


S. S. W. W.

DESCRIPTION OF PUMPING STATIONS
1921.

VOL. I

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ENGINEER.

SOUTH STAFFORDSHIRE WATERWORKS COMPANY.

PUMPING STATIONS.

<u>Index.</u>	<u>Page.</u>
Ashwood	1
Bourne Vale	31
Brindley Bank	47
Cawney Hill	61
Coneygre	68
Fradley	82
Hinksford	93
Huntington	106
Lichfield	118
Maple Brook	139
Moors Gorse	159
Pipe Hill	171
Romsley	196
Shavers End	204
Shenstone	210
Springs Mire	229
Trent Valley	246
Winshill	268
Wood Green	277

and supplementary
pages 156 A & J.

MOORS GORSE PUMPING STATION

situata near

RUGELEY in the County of STAFFORD

S U M M A R Y
- - - - -

Total Engine Power at Station is
equal to 3,000,000 Gallons per
24 Hours.

No. 1. Engine. Power per day = 1,500,000 Gallons
No. 2. Engine. ditto = 1,500,000 do

TOTAL SPECIFIED HEAD - 500 Feet.

C O S T S

	<u>£.</u>	<u>s.</u>	<u>d.</u>
Making Well ...	3,243.	14.	4.
Sinking Boreholes, etc	5,860.	10.	5.
Engine & Boiler Houses,	11,896.	12.	3.
Engines and Boilers,	14,347.	8.	2.
Cottages (Five) ...	1,776.	9.	3.
<u>VENTURI RECORDER</u>	<u>637</u>	<u>0</u>	<u>0</u>
<u>TOTAL COST</u>	<u>£ 37,761.</u>	<u>14.</u>	<u>5.</u>

Station Commenced - 1875.
Station Completed - 1880.

LAND. (2 Acres)

Leased from the Marquis of Anglesey

April, 1875.

NOTE:- The land upon which this Pumping Station stands (including 16 acres of land at Scout House) is subject to a perpetual rent of £300 per annum.

Level, E.H.F. above O.D. - 428.85 Feet.

CONTRACTORS

WELL.

Sunk by J. Aird & Sons, 1875 - 1880.

BOREHOLES

Sunk by South Staffordshire Waterworks Compsny ... 1893 - 1896.

TUNNEL.

Work done by ditto ... 1893 - 1896.

BUILDINGS.

Engine & Boiler Houses

W. Trow & Sons ... 1877.

Cottages (5)

ditto ... 1877.

ENGINES & BOILERS .

Nos 1 and 2 Engines, 4 Boilers.

J. Watt & Co, Birmingham 1877.

COSTS

	£.	s.	d.
Making Well ...	3,243.	14.	4.
Sinking Boreholes, and) driving Tunnel.)	5,860.	10.	5.
Engine & Boiler Houses,	11,896.	12.	3.
Five Cottages ...	1,776.	9.	3.
Engines, Nos. 1 and 2	12,947.	8.	2.
Boilers, Four ...	1,400.	0.	0.
<u>VENTURI RECORDER</u>	<u>637</u>	<u>0.</u>	<u>0.</u>
TOTAL COST	£ 37,761.	14.	5.

ENGINE HOUSE

Internal Dimensions ... Length, ...	33 Ft - 0 In
Width, ...	28 Ft - 0 $\frac{1}{2}$ "
Height to top of Wall Plate ...	40 Ft - 0 "
Depth, Foundations ...	19 Ft - 6 In.

BOILER HOUSE

Internal Dimensions ... Length ...	50 Ft - 11 In
Width ...	42 Ft - 9 "
Level, E.H.F. to Firing Floor ...	17 Ft - 6 Ins

WELL.

Diameter ...	16 Ft - 0 In
Total Depth from E.H.F. ...	104 Ft - 0 $\frac{1}{2}$ "
Top, above E.H.F. ...	3 Ft - 8 $\frac{1}{2}$ "

BOREHOLES IN WELL.

Two holes in bottom of Well both
3 inches diameter, one 33 Ft. deep
from bottom of Well, and the other
50 Feet deep.

Total depth of deeper Borehole and Well
 combined from E.H.F. ... 154 Ft - 0 $\frac{1}{2}$ Ins

TUNNEL OR HEADING IN WELL.

Heading. Floor from E.H.F.	...	94 Ft - 0 $\frac{1}{2}$ Ins.
Height	... ..	5 Ft - 6 Ins
Width	... ..	4 Ft - 6 Ins
Length (to Pilot Well)	... ..	377 Ft - 11 Ins.
do (Beyond do )	... ..	2512 Ft - 0 Ins.

ENGINES 1 AND 2.

These Engines are of the same size

and capacity in every respect.

Cornish Expansion Condensing Single -

Acting Beam Engines, working Well and

Force Pumps.

CAPACITY

Net Quantity pumped equals 1,500,000

Gallons per 24 hours at a speed of 8

double strokes per minute.

SPECIFIED HEAD

Depth of Well	... ..	135 Feet
Head on Pumping Main (including friction)	...	365 "

	<u>TOTAL HEAD</u>	<u>500 "</u>
		=====
Engine Speed per Minute	... ..	144 Feet
Pump Horse Power at 8 double strokes)		158.
per minute)		

RISING MAINS OR LIFTS

Distance apart, each Engine Lift	... ..	12 Ft - 6 Ins.
Number Lifts, each Engine	... ..	1
Diameter Cast Iron Pipes of Lift	... ..	22 $\frac{3}{4}$ Ins.
Length ditto	... ..	9 Feet
Thickness, Metal of Pipes	... ..	$\frac{7}{8}$ In to 1 $\frac{1}{8}$ In.
Diameter Flanges on Pipes	... ..	2 Ft - 7 Ins.
Thickness do	... ..	1 in to 1 $\frac{1}{2}$ in.

RISING MAIN OR LIFTS (Continued)

Each Lift consists of 6 - 9 Ft. Lengths
and 3 lengths 3 Ft - 5 In., 1 Ft - 8 $\frac{1}{4}$ In
and 6 Ft - 7 In. respectively, with
Working Barrel, Clack Box, Suction Pipe,
Snore Piece and top Guide Length.

WORKING BARREL.

Diameter	...	...	22 Ins.
Length	...	...	11 Ft - 3 Ins
Thickness, Metal	...	...	1 $\frac{1}{2}$ Ins.
Diameter, Flanges	...	...	2 Ft - 7 Ins.

CLACK BOX.

Diameter	...	...	22 $\frac{1}{4}$ Ins.
Length	...	...	7 Ft - 9 Ins,
Thickness, Metal	...	...	1 $\frac{1}{4}$ Ins.

SUCTION PIPE.

Diameter	...	...	18 $\frac{1}{2}$ Ins.
Length	...	...	6 Ft - 11 Ins
Thickness, Metal	...	...	$\frac{3}{4}$ In.

SNORE PIECE.

Diameter, Smallest part	...	18 $\frac{1}{2}$ Ins.
Length overall	...	2 Ft - 7 Ins.
Diameter, Flange on Snore Piece	...	25 Ins.

WELL PUMPS.

Single-Acting Pumps, operated from
end of Well Pump Beam of Engine.

WELL PUMP BUCKETS & CLACKSCast Iron Hat Band Buckets & Clacks.

Diameter, W.P. Bucket	...	2 1/4 Ins.
Stroke do	... ..	8'-6" Feet.
Number, Tiers of Hat Bands	...	4
1st India Rubber Band, inside dia.		12 Ins.
2nd ditto do		14 Ins.
3rd ditto do		16 Ins.
4th ditto do		18 Ins.

SUCTION VALVES OR CLACKS.

Diameter Clack, top of tapered Seat,		20 3/4 Ins.
ditto bottom do		19 3/4 Ins.
Number, Tiers of Hat Bands	...	4
1st India Rubber Band, inside dia.		12 Ins.
2nd ditto do		14 Ins.
3rd ditto do		16 Ins.
4th ditto do		18 Ins.

All India Rubber Bands are 7/8 In. thick

Diameter, Well Pump Rods	...	3 Ins.
Turned part of Rod inside Coupling,		3 3/4 In. dia.
<u>Couplings on Pump Rods - Parallel.</u>		

FORCE PUMPS.

Single Acting Plunger Pumps operated
from end of Engine Beam, with Weight
Box on top of Plunger.

Diameter, Plunger	... ..	20 7/8 Ins.
Stroke do	... ..	8'-6" Feet MEAN.
Gallons discharged per double stroke,		125.9
Multiplier given to Foreman	...	125
Excess of discharge of Well Pump over) Force Pump)		9.75 %
Diameter, Inlet & Outlet Branches on) F.P. Valve Boxes)		22 Ins.

FORCE PUMP VALVESCast Iron Hat Band Valves

Number Suction Valves to one Engine,	1
" Delivery ditto	1
Diameter, Seat of both Valves ...	3 Ft - 0 $\frac{1}{2}$ Ins.
Number, tiers of Hat Bands on each Valve)	5
1st India Rubber Band, inside dia.	2 Ft - 4 Ins.
2nd ditto do	2 Ft - 6 Ins
3rd ditto do	2 Ft - 8 Ins
4th ditto do	2 Ft - 10 Ins
5th ditto do	3 Feet
Thickness of Bands	$\frac{7}{8}$ In.
Depth ditto	8 $\frac{1}{2}$ In.

All Hat Bands are of the same

diameter for Suction and

Delivery Valve.

Steam Cylinder (Each Engine) Diameter,	65 Ins.
Stroke of Engine	10 Feet
Diameter Piston Rod (Each Engine)	6 $\frac{5}{8}$ Ins.
Piston Rod Packings - Ordinary Soft Type	

Cylinders - Steam Jacketted.

PISTON RINGS.

Broad Cast Iron Packing Rings with

Coach Springs,

ENGINE VALVE GEAR.

Cornish Gear with drop Valves

operated by Plug Rods

STEAM NOZZLES

Diameter, Steam Valve to Cylinder	14 $\frac{3}{4}$ In. in Seat.
" Equilibrium ditto	14 $\frac{3}{4}$ In do
" Governor ditto	14 $\frac{3}{4}$ In do

STEAM NOZZLES (Continued)

Lift above Three Valves	...	$1\frac{1}{8}$ In.
Diameter " Valve Spindles	...	$1\frac{3}{8}$ In.
Diameter, Exhaust Valve	...	$17\frac{3}{4}$ In. in seat
Lift ditto	...	$2\frac{1}{4}$ Ins.
Diameter Exhaust Valve Spindle		$1\frac{1}{2}$ Ins.

AIR PUMP

One Single-Acting Vertical Pump
operated from Air Pump Gudgeon
on Engine Beam.

Distance A.P. Gudgeon from Centre Gudgeon of Engine Beam	...	8 Ft - 2 Ins.
Diameter, Air Pump	...	32 Ins.
Stroke	...	4 Ft - 9 Ins.

Valves - India Rubber

Foot Valve - Flap Valve
of Pump Type.

Diameter, Bucket Valve	...	2 Ft - 3 Ins.
" Head Valve	...	2 Ft - $9\frac{1}{2}$ Ins.
" Bucket Rod	...	3 Ins.
Size, Inlet	...	6 " X 36 Ins.
" Outlet	...	9 Ins.

Packing round Air Pump Bucket

$\frac{7}{8}$ In. diameter Hemp.

CONDENSERS.

Open type with Tubes expanded into
Tube Plates. Condenser placed in
Force Pump Suction Tank.

NO. 1. ENGINE CONDENSER.

This was re-tubed in June 1905 with
 200 Brass Tubes in place of original
 392 W.I. Tubes, the remaining 192 holes
 being plugged up with cast iron plugs.

CONDENSER, NO. 1. ENGINE (Continued)

Cooling Surface	...	...	560 Sq. Ft.
Ordinary Brass Tubes, Number	...		200
	Ext. Diameter	..	1 ⁹ / ₁₆ In.
	Length	...	6 Ft - 1 ⁵ / ₈ Ins.
	Thickness	.	16 B.W.G.
W.I. Stay Tubes	..Number	...	28
	Int. Diameter	..	1 ¹ / ₂ Ins.
	Length	...	6 Ft - 4 Ins.
Pitch of all Tubes	...	...	3 ¹ / ₈ " X 2 ³ / ₄ In.
Diameter, Tube Plates	...		6 Ft - 1 In.
Thickness do	...	...	⁵ / ₈ In.
Distance apart over Tube Plates,			6 Ft - 1 ¹ / ₂ Ins.
W.I. Stay Bolts,	Number	...	5
	Diameter	..	1 ³ / ₈ In
	Length(Overall)		6 Ft - 4 ¹ / ₂ Ins.
Diameter, Exhaust Inlet	...		16 ¹ / ₄ In.
Size	"	Outlet	...
			6" X 36 Ins.

CONDENSER, NO. 2. ENGINE

This Condenser was re-tubed in 1906 with 240 Brass Tubes in lieu of original 392 W.I. Tubes, the remaining 152 holes being plugged up with Cast Iron Plugs.

Cooling Surface	...	...	659 Sq. Feet.
Number, Ordinary Brass Tubes	...		240

NOTE:- All other dimensions and particulars are as for Engine No. 1.

DELIVERY AIR VESSEL. (WROT IRON)

Total Height inside	...	24 Ft - 10 $\frac{3}{4}$ Ins.
Diameter	"	5 Feet.
Height above Branches	...	21 Ft - 11 $\frac{1}{2}$ Ins.
Thickness, Metal	...	$\frac{5}{8}$ In.
Working pressure per sq. inch,		130 Lbs.
Test Pressure	ditto	260 Lbs.
Capacity above Branches	...	422 C. Ft.
Total Capacity	...	479 C. Ft.

FEED WATER PUMPSOne Plunger type Pump on eachEngine operated from Engine Beam.

Distance, Feed Pump Gudgeon)		
from centre Gudgeon on)		4 Ft - 3 $\frac{1}{2}$ Ins
Engine Beam.)		
Diameter, Plunger	...	5 $\frac{1}{2}$ Ins
Stroke, Pump	...	2 Ft - 6 Ins.

AIR SUPPLY PUMPS TO AIR VESSELSOne Plunger Type Pump on eachEngine operated from Engine Beam

Diameter, Plunger	...	7 Ins.
Stroke	do	2 Ft - 6 Ins.

ENGINE BEAM.

Diameter, Bearings of centre)		12 Ins.
Gudgeon)		
Length	ditto	14 Ins.
Diameter, Bearings of Cylinder)		8 Ins
and Main Pump Gudgeons)		
Length of above Bearings	...	7 Ins.
Distance, Cylinder from Centre)		17' - 2.45 Ins.
Gudgeon)		
"	Main Pump	ditto
		15' - 6.005 Ins.

WELL PUMP BEAM.

Diameter, Centre Gudgeon	...	5½ Ins.
Length do	...	7 Ins.
Diameter, Gudgeons on ends of Beam) for Well Pump and over Steam) Cylinder	...) ...)	4 Ins.
Rod for Connecting Engine and Well Pump Beams. Brasses.	...	4 Ins dia
Length between centre of Brasses on Rods	...) ...)	5 Ft - 6 Ins.

STEAM BOILERS.

...)
...)
4
Of the "Lancashire Type, made by
James Watt & Co., Birmingham.

Diameter	...) ...) ...)	7 Feet
Length	...) ...) ...)	32 Feet
Thickness Shell Plates	...	7/16 In.
" End "	...	9/16 In.
Diameter Internal Flues. Front End,		2 Ft - 8 Ins.
Back End,		2 Ft - 8 Ins.
Thickness Flue Plates over Fire Grate,		9/16 In.
" other parts of Flue	...	½ In.
Size, Oval Manlid on top of Dome,		15" X 12 Ins.
Diameter ditto	...	2 Ft - 0 Ins.
" Steam Dome	...) ...)	3 Ft - 0 Ins.
Steam Pressure per sq. inch	...	30 lbs.
Total Heating Surface	...	976 Sq. Ft.

MOUNTINGS ON EACH BOILER.

One Junction Stop Valve with two Lever Dead Weight Safety Valves) attached. Stop Valve fixed on) top of Steam Dome.		8½ Ins dia.
One Feed Water Check Valve.		
One Blow Down Valve	...	2½ Ins. dia.
Two sets Water Level Gauges	...	¾ In. dia.
One Steam Pressure Gauge.		

FITTINGS AT STATION.

One Steam Trap of Lancaster & Tonge's Bucket type on drains from Main Steam Range	1 In. dia.
Height of Delivery Pressure Gauges from E.H.F.	5 Feet

NO. 1. ENGINE TRIAL.7TH AUGUST, 1894.

Duration of Trial	12 Hours
Duty of Engine per cwt of Slack consumed	42,383,294 Ft. Lbs.
Pump Horse POWER	64
Indicated Horse Power	71
Slack consumed per P.H.P. per hour,	5.6 Lbs
do " I.H.P. do	5.25 "
Mechanical Efficiency	90.2 %

NO. 2. ENGINE TRIAL3RD NOVEMBER, 1898.

Duration of Trial	24 Hours.
Duty of Engine per cwt of Slack consumed	45,170,000 Ft. Lbs.
Pump Horse Power	117.84
Indicated Horse Power	129.39
Slack consumed per P.H.P. per, hour,	5.39 Lbs.
ditto I.H.P. do	4.91 Lbs
Mechanical Efficiency	91.07 %