, DERBYSHIRE

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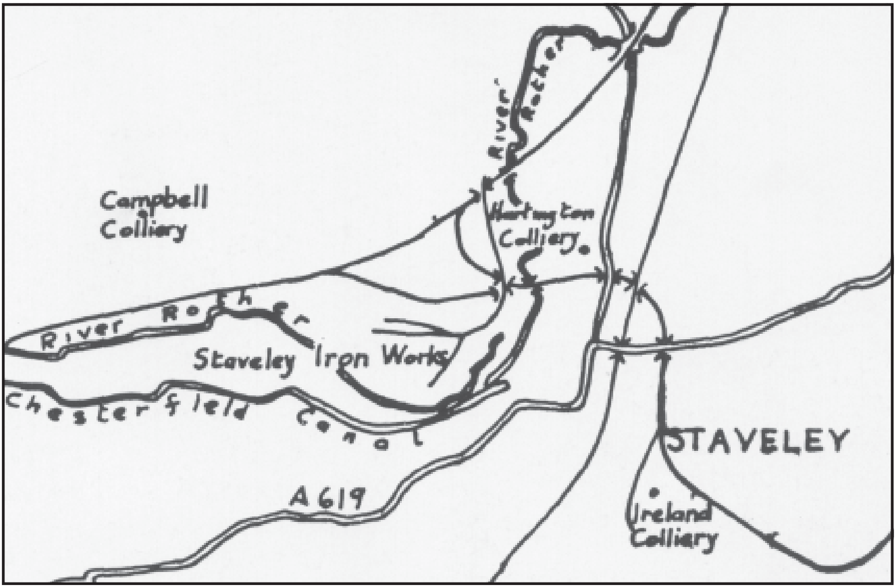
SYNOPSIS
An outline of coal working during the C19 at Staveley is presented, with detailed descriptions of pumping and ventilating machinery used at this location. A large Newcomen engine made at Coalbrookdale in 1776 was in operation here from 1827 to 1879. This was subsequently scrapped and replaced by other engines which the writer describes in detail.

Hartington Colliery

The Deep Soft or Sitwell seam of coal has been worked at the Staveley mines for a great number of years as a house coal for the London and other markets. It is said that the coal at Staveley is of a better quality than at any of the surrounding mines.



Formerly this seam was worked by Mr. Richard Barrow, near the outcrop and to the Deep from the Hollingwood colliery on Hollingwood Common. (marked A on the plan). Because of the occasional discharges of methane gas from the strata, this mine was being worked as a safety lamp mine during the 1850s. Also, a large sum of money had been spent providing a large underground furnace to ensure powerful ventilation of the workings. Another interesting feature of the mine was the method of hauling the tubs of coal underground by the use of an old Great Western Railway tank engine (broad gauge) which was fixed on the surface with ropes running down the shaft and along the roadways.

It was in this mine in November of 1857 that a fire in an underground lamp cabin caused the deaths of 12 men including the mine manager, Mr. D. Cooper. After an unsuccessful attempt to put out the fire, by means of brick stoppings which resulted in an explosion of the accumulated methane gas, the workings were flooded from the adjacent Chesterfield canal. Because of this, the whole of the dip workings, amounting to 90 acres of coal was drowned out and lost. From that time the coal worked by this mine was confined to the rise and at a level 200 feet above the point at which the fire had originated.

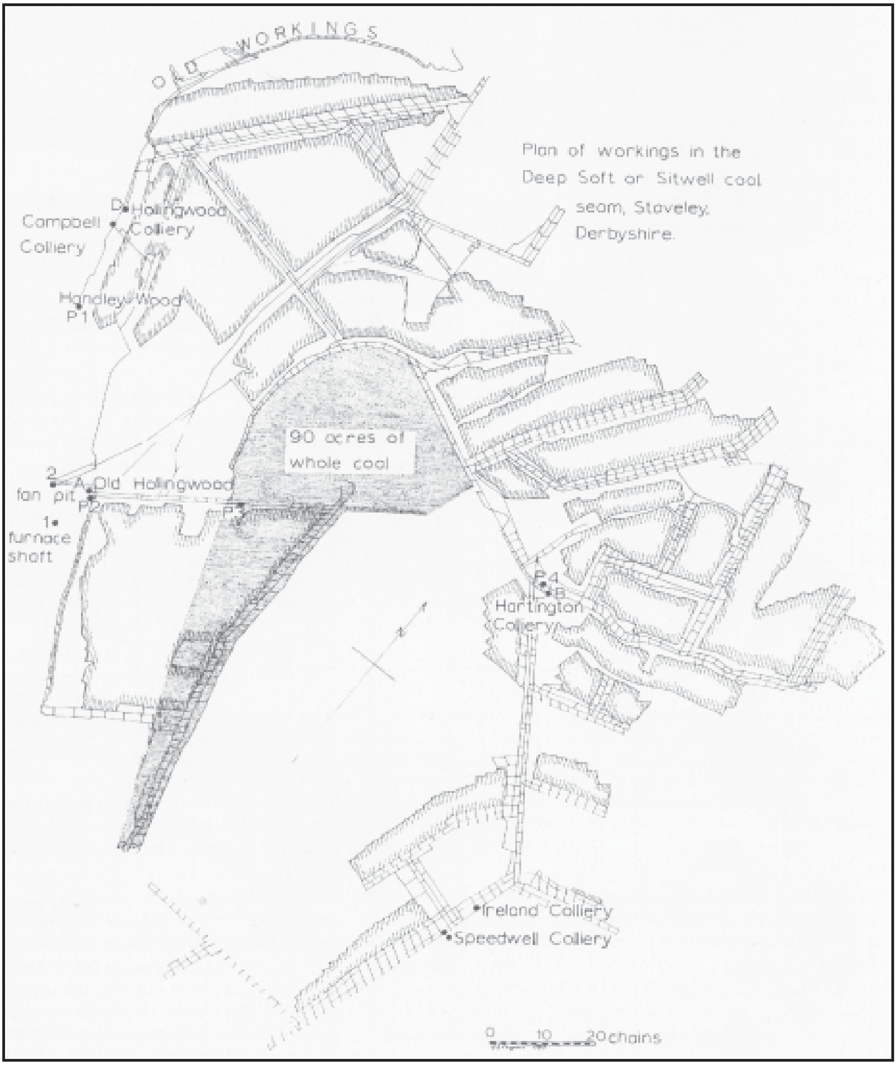
In 1858 a shaft was sunk called the New Hollingwood Deep Winning to work the Deep Soft seam to the dip of the then present workings. (marked B on the plan). This single shaft of 12 feet diameter and 218 yards deep to the coal seam was divided in half by a wooden brattice or partition in the centre. One side was used as a downcast and the other as an upcast with a ventilating furnace underground. The coal was drawn by single deck cages, containing two tubs each, on either side of the brattice. This left very little room for the air to pass when the cages were running in the shaft.

As time went on, a communication was made between the A and B pits, which made it possible to ventilate part of the B pit by a furnace shaft (No.l on the plan) which was set apart for this purpose.

During 1869 another shaft was sunk and equipped with a 30 feet diameter Guibal fan which at that time was one of the largest erected. (Fan pit on the plan). This was to improve the ventilation of a series of workings on Hollingwood Common.

As the coal trade was improving by 1872, it was decided to develop a new colliery further to the south and again to the dip of the then existing workings. This 15 feet diameter single shaft met considerable water problems during the sinking and eventually 141 yards of metal tubbing was put in to prevent the water from flowing into the pit. The Deep Soft coal seam was reached at a depth of 364 yards and the sinking completed during 1876. A twin cylinder vertical winding engine of 36 ins. x 90 ins. stoke, working at 651bs. per square inch steam pressure was installed. This engine was able to complete 58 winds per hour. The single shaft became known as the Ireland colliery and is still used as a main production mine by the National Coal Board.

In 1876 another shaft was sunk (D on the plan) near the Campbell colliery at Handley Wood and a heading driven into the workings of the A pit early in 1877. This D shaft was sunk to replace the A pit and to economise on the cost of coal production. The output from the seam at this period amounted to about 900 tons per day with the ventilation being produced by the above mentioned Guibal fan at the No.2 pit. The fan was driven by a horizontal high pressure engine of 25 inches x 2 feet stroke, operating at 60 r.p.m. and giving a ventilating pressure of 2.52 inches water gauge in the fan centre. The quantity of air moved was 84,800



cubic feet per minute. The indicated horse power of the engine was 33.682 giving a useful effect of 49%. Having shown that the mines were being well ventilated for this period, let us turn our attention to the removal of water from the workings.

The oldest water pump in use was the Handley Wood engine, (P1. on the plan). This was an open topped Newcomen engine of 48 inches x 5 feet stroke. It had been made by the Coalbrookdale Iron Co. and the date inscribed on the cylinder was 1776. Mr. Richard Barrow who was at that time the owner of the Staveley collieries had bought it in 1827 and it was [38] at work until December 1879. The engine operated two lifts of 12 inch. pumps, each of 99 feet in length, the bottom set delivering water to the base of the second set. Steam was supplied at 15 lbs. per square inch by two egg ended boilers 32 feet long by 7 feet diameter.

The Old Hollingwood pumping engine (P2. on the plan) was a 62 inch x 90 inches stroke Cornish beam engine built by Messrs. Thornewill and Wareham of Burton-on-Trent in 1842. It pumped over 60,000,000 gallons per annum until stopped during November 1879. In the 254 feet pumping shaft were two 14 inch bucket lifts, one lifting water from the shaft sump to the 125 feet level and delivering into a cistern for the second lift. The engine worked at 10 lbs. per square inch and made between 7 and 9 strokes per minute.

Placed underground (P3 on the plan) and delivering water to the pumps of the above Old Hollingwood engine was a single cylinder differential pumping engine by Messrs. Hathorn Davey and Co. of Leeds. This was their Works No. 2352 with a steam cylinder of 30 inches x 3 feet stroke operating a 12 inch pump, designed to deliver 400 gallons with a lift of 240 feet through 800 yards of pipework. The engine was supplied to the mine on September 8th. 1875 at a cost of £520. Steam was raised by egg ended boilers on the surface, taken in 6 inch. diameter pipes 100 yards to the bottom of the shaft then to the engine 665 yards away. Because of the complete lack of any form of insulation on the pipework, some experiments done on this engine in 1879 proved that when standing the pipework lost nearly 10 lbs. of steam per minute because of condensation. This type of experiment shows why compressed air and electricity were taken into mines at an early date to cut out the huge losses of steam when taken underground.

At the New Hollingwood Deep Winning shaft (B on the plan) was a rotary high pressure steam engine of 20 inches x 4 feet stroke working at 18 rpm. and operating three ram pumps delivering 50 million gallons of water per year against a lift of 654 feet. The engine was placed underground 40 yards from the bottom of the shaft. Here again steam was raised in boilers on the surface and piped down the shaft to the engine with a resulting loss of steam by condensation.

Worn out pumping plants were expensive to operate! The already mentioned 90 acres was drowned with a possible risk to the workings as they were extended to the dip of the flooded area. Added to this was the fact that the seam was dipping away from the outcrop, and a series of old workings which were full of water existed along the outcrop and had begun to leak into the current workings which meant that an improvement in the water handling was needed. At this time it was also apparent that a larger and better located ventilation system would soon be required as the workings developed. The mine manager, Mr. J. Humble submitted a scheme to Mr. C. Markham, the managing director of the Messrs. Markham & Co., and between them a plan for the effectual drainage and ventilation of the whole of this coal seam was developed.

On October 1st. 1877 the sinking of a 15 feet diameter shaft was commenced near to the B pit of 1858 (marked P4 on the plan) and by January of 1878 a depth of 70 yards had been reached, 60½ yards being lined with metal tubbing sections, while 9½ yards received a lining of 9 inches of brickwork. In May, a depth of 211½ yards was reached and during June the brickwork arching at the Deep Soft seam was constructed. Later a sump to collect water was sunk to a depth of 25 yards.

During the period of sinking this shaft the headings (dotted on plan) were being driven in the coal seam in the direction of the 'drowned out' workings so that this water could be brought to the pumps and removed.

Naturally, the size and type of pumping engine to be erected exercised the minds of the company's engineers and managers for a period of time during the sinking of the shaft. It was at one stage decided to erect a compound Bull engine and Messrs. Hathorn Davey and Co. were asked to provide nozzles, valves etc. for an engine of 45 inches, 72 inches x 10 feet stroke, but the order was cancelled on November 28th. 1877.

Eventually, probably influenced by Mr. Henry Davey's recent pumping engine at the South Durham colliery, where a new system of forcing pumps had been erected with a great saving in the cost of pitwork and maintenance, it was decided to construct a horizontal tandem compound engine. This engine of high pressure cylinder 45 inches, low pressure cylinder 72 inches by 10 feet stroke was made in the Staveley company's works and erected at the new sinking during October 1879. This new colliery (at first known as New Hollingwood) was now named Hartington. Messrs. Hathorn, Davey of Leeds supplied and fitted their patent differential valve gear known as a 'Steam Man' to the pumping engine. In this valve gear a secondary steam piston operated a series of levers that were regulated to work at a set speed by the adjustment of a cataract which controlled the point of steam cut off. Should the resistance to the engine increase then the steam man would have altered the cut off to help the engine. One of the major features of the steam man was, that should the engine suddenly lose it's load - which usually ended with the destruction of the pump and engine - it would close the valves, bringing the engine to a stop and save it from a smash. This form of heavy pumping engine took from the Cornish engine during the late 19th century the title of being the most economic available, only losing this with the advent of electricity at the beginning of the 20th. century. The Hartington engine operated at 4 to 5 strokes per minute, using steam at 55 lbs. per square inch, which was supplied by three Lancashire boilers of 30 feet long by 6 feet 8 inches diameter made by Messrs. Clegg of Oldham and assisted by four egg-ended boilers of 30 feet long by 5 feet diameter.

Instead of having the usual two or three sets of pumps to lift the water in stages from the depth of 243 yards, it was decided to put in a single rising main and by use of a pair of plunger pumps push the water up from the shaft bottom. This system required the development of non-return valves for the bottom of the pumps, capable of withstanding a pressure of 324 lbs. per square inch. Mr. Joseph Humble, the mines' manager suggested the use of a series of small valves instead of a single large one. To test the idea a number of mushroom valves were put into the pumps of the Campbell colliery and [39] proved to be able to take a pressure of 180 lbs. per square inch without any problems. In the event, a series of double beat valves similar to the Cornish pattern as fitted in some winding engines of the period were used and gave every satisfaction. Because of the use of this single rising main with two long timber rods to operate the pumps in the shaft bottom, more space was available in the upcast shaft than was usual, so it was possible to put in large cages and to wind coal in this shaft.

During November 1879, the engine was tested and proved to develop 290 horse power, raising 1,300 gallons per minute, with a speed in the pumps of 100 feet per minute, and an efficiency of 88%.

Once the Hartington pump had been at work for a couple of months the homogeneous group of pumping engines was no longer needed and were scrapped.

The following shows the savings made per annum in the cost of pumping.

Handley Wood	(P.1)	cost per year	£556,	pumping	60 million gallons
Old Hollingwood	(P.2)	cost per year	£862,	pumping	60 million gallons
Old Hollingwood	(P.3)	cost per year		pumping	45 million gallons
Hartington	(P.4)	cost per year	£340,	pumping	50 million gallons
			£1,758		170 million gallons

The new Hartington engine cost £492 and raised 170 million gallons per annum. It also drained the lost 90 acres of coal.

Having decided to develop a central pumping plant, the management of the Staveley Company considered the possibilities of improving the mines' ventilation for the series of workings on Hollingwood Common: After long discussion and tests, it was decided that a more effective system could be produced by the addition of a large fan to the Hartington plant. This would mean improvements to the workings centring on the Ireland shaft with the realisation that the future of the mines lay to the south of this shaft. Following from this decision, a 40 feet diameter Guibal fan was erected against the south wall of the pump house as it was being built. The steam engine for the fan was placed within the pump house and operated a drive shaft through the wall into the fan house to drive the fan. This fan was at work early in 1879, leading to the closure of the earlier Guibal fan already mentioned and the concentration of all the ventilation for these mines on the Hartington Colliery. During 1881 a report says that this fan worked at 40 rpm. to deliver 144,000 cubic feet of air per minute with a water gauge of 2.05 inches giving a useful effect of 52.88%. Air to ventilate the workings was drawn down the Hartington and Ireland shafts, round the airways, to be exhausted at the Hartington upcast shaft. About this period a further 40 feet diameter Guibal fan was constructed on the opposite side of the upcast shaft with its steam engine in a lean-to building against the fan house wall. This duplicate fan was operated as a standby unit so that if one fan was stopped the other could take over.

Coal production had commenced by 1881 with a build up to an average of 10,500 tons per week, a lot of this coming from the workings on Hollingwood Common.

By the turn of the century the workings of the Speedwell, Seymour and Camp bell collieries were nearing exhaustion with mining concentrating on the Hartington and Ireland areas with new sinkings such as the Markham pits being to the south on the deeper parts of the coal field.

Following the 1911 Coal Mines Acts, which required the ventilation system of a colliery to be reversible (the Guibal fan being unable to do this,) a 12 feet diameter Waddle fan with a capacity of 170,000 cubic feet of air per minute was installed, complete with a system of doors so as to reverse the air flow to comply with the legal requirements. This fan was driven by a two cylinder horizontal Ruston and Hornsby diesel cold-start oil engine of 200 horse power, capable of running largely on creosote made at the company's works nearby. The two Guibal fans then became standby units.

Starting in 1921 a development scheme to work deeper coal seams was commenced with the sinking of the shafts at Hartington to the Blackshale seam. An electric winding engine of 440 horsepower made by Messrs. Markham and Company of Chesterfield was installed at the upcast shaft. At this time a lattice steel headgear of 55 feet high was erected over this shaft. To permit the winding of coal in the upcast shaft two large doors covered the mouth of the pit. To open them, small circular covering lids, 2 feet in diameter were lifted by a bracket attached to the cage chains. The large covering door was not lifted until a point 9 feet below it was reached by the cage, when the small pilot door was lifted by the bracket and acted as a valve to reduce the shock when the large doors were moved.

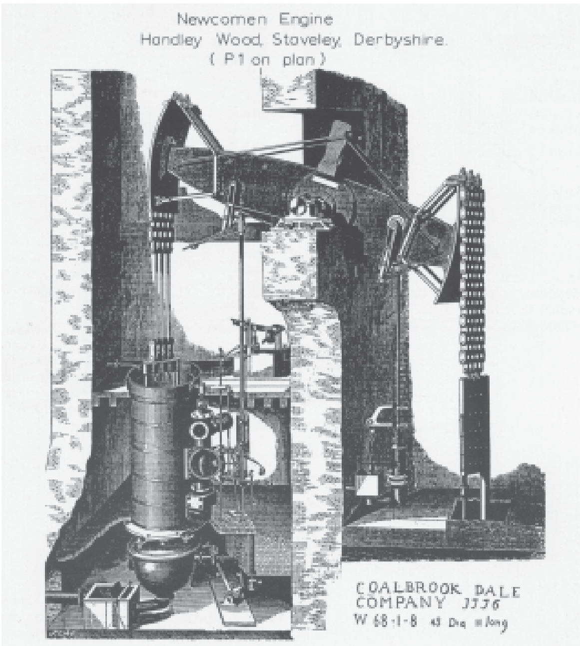
Unfortunately the unrest of the coal industry at this period culminating in the General Strike brought a stop to the work and a change in policy by the company. So during 1927 the Hartington Colliery was closed, the downcast shaft capped and the head frame with its winding engine demolished while the Ireland colliery continued to draw the Hartington coal. From this date the pumping and ventilation duties of the Hartington site have continued to the present day with any unused buildings being demolished.

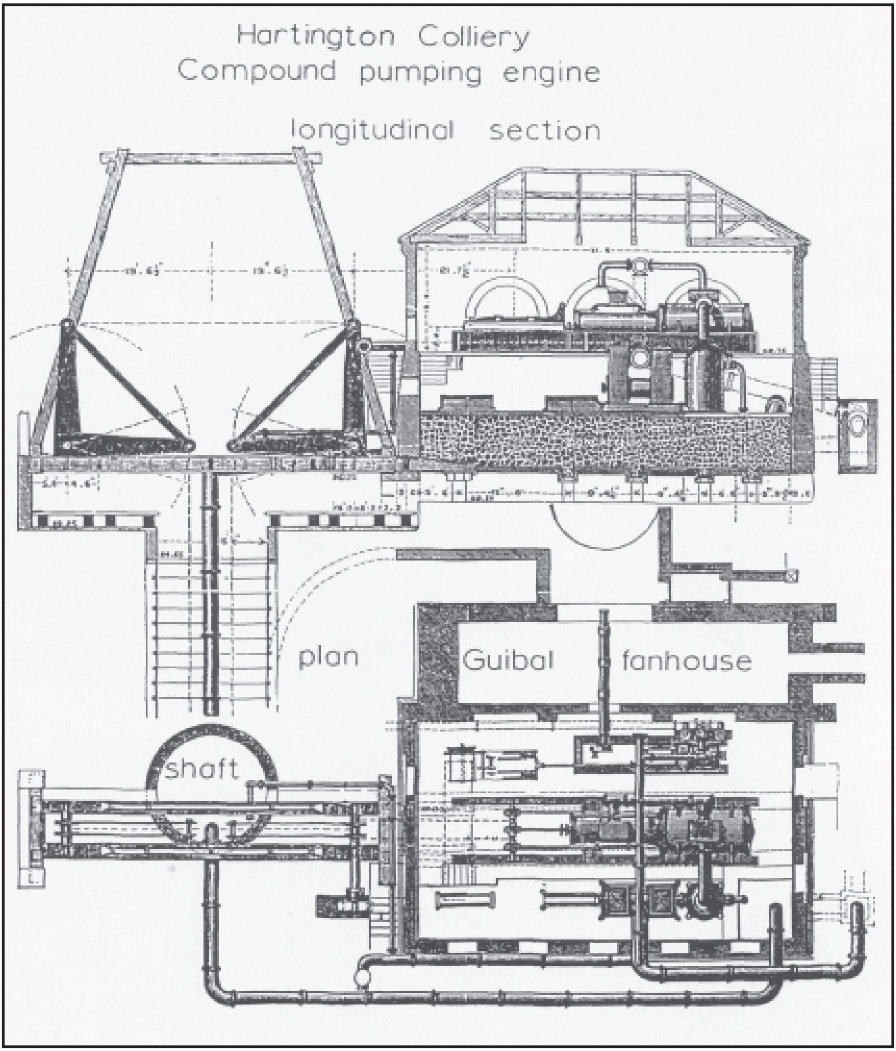
Remains today

The superb differential pump house of 1879 is basically complete and being used as an electrical equipment store with an electric motor to drive an Airex fan working in the place of the former steam engine. The Guibal fan house against the pump house was partly demolished in the 1970s to provide space for the Airex fan which sits on top. The other Guibal fan house remains on the opposite side of the shaft having been bricked up and left when the Waddle fan became a standby to the Airex fan. It is said that this Guibal fan was complete with its wooden paddles and still exists within the bricked up house. A recent visit to the site revealed that the central spindle shaft with the cast iron bearing remained so that the large [40] iron boss is still within the house. This points to the existence of a complete fan in the building which would make this the last in the country. It should be preserved as this type of fan was the first successful and most commonly used of the 19th century fans. Two examples of Guibal fan houses have been preserved as Ancient Monuments, but so far no examples of the fan itself has been kept. An engine from the Cannock Wood colliery Guibal fan is preserved at the Beamish Open Air Museum at Stanley, County Durham so why not preserved an example of the fan itself?

Coal Seams of Derbyshire

No.1 High Hazel	of about 4 feet 0 inches thick	
No.2 High Hazel	of about 3 feet 0 inches thick	
Top Hard	of about 5 feet 0 inches thick	Depths found in the
Dunsil	of about 2 feet 6 inches thick	Hartington shaft
No.l Waterloo	of about 5 feet 0 inches thick	89 feet
No.2 Waterloo	of about 2 feet 0 inches thick	178 feet
Ell	of about 3 feet 0 inches thick	352 and 390 feet
Deep Hard	of about 3 feet 6 inches thick	652 feet
Deep Soft	of about 3 feet 6 inches thick	800 feet
Three Quarter	of about 2 feet 9 inches thick	not present
Tupton (Low Main)	of about 4 feet 0 inches thick	976 feet
Blackshale	of about 4 feet 6 inches thick	1170 feet
Kilburn	of about 3 feet 6 inches thick	1172 feet bottom of shaft
Mickley	of about 2 feet 6 inches thick	
Alton	of about 4 feet 6 inches thick	





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