


S. S. W. W.  
  
DESCRIPTION OF PUMPING STATIONS  
1921.

VOL. I

FRED. J. DIXON, M. INST. C.E.  
ENGINEER.



SOUTH STAFFORDSHIRE WATERWORKS COMPANY.

PUMPING STATIONS.

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PIPE HILL PUMPING STATION

situated at

PIPE HILL, near LICHFIELD

S U M M A R Y

Total Engine Power at Station is equivalent to Four Million gallons per 24 hours.

No.1. Engine power, per day = 2,000,000 gallons  
 No.2. ditto do = 2,000,000 "

TOTAL SPECIFIED HEAD:- No.1.Engine = 733 feet  
 No.2. do = 554 "

TOTAL COSTS

	£.	s.	d.
Land and Law Charges ...	507.	13.	11.
Four Boreholes. ...	4,282.	18.	7.
Buildings ...	6,404	17.	11.
Cottage ...	404.	7.	9.
Two Engines and Three Boilers, AND No. 2. FOUNDATIONS	20,382	7.	2.
Fencing, Main Connections and Wharf,	1,041.	0.	4.
Electric Light Installation, .	246.	19.	0.

COLE VENTURI METER  
 HAYS CO RECORDER  
 2

£ 33,270	4.	8.
227	3.	0.
85	0.	0.
<u>33,582.</u>	<u>7.</u>	<u>8.</u>

PUMPING STATION commenced, 1904.  
 completed, 1915.



LAND.

Date purchased ... .. May, 1904  
 Area ... .. 2a. Or. 7p.  
 Level above O.D. ... .. 367.66 feet  
 Purchased from H.A. Russell, Pavier.

CONTRACTORS.

Boreholes 1 and 2. Mather & Platt. 1904 - 5  
 do 3 and 4. Potter A.C. & Co. 1912 - 13.

BUILDINGS.

Henry Lovatt & Co.  
 Date of erection ... .. 1907 - 9

ENGINES.

No. 1. Engine & Boilers. Hathorn Davey Ltd. 1905  
 No. 2. Engine Ashton Frost & Co. 1915.  
 Boilers made by H & T Danks Ltd.

C O S T S

			£.	s.	d.
LAND.	Land	'... ..	400.	0.	0.
	Law Charges	... ..	107.	13.	11.
BOREHOLES	No. 1. Sinking Shaft & Boring	)	2,044.	12.	0.
	No. 2. ditto ditto	)			
	No. 3. ditto ditto	)	1,955.	3.	3.
	No. 4. ditto ditto	)			
	Cost of Test Pumping	... ..	283.	3.	4.
BUILDINGS	Engine and Boiler Houses	... ..	6,404.	17.	11.
	Cottage	... ..	404.	7.	9.
	Fencing, main connections and Wharf, etc.	... ..	1,041.	0.	4.
	(Wharf Erected 1908).				
ENGINES	No. 1. Engine and 3 Boilers	} ... ..			
	Foundations of No. 2. Engine.	} ... ..	<b>20,382.</b>	<b>7.</b>	<b>2</b>
	No. 2. Engine	... ..			
ELECTRIC LIGHTING INSTALLATION.	Electric Light Installation	... ..	246.	19.	0.
			<b>227.</b>	<b>3.</b>	<b>0.</b>
	<u>COLE VENTURI METER</u>		<b>85.</b>	<b>0.</b>	<b>0.</b>
	<u>HAYS CO<sub>2</sub> RECORDER</u>				
	TOTAL COST	... ..	<b>£ 33,582.</b>	<b>7.</b>	<b>8.</b>

DESCRIPTION OF ENGINE HOUSE.

Internal dimensions, Length, ..	100 feet.
Width, ..	37 "
Height to top of Wall Plate, ..	29 " - 6 ins
Depth of Foundations .. ..	16 " - 1½ "

BOILER HOUSE.

Internal Measurements, Length, ..	59 " - 6 "
Width, ..	36 " - 6 "

CHIMNEY

Height ... ..	120 "
Internal Diameter at top, ...	5 " - 6 "

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PARTICULARS RELATING TO NO. 1. ENGINE

Engine Builder's Order NO.,	...	6222.
Boreholes	... ..	1 and 2.
Distance apart	... ..	20 feet
<u>NO.1.</u> Borehole	30 inch dia. to a depth of	311' from E.H.F.
	20 " " ditto	556 " E.H.F.
<u>NO.2.</u> do	30 " " ditto	310 " E.H.F.
	20 " " ditto	516 " E.H.F.
Top of Boreholes from E.H.F.	...	10.02'
Cast Iron Lining Tubes for suspending		
Rising Mains, concreted round		
Boreholes to a depth (from E.H.F.) of		49.02 feet
Inside diameter of Castings	...	3 feet
Thickness of metal	... ..	1½ inches.

RISING MAIN OF BOREHOLES.

Diameter of mild steel tubing, inside,		16 inches.
Length of each tube	... ..	15 feet.
Thickness of each tube	... ..	½ inch
Diameter of couplings, outside,	...	18½ inches.
Length of couplings,	... ..	9 "

Each Rising Main consists of 18 tubes and 17 Couplings. Tubes and couplings screwed 8 threads per inch.



RIISING MAIN OF BOREHOLES, continued.

One suction Tube to each main.	Diameter,	14	Inches.
ditto	Length,	15	Feet
ditto	Thickness,	$\frac{1}{2}$	Inch.

Joints between Tubes made of  
 $\frac{3}{8}$  Inch diameter Gutta Percha  
Cord.

Distance between Boreholes	...	20	Feet
----------------------------	-----	----	------

CAST IRON WORKING BARRELS IN BOREHOLES

Diameter	...	...	15	Inches
Length	...	...	8	Ft - 11 Ins
Flanged one end .	...	dia.	$23\frac{1}{2}$	Inches
Thickness of Flange	...		3	"
Thickness of Metal of Barrel	...		$1\frac{1}{2}$	"
Screwed other end of Barrel to receive M.S.				
Tube of Rising Main internally for a				
length of ..	...		5	Inches
No. of threads per inch	...		8	

SUCTION VALVE BOX ( CAST IRON. )

Diameter (Narrow part)	...	$15\frac{1}{2}$	Inches
Length of Valve Box	...	5	Ft - 11 In
Thickness of Metal	...	$1\frac{1}{4}$	Ins.
Flange $23\frac{1}{2}$ inches dia. one end, screwed			
other end internally for Suction Tube			
to a length of	...	8	Inches

CAST IRON STRAINERS.

Inside diameter of perforated part	...	14	Inches
Diameter over flange and ribs	...	2	Ft. 5 Ins.
Thickness of Barrelled part	...	$1\frac{1}{2}$	Inches
Length of strainers overall	...	5	Ft. 5 Ins.

Suction Valve Box fitted with  
Gunmetal seat for Suction Valve.

TYPE OF ENGINE

Horizontal Compound Tandem Surface-Condensing  
Rotative Pumping Engine.

CAPACITY OF ENGINE

Net quantity for 24 hours at 18 r.p.m. - 2,000,000 gals.

SPECIFIED HEAD

Maximum lift in Boreholes	...	...	300	Feet
Ordinary working lift	...	...	250	Feet
Head on Delivery Main (including friction)			433	"
TOTAL SPECIFIED HEAD			<u>733</u>	"
Distance apart of Boreholes	..	...	20	"
Pump Horse Power at 18 revs.	..	...	309	
Speed per minute	...	...	18	Revs.
Diameter of Steam Cylinders	..	...	H.P. 32	Ins.
ditto	...	...	L.P. 62	"
Stroke of Engine	...	...	5	Feet

Cylinders steam jacketted.

Type of Piston Rings - Mather & Platt.

Diameter of Piston Rods, H.P. Front end	..		5 $\frac{3}{4}$	Ins.
ditto		Centre	7 $\frac{1}{4}$	"
ditto		L.P. Back end	4 $\frac{1}{4}$	"

Piston Rod Packings ... U.S. Metallic.

TYPE OF ENGINE VALVE GEAR .

Corliss gear actuated by Wrist Plate from Crank  
shaft by eccentrics and rods, and Trip gear  
with noiseless dashpots.



Diameter of Connecting rod Crank Pin	...	11 Inches.
ditto " Crosshead Pin	...	7 Inches
" of Crank Shaft Bearings	...	13 Inches.

TYPE OF AIR-PUMP

Vertical Single Acting driven from Crank Shaft.

Diameter	...	25 Inches
Stroke	...	2 Ft - 4 Ins

Type of Valves - India Rubber

Diameter of Foot Valve	...	18 Inches
" " Bucket Valve	...	21 "
" " Bucket Rod	...	3 "
" " Inlet	...	8 "
" " Outlet	...	5 "

NUMBER OF BOREHOLES ... .. 2

TYPE OF BOREHOLE PUMPS.

Pumps actuated by compensating levers and rods from Engine crosshead.

TYPE OF BOREHOLE BUCKET & SUCTION VALVE

Gunmetal "Pernis" or Multi-annular type with Leather Beats.

Diameter of Borehole Bucket	...	15 Inches
Stroke do	...	5 Ft. 6 In
Number of Valve Rings on Bucket	...	5
Lift ditto	...	5/16 Inch
Diameter of Borehole Suction Valve	...	14 3/4 Ins.
Number of Valve Rings on Valve	...	6
Lift ditto	...	5/16 In.
Diameter of Borehole Rods	...	4 Ins.
" " ditto (top)	...	4 13/16 "
Number of Borehole Guides in one lift	...	17.



TYPE OF FORCE PUMP.

Double Acting Piston Pump driven by  
L.P. Piston Tail Rod.

Diameter of Force Pump Piston	...	...	15 $\frac{3}{4}$ Inches
Stroke ditto	...	...	5 Feet
Diameter of Force Pump Rod (Front end only)	...	...	4 $\frac{1}{4}$ Inches
Gallons discharged per double stroke	...	...	81.27
Multiplier given to Foreman	...	...	81.
Excess of discharge of Borehole Pumps over Force Pumps	...	...	3.43%

TYPE OF FORCE PUMP VALVES.

Phosphor Bronze Valve and Seats of the  
Multi-annular type beating metal to metal.

Number of Suction Valves in all	...	...	62.
" " Delivery Valves "	...	...	62.
Diameter of screwed part of Valve Seats	...	...	4 Ins. gas
Free lift of Valves	...	...	$\frac{1}{4}$ Ins.

CAST IRON FLYWHEEL.

Made in Segments.

Diameter.	...	...	25 Feet
Internal Diameter of Boss	...	...	17 $\frac{1}{2}$ Ins.
Width of Rim	...	...	13

TYPE OF CONDENSER.

Open type with tubes expanded into tube  
plates. Condenser placed in Force Pump  
Suction Tank.

Cooling Surface	...	...	712 Sq. Ft.
No. of ordinary Tubes	...	...	349
Length ditto	...	...	8 Ft - 0 $\frac{1}{8}$ In
Diameter ditto	...	...	1 In. extn'l



TYPE OF CONDENSER - continued

Thickness of ordinary Tubes	...	19 B.W.G.
Stay Tubes	... ..	None.
Pitch of Tubes	... ..	1½ Ins.
Diameter of Tube Plates	... ..	3 Ft - 3¼ Ins
Thickness ditto	... ..	1½ Ins.
Distance apart	... ..	7 Ft - 9¾ Ins
Diameter of Exhaust Inlet	... ..	12 Ins.
ditto Outlet	... ..	8 Ins.

TYPE OF AIR VESSEL.

Mild Steel

Total Height Inside	...	19 Ft - 11½ Ins
Diameter inside	... ..	2 " - 6½ "
Height above branches	... ..	18 " - 5 "
Thickness of Metal .	... ..	⅝ Ins.
Working pressure per □ Inch	... ..	188 Lbs.
Capacity above Branches	... ..	94 C.Ft.
Total capacity	... ..	101 C.Ft.

FEED WATER HEATER ON EXHAUST

Type:- Special No. 10 Simplex Berryman  
Heater made by Messrs Joseph Wright &  
Co., Tipton.

Heating Surface	... ..	127 Sq. Ft.
External diameter of Tubes	... ..	2½ Ins
Thickness ditto	... ..	14 B.W.G.
Diameter of Exhaust, Inlet and Outlet	... ..	12 Ins.
" " Cold Water Inlet	... ..	2½ "
" " do Outlet	... ..	2½ "
Overall Length	... ..	6 Ft - 3 In
Diameter of Tube Plate	... ..	3 Ft - 7 "
Metal of Body containing tubes	... ..	Mild ) Steel)



OVERHEAD TRAVELLING CRANEMakers:- Herbert Morris & Bastert.

Type	...	...	...	G
Load	...	...	...	15 Tons
Span	...	...	...	36 Feet
Top of Crane Rail from E.H.F.	...	...	...	21 Ft - 6 Ins
Fixed load at 10 ft. 6 Ins. from either rail centre	...	...	...	20 Tons.

WINCHHorizontal Steam Type made by :-Clarke, Chapman & Co., Gateshead.Maker's mark on Shaft ... 24.1949 ...

Diameter of Cylinders	...	...	...	8 Inches
Stroke	...	...	...	12 "
Barrels	...	...	...	Grooved
Diameter of wire rope	...	...	...	1 Inch
Diameter of Barrel	...	...	...	18 "
Length of "	...	...	...	20 "
Diameter of Steam Inlet	...	...	...	1 $\frac{3}{4}$ "
" " Exhaust Outlet	...	...	...	2 "

BARRING ENGINEType:- Double Geared made by -Hick & Hargreaves, Bolton.

Number of Cylinders	...	...	...	2
Diameter "	...	...	...	10 Inches.
Stroke of Engine	...	...	...	7 $\frac{1}{2}$ "

STEAM REHEATERS(Used) As Receiver of exhaust steam  
from H.P. Cylinder.

Number of solid drawn brass tubes	...	...	...	20
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STEAM REHEATERS continued.

Bore of Tubes	...	...	$\frac{7}{8}$ Inch
Thickness "	...	...	16 B.W.G.
Heating Surface	...	...	52 Sq. Ft.
Diameter of body of reheater over flanges,			2 Ft. - $3\frac{3}{4}$ Ins
" " Exhaust Inlet	...	...	10 Ins.
" " Outlet	...	...	8 "

STEAM SEPARATOR on STEAM MAIN

Made by Reid & Adie, Tayport

Diameter of Steam Inlet to Separator 6 Ins.

AIR COMPRESSOR

Single Stage. Type - Westinghouse.

Size	-	...	...	$\frac{8}{5}$
Class	.	...	...	F.
Steam Inlet		...	...	1 Inch diameter.
Exhaust Outlet		...	...	$1\frac{1}{2}$ " "
Air Delivery		...	...	$\frac{5}{4}$ " "
Diameter of Steam Cylinder		...	...	8 Ins. "
" " Air do		...	...	5 " "
Stroke of Compressor ..		...	...	10 " "
Maker's number on Name Plate		...	...	40747
London Works	ditto	...	...	14866

AIR CHARGER ON AIR VESSEL.

Makers:- Hathorn Davey & Co. Leeds.

Type:- Wipperman & Lewis.



MAIN BRAKE ON STEAM RANGE

Diameter of Piston	...	...	3	Inches.
Delivery Pressure Valve ( Dewrance's make, No. 3345)			1 $\frac{1}{2}$	" dia.
Diameter of throttle Valve operated by brake in Main Steam Range	...	...	6 $\frac{1}{2}$	" "
Valve No. 3360 made by Dewrance & Co., on Vacuum Spoiler Pipe	...	...	$\frac{3}{4}$	" "
Valve of same make and size at Condenser end of Pipe.				

NOTE:- This Main Brake was supplied by  
Ashton, Frost & Co. Ltd., Blackburn,  
with the second Engine.

STEAM BOILERS.                   ...                   ...                   ...                   3

Lancashire Type, made by  
H & T Danks - Netherton

Diameter	...	...	...	8	Feet
Length	...	...	...	30	"
Thickness of Shell Plate	...	...	...	$\frac{5}{8}$	Inch
" " End do	...	...	...	11/16	"
Diameter of Internal Flues (Front end)..				3 Ft. - 2 In	
ditto (Back end)				2 " - 8 "	
Thickness of Flues. Front end Section				7/16	Inch
Intermediate "				7/16	"
Back end "				$\frac{1}{2}$	"
Type of Manhole, Mc. Neil.					
Size	...	...	...	16 In x 12 In.	
Steam pressure per square inch	...	...	...	110 lbs.	
Total Heating Surface	...	...	...	1068 Sq. Ft.	



MOUNTINGS ON BOILERS

All made by Hopkinson & Co.

Specification - "A".1905

One Figure 1000 Patent "Triad" Junction Valve,	7 Inches dia
One Anti-priming Pipe ...	
One Figure 7 Patent "Duad" Safety Valve with Plate Weights complete.	
One Figure 20 Patent dead weight Safety Valve for high steam only ...	3 " "
One Figure 2540 patent Parallel Slide Blow-off Valve, all bronze with locking gland and W.l. Box key ...	2½ " "
<u>One Box Key for two Boilers.</u>	
Two Figure 6440 "Absolute" Water Gauges with safety shields "B" ...	¾ "
Centres of Top and Bottom Arms ...	18 "
One Brass engraved water-level pointer.	
One Figure 4180 Steam Gauge graduated to 220 lbs with red mark at 110 lbs. ...	10 " dial
One figure 1320 Patent accessible check Feed Valve ...	2½ " dia.
Fusible plugs in each boiler ...	2
One Asbestos packed "U" Syphon for Gauges .	
<u>BOILER FEED PUMPS</u> ...	1

Made by J. Cameron Ltd., Salford.

Maker's No. on Pump - 18069

Type of Pump ...	Double Ram.
Diameter of Ram ...	3 Inches 3"
Stroke of Pump ...	5 " 12"
Diameter of Steam Cylinders ...	5 " 4½"
" " Suction ..	2½ " 1¾"
" " Discharge ...	2 " 1½"

One Vertical Tipton to Red.



Makers:- Hunt & Mitton, Birmingham.

2 on Engine Slidebars, 3 in. dia.	No. 4.	Screwed $\frac{1}{2}$ gas
1 on end of Engine Connecting Rod, 3 in. dia.	No. 4.	" $\frac{1}{2}$ "
2 " end of Quadrant do	No. 4.	" $\frac{1}{2}$ "
4 " Pump Slidebars, do	No. 4.	" $\frac{1}{2}$ "
6 " Crankshaft Bearings, do	No. 4.	" $\frac{1}{2}$ "
1 " Engine Crosshead Pin, do	No. 4.	" $\frac{1}{2}$ "
2 " Quadrant ends of Crank do	No. 4.	" $\frac{1}{2}$ "
8 " Pump Connecting Rods $2\frac{1}{2}$ in. dia.	No. 3.	" $\frac{3}{8}$ "
4 " Quadrant Bearings do	No. 3.	" $\frac{3}{8}$ "
1 " Main Eccentric do	No. 3.	" $\frac{3}{8}$ "
4 " Connecting Rods between Quadrants. 2 in. dia.	No. 2.	" $\frac{3}{8}$ "
1 " Air Pump Con. Rod. do	No. 2.	" $\frac{3}{8}$ "
1 " Trip Eccentric do	No. 2.	" $\frac{3}{8}$ "
3 " Valve Gear do	No. 2.	" $\frac{3}{8}$ "
2 " Air Pump Conn. Rod. $1\frac{1}{2}$ in. dia.		" $\frac{1}{4}$ "
3 " Valve Gear do		" $\frac{1}{4}$ "
8 " Corliss Valve Sleeves do		" $\frac{1}{4}$ "
4 Tangey's Lubricators for Corliss Valves		" $\frac{3}{4}$ "

CAST IRON FEED TANK.

Size - 3'-4" x 5'-4" x 4'-0".

Maker:- (of Heater) J. Wright & Co. Ltd., Tipton.

Berryman Heater in Tank - Simplex.

Size of Heater	...	...	...	"G"
Heating Surface	...	...	...	30 Sq. Ft.
Tubes	...	...	...	Brass
Diameter of Tubes	...	...	...	1" ext. dia.
Thickness "	...	...	...	18 B.W.G.



ELECTRIC LIGHT INSTALLATION.

Makers of Engine:-

Bumstead & Chandler, Hednesford,

No. on Engine - 1789

The dynamo was constructed by The

Electric Construction Co. Ltd.,

Wolverhampton. S.P.Type. K.W.1.4.

Volts 50. Revs.500. Rating continuous.

No. on Dynamo - 26457

TACKLE ON OVERHEAD CRANE

One 4 Sheave 20 in. dia. Wire Rope Blocks to lift	25 Tons.
One 3 ditto ditto "	25 "
Diameter of Wire Rope for Blocks ... ..	1 Inch

FITTINGS.

One 10 Inch dia. Steam Gauge for Gauge Board	open dial.
One 10 " " Vacuum ditto	do
One 10 " " Delivery ditto	do
One 7 " " Steam Gauge for L.P. Steam Jacket ... ..	do
One 6 " " Delivery Gauge for Main Brake	do

The above Gauges are of Messrs

Schaffer & Budenburg's make.



PARTICULARS RELATING TO

NO. 2. ENGINE.

Engine Builder's Order No.	...	E.202
Boreholes	... ..	3 and 4
Distance apart	... ..	20 Feet
<u>NO.3. Borehole.</u>	30 Inch dia. to a depth of	303 Feet from E.H.F
	18 " " ditto	518 " " E.H.F
<u>NO.4. Borehole.</u>	30 " " ditto	303 " " E.H.F
	18 " " ditto	367 " " E.H.F
	15 " " ditto	425 " " E.H.F
Top of Boreholes from E.H.F.	<u>No.3.</u>	10 Ft - $3\frac{1}{16}$ In.
	<u>No.4.</u>	10 Ft - $3\frac{5}{16}$ In.

Cast Iron lining tubes for suspending  
 Rising Mains concreted round Bore-  
 holes to a depth of (from E.H.F.) 55 Ft -  $3\frac{1}{2}$  Ins.  
 Diameter of Cast Iron Tubes (inside) 3 Feet  
 Thickness of Metal ... ..  $1\frac{1}{2}$  Ins.

RIISING MAIN OF BOREHOLES

Diameter of mild steel tubing , inside,	16 Ins.
Length of each Tube ... ..	15 Feet
Thickness do ... ..	$\frac{1}{8}$ In.
Diameter of Couplings, outside, ...	$18\frac{1}{4}$ Ins
Length " " ... ..	9 Ins
Tubes and Couplings screwed ...	8 threads p.inch.

Each Rising Main consists of 8-15  
feet lengths and one length 4 Ft.

$10\frac{1}{4}$  Ins and 9 Couplings.



TWO MILD STEEL TEMPORARY WORKING BARRELS.

Diameter	...	...	...	15 $\frac{1}{2}$ Ins.
Length	...	...	...	8 Ft. - 6 Ins
Thickness	...	...	...	$\frac{3}{4}$ In.

One end of Working Barrels screwed  
and other end flanged.

TWO PERMANENT WORKING BARRELS (Cast Iron).

Diameter, inside	...	...	...	15 Ins.
Length	...	...	...	8 Ft - 6 Ins
Flanges	...	...	...	22 $\frac{3}{4}$ Ins.
Thickness of Flanges	...	...	...	2 Ins.
Thickness of Metal of Barrel .	...	...	...	1 $\frac{1}{2}$ Ins.

SUCTION VALVE BOXES (Cast Iron)

Diameter of narrow part	...	...	...	15 $\frac{1}{2}$ Ins.
Length	...	...	...	5 Ft - 9 Ins.
Thickness	...	...	...	1 $\frac{1}{4}$ Ins.
Flanges	...	...	...	22 $\frac{3}{4}$ Ins.

Suction Valve Boxes fitted  
with G.M. Seats for Valves.

STRAINERS ( Cast Iron )

Diameter internally	...	...	...	14 Ins.
Length	...	...	...	7 Feet
Thickness of Metal	...	...	...	1 In.
Total depth of Rising Main from E.H.F.	...	...	...	163 Feet
Joints between tubes of Rising Main	...	...	...	$\frac{3}{8}$ In. G.P. Cord
Joints between flanges of castings	...	...	...	$\frac{7}{16}$ In. do

TYPE OF ENGINE

Horizontal Compound Tandem Surface  
Condensing Rotative Pumping Engine.

CAPACITY OF ENGINE

Net quantity for 24 hours at 18 r.p.m. 2,000,000 Galls.

SPECIFIED HEAD.

Maximum Lift in Boreholes	...	150	Feet
Ordinary working lift	...	100	"
Head on Delivery Main (including friction)		404	"
TOTAL SPECIFIED HEAD		554	"
<hr/>			
Pump Horse Power	... ..	233.	
Speed per Minute	... ..	18	Revs
Diameter of Steam Cylinders, H.P.		26	Ins
ditto	L.P.	49	"
Stroke of Engine	... ..	5	Feet

Cylinders steam jacketted.

Type of Piston Rings:- Buckley's

No.2. with restrained tongue pieces.

Diameter of Piston Rods ,. H.P. Front end		5 $\frac{1}{2}$	Ins.
ditto	Centre	6 $\frac{1}{2}$	"
ditto	L.P. Back end	4 $\frac{1}{2}$	"

Piston Rod Packings - U.S.Metallic

TYPE OF ENGINE VALVE GEAR.

Corliss gear of the "Dobson" Type  
actuated by eccentrics and rods  
from Crankshaft and Trip Gear  
with noiseless dashpots.

PACKINGS OF VALVE GEAR SPINDLES

U.S. Metallic.

Diameter of connecting rod Crank Pin		11	Inches.
" " " " Crosshead Pin.		7	"
" " Crankshaft Bearings, ...		13	"



TYPE OF AIR PUMPVertical Single-Acting driven from  
Crank Shaft.

Diameter	...	...	24	Inch
Stroke	...	...	24	"
Valves	-	India - Rubber.		
Diameter of Foot Valve	...	...	18	"
"	"	Bucket	20	"
"	"	Bucket Rod	2 $\frac{1}{2}$	"
"	"	Inlet	7	"
"	"	Outlet	5	"
<u>BOREHOLES</u>	...	...	2	

BOREHOLE PUMPS.

Pumps actuated by Compensating  
Levers from Engine Crosshead.

BOREHOLE BUCKET & SUCTION VALVE.

Gunmetal "Pernis" or Multi-Annular  
type with Leather Beats.

Diameter of Borehole Bucket	...	..	15	Inches
Stroke	ditto	...	5 Ft - 6	Ins.
Number of Valve Rings on Bucket		..	5	
Lift	ditto	..		
Diameter of Borehole Suction Valve		..	14 $\frac{3}{4}$	Inches
Number of Valve Rings on S. Valve		..	6	
Lift	ditto			
Diameter of Borehole Rods	...	..	3	"
"	"	top of do	3 $\frac{1}{2}$	"
Number of Borehole Guides in one lift			8	
Diameter	ditto		15 $\frac{1}{2}$	"

TYPE OF FORCE PUMP

Double Acting Piston Pump driven by  
L.P. Piston Tail Rod.

Diameter of Force Pump Piston	...	15 $\frac{3}{4}$ Inch
Stroke	... ..	5 Feet
Diameter of F.P. Rod (Front end only)	..	4 $\frac{1}{2}$ Ins.
Gallons discharged per double stroke	..	81.27
Multiplier given to Foreman,	...	81.
Excess of discharge of Borehole Pumps over)	Force Pumps)	3.43%

FORCE PUMP VALVES

Phosphor Bronze Valves and Seats of  
the multi-annular type with Gutta -  
percha beats in Valves.

No. of Suction Valves in all	...	62
No. " Delivery Valves "	...	62
Diameter of screwed part of Valve Seats		4 In. gas
Free lift of Valves	... ..	$\frac{1}{4}$ "

TEMPORARY WORKING BUCKETS & SUCTION VALVE

Bucket for Borehole	... ..	Cast Iron
Diameter of Bucket	... ..	15 $\frac{1}{2}$ Ins.
G.P. Gearing for Buckets	... ..	3 " dup.

Beats of flap Valves - Leather

SUCTION VALVE FOR BOREHOLE. (Cast Iron)

Diameter of Valve	... ..	14 $\frac{3}{4}$ Ins.
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Beats of Flap Valves - Leather

CAST IRON FLYWHEEL.

made in 10 segments

Diameter	... ..	24 Ft - 6 Ins
Internal diameter of boss	..	17 Ins.
Width of rim	... ..	12 "



CONDENSER.

Open type with tubes expanded into  
tube plates. Condenser placed in  
Force Pump Suction Tank.

Cooling Surface	...	...	498.5 Sq. Ft.
No. of Ordinary Tubes	.	...	212
Length	ditto	...	7 Ft - 5 Ins
Diameter	ditto	...	1½ In. extn'l
Thickness	ditto	...	16 B.W.G.
No. of Stay Tubes		...	0
Pitch of Tubes	...	...	1½ Ins.
Diameter of Tube Plates		...	3 Ft - 4 Ins.
Thickness "	do.	...	1½ In.
Distance apart over plates		...	7 Ft - 4½ Ins
Diameter of Exhaust Inlet		...	11 Ins.
"	"	Outlet	7 "

AIR VESSEL. (Mild Steel)

Total height inside	...	...	19 Ft - 7 Ins
Diameter inside	...	...	30 Ins.
Height above Branches	...	...	17 Ft - 10 <sup>7</sup> / <sub>16</sub> "
Thickness of Metal	...	...	⅝ In.
Working pressure per <input type="checkbox"/> Inch			175 Lbs.
Capacity above Branches	...	...	87 C. Ft.
Total capacity	...	...	96 "

OIL SEPARATOR ON EDUCTION PIPE

Horizontal and Cylindrical. Made by

Baker Oil Separator Co. Ltd. Leeds

Diameter	...	...	3 Ft - 6 Ins
Length	...	...	4 " - 6 "
Capacity	...	...	5000 lbs of steam. per hour.
Diameter of Steam Exhausts	...	...	11 Ins.

OIL PUMP FOR OIL SEPARATOR

Maker:- Baker Oil Separator Co.

Diameter of Plunger	...	...	3 $\frac{1}{4}$ Ins.
Stroke	...	...	4 $\frac{1}{2}$ "
Size of Pump	...	...	"C"

Oil Tank for Oil Separator

2'-9" x 1' - 9" x 2'-6".

OVERHEAD TRAVELLING CRANE

Trolley provided to run on crane rails  
to carry existing three and four Sheave  
Blocks for use over either engine.

WINCH FOR BOREHOLES

... .. 1

Special Diagonal Steam Type

Maker:-Robert Rodger & Co.,

Stockton-on-Tees.

Diameter of Cylinders	...	...	7 Inch
Stroke ditto	...	...	10 "
<u>Barrel - Grooved</u>			
Diameter of Wire Rope	...	...	1 "
Diameter of barrel	...	...	18 "
Length do.	...	...	22 "
Diameter of Steam Inlet	...	...	1 $\frac{1}{2}$ "
" " Exhaust Outlet	...	...	2 "

AIR CHARGER ON AIR VESSEL.

Wipperfman & Lewis

Maker:- F. Pearn & Co.

Size	...	...	Special "B"
Diameter of Delivery Pipe	...	...	$\frac{1}{2}$ Inch
" " Suction Pipe	...	...	1 $\frac{1}{2}$ "
Regulating Cook of F. Pearn's make	...	...	1 $\frac{1}{2}$ "



AIR CHARGER ON AIR VESSEL

Inlet Stop Valve on Air Vessel ...  $\frac{1}{2}$  In. dia.  
Dawrance's make - No. 3062

BARRING ENGINE

Double geared.

Maker - Hick Hargreaves, Bolton

Number of Cylinders	...	...	2
Diameter of "	...	...	10 Inch
Stroke of Engine	...	...	$7\frac{1}{2}$ "

STEAM RECEIVER between H.P. and L.P. Cylinders.

Diameter of body over flanges	...	...	$25\frac{1}{2}$ Inches.
Length ditto	...	...	12 Ft - $8\frac{3}{4}$ "
Diameter of Inlet	...	...	10 Inches.
" " Outlet	...	...	6 "

STEAM SEPARATOR ON MAIN RANGE

Maker:- Ashton Frost & Co.

Diameter of Steam Inlet and Outlet	...	...	6 Inches
Hopkinsons Water Gauge Fittings	...	...	No. 6520
Water Gauge Protector	...	...	Class "C"

FITTINGS - STOP VALVES

6 Inch Hopkinson Ferranti Stop Valve on Steam Separator ..	...	...	No. 2025
6 " Main Stop Valve on Engine on Dewrance make - Figure	...	...	No. 3090
2 " Hopkinson S.P.S.Valve on Branch of Steam Pipe	...	...	No. 8115
$1\frac{1}{2}$ " Hopkinson S.P.S.Valve to Electric Light Engine	...	...	No. 8115

STOP VALVES TO OIL SEPARATOR.

$\frac{1}{2}$	Inch	Dewrance Valve	on Equilibrium pipe	No. 3002
$1\frac{1}{2}$	"	"	" " Suction pipe	No. 3002
$1\frac{1}{2}$	"	"	" " Delivery pipe	No. 3173
$1\frac{1}{2}$	"	"	" " Drain pipe of ) Separator )	No. 3173

BYE-PASS ON FORCE PUMPS, etc.

Two	1	inch	Dewrance Valves, Figure	...	No. 3052
One	$1\frac{1}{2}$	"	" " Suction to air)	No. 3052	
			Charger ... )		
Two	1	"	" " on drains of )	No. 3052	
			F.P. Valve Boxes)		

ENGINE COUNTER

Maker:- Harding, Richardson, Rhodes & Co.

Leeds.

Type :- Harding's Patent Engine Counter

NO. 1. SIZE

BARRING ENGINE

$\frac{1}{2}$	Inch	Drain Cocks	- Hopkinson's make	...	No. 9098
$1\frac{1}{2}$	"	Stop Valve	- Hopkinson. S.P.S.V.	...	No. 8135
2	"	ditto	" (on Exhaust	No. 8115	
			pipe)		

Drain Valves from Cylinders. H.P.

Cylinder  $\frac{3}{4}$  inch pipes fitted with

$\frac{3}{4}$  inch Hopkinson "Mac" Valves. Figure No. 8210

L.P. Cylinders are  $1\frac{1}{2}$  inch Hopkinson "Mac"

Valve ... .. No. 8210

INDICATOR COCKS

$\frac{3}{4}$  Inch Cocks - Hopkinson's make. Figure No. 9142

WINCH FITTINGS

$1\frac{1}{2}$	Inch	Hopkinson Valve	S.P.S.	Figure No. 8115
2	"	do.	S.P.S. (Exhaust	" " 8115.
			side)	



DRAIN VALVES FOR METALLIC PACKINGS

$\frac{1}{4}$  Inch dia. Supplied by

U.S. Metallic Packing Co.

Valves with male and union ends

3 - Air Valves for Force Pump  $\frac{1}{2}$  In. dia.  
 Outlet arranged to take  $\frac{5}{8}$  inch  
 external diameter piping.

GAUGES

made by Dewrance & Co.

Delivery Pressure Gauge on main brake	4 $\frac{1}{2}$ In. dia. open dia
L.P. Jacket Steam Pressure Gauge.	0 - 200 Lbs 7 " " do
Delivery Pressure Gauge on Pressure Gauge Board	0 - 300 " 10 " " do
Borehole Gauge do	0 - 300 " 10 " " do
Vacuum " do	10 " " do
Steam " do	0 - 200 " 10 " " do

WATER LEVEL INDICATOR FOR CONDENSER CISTERN ... 1

Maker:- Glenfield & Kennedy

Mark on Dial:- ... 0 to 7 Feet

OIL LUBRICATORS ... 2

For H.P. and L.P. Cylinders

Type - "Feedwell."

Maker:- Empire Engineering Co.,

Salford.

Capacity ...	$\frac{1}{4}$ gallon each.
Delivery Pipe - outside diameter	$\frac{5}{8}$ Inch.
Back Pressure Valves fitted for Pipe, outside diameter	$\frac{3}{8}$ "

Lubricators supplied with  
Michigan Hand Flushing Cups.

Hunt & Mitton's Lubricator. (Catalogue No) D.1084  
On Rocking levers of H.P. and L.P. Steam  
and Exhaust Valves.

4 Lubricators on Metallic Packings No.24 2 Inch dial  
12 do " Corliss Valve Sleeves 1½ " "  
5 do for oiling Crank Pin, etc.

Tangye's Grease Cups on Corliss Valve Sleeves, 2 " "

One Mild Steel Cotter )  
One Mild Steel Cap ) For lifting Borehole Rods.

RUNWAY FOR WORKSHOP.

Maker:- H. Morriss & Bastert.

One H.M.B. Travelling Trolley.

To carry	...	...	...	½ Ton
Tested to	...	...	...	¾ "
Travelling Wheels	...	...	...	Ungeared
Section of steel joist	...	...	...	10 In x 5 In
PRICE including ball bearings for trolley,				£7. 12. 11.
<u>H.M.B. PULLEY BLOCKS (Spur Gear)</u>	...	...	...	One.
To lift quick gear	...	...	...	10 Cwts
Tested to	...	...	...	15 "
Overall from hook to hook when full out,				9 Ft - 6 Ins
ditto do close up				1 " - 2½ "
Clear Lift obtained	...	...	...	8 " - 3½ "
PRICE (accepted 30/11/08)	...	...	...	£.4. 5. 6.