[ZB-10-p1]

Experiments with Ventilators

At

Usworth & Penshaw Collieries

May 13th 1876

Size of Fan (Guibal) 45’ x 12’

Engines—two 36” x36” stroke set diagonally

Barometer at 10.45 am—30.27

Being pay Saturday none of the Engines underground were at work—the fan therefore derived no benefit from this source.

Only one Engine (east) worked

[ZB-10-p2]

Steam pressure in cylinder –see diagrams on next page

	Revs.	Water gauge
12.5	41	3
15.4	42	3
13.1	42	3
15.6	42	3
56.6	166	12
14.15	41.5	3

36” cylinder 36” stroke

36 x 36 x 7854 = 1017.8784

41.5 Revs x 6’ = 249.0 speed

1017.8784 x 249 =253452.12

253452.12 x 14.15 div. by 33000 = 106.677

Indicated Horse power of Engine 108.677

112108 cub. Ft. per win see page

5.2 x 3 = 15.6 –n.G.

112108

15.6

672648

560540

112108

33000 div. 1748884.8 52.9 horse power in the air- effective power

165

98

66

328

297

318

297

108.67) 52.9900 (48.76

43468

95220

86936

82840

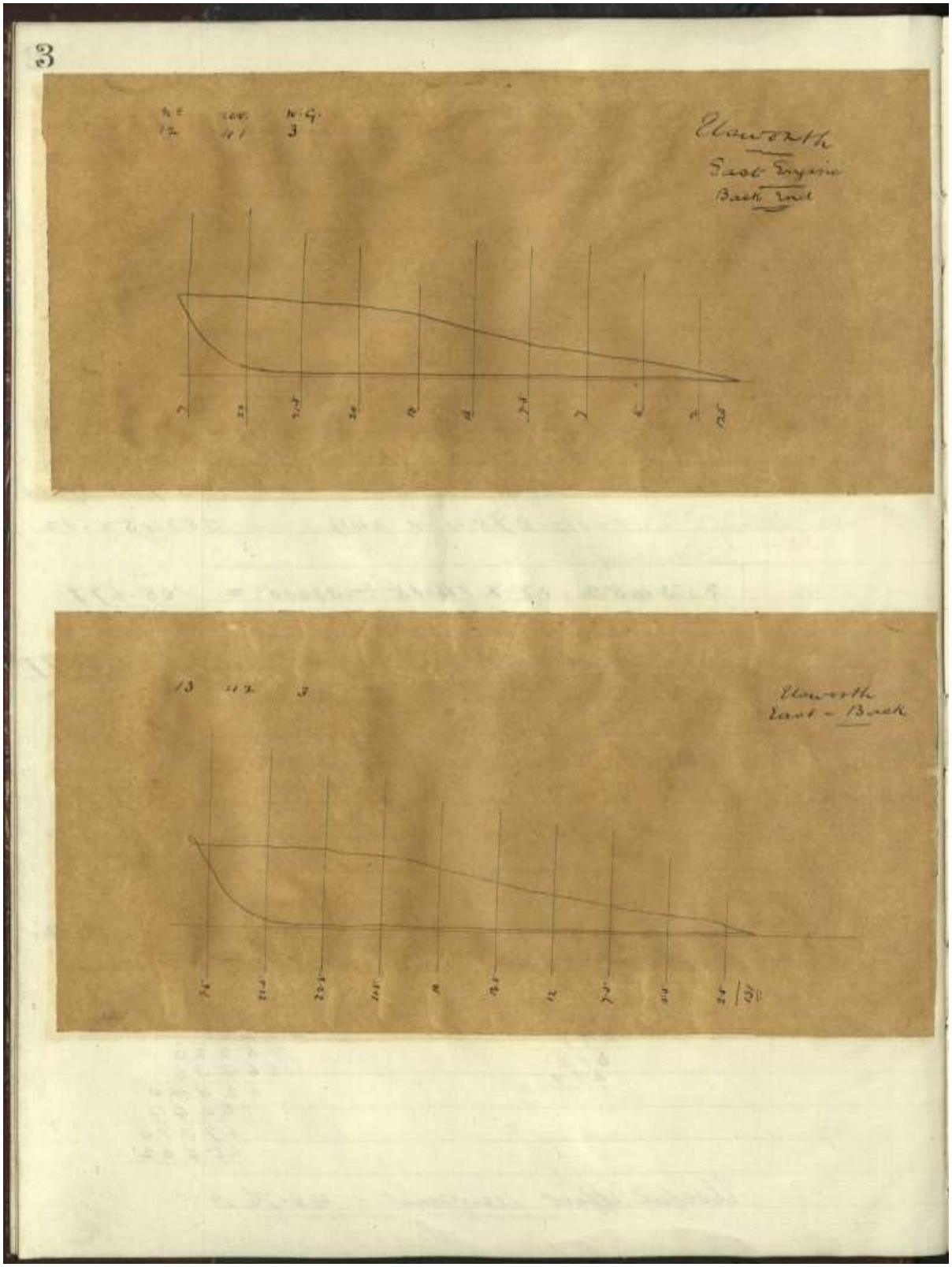
76049

67710

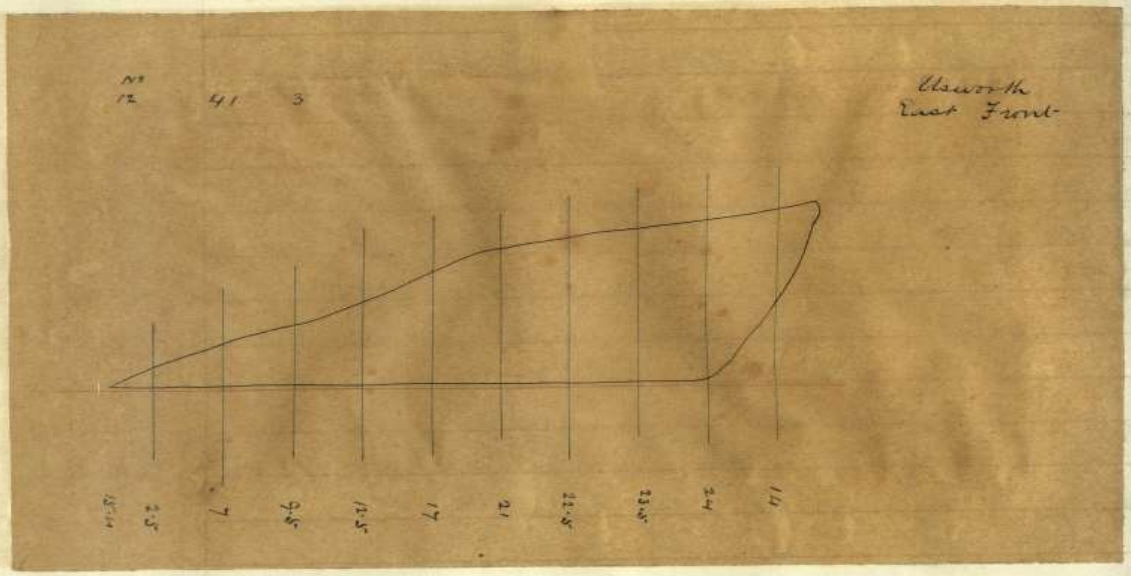
65202

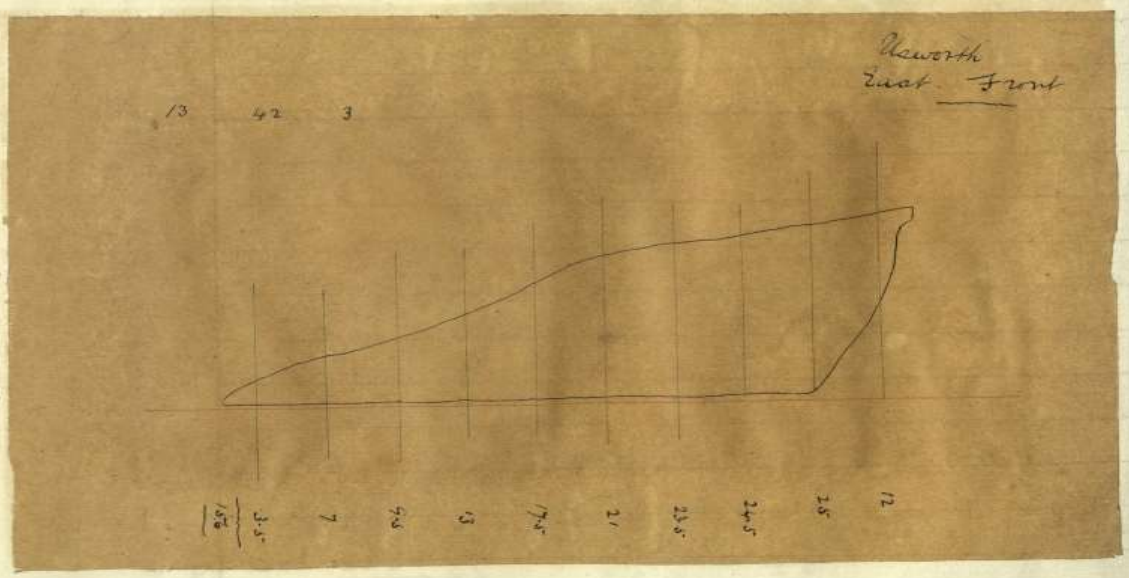
Useful Effect per cent 48.76 pc

[ZB-10-p3]



[ZB-10-p4]


No 12 41 3
Usworth East Front
11
24
23.5
21.5
21
17
17.5
9.5
7
2.5
12.5


13 42 3
Usworth East Front
12
2.5
24.5
23.5
21
17.5
13
9.5
7
3.5
1.5

[ZB-10 p5]

Measurement of Air

Air met No. 75-Casella Correction for friction etc. - $V= 1.02R^2+41434$

Area of drift 147 sq.ft.

To ensure accuracy the drift was divided by wires into 25 squares-the anemometer being held for one minute in each division and the number of revolutions carefully noted for each

No. of square	R Revs. Per min.	V
1	732	766
2	883	914
3	923	954
4	910	941
5	832	864
6	711	746
7	780	813
8	828	860
9	831	863
10	820	852
11	615	653
12	642	679
13	713	748
14	780	813
15	730	764
16	620	658
17	625	663
18	663	699
19	694	729
20	670	706
21	570	610

22 622 660

23 670 706

24 660 697

25 18196 19066

727.84 762.64

[ZB-10-p6]

Coals consumed during the time the experiments were being made on the Engines.

Two boilers used 6’ x each extending fired and standing yds. From the engine the steam being carried through a pipe

No1 Boiler			No2 Boiler	
Coals used	Lbs pressure in Boiler		Coal lbs.	Pressure lbs.
9.50	430	30	0	29
10.20	215	30	215	29
10.35	107	31	215	30
10.50	108	32 1/2	107	31
11.5	0	34	108	32 1/2
11.20	107	33	215	32
11.35	108	32	215	30
11.50	0	31	108	31
12.5	215	34	215	32 1/2
12.20	0	31	108	30
12.35	0	30	0	29
12.50	107	32	107	30
1.5	108	32	0	30
	1505		1505	

Bowdon’s steam gauge on each boiler water carefully kept as near as possible at same level during the whole of the time—fires left same as when started.

1505

1505 3010 lbs. of coal

3010 3.25 hours = 926.15 lbs. of coal per hour 8.267

Total consumption 3010 lbs or 26.87 cwts.

926.15

108.677 = 8.52 lbs of coal considered per indicated HP per hour

[ZB-10-p7]

Penshaw Colliery Sunday May 14th 1876

Experiments with 'Guibal' ventilator and Engines

Fan -40ft. x 12 ft.

Engines- Pair of 36" cylinders x 36" stroke horizontal

Barometer-

Temperature on Bank – 52

Temperature in drift- 65

No Engines at work underground. Only one of the fan Engines worked. The drift divided into 16 parts by intersecting wires.

[ZB-10-p8]

Power of Engine (east only) etc. see diagrams next page

Lbs press. In cyl.	Revolution	Water gauge
8.65	39	1.9
6.1	39	1.9
9.0	39	1.9
5.75	39	1.9

4/29.50

7.375

39 Revs x 6 ft. stroke = 234 ft. per min

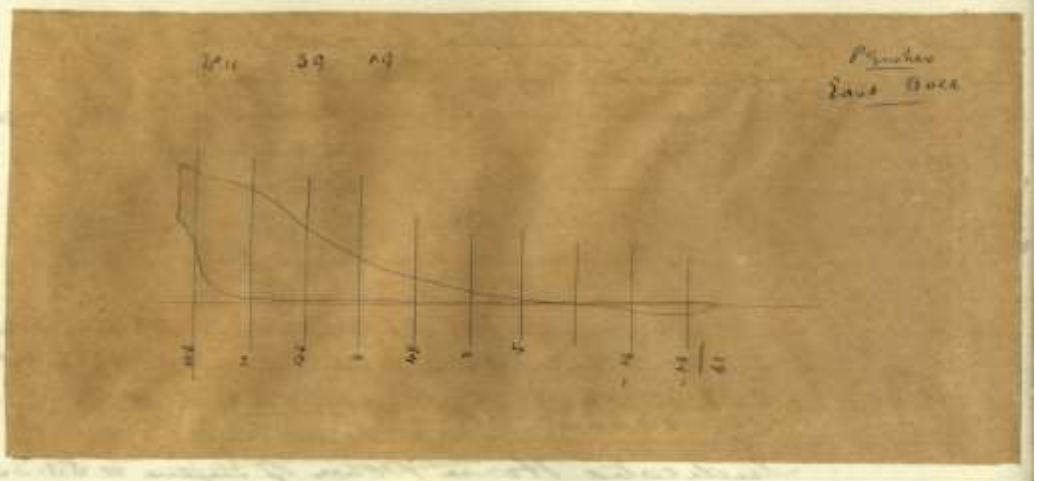
1017.88 x 234 x 7.375= 1756606.41

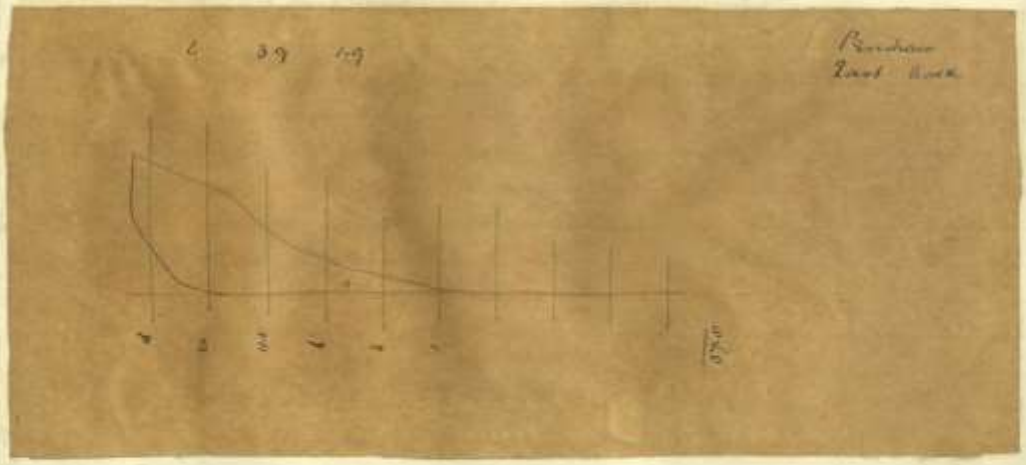
175660.41 = 53.23 I. H. P.

33000

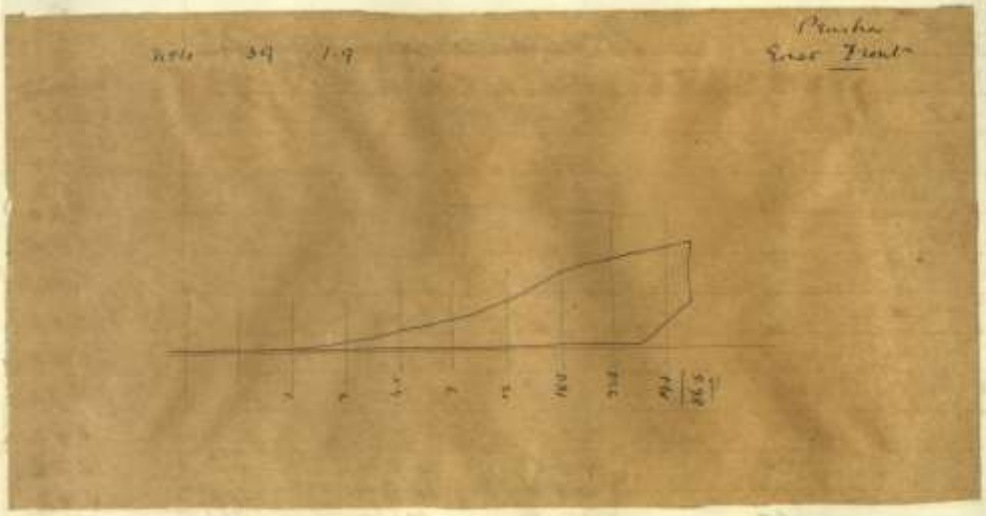
Indicated Horse power of Engine = 53.23

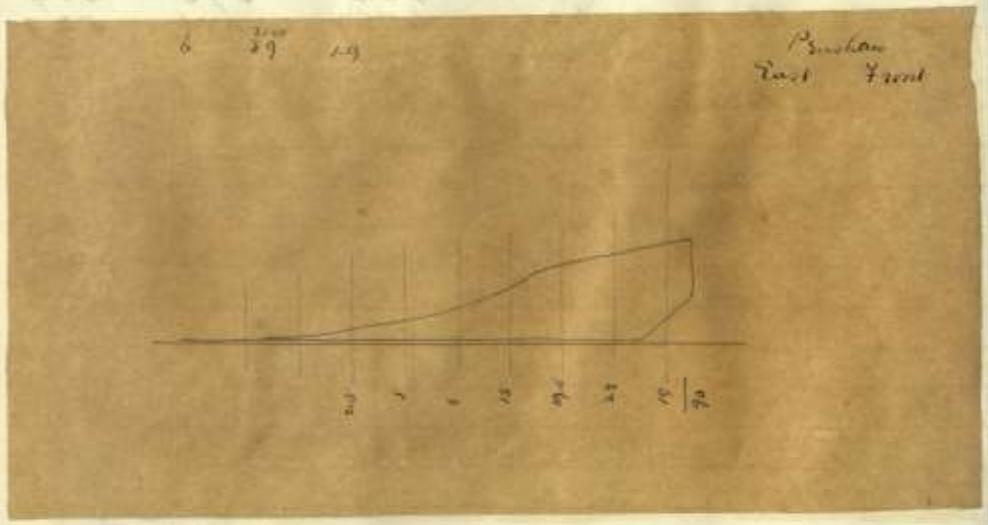
[ZB-10-p9]





[ZB-10-p10]





[ZB-10-p11]

Measurements of Air

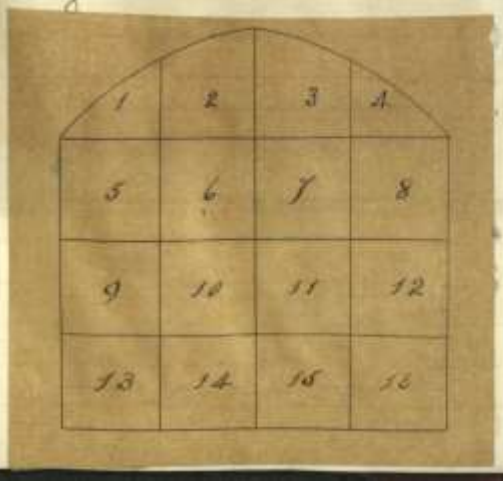
No. of Div.	Revs. Meter No. 75	Velocity	Revs. Meter No. 433	Velocity
1	650	687	630	697
2	645	682	680	752
3	671	707	596	660
4	588	629	500	555
5	520	563	580	642
6	570	616	550	610
7	509	553	578	640
8	611	649	605	670
9	532	574	506	562
10	435	484	529	586
11	450	497	452	503
12	505	549	518	575
13	503	547	477	530
14	442	490	430	479
15	413	464	375	419
16	440	488	476	529
14	8484	9179		
Mean –		573.7		

Meter No. 75 $v = \sqrt{1.02R^2 + 41434}$

Meter No. 433 $v = \sqrt{1.21R^2 + 6133}$

Both Casella's Anemometers.

Area of drift



[ZB-10-p12]

Consumption of fuel during the fore-going Experiments –

Three boilers double flue 30' x 7'. Immediately adjoining Engine House.

Time	No 1	No 2	No 3
9.45 a.m.	Steam pressure lbs. per sq. in.		
10.45	59	50	59
11.15	58	50	58
11.45	53	45	53
12.15	50	45	52
12.45	54	43	52

Fires charged at 11.10 and 12.13. Total quantity of coal consumed for the three Boilers being 9 cwt.? Water kept at original level & fires left in same state as at the commencement.

112 x 9 = lbs. consumed = 1008

$\frac{1008}{3.25 \text{ hours}}$ = 310.153 lbs. per hour.

$\frac{310.153}{53.23 \text{ I.H.P}}$ = 5.826 lbs.

Coals consumed per Indicated Horsepower of Engine per hour = 5.826 lbs.

Consumption of fuel during the foregoing experiment

Three boilers double flue 30'x7' immediately adjoining Engine house

Time No1 No2 No3

10.45 59 50 59

11.15 58 50 58

11.45 53 50 58

12.15 50 45 53

12.45 54 43 52

Fires charged at 11.10 and 12.13. Total quantity of coal consumed for the three boilers being 9 cwts. ? Water kept at original level and fires left in same state as at the commencement.

ZB-10-p13

Usworth Colliery 18th May 1876

Experiment with Guibal ventilator pit in full work –Four multitube Boilers and three Engines at work underground.

Temperature on Bank 52 f

Temperature in drift 74.5 to 82 f

Barometric pressure 30.2 ins

[ZB-10-p14]

Engines-; east only worked

	Steam	Revolutions p min.	Water gauge
	18.15	44	3.15
	16.9	42	3.05
	13.95	42.5	3.10
	14.2	42.75	3.10
	14.425	42	3.0
	14 .95	42	2.95
	16.65	42	3.0
	128.125	339.25	24.45
mean	16.015	42.4	3.05

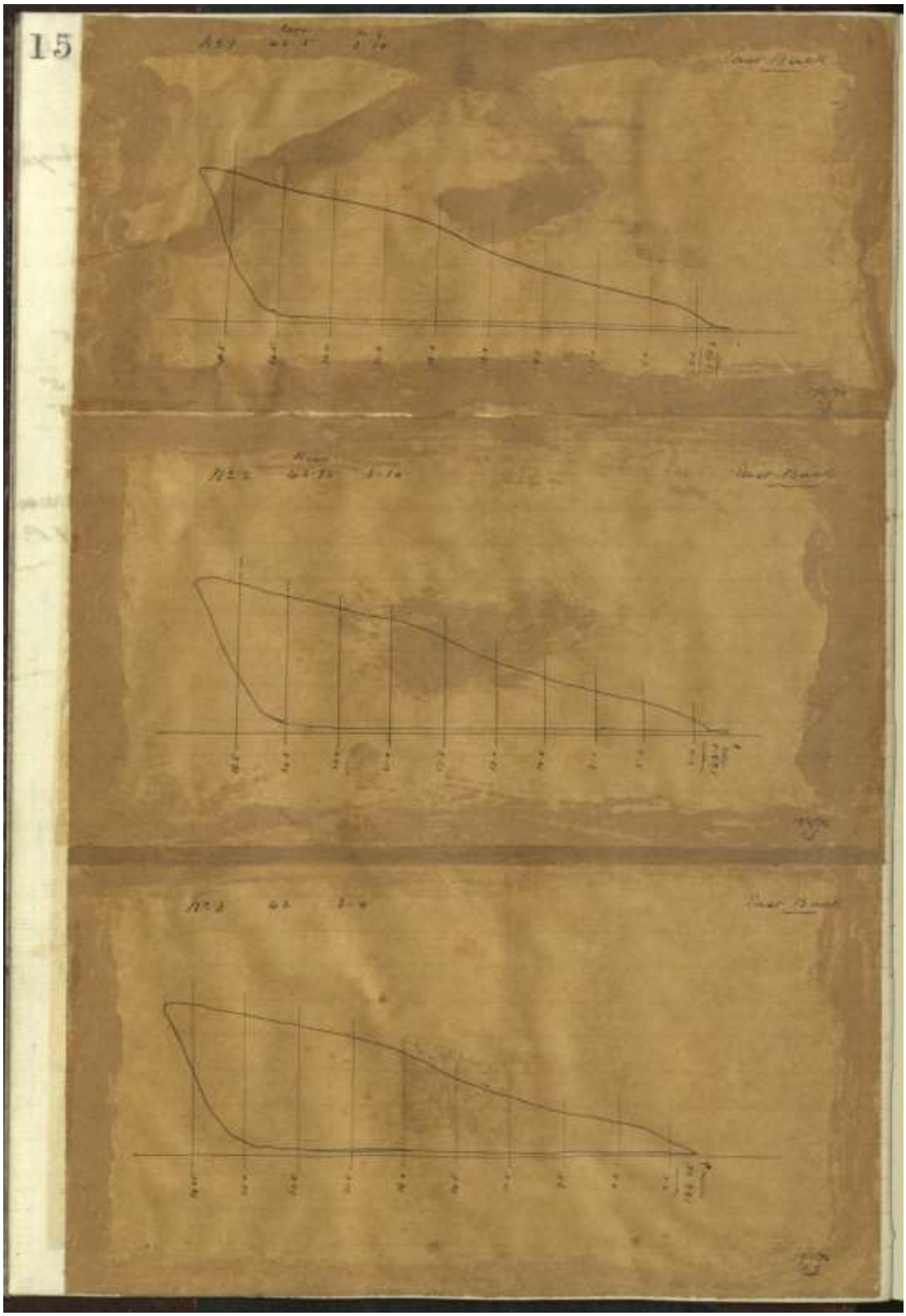
42.4 Revs x 6’ = 254.4

1017.8784 x 254.4 x 16.015 = 4147056.4633344

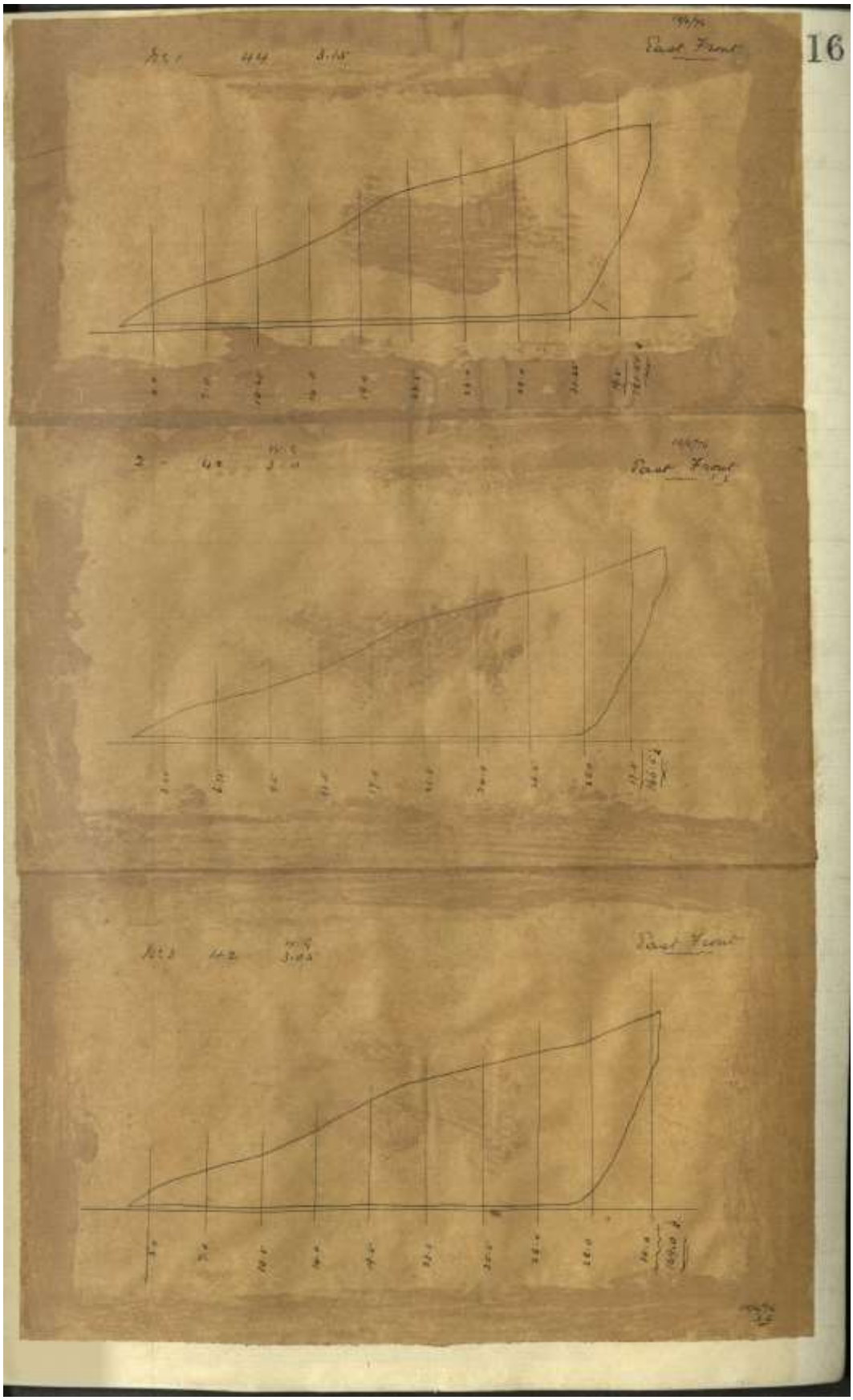
4147056.4633344 div. 33000 =125.66 IHP

Indicated Horse power 125.66

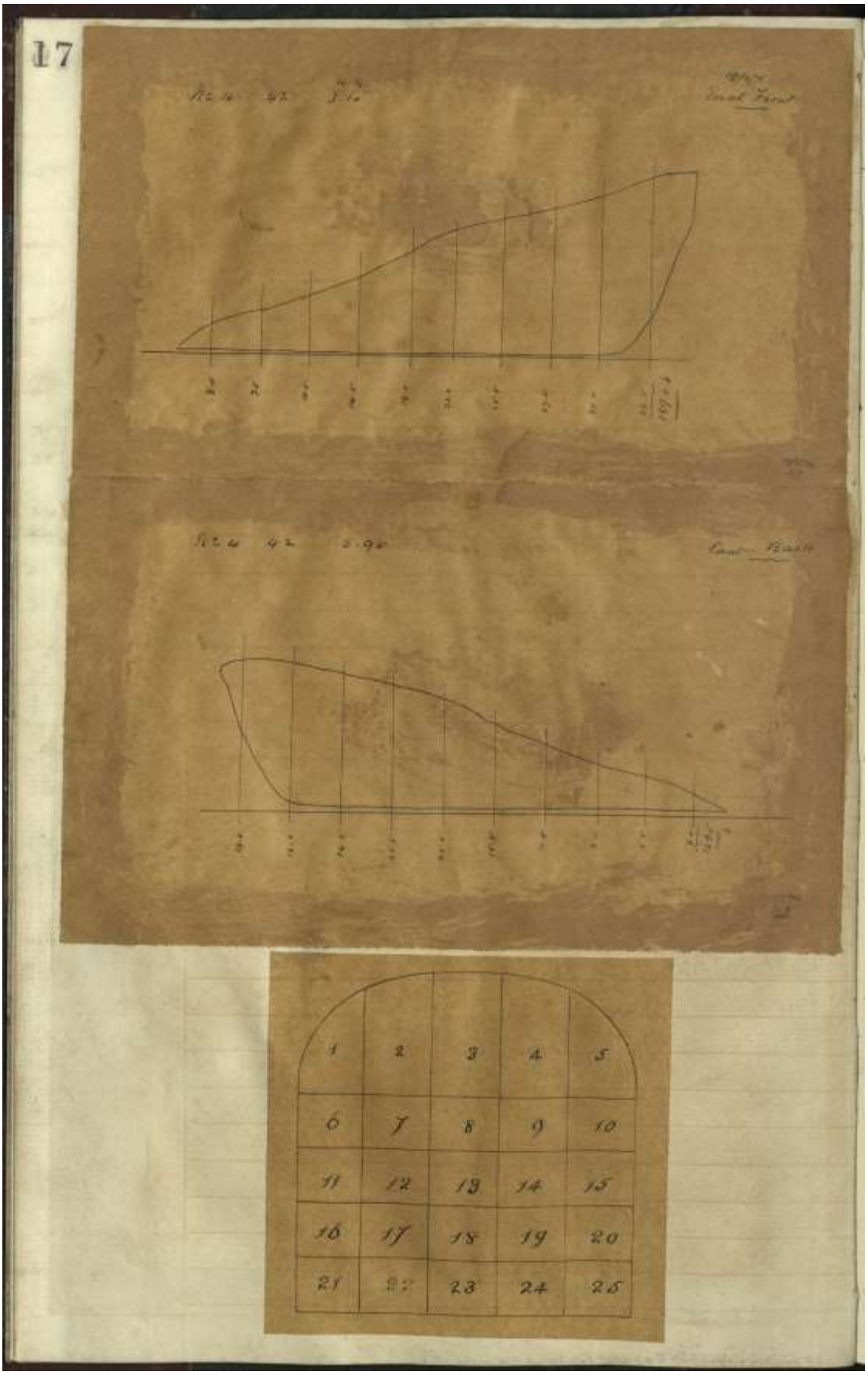
[ZB-10-p15]



[ZB-10-p16]



[ZB-10-p17]



[ZB-10-p18]

Measurements of Air

Division	Revs.	Division	Revs.
1	840	15	780
2	970	16	627
3	980	17	669
4	980	18	757
5	900	19	798
6	970	20	883
7	870	21	581
8	843	22	645
9	825	23	779
10	740	24	792
11	860	25	662
12	800	25 div. 20056	
13	860	mean	802.24
14	695		

V= R^2 x1.2+6133 = (802.24) x^2 1.21+6133

=885.93 velocity of air in ft. per min.

Area of drift 147 sq. ft.

885.93 x 147 = 130231.71 cub. Ft. per min.

130.232 x 5.2 x 3.05 w.g. = 2065479.52

2065479.52 div. 33000 = 62.59 HP

Horse power in air = 62.59

62.59

125.66 IHP = 49.80

Therefore percentage of utilised power =49.8

[ZB-10-p19]

Coals consumed by the Boilers used to drive the fan engine during experiments-----

Three boilers each 36' x6'—external fired

		No1		No2		No3	
Gauge in fan house		Steam Ch Coal Bs.		Steam coal		Steam coal	
32	10a m	34		36		36	
33	10.30	38	1	38	1	38	1
32	11.0	36	1	36	1	36	1
33	11.30	37	1	37	1	37	1
	12.0	41	1	39	½	39	1
	12.30	40	1	39	1	39	1
	1.0	40	1	39	-	39	1

16 1/2 boxes of coal at 215 lbs. Per box

215 x 16.5 = 1182 lbs per hour

= 10.56 cwts.

1182.5 div. 125.66 = 9.4 lbs.

[ZB-10-p20]

Ventilation Experiment

Description of ventilator		Guibal	Guibal
Name of Colliery Ventilator dia. & width	Feet	Usworth 45 x12	Penshaw 40x12
Date of Experiment	1876	May 13th	May 14th
Anemometer, description		Casella	Casella
Revs in 1 min.	Revs	736	530
Velocity of air	ft. per min.	770	572
Area of Drift	sq. ft.	146.45	151.8
Air per minute	cub. Ft.	112766	86829
Water gauge	In	2.99	1.91
Effective HP	HP	53.13	26.13
Revs. Engine & vent. per min		42.23	39

Cylinders, No. diam. & stroke	In	1, 36, 36	1,36,36
Mean effective steam pressure lb. per in		14.58	7.275
Ind HP from Diagrams	HP	113.94	52.5
IHP	HP	51.13	26.13
Useful effect vent. Engine	%	46.62	49.77
Coal consumed per eff HP p.hr.	lbs.	17.37	11.8
----------Ind HP	lbs.	8.1	5.9

Revs of Anemometer corrected by the Formula

V= 1.02R2x41434

W Daniel May 19th 1876

[ZB-10-p21-22]

Experiments with 'Guibal' Fans

Coll., fan, dia.,w.	ft.	Usworth 45x12	Penshaw 40x12	Usworth 45x12
Date of exp.		1876 May 13th	May 14th	May 18th
Anemometer descr.		Casella	Casella	Casella
Do. Revs in 1 min.	Revolutions	727.84	530.25	802.24
Velocity of air	ft. per min	762.64	537.7	885.93
Area of drift	sq. ft.	147	155.42	147
Air per min.	cub. Ft.	112108	89164	130232
Water gauge	Ins.	3.0	1.9	3.05
Effective H.P.	HP	52.99	26.69	62.59
Revs. of engine p. min.		41.5	39	42.4
Cyls. No. dia. & stroke ins.		1.36,36	1.36,36	1.36,36
Mean steam pressure eff.				
Lbs. per in		14.15	7.375	16.015
Ind HP diagrams	HP	108.67	53.23	125.66
Effective HP	HP	52.99	26.69	62.59
Useful effect	%	48.76	50.14	49.80
No.& style of boilers		2 externally fired	3.Lancashire	3. Externally fired

Lbs. per Ind. HP p hour	8.52	5.286	9.4
Ht. of barometer ins.	30.27	30.25	30.27
Temp. on surface Fa.	60	52	52
Do. In drift do.	65	63	average 78.5

John Shiel May 19th 1876

[ZB-10-23]

Penshaw Colliery

March 1876

Consumption of coal at the Fan Engine Boilers measured 3 1/2 hours.

March 24th These boilers at worst consumed 3 tubs of coals =18 cwt. 3 qtrs.

March 25th With two boilers at work consumed 4 tubs of coals = 25 cwts. 0 qtrs.

Weight of one tub =6 cwts. 1 qtr.

Steam 41 lbs.

Engine 41 revs per minute

In above experiments the right or west engine only was worked.

[ZB-10-p24]

Penshaw Colliery

October 1876

Consumption of coal at Fan Engine Boilers whilst the left or east cyl. Only was worked.

Two Boilers at work consumed in 36 hours 27 tubs of coal each weighing 7 cwts.

210 cwts.---189 cwts. 21 cwts. Diff.

Working 42 revolutions

2 1/2 water gauge

[ZB-10-p25-26]

No. 16 Pay ending August 7th 1830

Broken

xx	t		xx t	£ s d	s d
71	5	Geo. Armstrong West Blossom Pit	363.1	371.1.5	average 13 2
261	3	John Graham East Blossom Pit	529.12	346.18.6	average 13 1

159 19 William Lishaw West Minor Pit 582.0 337.10.1---average 11 7

239 4 Robert Fraser East Minor Pit 602 .0 317.13.6—average 10 6 1/2

Morgan Fraser Isabella Pit Elmore 636.0 368 13 2 average 11 7

Jacob Graham George Hutton Seam 320.7 205 15 11 average 13 0

William Bailey George Main Coal 210.10 157 17 9 average 15 0

766.10 3443.9 2108.10.4

Cost of production at Hetton Colliery

Score = 21 corves of 20 pecks each

The above is a copy of a cost sheet given to me by Mr James Easton Nest House, Gateshead 1876

[ZB-10-p27]

Penshaw Colliery

Experiments with Furnace Ventilation 27th June 1876

Barometer on Bank 30.08

Do. Underground 30.77

Mean 30.425

Thermometer on Bank 62f

Do. Bottom of shaft 58f

Do. Do. 66f HS

Do. Hutton return 81f

Do. Maudlin 79-82f

Do. In Upcast shaft

2 faths. Below 5/4 223

Do. 10----------5/4 227

Do. 25 faths. From Bank 200

Depth of shaft to Hutton 123f. 3ft. 10in.

Dia—5/4 Bank upcast 6ft. 3

Dia.---5/4 to Maudlin 8ft. 0”

Dia. Maud. To Hutt. 7ft. 0”

Diameter of Downcast (Whitefield) 7’ 0”

Do. D pit 9’ 0”

Do. North Biddick 10’ 0”

Steam pipes in D pit

[ZB-10-p28]

Water gauge-Hutton Seam-5in.

Do. Maudlin-- 5in.

7’ pit at 59f. temp}

9’---@66f- } mean 63f downcast

Mean temperature upcast 213.5

W= 1.3253x I

459 + t

= 1.33253 x 30.425 = 40.3222525

459 + 63 522

= . 0772265

Upcast W = 1.3253 x 30.425

459+213.5

= 40.3222525 = . 0599587

672.5

. 0772265

. 0599587

. 0172678

Total depth to Hutton 123 fathoms. 3. 10

Say 742 feet

. 0172678 x 742 = 12.8127076

Diff. of pressure per sq. ft. on the bases of the two columns of air.

Air Measurements

Area in sq. ft.	Revs	Velocity	Cub. Ft.
32 Hutton furnace	620	686	21952

1	Scale	455	506	506
				22458

[ZB-10-p29]

Forward Cub. Ft. per min. 22458

Area 54 Hutton Seam Engine 120 revs. 152 velocity 8208

Maudlin Furnace

	Area	Revs	Velocity	
21 No1	21	180	212	4352
No2	22.5	175	207	4657
No3	20	990	1091	21820
No4	16.5	190	223	3679.5
No5	15	685	757	11355
Five Quarter Seam				12324
				88853.5

Measured with Casella Anemometers and velocities obtained by formula

12.8127076 x 88853

33000 = 34.393 HP

Power in the air = 34.393 HP

[ZB-10-p30]

Coal Consumed

4 tons 3 cwt. 3 qtrs. 0 lbs.

=9380 Lbs. = 781.61 lbs. per hr.

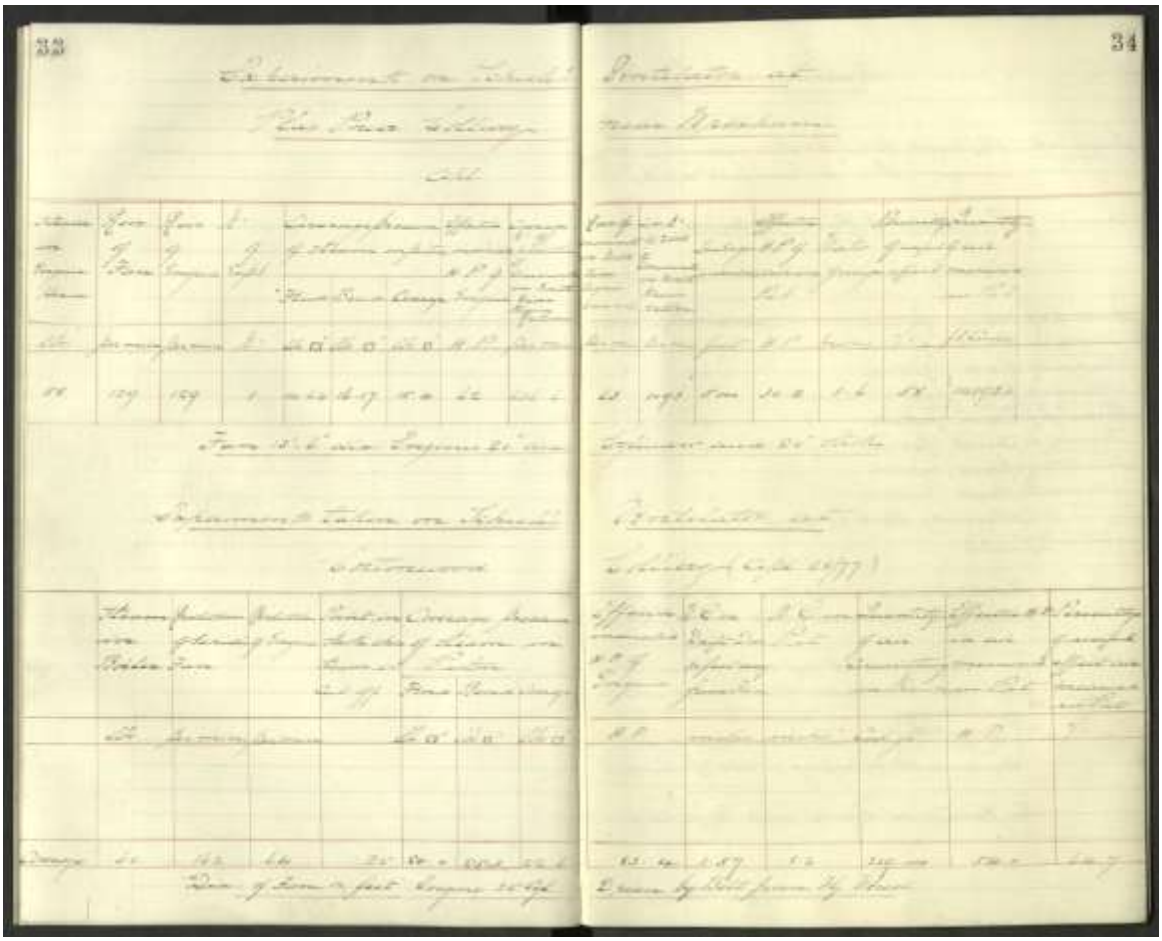
=13.027 lbs. per min.

88853 = 6799 cubic feet of air per lb. of coal consumed

[ZB-10-p31-32]

[Blank Pages]

[ZB-10-p33-34]



[ZB-10-p35-36]

Measurement of air at Hoyland Colliery

July 11th 1876 Present Mr. JH Carrington Mr Perriman (who corrected the measurements) Mr Bowling

Revolutions of fan 175 per minute

Places of measurement and quantity of air per minute

Silkstone Team} South Return J Pearce Air master 1040 revs. Per min.			43,680
}North Return …	1376	….	
Parkgate Team} North Return …	620	….	28210
}South Return …	656	….	36736
Thorncliffe Team} Main Return …	210	….	14070
} South Return …	470	….	5757
Flockton Team} North Intake …	325	….	13975
}South Intake …	610	….	30652
Barnsley Bed (sealed) …	300	….	1575
			261,109 cub. Ft. per min.

The closing in of Pit top not in a finished state there were considerable leakages there estimated at 10,000 cubic feet per min. where are not taken into account in the above. The air meter used was belonging to the colliery. The fan is 13’ 6” dia. And is driven by belt from fly wheel of engine 17 feet dia.

[ZB-10-p37-38]

[Blank]

[ZB-10-p39-40]

[Blank]

[ZB-10-p49]

Pounds of Coal for each ton raised out of a pit 100 fathoms deep

	Boiler Pressure	Single engine	Double engine	% in favour of a single cyl. engine
Without condenser full steam	{ 30	14	20.5	32
	{ 45	11.4	15.5	26

	{ 60	10.2	13.2	23
Cut off half stroke without	{ 30	9.5	15.7	40
condenser	{ 45	7.3	10.2	28
	{ 60	6.3	8.5	26
Full steam	{ 45	8.5	9.6	12
	{ 60	8.2	9.1	10
Cut off half stroke	{ 30	5.3	6.7	13
	{ 45	5.0	5.7	12
	{ 60	4.8	5.4	11
Compound Engine with				
Expansion	60	3.0	3.6	17

ZB-10-p49

Pounds of Coal for each ton raised out of a pit 100 faths. Deep

	Boiler Pressure	Single Engine	double engine	5 in favour of a single cyl. engine
Without condenser	{30	14	20.5	32
Full steam	{ 45	11.4	15.5	26
	{ 60	10.2	13.2	23
Without condenser	{ 30	9.5	15.7	40
Cut off half stroke	{ 45	7.3	10.2	28
	{ 60	8.2	9.1	10
Full steam	{ 30	9.0	10.3	13
Cut off	{ 45	5.0	5.7	12
Half stroke	{60	4.8	5.4	11
Compound engine				
With expansion	60	3.0	3.6	17

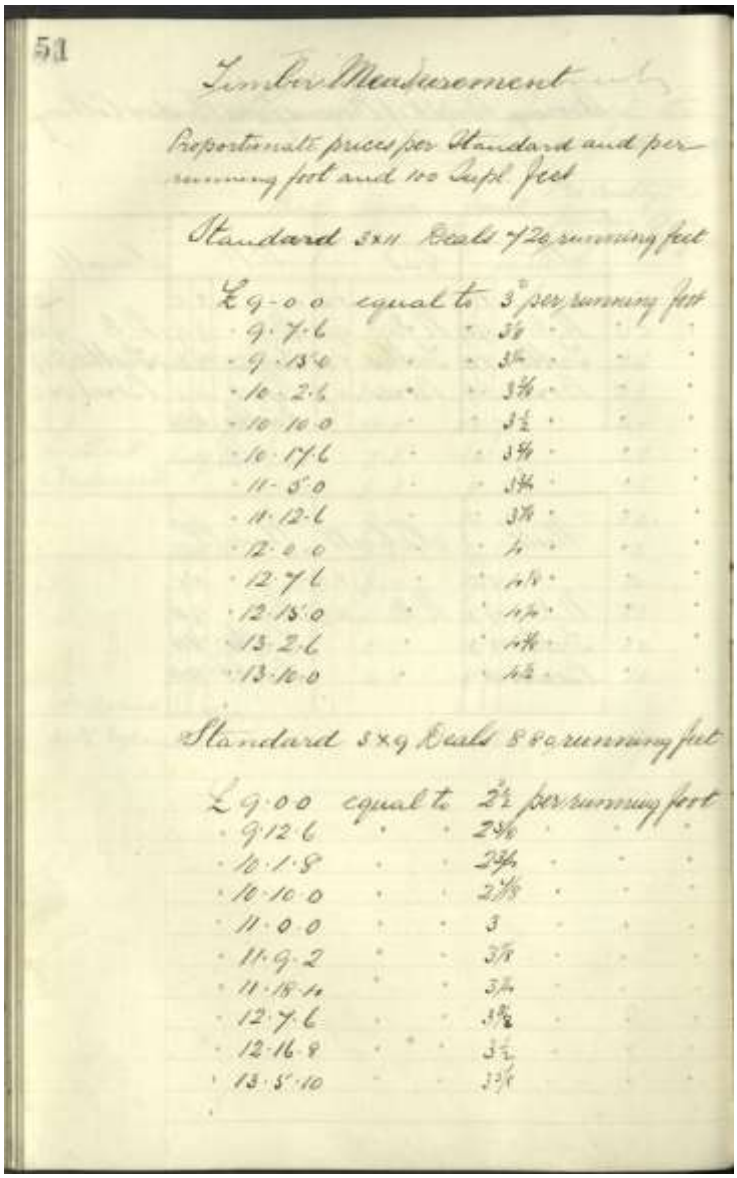
[ZB-10-p50]

Average Weight of Wagons from Rother Colliery

Steam			Gas			P.P.			Small		
	T	C		T	C		T	C		T	C
R.D.	9	9	R.D.	9	12	R.D.	9	9	R.D.	9	12
Trebles	8	18	Trebles	8	14	Trebles	8	12	Trebles	8	9
Boxes	10	5	Boxes	10	7	Boxes	10	5	Boxes	10	2
						Doubles	8	16			

Nutts			Splints			Unsc P.P.			
	T	C		T	C		T	C	
R.D.	9	7	R.D.	10	9	R.D.	9	11	
Trebles	8	7				Trebles	8	11	
Boxes	10	.				Boxes	10	11	

[ZB-10-p51]



51

Timber Measurement

Proportionate prices per Standard and per running foot and 100 Supl. feet

Standard 3x11 Deals 720 running feet

£9-0-0	equal to	3 per running foot
9-7-6		3⅛
9-15-0		3¼
10-2-6		3⅜
10-10-0		3½
10-17-6		3⅝
11-5-0		3¾
11-12-6		3⅞
12-0-0		4
12-7-6		4⅛
12-15-0		4¼
13-2-6		4⅜
13-10-0		4½

Standard 3x9 Deals 880 running feet

£9-0-0	equal to	2½ per running foot
9-12-6		2⅝
10-1-8		2¾
10-10-0		2⅞
11-0-0		3
11-9-2		3⅛
11-18-4		3¼
12-7-6		3⅜
12-16-8		3½
13-5-10		3⅝

Timber Measurement

Proportionate prices per standard and per running foot and 100 supl. Feed

Standard 3 x11 Deals of 20 running feet

£9.0.0 equal to 3 per running foot

£9.7.6----------3 1/8

£9.15.0----------3 1/4

£10.2.6----------3 3/8

£10.10.0----------3 1/2

£10.17.6----------3 5/8

£11.5.0----------3 3/8

£11.12.6----------3 7/8

£12.0.0----------4

£12.7.6----------4 1/8

£12.15.0----------4 1/4

£13.2.6----------4 3/8

£13.10.0----------4 1/2

Standard 3x9 Deals 880 running feet

£9.0.0 = to 2 1/2 per running foot

£9.12.6----2 5/8

£10.1.8----2 3/4

£10.10.0---2 7/8

£11.0.0----3

£11.9.2-----3 1/8

£11.18.4----3 1/4

12.7.6------3 3/8

£12.16.8---3 1/2

£13.5.10----3 5/8

[ZB-10-p52]-

Standard 2 1/2 x 7 in. Batteus 1357 5/7 running deals

£8.9.9 equal to 1 1/2 per running foot

£9.3.10----------1 3/8

£9.18.0 --------1 3/4

£10.12.2---------1 7/8

£11.6.3----------2

Standard 2 1/2 x 6 1/2 per running feet

£9.2.9 equal to 1 1/2 per running foot

£9.18.0--------1 2/8

£10.13.3------1 3/4

Standard 1 inch boards 1980 superficial feet

£8.5.0 equal to 8/4 per 100 superficial feet

£9.0.0-------9/2

£10.0.0-----10/-

311.0.0-----11/1

Standard 1 3/4 Boards 1584 superficial feet

£8.5.0 equal to 10/6 per 100 superficial feet

£9.0.0----------11/-

£10.0.0----------12/7

£11.0.0----------13/11

165 cubic feet to standard for carriage 2 1/2 tons to the standard 50 cubic feet of Fir x 40 cubic feet of coal to the ton , 8 doz. Com. Crops x 5 doz. Crowns to the ton

FS Coxonby

[ZB-10-p53]

[Blank]

[ZB-10- p54]

Synopsis of seams of coal in the coal field of Durham and Northumberland

Synopsis of Seams of Coal in the Coal Field of Durham and Northumberland

Hilton district	Sheriff Hill	Wallsend	Sophia	Pontop	Wallbottle
Three Quarts Seam	High Main	High Main	High Main	Shields Row	—
Five Quarts	Metal Coal / Stone Coal	Metal Coal / Stone Coal	Grey Seam	Five Quarts	—
Main Coal	Gard Seam	Gard Seam	Gard Seam	Bones Hill	—
Brandlin	Brusham	Brusham	Brusham		—
Low Main	Six Quarts / Five Quarts	Six Quarts / Five Quarts	Five Quarts	Hilton	—
Hilton	Low Main	Low Main	Low Main	Main Coal	Groove Seam
Harvey	Beaumont	Beaumont	Beaumont	Busty Bank	Engine Seam
Brockwell	Brockwell	Brockwell	Brockwell	Brockwell	Splint —

Copied from plans hanging in Coal Trade Offices Newcastle on Tyne - November 1876

54

[ZB-10-p55-56]

Statement showing the Saving that might be effective by being the Winding Engine to do the work which is now done by the Pumping Engine at North Biddick Colliery

This statement is made for one year

Pumping engine

Coal 1783 tons 12 cwt. @ 5/- per ton £445.18.0

Wages for two men @ 7/6 per day----£136.17.0

Leather for 26 buckets @ 30/- per lb. £39.0.0

Wages for charging @ 6/- ----------£7.16.0

Leather for six clacks @ 6/- ---------- £1.16.0

Wages for charging---@ 3/----------£0.18.0

Tallow----------£10.0.0

Oil----------£1.10.0

----------£643.15.0

Winding Engines

Coal 765 tons 8 cwt. @ 5/- per ton £191.7.0

Saving effected £452.8.0

£64s.15.0

Report of Pumping Water at North Biddick Colliery

Pumping Engine going at the rate of 4 1/2 strokes per minute for 9 hours 2430 strokes at say 50 gall. Per stroke 121,500 galls. Burning 14 tubs of coal special pump off

Winding engine going 5 hours 40 mins drawing 350 tubs of water @300 galls. Each 105,000 Galls burning 6 tubs of coal

Special pump working

[ZB-10-p57]

Lintz Colliery

April 23rd 1877

S.B. Corfow esq,

Dear Sir,

On the other side I send you cost of the manufacture of coke at this Colliery the load our ovens at the top and from them 72 7 96 tons

Yours truly

GH Gooch

50 ovens per day loaded and drawn

1 burner------6/6 per day

Drawers (6 3/20 tons of coals) 1/11 per oven

4 Levellers (12-13 ovens each) 4 1/2 per oven

5 top runners (10 ovens each per day) 3/7 per day

2 Damper boys 2 1/10 per day

2 Ballast men 2 2.66 per oven hours etc.

1 breeze plan 1 2/10 per day

1 Bank rider 1 3/1 per day

1 Engineman minds his own boiler 11/-per day

1 do. Blower 2/9 per day

Wrights Smiths Bricks etc. £21 per fortnight

These items on a make of 2000 tons of coke per fortnight as equal to about 16 1/2 per ton

[ZB-10-58]

[Blank]

[ZB-10-p59]

Usworth Colliery

February 2nd 1877

Mr Stevenson esq.

Iron- master

Middlesbrough

Sir,

In the following report I have as you requested, confined my observations to matters bearing more directly on the possible lessening of the cost of production and have not attempted to write an exhaustive paper on the extent, value and prospects of the Colliery. Indeed this could scarcely be undertaken without more than one examination of the Workings and mechanical appliances.

It is difficult to avoid being hypercritical whilst writing on the general management, especially under the peculiar circumstances in which I am placed; this, I have endeavoured to avoid, and believe that in the following observations I have stated nothing that may not be carried into effect. Although…

[ZB-10-p60]

.. in a colliery like Framwellgate where the management is of the most careful character in may be difficult to effect large savings yet there are a few items of cost on which I have though it my duty to enlarge.

Passing over the rents, and extent and durations of royalties and various other particulars usually embodied in an exhaustive report, as not being requisite in the present case I will first deal with the cost of hewing and other underground charges as being the primary steps towards the production of the coal.

The present hewing price in the Busty Seam is –whole 1/4d per ton with a scale of allowances for the band of-

1 1/2d for 6 ins.

3d------9

4 1/2d----12

And by the award of Mr. Robson, lately received, the prices for the 'Beoken' are—when the band is not worse than 6 in. thick 1/- per ton; and when the band is over 6in. 1d per ton and for every complete 3in. of further thicknesses /1d

[ZB-10-p61]

From the sections obtained in the pit the hewing prices on an average will I think, amount to about 1/5 1/2 per ton for the 'Whole' and 1/0 1/2 for the 'Broken'.

The following are the sections referred to, the hewing prices with allowances for band being shewn in black ink for the 'Whole' and in red for the 'Broken'.

No1 North Way

Roof-post	Ft.	in.	
Top Coal	1	7 1/2	
Band		8	
Grey coal		4 1/2	1s 5 1/2 per ton
Bands		2	1s 2d
Coal	2	6	
	5	4	

Fire Clay Thill

West Bords

Top Coal 1ft. 10 1/2 ins.

Band 1

Grey coal 3 1s 4d per ton

Band 1 1/2 1/-

Coal 1 10 1/2

4ft. 2 1/2

[ZB-10-p62]

South West

Taken in 'Fore X Cut'

Ft. in.

Top Coal 1.10 1/2

Band 2

Grey Coal 1 1/2

Band 2 1/2 1s 5 1/2

Coal 1.9 1/-

Coarse coal & Beat 3

Coal (somewhat coarse 1.0

5.4 1/2

West Barrow Bord

Cater House Royalty

Coal 1ft. 11 1/2

Band 2 1/2 1s 4d

Coal 1ft. 8 1/2 1/-

3. 10 1/2

Grey Coal (coarse) 4

Having examined the small area of 'Broken' that has been worked and carefully observed the condition of the pillars standing, I see no reason now that the price for hewing in this part of the pit has been fixed, why some of this cheaper work should not be started with shortly. It is difficult to say however what proportion of the total output could..

[ZB-10-p63]

…be thus obtained; but from what I have seen I think it not improbable that in the course of a few months almost 50% of the total drawings might be worked from the 'Broken'; And as the difference in the hewing price is 5d per ton, the reduction obtained on the gross output would amount to 2 1/2 per ton or on the present drawings £1500 per annum.

The men in the 'Broken' being able to hew considerably more coals than those in the 'Whole', the owners will also derive benefit from this source; as, fewer men being required to obtain the same amount of work, the cost for house rent will be lowered.

From the figures obtained at the Colliery the average earnings of the hewers appears to be somewhat high; so it is possible that if a readjustment of prices were sought a reduction might be obtained.

The system of working, at present pursued, is to (?) in the 'Bottom Coal', then to take down the Band and fray coal and cast it back; the 'Top Coal' to be shot down or…

[ZB-10-p64]

…'scalloped' as the circumstances may require. Generally speaking the coal so obtained seemed to be clean and free from stone etc. but I noticed, that in the 'First North Way' an wich (?) or two of (?) or dirt lying at the top of the 'Bottom Coal' very often falls amongst the Rowings, will be filled up with the good coals and without doubt will prejudice the quality of the coke by increasing the percentage of ash. It would I think, therefore be an advantage if it were possible to induce the men to (?) in the grey coal & band and to cast it back together with the dirt I speak of- the Top and Bottom Coals could then be worked with little fear of having them mixed with stones.

The 'off handed' work appears to be very reasonable, and generally speaking the number of men employed is cut down to the lowest figure; perhaps the number of overmen is the only exception to this rule and as the Hutton Seam will soon be started one of them may be transferred to it, when of course the Busty bill would be relieved of his wages-about 35/- per week.

[ZB-10-p65]

A water level drift is at present being driven back to the new pit, in which 4 men are employed their earnings amounting to about £12 per pay ---as this work is nearly finished the bill will be correspondingly reduced in a short time.

The Engine planes underground are carried well up to the 'Face' and arrangements made for extending them at the workings entrance.

The air currents in the various districts visited were ample and, although the system of ventilation is somewhat complicated, owing to the position of the 'Upcast' in no case were any traces of gas found.

Having visited the Hutton Seam the following is the section I obtained—

Roof---blue metal

Good coal 2ft. 10 ins.

Coarse coal 0ft. 4ins.

The thill is a kind of coarse 'sagger' mixed with coal pipes.

[ZB-10-66]

This seam appears to be of most excellent quality, but I am told there is not much remaining of it. It is possible however from the questionable correctness of most very old plans that a larger quantity may be found than is at present expected. From that portion of the seam now being freed from water it may be possible to produce about 100 tons per day for some little time- and as the hewing price is low 7/6 per score of 21-6$_{1/4}$ cwt. Or 1/1 per ton, and the lead to the new pit short, the cost of working it should be light.

Under the present arrangements it is unfortunately necessary to keep an establishment- screeners, engineman, banksman etc. at the new as well as the old pit; but as there appears to be no difficulty in transporting the new pit coals to the bottom of the latter shaft and the winding engine there has time to draw the whole present produce of the colliery, providing a plentiful supply of steam to be kept up ; it would I have no doubt to be found an advantage to draw all Busty coals at the old pit-whilst at the new shaft the..

[ZB-10-p67]

..men would side, as at present and when the Hutton Seam should be ready to start it could be all drawn at the new pit. To carry this into effect it would be necessary to have a new boiler which would probably cost £250 or thereabouts-to be placed at the side of the present range and heated by the gases from the coke ovens.

Amongst the wages at Bank the pick sharpers earnings appear excessive –the Owners paying him 2/1 per day and the men 3d which amounts to 3/10d or in all 3/11d per shift probably some reduction might be made in this man's wages.

When the new coke ovens are finished it will be possible to get the locomotives along the coke branch and to dispense with the horse and branch driver, which will amount to about £84 per annum.

Forage- at the present time I believe the feed used for both bank and underground horses consists of chopped hay and a mixture of grain composed of about 2/3 oats 1/6 beans 1/6 maize..

[ZB-10-p68]

I would suggest that the owners should erect a small machine and crush the grain themselves instead of buying it from the mill; and also that the large proportion of oats should in a great measure be replaced by maize—the latter being a much heavier grain, and the price bulk for bulk, almost the same, its cost per stone is considerably less than that of oats.

The following are the present prices of grain-

Maize 31/6 per quarter of 480 lbs= 11.028d

Bran 40/- ----------504 = 1.1.333

Peas 41/- ----------504 = 1.1.666

Scotch oats 31/- ----------336 = 1. 3.5

Whilst English oats are still more expensive as they seldom weigh over 300 lbs per quarter.

Of late year's maize has been extensively used as a substitute for oats by such large customers as Tramway and Omnibus companies in many of our principal towns and in almost every case the results of the change are stated to be decidedly economical as compared with the old mode of feeding. From my own experience..

[ZB-10-p69]

…I feel satisfied that if used with care and introduced gradually it may in a great measure replace oats.

The following analyses of the grains most generally used will shew their different feeding properties.

	Oats	Maize	Peas or beans
Water	11.8	13.5	14.5
Woody fibre	20.8	5.0	10.0
Ash	3.0	1.3	3.5
Starch & sugar			
(fat forming matter)	52.0	67.8	46.0
Nitrogenous matter			
(muscle forming)	12.5	12.3	26.0
	100.1	99.9	100.0

It will thus be seen that a mixture of maize with either peas or beans is not only a cheaper feed but is also more nutritious than oats alone—there is little doubt the latter contains in itself the several properties required for horse feeding in a higher degree than any other grain taken singly, but as maize contains almost the same amount of nitrogenous matter without the large proportion of woody fibre and ash found in oats –it may be taken that when mixed with peas or..

[ZB-10-p70]

..beans, maize may be used with satisfactory results.

The consumption at Framwellgate per week at present is—

175 stones crushed oats @ 1/4 = £11.13.4

40 ……. Beans @ 1/6 = £3.0.0

40 ……. Maize @ 1/2 = £2.6.8

255…… £17.0.0

= 1/4 per stone

I would propose that it should consist of—

140 stones of maize @ 11.025d = £6.8.8$_{1/2}$

85----------beans @ 1/1.3 = £4.14.5

30---------- oats @ 1/3.5 = £1.18.9

255---------- = £13.1.9$_{1/2}$

= 1/0.32 per stone

Including cost of crushing say 1s 1d or a reduction of 3d per stone, which on the present consumption would mean a saving of:

255x52x3d = £165.15.0 per annum

The only outlay requisite would be about £15 for the purchase of a crusher and the cost of erection which would be trifling. The power would be obtained from the Engine now used for driving the Hay-Cutter

[ZB-10- p71]

In conclusion I have pleasure in acknowledging the promptitude and care with which Mr Longbotham has supplied all necessary information.

I am sir, your obedient servant

John Shiel

[ZB-10-p72]

[Blank]

[ZB-10-p73]

Abstract of No1 Pay 1878 (?)

Lintz Colliery

	Cost this pay on 3691 tons	average cost this last half year on 42712 tons
Hewing	15.50	14.71*
Putting	1.14	1.03
Shift work	2.14	2.37
Viewing overmanship	4.65	5.48
Pumping waterleading	.02	.31

Onsetting switchkeeping	.29	.31
Horsekeeping rolleywayman	.76 .4	.87
Keep of underground horses	1.25 x .75	1.71
Incidental expenses	.35	.45
Total underground expenses	28.37	29.62
Banking out	.53	.55
Screening & waking	1.96 x1	2.12
Enginemen firemen		2.15
Wrights smiths & labourer	1.5	3.51
Keep of bank horses	0	.63
Incidental expenses	.19	.20
Total bank charges	8.48	9.16
Royalty	6.00	5.77
Cesses and taxes	.74	.88
Coals and house rents	6.20 x 1.5	6.63
Damaged ground rent	.29	.35
Wayleaves rent	.00	.00
Contingencies	.18	.09
Total rents etc.	13.41	13.72
Tradesmen's bills	8.29	8.60
	59.55	61.10

* This higher owing to a great deal of yard work. £30 per pay put on here for G.H.G & office in London

[ZB-10-74]

Cost of Manufacture of Coke at Lintz Colliery in an average fortnight

Coke made 2100 tons

	£ s d	s d
Loading & drawing incl. levelling	72. 19. 3	0 8
Filling into trucks	26. 5. 0	0 3

Cleaning yard	7. 5. 6	0 0 .83
Repairs to ovens	10. 0. 0	0 1 .14
Stores	4. 0 .0	0 0 .45
Incidental taxes	12. 0. 0	0 1 .37
	!32. 9. 9	1. 13. 13

Yield of Coke 56%

I should treat this as a very favourable pay. I think the average is about 1/5d

Jan. 31st 1878

Dear Sir,

I give you particulars of coke cost & I also enclose copy of the cost of coal I may also say cost of manufacture of Coke 'including coal' on a pay like No1 enclosed is about 10/ per ton.

Yours R Reed

[ZB-10-p75]

West Rainton

Fence House

February 2nd 1878

Sir,

Framwellgate Colliery

In accordance with your request I have inspected the above and underground works of this Colliery and now beg to hand you my report. In so doing I would express my thanks to Mr Longbotham for the kind manner in which he has placed all necessary papers plans etc. at my disposal and given instructions to the officials to afford me all the information I might require.

For convenient reference I have arranged my remarks, suggestions and estimates under the following divisions

Section of the Busty Seam

Mode of working

Hewing charges

Haulage

Housekeeping

Drawing coal at Framwellgate pit

Economy of .18 per ton on cost of working

Materials

Pumping engine etc.

Area of Royalty

Wayleaves

Coke making reduced 7d per ton

Buck works

Hutton Seam

[ZB-10-p76]

Sections of Busty Seam

I observed that the Busty Seam which at the North Flat had a section of

Coking Coal	1ft. 10 in.	
Hard Band	1ft 2 in.	
Coal	0 8 in.	
Coking Coal	0 2 in.	
Coking Coal	1ft 11 1/2	
	3ft 10	2ft 0

Is so far improved to the west as proved in the workings as to present a section in the South West Crosscuts of

Coking Coal	1 ft. 11	
Band		
Coal	0 ft. 5 1/2} cast back	
Coking Coal	1ft 10	
Very coarse coal	0 4} only taken up in the wagon ways	
Firecoal	0 11}	
	3ft. 9	1ft 8 1/2

And there appears every probability of improvement in this direction before reaching the boundary against Bearpark Brancepeth Colliery, where the working face progressing towards F gate colliery has the following favourable section

Coking Coal 1ft 10	
Band	0 1}

Coal 0 5} picked out at bank

Band 0 0 1/2

Coking 3ft 0

4ft 10 6 1/2

[ZB-10-p77]

From this it appears that the lower portion of the Framwellgate Seam so far improves as to be capable of producing a coke which compares favourably with that produced from the rest of the Seam. If this should prove to be the case in the Framwellgate Royalty it would ensure the working of the seam altogether with a section of the clean coal 4 feet 10 inches in thickness. The hewing price which is 10d per ton in Bearpark might be reduced in this portion of Framwellgate from 1/6 per ton to at least 1/- per ton.

Mode of Working

The usual method of working the seam on both the whole and broken working is shown in the annexed sketch. The men (?) and remove the whole of the lower portion of the seam (5) before attempting to touch the band (4) after this coal is taken out clean and square, the thin and soft portion of the band together with the thin coal and hard band (4,3, & 2) is taken down leaving the top coal (1) which being taken down last , produces the greater portion of the saleable round coal. In these parts of the pit where the band attains its maximum thickness (in the North Way) there is great difficulty in getting the hewers not to fill any of the thin…

[ZB-10-p78]

… soft band with their coals (14 tubs were laid out in one day, from this cause alone). This lower band from its soft pliable nature, falls as soon as the lower coal is removed and unless extraordinary care is used by the hewer to remove it as soon as it falls, it is filled with the coals and when the tub is teemed the pieces being of small size; pass through the screens and become intimately mixed with the small coals intended for the coke ovens.

This lower band yields on analysis

Fixed carbon 3.7

Volatile matter 20.41

Sulphur .16

Ash 43.76

100.00

The relative amounts of this band mixed with the coal may be estimated as under

In the natural bed when filled at the tub supporting 1/8 of band is put in

Coal 95 98

Band 5 2

After removal of 25% of round coal by passage over wide screening

Coal 98

Band 2

At present about one ton of stone and band is (?) out daily but this is only representing .2% of the drawings, the screens with the small coal. This soft band when burnt with the coal in a coke oven, renders the adjacent coke very soft, light and porous, It does not intermix with the coke and make it….

[ZB-10-p79]

…heavier, but comes out of the oven as ballast, it also makes the coke very much shorter.

To prevent this obnoxious mixture of coal and band it would be advisable in the North Way (where it is proposed to start a broken flat in a short time) to secure the adoption of the following mode of working subject to the approval of the Joint Committee.

The men to Carve out the middle band of coal (2,3,&4) leaving the upper and lower portions of the seam (which are suitable for coking) to be detached free from danger of admixture with stone. By this means the best coal would be brought to bank in a much larger condition and almost free from stone if the men exercise ordinary care.

If this proposal was sanctioned by the Joint Committee some rearrangement of the hewing prices in the North Way might be affected. This by measuring the band (inclusive of the coarse coal) it has a thickness of two feet and the present price of hewing is 2/1d per ton; now if the top and hard band only were measured the hewing price would be reduced to 1/9d per ton.

[ZB-10-p80]

Hewing charges in the Busty Seam.

In collieries such as this where the cost of hewing bears such a high proportion (50% nearly) to the total labour charge (the average costs for the last pays being

Hewing and yard work 1/8d .27 per ton

All other labour charges 1/8 .53 per ton

Total labour charges……..3/4 .80 per ton

It is clear that the greatest attention should be paid to this important item of cost, having regard to the average earnings of the hewers per shift. For the last 3 pays, those earnings were:-

Year		1877	1878
Pay	26	1	2
Crosscut way	4/5d.89	4/6.63	4/8.00
West way	4/10.38	4/6.41	4/7.63
North way	5/7.93	5/8.38	5/2.48

South west way	5/4.32	5/0.89	5/2.67
Broken way	4/10.66	4/10.5	4/6.87
Pottersmoor way	5/0.27	5/5.35	5/8.79

The county average for the same period being 4/8 1/4d per shift, if the pit continued in its present condition such reductions might be effected by appeal to the Joint Committee, as would reduce the hewing charge by at least 1/2d per ton.

But owing to the position which the pit has at length been placed by the exertions of your present manager it is now possible to reduce the cost…

[ZB-10-81]

… to a much greater extent than above indicated. This would be affected by starting broken on a pillar workings in additional districts: the most suitable for this purpose are:

The Northway

Cater house way and

South west way broken now in operation

The present demand is

Coals to ovens	330 tons per day
Railway sale	170 . .
Colliery consumption	30 . .
Total drawings	530 . .

This might be derived from

Whole mine	220 tons per day
Broken mine	310 . .
Total	530 . .

The present average cost of hewing and yard work is 1/8 1/4 per ton

And the proposed cost, as reduced by working a certain quantity of broken mine is 1/6 1/4 per ton

Saving at least 1/2d per ton, and a saving of 2d per ton upon 132,500 per annum is £1104.3.4

This saving of 2d per ton, to be effective by additional broken working is dependent upon the extension of the principle of Mr J Robson's recent…

[ZB-10-p82]

…award to the other districts of the pit

The Award was

Broken mine where band is up to and including 6” thick 1/- per ton

Where band is over 6” thick and for every complete 3” of further thickness 1d per ton additional

The price previous paid in the whole mine where band is up to and including 6” thick 1/6d per ton

Where band is is up to and including 9” thick 1/8d per ton

I should advise that an application be made to the Joint Committee for this purpose.

Ventilation

The present ventilation produced by means of Guibal Fan, placed upon the Framwellgate pit is a volume of 70,000 cubic feet of air per minute and more than adequate for the present requirements of the mine; the workings are swept by powerful currents, so as to render the detection of even small volumes of gas, a very difficult matter.

Owing to the Fan being placed upon the Framwellgate pit the whole of the Engine planes are required to be separated by doors from the wagon way in order to carry the fresh air around the face of the workings.

[ZB-10-p83]

Underground Haulage

The coal is brought from the working flats to three stations by nine horses and ponies, and five horses are employed in conveying coals to the Cator House Pit; and by engine power from these stations to the old pit bottom.

The present positions of the in bye stations (A & B) are too far from the face it would be desirable to shift them to points C and D and that another branch to be formed into the south west crosscuts and the station placed at E .

For these purposes about 30 tons of flat bottomed rails would be required weight 28 lbs per yard

These alterations including the necessary changes in the ventilation, erection of air crossings, shifting of the main doors at an in-bye end of stations, would permit the number of horses to be reduced to 7 in addition to which the 5 horses now driving to Cator House pit, will not…

[ZB-10-p84]

…be required (as soon as the necessary arrangements are completed) when the whole of this coal will be drawn at the Framwellgate pit. The proposed new engine plane stations, as now intended will from their positions not require any further removal, as all of them are within a convenient distance from the external barriers of the royalty.

It would be advantageous if another boiler were erected at the Framwellgate pit, because by the supply of more steam to the underground hauling engine, the convoy of tubs running on the engine plane could be increased to 36 instead of 30 tubs as at present

Cost of Housekeeping

The present staff of horses and ponies is

	at bank	underground	Totals
over 15 hands	5	9	14
over 12 1/2	1	4	5
over 10	4	32	36
Totals	10	45	55

And adopting Mr Hunting's hypothesis that 3 large ponies are equal to two horses, and 2 small ponies are equal to one horse, then the preceding 55 head are equal to 35 1/3 horses. At the high prices paid at present for maize and beans as detailed in following table, it is hardly to be expected…

[ZB-10-p85]

.. that the horses can be fed at a lower cost than the present; as by reference to the second table it will be seen that the quantities of feed are as low as can be fairly given to the horses consistent with efficiency.

The cost of the present feeding per week is

175 stones of crushed oats @ 1/4d				£11.13.4
40 " "	beans @ 1/6d		£3.0.0	
40 " "	maize @ 1/2d		£2.6.8	
8 " "	Bran	@1/-	£ 0.8.0	£17.8.0
160 stones of hay at 9d				£ 6.0.0
Total cost of hay and corn etc.				£23.8.0

This upon 55 head is 8/5d per week upon 55 horses and ponies or 35.5 horses is 13/2d per horse per week.

The daily quantities of corn etc. to each horse over 15 hands are

9.8 pounds of oats

2.2 beans

2.2 maize

.4 bran

14.6

And 9.0 pounds of hay

23.6 total weight of hay corn etc. supplied to each horse over 15 hands.

In Mr Hunting's hands greater economy is not secured by less quantities, but is due to his buying cargoes of 3000 to 4000 quarters of oats and maize at a time which he distributes to the various collieries where the…

[ZB-10-p86]

…horses are under his management.

The whole of the horses and ponies under the present system of feeding are maintained (as far as I could see) in perfect conditions, being perfectly hard and ready to undergo a lengthened effort if occasion should require it

On the relative advantages and disadvantages of drawing all the Busty Seam at the Framwellgate Pit

The advantage resulting from this change are being very numerous, one of the most obvious being the centralization of the whole of the surface operations upon one spot and saving of men's time travelling between the pits. The keeker can devote more time and attention to the thorough cleaning of the coals. Two winding enginemen and the whole of the screeners etc. (5) would be dispensed with. The locomotives would have the traffic over a shorter distance, consequently there would be less delay in working the long incline connecting the collieries with the North Eastern Railway system.

The Cator House pit could (if there arose any expansion of the coal or coke trades) readily put into the market from 100 to 300 tons of coals daily, but with the present requirements of trade (530 tons) it is desirable that it should be laid in.

[ZB-10-p87]

The practise of riding all the men at the Cator House pit should be continued and thus by preventing any stoppage allow a large quantity of coals to be drawn at the Framwellgate pit as there would be no cause of stoppage due the presence of the men.

It would be advisable to insert a few yards of brick arching on each side of the Cator House pit in order to prepare the old pit to draw 530 tons per day, without delays on Mondays arising from want of steam (due to so many ovens being drawn upon that day) it would be desirable to erect and connect another boiler, for the more efficient supply of steam to the winding and underground hauling engines.

If all the coals are drawn at the old pit, the present "kip and dish" at the outbye end of the engine should be lengthened so as to afford standing room for the two sets of tubs. By this means even if the pit were standing for 15 minutes at any time by reason of accident, it would not immediately effect the entire running of the engine plane. The difficulties connected with drawing the coals at Framwellgate pit are more than counterbalanced by the fact of the coke ovens being situate near it, and by the saving of instroke rent upon Ecclesiastical Commissioner's coal.

[ZB-10-p88]

General economies on coal cost

The present position of the charges for labour is capable of considerable diminution, The cost of hewing can be reduced to the extent of at least 2d per ton, by the working of a portion of the coals from the broken mine. The annual saving upon a vent of 132,500 tons will be £1104.3.4. The working cost will be further reduced by the extension of the engine planes and so reducing the number of horses required: there may be seven horses dispensed with; the annual saving if the cost of food be taken at £36 per annum will be £252.0.0.

A reduction of the coal used for colliery consumption might be effected by the use of rough coke, screened from the breeze; it could be used under the boilers attached to the brickworks if mixed with equal quantities of coal, as about to be adopted by your present manager. By the starting of broken working a number of the hewers can be dispensed with because each man will hew more coal from the broken than the whole mine. At least 15 hewers can be dispensed with, and if possible 10 hired horses might be given up in addition to the 14 horses now proposed to be left by Mr Longbotham. These…..

[ZB-10-p89]

Are 16 stone men employed on the colliery and after the extension of the "kip" is completed in the course of 2 months' time & this would effect an annual saving of £200.

A slight reduction of the working cost will be effected by the stoppage of coal work at the Cater House pit but owing to the very general nature of my inspections I cannot specify its extent I would direct the full strength of the screening department to the careful cleaning and screening of the small coal used for coke making as nothing is more important.

Engineer's department

After the completion of certain works now in progress, and which are expected to be finished in six weeks a reduction of this bill should be made; a rigid supervision should be exercised as to overtime, and generally the mechanics should only work when the pit is working. The annual saving should be at least £200.0.0

[ZB-10-p90]

..use of coke under certain borders.

This annual saving represents about 3.18 per ton upon a vend of 132,500 tons of coal and after the expiration of three months the broken working being then in full operation a further reduction of 1d per ton would ensure making a total saving of 4.18d per ton.

Materials

It is possible that a reduction of these might be effected but I have not had the opportunity or knowledge of the requirements of the colliery sufficient to enable me to judge.

Cator House Pumping Engine

The present feeders of water, raised to back are :-

Main engine from Hutton Seam 200 gals per min.

Main engine from Hutton 100 gals. per min.

" " " Busty 150 250

Total Feeder 450

As the broken workings extend to the South and West under the dip feeders of the Hutton Seam, there may be some danger of the waste water passing through the broken strata but this would not cause more than a temporary in convenience as the feeders do not extend to more than 150 gallons per minute and although the first break away might be attended with some danger, the attendant difficulties..

[ZB-10-p91]

… would not be insurmountable. After the appearance of such overlaying water, in the Busty Seam broken, it would be advisable that the special pump now standing in the Hutton Seam should be removed and placed in the busty Seam and by this apparatus the water could be raised to the level of the Hutton Seam and there lifted to Bank by the high sett of the Main Engine. Of course if the waste was thus tapped a ready access could be obtained to the waggon way pillars which it is proposed to recover in the Hutton Seam. The danger to be apprehended from the overlaying waste water may never occur, as there are several thick beds of metal lying between the two seams, which would turn any quantity of water, unless they are severally ruptured by heavy falls in the Busty Seam broken.

There is about 3 weeks standage at the foot of the Cater House pit for the present water feeder.

Area Of Royalty

I am informed that the company are pressed to abandon a portion of the Potter Moor royalty laying in the north and dipside of the Potter Moor Dyke. This detached piece of coal royalty…

[ZB-10-p92]

… has an area of above 100 acres.

I calculate that there are 3,000,000 tons of coal now remaining in the 800 acres of Busty seam sufficient to supply a vend of 150,000 tons per annum for 20 years and the abandonment of the 100 acres of coal laying to the north of Potter Moor Dyke, will decrease the duration of the colliery in the Busty Seam to 17 years. I may be excused for remarking here on the importance of securing during the present depressed state of trade a reversionary lease for a long time of the Framwellgate royalty, now held by the Ecclesiastical Commissioners by a lease terminating in 1884; because if the lease be allowed to lapse, greatly increased tennage rents will be demanded.

Again by sinking the Cator House pit down to the Brockwell seam, and driving a drift in it towards the Potter Moor Dyke it is in every way probable that the Busty Seam on the dipside of the Dyke would be won, as explained by annexed sketch.

[ZB-10- p93]

Wayleave Charges

The new pit is sunk in the Cater House royalty, held by lease from Mr Fawcett who reserves a certain rent of £150 in lieu of any payments for outsroke shaft and wayleave rent.

It would be proper that none of the Commissioners coal be drawn at the Cater House pit, as long as the present depressed state of the coal trade continues as by this means an instroke rent of .62 per ton payable on all their coal drawn to bank in foreign royalties will be saved.

None of the coals from the Cater House royalty should be drawn at the Framwellgate pit (if it can be avoided) because all coal so drawn is liable to a payment of 1.62 per ton, which can be otherwise saved. As the principal making up short workings from the Cater House royalty is co-extensive with the term of the lease, any accumulated shorts can be liquidated at any time, when a revival of the coal trade occurs.

Cokemaking

The cost of coke manufacture is favourable low owing to the position with regard to top loading, short distance from the small apparatus to the ovens and…

[ZB-10-94]

… favourable gradient. The cost as compared with other establishments in the neighbourhood being per ton of coke.

	Framwellgate	Brancspeth	Hamsteels
Small winning	0s 1.30d		0/2.00
Levelling ovens	0/1.03		0/1.25
Drawing coke	0/5.83		0/6.00
Filling coke etc.	0/3.34	1/0.81	0/3.00
Filling coal at the New pit	0/0.32		
Smith work etc.	0/1.79		0/3.50
Total cost	1/1.61	1/0.81	1/3.75

The only cost which appears excessive is that for filling coke, as is due to the arrangement of the 56- 10 foot ovens; the charge for filling coke from them being into “stipes” 3 5/8 p ton, and into (?) 4 5/8 per ton whilst from the other ovens which are provided with a proper benchwalk the cost of coalfilling is 2 7/8 per ton.

By building a coal hopper at the old pit to hold about 200 tons for the supply of the ovens on pay Saturdays the charge of over ¼ p ton of coke for filling up coal for the ovens could be avoided. The hopper should be arranged with a false bottom, under which the small runners tub could be filled.

The eleven foot ovens instead of being loaded light 101 1/2 cwts. Heavy 130 1/2cwts. And average 116 1/2 cwts. Might have the…

[ZB-10-p95]

…charge of coal increased to light 11 cwts, heavy 134 cwts and arrange 12 cwts in a few cases this change would require the oven doors to be made higher, so as to permit levelling but this change should be affected gradually when any of the doorways are under repair.

This increased charge of coal would have the effect of making the coal burn slower and by the oven being better filled, create a high heat in the dome so as to clear the top and fuze the coal as much as possible and hence increase the yield of coke.

The effect of the reduced cost of the coal to the extent of 4.18p per ton will be to diminish the cost of the coal made form it 6.97 p ton on the supposition that the yield of coke is 60%.

Brickworks

It is desirable that a large stock of sagger clay be laid in (sufficient say for months) so as to permit of it being weathered before being (?) to the grinding mill. No doubt the detentions of the brickworks which have lately occurred (by the breaking down of the machinery) are due to this cause.

The sagger clay underlaying the Busty Seam, is usually of a hard pasty nature and when the percentage of iron and fusible salts of lime etc. is small they clay is very suitable for lining furnaces etc.

[ZB-10-p96]

The works are capable of turning out at present over a million bricks per annum. The prices paid to the men are very moderate and after a charge of 1/- per ton for sagger clay, I estimate that 3 inch bricks can be made for 20/- per thousand including coals, labour materials etc.

Hutton Seam

When the standing water in the SW districts of the Hutton Seam is lowered and if demand for household coals of a good quality should arise about 50 tons per day could be wrought from the old wagon pillars, but this will depend on the accuracy of the Hutton Seam plan, as it is more than probable that pillars are marked as still standing which were got out years ago.

The coal presents a section of 2ft. 10 ins. And the hewing price has been fixed at 1/1.7 per ton.

Under these circumstances I estimate that the labour charge will be 3/6d per ton.

I beg to remain your obedient servant

M Walton Brown

Jno Stevenson esq.

Iron Master

Middlesbrough

[ZB-10-p97]

Whitworth Colliery

No.19 pay ending September 30th 1879. The actual cost of coke may now be taken at 7/1.44 per ton as below:-

Coke 59% 59 = 1.69 coals @ 3/7.07 = 6s 0.72 per ton

Labour etc. 1s 0.72

7/1.44

Analysis for coke and tar at Colliery near Glasgow

Coal—Gas Tar etc.	36.12	
Sulphur	.44	
Water at 212f	1.94	38.50
Coke—fixed carbon	56.50	
Sulphur	.64	
Ash	4.36	61.50
		100.00

[ZB-10-p98]

Framwellgate Colliery –March 1879

Trial of yield of coke from Busty small and Busty rents (?) respectively –each burnt 96 hours and in an oven 10 feet dia. Burning into a flue and chimney.

Small

Tons c	Tons c
5..4 produced	3..1 produced

104) 6100 (58.65%

520

.900

832

680

624

560

520

Nuts

Tons cwt. Tons

4 .. 14 produced 3 ..6 of coke

=

94) 6600 (72.12%

658

. . 200

188

.120

94

260

188

The nuts were well free of duff and thoroughly cleaned.

In appearance the coke from the small was much the better and harder, although the other appeared to have been sufficiently burnt.

JS

[ZB-10-p-99]

Framwellgate Colliery June 1879

Experiments with coke oven taking air from pipes placed above the doorway instead of ordinary method of leaving apertures in the door itself.

June 11th to 17th last

First expt. 11ft. oven 90 yds. From the boilers & 121 yds. From chimney-

No. and sizes of pipes 32in. pipes2-1 ¼ dia. & 1-3/4

Area of airway

Size & height of chimney

Loaded with coal 6t 2c

Produce of coke 4 0

Percentage of latter to former 65.57%

Quality of coal Rough small

Quality of coke very inferior soft and not thoroughly burnt

Ordinary time for a similar oven with a like load to burn when air admitted in ordinary way 96 hours

Expt. 2 An 11 ft. oven in No.4 low drawing to same chimney as above but 11 yds. From boilers draught strong

No. and sizes of pipes 2 1 1/2 pipes

Area

Load of coal 6t 17c

Produce of coke 4 13

Percentage 67.88%

Length of time burning 96 hours

Quality of coal - rough small

Quality of coke - good and so far as…

[ZB-10-p100]

…appearances went –equal to the coke usually drawn from this area.

July 1879

Expt. 3 Same oven as in last expt. Loaded with rough small at the same time as the west oven but due to it, both loaded with same coal and drawn on same day the former however based through whilst the latter was supplied with air in the usual way- the door very carefully daubed and the doorway pointed within the last few days the: following were the results.

Oven burnt through pipes was loaded with 6 tons 16 cwt of coal and produced 4t 10 cwt. Of coke. The oven loaded in the usual way received 6 tons 14 cwts. and produced 4t 6 1/2 cwts. And 63.65% respectively.

Each oven burnt 96 hours and the coke to all appearances of equal quality

July 8th

ZB- 10- p101

Expt. 4 July 15th '79

Distance from chimney yds.

Oven with pipes in

Coals used- 6t. 11 cwt.

Coke produced 4. 6

Proportion 65.65 %

Oven burnt in ordinary way

Coals used 6t . 15 cwt.

Coke produced 4 . 13

Proportion 68.88%

May 3rd 1881

Coke from ovens in lower part of No.2 low- H (11.6) dia. And coal in each case rough Busty small. Such as we usually use- in similar in each case.

Both coal and coke carefully weighed

Burnt 120 hours

Load of coal 10 tubs or 9t.18 c producing 6t 8 c of coke = 64.65 % - coke good but broke much in drawing

Load of coal 8 tubs (an ordinary 96 hr. load) or 7 t. 18 c

96 hours produced 4t.18.c.3 qtr. of coke = 62.50% quality excellent

72 hours

Load of coal 7 tubs (ordinary 72 hrs. load) or 7t.0c produced 4t. 15c of coke= 68.57% quality excellent

[ZB-10-p101]

Expt. 4 July 15th '79

Distance from chimney yds.

Oven with pipes in

Coals used 6t 11c

Coke produced 4. 6

Proportion 65.65%

Oven burnt ordinary way

Coals used 6t.15

Coke produced 4.13

Proportions 68.88%

May 3rd 1881

Coke from ovens in low part of No2 row H (11.) dia. And coal in each case rough Busty small such as we usually use in similar in each case. Both coal and coke carefully weighed.

Burnt 120 hours Load of coal 10 tubs or 9t.18 c producing 6 t 8c coke = 64.65% coke good but broke much in drawing.

Load of coal 8 tubs (an ordinary 96 hour load) or 7t.18c 96 hours produced 4t.18c.3qtr of coke 62.50% quality excellent.

[ZB-10-p102]

In a 10ft. flue (wall side) burnt into flue Burnt 72 hours 6!/2 tubs of coal weighing 4t.14 c produced 3t.2c of coke equals 65.96% quality excellent

Framwellgate Colliery analysis of coke made from Busty 'duff'- screened over small grating and burned for 72 hours in an 11ft oven beehive oven.

Sulphur 1.05%

Ash 8.20%

The same coal burnt 96 hours in a similar oven produced a proportion of 68.17 of coke to the coal consumed.

Busty Coal, large screened coal, crushed in the clay will under ordinary burnt same as above 96 hours produced a proportion of 69.59%.

The same crushed coal burnt 72 hours produced a prop. Of 66.92%

Coal made from Framwellgate Busty duff Aug.9th
72 hour coke

Sulphur 1.11%

Ash 9.60%

96 hour coke

Sulphur 1.22%

Ash 10.15%

[ZB-10-p103]

Analyses of Coke and Coal

Framwellgate coal- April 11.74

East Pelton gas coals-Mr Pattinson to the Colliery Cos. Agent Mr R. Hindhaugh .23 side yield of gas per ton 11,000 cub.ft.

H Power 14.4 Spear candles

Yield of coke per ton 13 1/2 cwts.

The coke is of good quality

Analysis of same coals

Fixed carbon 66.51%

(?) at a red heat other than

Sulphur & moisture 29.13

Sulphur .82

Ash 2.88

Moisture .66

Garesfield Coal March 11.78

Yield of gas per ton 10200 cub ft

Ill. Power 17.1 Candles (?)

Coke 73.52%

Vol. matters 26.48

Coke of very good quality

By Thompson's calorimeter 14.46 lb of water can be evaporated from 212d Fahr. By 1Ib of coal

Analysis- Carbon		84.55
Hydrogen	4.75	
Oxygen	5.48	
Nitrogen	0.89	11.12
Sulphur		0.62
Ash		2.20
Moisture		1.51
		100.00

Coal well suited for gas making & also for steam raising. Yield of coke is very high & the coke is of good quality.

John Pattison

[ZB-10-p104]

Analysis of Coke

Name of coke	from which coal made	Date	Carbon	Sulphur	Ash	Moisture
Bates Garesfield		31.10.81	91.84	0.68	7.33	0.20
Luitz coke		18.9.85	90.40	0.88	8.50	0.20
Do.		18.9.85	91.66	0.68	7.50	0.16
Do.	Coal riddled & crushed	8.9.85	87.88	0.78	11.13	0.21

Do.	Do.	14.9.85	90.95	0.549	8.40	0.10
Do.	½ Busty-1/2 Buckland burnt 72 hrs.	Oct.84	91.96	0.73	7.07	0.24
Do. M. Coal 1 Post ¾ seam1 {			92.73	0.65	6.04	0.58
Laycock's Garefield Busty 3{						
Do. From same or as last		16.1.78	92.43	0.76	6.50	0.31
Do. 1/3 Busty2/3 brockwell		11.4.85	88.28	0.73	10.83	0.16
North Luitz ¾ Busty ¼ Brockwell		do.	90.69	0.91	8.27	0.13
Luitz	washed small	5.1.84	91.38	1.02	7.33	0.27
Do.		9.2.83	90.97	1.10	7.73	0.20

[ZB-10-p105]

Mar.29 '70

Luitz main coal (Laycock's Garesfield)

Fixed carbon 63.06%

Hydrocarbons 28.85%

Sulphur 2.04

Ash 5.02

Moisture 1.03

20 tons of coal were treated at Ordinary gas works yield of gas was 9750 cub. Ft. per ton of 13.20 (?) candle ill. Power

Pattison

[ZB-10-p106]

Felling Colliery

Cost of tubs

29 ft. deal 9$_{1/2}$ x 1x 1c 4$_{1/2}$d £- 10-10$_{1/2}$

10 do do 9x1$_{1/2}$ c4d 3. 4

Centre box 46 lbs 32s/6d cwt. 12.5$_{1/2}$

4 tub wheels c 30 lbs each

120 lbs c 35/- cwt £1. 15.0

2 tub axles c 20 lbs each = 40 lbs c 10/6 0.6.8

Weight of wrought iron for each tub 136 lbs c 18/6 £1.2.8

Barrier work (making) £0.3.8

Blacksmith do. £0.4.4

Cost of tram 30.8.6

Total £5.7.6

March 5 1878

Framwellgate Colliery

An account of Special pump & bucket leathers

Special pump copper rod and plunger with brass rings put in on 31st May. Rings taken out on July 4th Peston complete

Brass rings lasted 34 days

The quantity of leather used in 34 days= 17 pair = £3.16.8

July 15th

[ZB-10-p107]

Felling Colliery

Cost per ton of hay stacking

182t.13.c.2 qtr. ' £3/10/0 per ton £639.5.6 Cost per ton £3.10.0

Stacking……..35.14.4……£3.11.10

Covering……5.2.9……6.77

Straw 8 loads @ 3/6/0……..26.8.0……2-11.81

Rope 1 cwt……2.1.8……3.75

Sept 18th 1877……..£716.12.2……£3.18.8.97

Cost 1876-5/11/4.75

Copy of analysis of coal received from Messrs. Pattison Stead on Aug/8/82

Ash-No1. 36.30% No2. 21.35% no3. 33.10% No4. 72.50% No5. 6.00%

Above coal taken from seam on low side of Dryburn Drift 56ft. below ordinary Busty (Refuse)

[ZB-10-p108]

Analysis of different kinds of coke recd. At Acklam Ironworks

Date	Name	Result	
1882			
June 2nd	Framwellgate	1.16% sulphur	10.65% ash
26th	"	1.12%	11.50%
24th	"	1.11%	10.65%
June 8th	Ushaw Moor	0.85%	9.00%
July 24th	"	0.93%	8.75%
Feb 1st	Hawstells	0.97%	8.60%
May 31st	"	0.86%	9.35%
June 26th	"	0.92%	9.10%
March 30th	East Hetton	1.11%	8.20%
May 15th	"	1.03%	6.35%
Dec. 5th	"	0.82%	5.85%
March 20th	Wittington	0.90%	6.65%
June 13th	"	0.66%	4.70%
July 11th	"	0.81%	6.15%
Feb.2nd	Brandon	0.85%	7.50%
May 31st	"	0.86%	8.10%

[ZB-10-p109]

April 1883

Analysis of coke made from coal from Busty seam F. gate Colliery wrought from the low (So.) side of Dryburn Dyke and about 50 yds. from it. The coal being that portion of the seam shewn in the section of coal below –

Roof Good

Good Coal 1.10 1/2

Stone 0.1

Grey coal 0.4 1/2

Stone 2 1/2

Good coal 2.1

Coarse coal 3 1/2 (A)

Stone 0.1

Coarse coal 4 (A)

Coal bright and good 11 1/2 (B)

……..5.6 1/2……0.9

Coke from coal worked B

Sulphur 1.81%

Ash 13.9%

Coke from A&B mixed-

Sulphur 2.14%

Ash 15.30%.

[ZB-10-p110]

6th March 1884

Analysis of coal and coke from Busty Seam gate –low side of 2nd Dryburn Hitch about 95ft. below ordinary level of Busty

Roof - post

Coal (good) 1ft. 11 in. B

Stone 1 1/2

Coal 3 1/2

Stone 2 1/2

7 1/2

Coal (good) 2. 0 A

Split coarse 7 1/2

Good coal 1. 0 C

Stone 1 1/2

6.3 1/2

A- Coke used in usual manner in an 11ft oven

Sulphur 1.33% Ash 9.30%

B- 0.92% 5.70%

C- 0.86% 11.20%

Coal	A	B	C
Fixed carbon	63.52%	65.15%	56.26%
Volatile hydrocarbon	30.61	28.84	27.74
Sulphur	1.18	0.94	3.78
Ash	3.85	4.40	11.50
Moisture	0.84	0.66	0.72
	100.00	100.00	100.00
Yield of coke	68.00%	70.10%	69.90%
Sulphur in ash	0.07	0.14	0.49

Analysis of coke made from coal by Pattison & Stead

	A	B	C
Sulphur	0.91%	0.77%	3.04
Ash	5.66	6.57	16.42 (this contains a large amount of pyrites)

[ZB-10-p111]

Analysis of Framwellgate Coke made by Messrs. Pattinson & Stead on the 8th July

Sulphur 1.12%

Ash 12.00%

Analysis of Black 'Top' coke returned by Messrs. Merrick

Ash 11.80%

Sulphur 1.20%

[ZB-10-p112]

Analysis Framwellgate Colliery

	Ash	Sulphur
Busty coal as it comes to the travelling belt	11.50%	0.97%
As it leaves the same belt	7.65	1.12
Same coal after being washed in Mr Robinson's machine	5.50	1.06
Debris from same coal taken from Mr Rs machine	68.00	8.31

Amount of debris extracted = 5 1/2% of gross weight washed

[ZB-10-p113]

Copy of Analysis made by John Pattinson of Framwellgate Coal

Shipping Ports:- Tyne, Wear, Hartlepool, Tees

Laboratory and Assay office

75, The Side

Newcastle August 2nd 1885

I hereby certify that I have examined a sample of coal received from Messr.s The Framwellgate Coal Company on the 24th and that I find the following results:-

On submitting the coal to distillation in a coal testing apparatus 10,500 cubic feet of gas were obtained per ton of coal having an illuminating power equal to 15.8 standard sperm candles as ascertained by burning the gas at the rate of five cubic feet per hour in a photometer filled with Suggs No1 London Argand Burner.

The coke assay gave as follows:-

Coke…….69.70%

Volatile matters…..30.30%

……..100.00%

The coke was of good quality

A complete ultimate analysis of the coal was made and the following results obtained

Carbon……81.26%

Hydrogen…4.78%

Oxygen…..7.48%

Nitrogen….0.76%

Sulphur…….0.91%

Ash…..3.88%

Water…0.93%

……..100.00%

[]ZB-10-p114

Laboratory Assay office 75, The Side, Newcastle 18th April 1885

I hereby certify I have examined a sample of coal received from Messrs. The Framwellgate Coal Company marked “East Hetton Gas Coal” and that I find the following results.

On submitting the coal to distillation in a coal testing apparatus 10,500 cubic feet of gas were obtained per ton of coals, having an illuminating power equal to 15.6 standard sperm candle as ascertained by burning the gas at the rate of five cubic feet per hour in a photometer fitted with the No1 London Argant Burner.

The Coke Assay gave as follows:-

Coke….67.7%

Volatile matters….32.2%

……100.00%

The coke was of good quality

A complete ultimate analysis of the coal was made and the following results obtained:-

Carbon…82.09%

Hydrogen…11.50%

Oxygen…..8.35%

Nitrogen…0.67%

Sulphur…0.57%

Ash…..2.43%

Water….1.39%

…….100%

[ZB-10-p115]

[Blank]

[ZB-10-p116]

Coke Washing- March 16th 1886

Copy of letter from Mr Henry Simon 20 Mount Street Manchester to Mr Stevenson esq. Middlesbro'

Dear Sir,

We have tested the coal you sent to Germany in conformity with our previous correspondence and I have now the pleasure of submitting to you my report.

Your coal in its raw state was found to contain 8.75% of ash while after having undergone our process is proved only to contain 2.48% of ash by careful analysis.

On the face of this fact which is strictly reliable, I should be prepared to guarantee that in case you decided to adopt our process.

1. That your coal when washed should not contain more than 3% of ash.

2. That the cost of washing daily about 450 tons of coal including repairs, all labour together with loading , also upholding the plant but excluding steam, shall be no more than 1d per ton of coal.

3. That no more than 2% of coal should be found in the shale which is washed out of the process.

Each one of these three vital questions for the Establishment, I would guarantee under substantial penalties to be named which you could deduct from the contract price in case the promised conditions are not fulfilled.

The coke which you could produce with coal containing only 3% of ash would be of the very best description & well capable to compete, if….

[ZB-10-p117]

… necessary, with the best Westphalian coke made which you can see from the enclosed details about the produce of the Maria Anna pit where one of the proposed plants is at work.

I should also here remark that by those cheap washing machines in use at present in this country the very finest coal (say up to 1/64 mesh) is allowed to run to waste, whereas this "Schlamm" gives the best coke & is recovered by our process.

The cost of an establishment to wash the total quantity of coal you send to the ovens (about 460 tons daily) would be about £4000.0.0 which sum however would not include the building but it would include everything else together with firing ready to start. You would require about 25HP to drive such a plant, and it would not be much cheaper for you to go in for a smaller plant, as a works of, say, half the above mentioned capacity would cost you about £3000.0.0

By means of a few roughly jotted down figures I see the advantage derivable by you in the furnaces alone from a coke containing 8 to 9% less ash than what you are using now must be very great & indeed amount to a great many thousand pounds in the year.

(This 8 to 9 % I obtain on the assumption that your ovens give you about 65% coke). To this saving would moreover come the fact that by continuing to draw the same tonnage of coal from the pits as you do now, you would, if desirable, be able to sell a good many thousand tons of your coke at a good figure after having satisfied the demands of your blast furnaces, in the production..

[ZB-10-p118]

…of the same quality of Pig Iron as we are making now!

I now offer to make you a project of the establishment proposed by you by us- The most rational place for the site would be in your case probably near the pits, in order to save the carriage of the shale as much as possible, & I therefore ask you send me a ground plan with levels etc. of the proposed site, showing also at what levels the coals arrive at bank & what level they have to leave for the ovens-

With regard to the kind of building to be adopted this could be carried out in a very economical manner, I should think, and I should be glad of your opinion on that subject and accompanied if possible with rough sketch or two, so that I might be guided thereby in getting out my arrangements of the plant.

If you desire to go into the matter in the way proposed by me, I might if you like send you my Mr Schroller who has this business in hand for me to see you & to consult with you on the subject.

In making now your own calculations as to rentablity I should also like to mention as a fact that in Germany it is found, that if for example 5% of shale etc. are washed out of a certain coal by our process, the general experience is that 2-3% more coke are made at the ovens-The reason is that the ovens are much hotter and the coking quality of the coal is increased to that extent-

I should also mention to you that there is no fear of destroying your ovens more by using washed coal than by using it unwashed-We have an arrangement by means of which the coal is sufficiently drained in very few hours ready for the ovens-

[ZB-10-p119]

As to using wet coal in Disintegrator it is our opinion that this will be rather an advantage in your case than otherwise because if you crush dry coal such as you sent for our experiments in disintegrators you are bound to lose gas in grinding, the effect of which result you no doubt sufficiently know.

In conclusion I should say that in view of the notable waste which is taking place at present at your furnaces, the advantages held out to you are so great that the expense for the rather costly apparatus proposed to you would be recouped in a very short time and that I feel sure you would be satisfied in point of utility in every way with your venture.

Yours truly

Henry Simon

[ZB-10-p120]

Copy of letter from Mr Borkbeck to Jno Stevenson esq.

Dear Sir,

I have read over and considered the report of Mr Simon you have sent me-

The plan of washing coal by pulsation is much the same all the world over, and as coal in this country is as a rule better than on the continent, it can be made fairly clean with one washing without further sub division than is done by screening. If the coal is very dirty and the whole is to be coked then it is necessary to sub divide it & wash it in different vessels, but I think Framwellgate small coal could be well cleaned by a much less costly and complicated machine than n that which Mr Simon recommends.

I think a plant washing 460 tons per day could do the work for 1d per ton, but I very much doubt that it is possible to clean the coal so as to contain only 3% of ash and only lose 2% of coal during the process.

I cannot but notice the remark that the coke from washed coal would contain from 8 to 9% less ash than it does now, to effect this would indeed be an achievement! I concluded this statement is an error, for if the present coal contains 8 3/4% of ash and the coke made from it about 11%

however can the same coal (supposing that when cleaned it really contained only 3% of ash) make a coke with but from 2 to 3% of ash.

Yours faithfully

J Birkbeck

[Pages ZB-10-p121 is-p128 are blank]

[ZB-10-p129]

Axwell Colliery Sept. 30th 1879

Extracts from report of above date made by WH Hedley & Matthew Bates for the executors of the late HR Bagnall.

Lease held from Sir WA Clavering Bart.

31 years from May 1st 1871

Certain rent £600 pa

Coal 30/- a ton £47.14 = 7.847d per ton

Fireclay 8d a ton of 22 1/2 cwts. =7.11d per ton of 20 cwts.

Easement rents for other coals etc. =2 1/4d per ton for shaft rent & underground and surface wayleaves. Barrier of 5 yards. Reserved also fireclay under a portion of the estate.

Total area 432 acres but seams all outcrop on estate very considerably curtailing available coal.

[ZB-10 p130]

Seams with their depths and sections

Seams	depth			Thickness and quality
	Fath.	Ft.	in.	
Main coal or Townley	9	1	2	contains of coal 2.9 1/2 7 band 4 1/2 this seam is ……..said to be all worked out
Cannel coal or Hodge seam	14	1	1	Cannel coal bright and good .8 1/2….
				…….Rather coarse 9!/2
				…….Total workable coal 1.6
				……Band- stone shale 1.3
				…….Coal coarse and not cannel 3’4”
				……..used for workmen 7
				……2.1

Top Busty or stone coal 20 0 10 good coal…….2.0

…… Band 1 1/4

…… good coal 1.11 2.9 1/4

……2.8

Three Quarter Seam 25 0 2 Good coal 1’.6” & 1.5}

…… Band 1}

……Good coal 0.7} 3.9

……..Sagger 1.6

……Coal 0.2

Brockwell 36 0 0 Good coal and 4 ins. Splint at bottom 2.10 3.2

Cannel Upper 8” cannel seam very excellent gas coal 10000 c. ft. of 26 candles other portion of seam not so good –difficult to keep separate and expensive to work.

Busty ¾ etc. All good coking coals but ¾ rather more sulphur than the other two

Brockwell & ¾ --good house coal –Busty makes good manufacturing or gas coal- or bunker coal for short voyages

[ZB-10-131]

Calculations of the quantity of marketable coal –the acreages stated being the net areas of workable coal- after deduction for effect of outcrop and Dyke and for buildings- barrier of 5 yds. Round the out boundary and coal already worked.

Seams Coking coal by experiment gas and manufacturing coal totals

	Acres	tons	Acres	Tons	Acres	Tons
Cannel	--	--	178	320000	178	320000
Top Busty	144	432000	53	158000	197	590000
Bottom Busty	155	527000	53	180000	208	707000
¾ Seam	168	430500	70	168000	238	571000
Brockwell	165	577500	73	254000	238	831500
Total tons		1940000		1080000		3020000

About 20 more cottages for officials etc. at an average of £125 each say £2500

Another boiler 40’ x 5 1/2 (including setting 240

For working the Top Busty – an incline drift & for large output more tubs and plant say 660

A water level drift from point W. on plan to be driven from the Derwent into & in the Brockwell seam to communicate with headings….

[]ZB-10-p132

….from the shaft. The winding engine now draws all the water at a cost of about--£600

150 a yr.

£4000

Permission will have to be obtained from Lessor

Working expenses on rates of date & on 300 tons a day

Labour……..2s.1d

House rents for men in addition to those built or allowance to workmen ….1 3/4

Colliery consumption for workmen 1640 tons

Boilers winding only water running away 900

Furnace etc. ……..260

Brasses etc……1200

4000 @ ¾ = 7500/8000……..2 1/4

Stores and Material……4d}

Horse keep……2d} ……6

Royalty Rent……7 1/2

Rates and taxes damaged ground etc. 1 1/4

Salaries and several charges connected with the production but not sale of coal 1 3/4…….3

……..3 9

Cost of coal into wagons at the screens selling price

…….Average price

Unscreened (with 33% of small taken out……s d

Leaves at pit 4/6 a ton 4/6 x 2/3

The small 3/3……3/3 x 1/3 ……4 1

15% is being sold as screened 6/3 x 60%

& the rough small produced @ 3/9 x 60% ……..4 9

An average price for whole vend of……..4 2 a ton

Leaves a profit 5d a ton

[ZB-10-p133]

The present prices being so low the following calculation is based on a profit of 9d a ton.

80,000 tons a yr. less Coll. Cons. =76,000. A vend of 76,000 tons a year @9d a ton =£2850

It will be reasonable to presume that for the 1st year no profit would be realised & for the second say 6d a ton on 72000 ton =£1800.

Allowing to a purchaser as is usual for this class of investment -14% for interest on capital & risk, with such annual surplus as invested at 4% will reproduce the purchase money-

The value of the Colliery will be

1st year gross profit nil

2nd year " £1800 x.710 yrs. purchase £1278

3rd year following £2850 x 4.86 yrs. purchase 13581 £15129

Deduct requisite outlay ……4000

……£11129

Add value of shorts redeemable £1011.1.5 at May 3rd 1879 calculated to be worth now £817 and value of stock machinery etc. at end of term –excluding houses etc. not recoverable –This at present is £2233 which added to £500 part of further outlay coming under same head = £2733 which 33 years hence may be considered as worth £1094 and discounted at 5% = £219 1,036

Value of coll. If carried out under present arrangements & produce sold in the shape of coal

……£12,165

[ZB-10-p134]

To provide for coking about 70% of the produce would entail beyond the £4000 previously stated.

80 coke ovens, with cutting, branches reservoir etc. complete £4000

Drift near the screen in ¾ Seam to serve the four seams with rising drifts to Top Busty (2 faths.) and into Bottom Busty (3 faths. Further £500 Dip Drift ¾ to Brockwell 350……..850

2 extra houses for coke chargemen……..350

Distintegrator to crush all coking coke except 20% dead small

Engine for do. One cyl. Of winding engine should serve

Elevator & hopper

Engine for ditto the one at furnace pit moving setting and fixing

Screen alternations for crushing……900

Cyl. Of winding engine with drums added £400

Boilers 2 from pit & I new allowed for in 1st estimate –removed & fixed at ovens to be fixed by oven heat including 300……..700

Sundries……200

…….Total £7000 &

Working costs would be reduced ……per ton

Surface drift -Brakesman & banksman saved…….3/4d

Underground haulage instead of horses…….3/4d

Saving of coal by applying oven heat …….1/2d

Pay……..2d

[ZB-10-p135]

Working cost would therefore be 3/9 less 2d = 3s 7d a ton

Coke –including all charges for labour stores rates, damaged ground & a portion of salaries and general charges –with coal at 3/7 & produce 60% could be put into truck for 7/2 a ton.

Coke should sell for 8/6 to 9/- a ton = 1/6 a ton profit but ½ more might reasonably be calculated on say 2/3d a ton-

Disposal of produce	Tons
Coking coal	55000
Manufacturing screens, house etc. Colly. Costs less saved by raising	21,900
Steam by coke oven 4000-900	3100

……80,000 per ann.

Results

In 1st year –I allow for present condition of trade and for execution of works- ovens, houses Drifts etc. and assume no available profit.

2nd year allowing for ovens not being in full working order say –

24000 tons coke @ 1/6}

32,000 2 " " @ /6 } = £2600

3rd & following years

33000 tons coke @ 2/3

21900 " coal @ /9d +/2d/11d = £4716 per annum.

[ZB-10-p136]

Upon these data & allowing the same rates of interest as before—the value would be—

1st year's profit……nil

2nd year £2600 x 0.71 £1846

3rd yrs. Following £4716 x 4.86 2290

Deduct—outlay on cottages etc. £4000

Coke ovens etc……. £7000

……. £11000

The £4000 to be expended quickly 4000

" £700 about a year hence

Deferred value……£6140

……..£10140

……£14626

Add value of shorts……. £817

Plant machinery etc. £2233 with £1500 added… £299……. £1,316

Value of Colliery if worked by day drifts & 70% of produce coked …..£15742

[pages ZB-10-137 to 149 blank]

[ZB-10-p150]

Gas Certificate

17th January 1895

I hereby certify that I have examined the undermentioned samples of coals for Gas etc. and that I find the following results:

Samples marked "No1 South Garesfield" "No2 Bank Foot" "No3 Lintz"

Quantity of Gas per ton in cub. Ft. = No1 10,500 No2 10,500 No3 10,500

Illuminating power in standard candles 16.16 17.30 16.83

Tested by the No1 London Argand Standard Burner

Coke in lbs per ton……..16.03 15.87 15.87

Appearance of coke……..very good very good very good

WW Procter

Figures given by Mr Field—Gas Light Coke Co. January 29th 1895

	Cub ft gas	Candles	lbs sperm
Holmside	10184	15 1/2	548
Walker Lambert Gas	10276	15.3	540
So. Garesfield Dec '93	10139	15.4	

So. Garesfield begins to fall in Sept. 1894

So. Garesfield results gave :-

June 1893 Av.	10577	15.62	566 and 11.1% ash in coke
Jan. 1895 Cargo sp. Kent	9885	111.80	502 16%

ZB-10-151

Coke Certificate Feb 10th 1892

I hereby certify that I have examined the undermentioned sample of coke and that I find the following results:

Sample marked nil, received Feb. 8th '92

Fixed carbon…… 88.14

Volatile hydrocarbon… 0.42

Sulphur……. 1.20

Ash…… 9.82

Moisture……. 0.42

……. 100.00

WW Procter

Messrs. The South Garesfield Colliery Co. Ltd.

Newcastle on Tyne 18th Feb. 1895

Certificate

I do hereby certify that I have examined and analysed the same of coal sent to me on Feb. 4th '95 by J Shiel Esq. Sniperley Hall Durham. The above was marked No1 & I find it to contain:

Volatile hydrocarbon 26.36%

Fixed carbon …… 68.22%

Ash…….5.42%

= 73.64 coke

…….100.00%

This coal contains 58% of Sulphur & 1 ton will produce 8960 cubic feet of illuminating gas

John Bradburn Dodds Public Analyst

[ZB-10-p 152]

Newcastle on Tyne 18th Feb 1895

Certificate

I do hereby certify that I have examined and analysed the same of coal sent to me on Feb 11th 1895 by J Shiel esq.: Sniperley Hall Durham. The above was marked "No. 2" and I find it to contain

Volatile hydrocarbon 24.36%

Fixed carbon …….66.94%

Ash……8.7

……75.64% coke

……100.00%

This coal contains.5% of sulphur and 1 ton will produce 9333 cubic feet of Illuminating Gas

Signed John Bradburn Dodds Public Analyst

Newcastle on Tyne 6th March 1895

Certificates

	Sample No1	Sample No2	Sample No3
Volatile hydrocarbon	26.36%	24.36%	28.46%
Fixed carbon	68.22%	66.94%} 75.64% coke	69.21% 71.54}coke
Ash	5.42%	8.7%	2.33%
Total……	100.00…..	100.00…	100.00
Also contains sulphur	.58%	.5%	.76%
1 ton of coal produced cu.ft.gas	8960	9333	9856
Illuminating power = to standard			
Sperm candles	16.7	16.7	16.7
Produces gas equivalent to	513 lbs sperm	534	564

J Bradburn Dodds

Coake made from Busty or Brockwell at Lintz Colliery

Carbon 91.96

Sulphur .73

Ash 7.07

Volatile hydrocarbon 24

……..100.00

The small coal gives about 3 or 4 % of nuts when riddled (extracted from letter of W Braidford dated 21/3/95)

[ZB-10-p154]

18th Dec 1895

Paisley's Royalty

Coal washed in Craig's Washer

Carbon…..94.144%

Sulphur……..446%

Ash……5.41%

Total……..100.00%

J B Dodds

24 Jan 1895

Coal washed in Wood Burnett's washer

Carbon……93.68%

Ash……5.75%

Sulphur……57%

Total……100.00%

JB Dodds

Coke made from unwashed (No2) coal same day as above (No1)

Carbon……89.38%

Ash……..9.9%

Sulphur… .72%

Total…….100.00%

JB Dodds

Analyses by Messrs Pattinson and Stead

		1896	Feb7*	Feb11#	Feb 18#	Feb20#
South Garesfield	{Sulphur	1.18%	1.30%	1.26%	1.26%	
	{Ash	8.70%	7.75%	9.70%	10.05%	

* 2/3 three quarter seam 1/3 Brockwell seam

¾ seam only

[ZB-10-p155]

Extract from a letter of Mr W Reah of 18/4/96

	So. Garesfield All ¾ Coal	Lintz Main Coal 3 parts Busty
Sulphur	1.08%	1.30%
Ash	9.52%	8.42%

75 The Side Newcastle April 1st 1899

Sample of coal from So. Garesfield on 14th March submitted to distillation in a coal testing apparatus. 7200 cubic feet of gas obtained illuminating power equal to 16.4 standard sperm candles ascertained by burning gas at a rate of 5 cubic feet per hour in a pholometer filled with No1 London Asgard solid burner.

J Pattinson analytical & gas examiner

April 14th 1899

Sample of Lintz Coke recd. 12.4.99

Carbon 89.48%

Sulphur 0.84%

Ash 9.42%

Moisture 0.05%

……..100.00%

(Lintz Mixed Coal) J Pattinson

[ZB-10-p156]

Analysis of 10 wagons of Lintz Coke per the Lowther Hematite Co.

Ash 10.05%

Sulphur 1.92%

Analysis per Lowther Lintz coke Ash 10.49

Moisture 3.68

Sulphur 1.33

1899	Analyst	Ash	Sulphur	Moisture	Carbon	Coal used
Sept	Per Moss Bay Co	11.94	1.55			Lintz
Sept 20	NW Hematite Steel Co	10.26		7.28		Lintz Coke
28	Pattison	11.15	1.10	0.32	87.43	So. Garesfield
Oct 5th	do	9.70	1.88	0.18	88.24	Lintz
"	Cammell & Co		1 1/4%	7%		
23	NW Hematite Co	9.88				Lintz Coke 17 Oct

[ZB-10-p157]

Coke

Analysis of Samples 29th July 1902

	Lintz	S Garesfield
Fixed Carbon	88.57	89.62
Volatile hydrocarbon etc.	0.18	0.12
Sulphur	0.81	0.61
Ash	10.20	9.46
Moisture	0.24	0.19
	100.00	100.00

WW Proctor

No1		No2	
Busty 35%		¾	14%
¾	12	Brockwell	86
Brockwell 53			
	100		100

[ZB-10-158-159 blank]

[ZB-10-p160]

Section of Strata in Anna Pit Lintz Colliery

	Fms	ft	in	Fms	Ft	in	
Timber outset above the surface	.	5	0				
Soil			9				
Yellow gravelly clay		4	6				
Brown gravel		3	0				
Grey sand		1	3				
Loam and gravel	1	3	6				
Brown post	5	4	0				
Grey metal	2	0	0				
Strong grey post	4	2	0	16	0	0	Hutton Seam
Black metal coal	1	0	1				
Grey metal coal		1	9				
Post thill coal		3	0		2	3	Little Hutton
Grey metal	1	5	5	20	5	7	Main coal seam
Fire clay thill coal		3	5				
Blue metal		3	6				
Water grey metal with iron balls	1	1	0				
Water grey metal	8	1	3				
Strong grey post coal	1	0	5				
Black stone			2				
Grey metal stone coal	1		2				
Grey metal	3		9				
Blue Metal	5		6 1/2				
Grey post with metal partings	5		0				
White post with whin balls	4		6				
Black metal with iron girdles	3		9				

White post			3	0			
Black metal			5	0			
Mild blue metal coal (good)			1	0			
Fireclay			1	9			
Black stone coal				2			
Carried forward	45	2	5		36	5	7
[ZB-10-p161]							
Section continued							
Brought forward	45	2	5		36	5	7
Grey post			5	3			
Grey metal			3	0			
Black stone coal				5			
Grey metal coal with post girdles			4	8			
Stone grey post	2	0	8				
Leafy post (dark grey coal)			1	6			
Post shill			3	3			
Strong grey metal (with pool							
Girdles coal)	1	0	1				
Strong post thill			2	2			
Post girdles with metal partings			4	8			
Grey post			5	2			
Brown whin			2	2			
Post with metal partings	1	4	7				
Black stone coal				9			
Strong grey metal	2	3	0				
Post girdle		1	0				
Grey metal		4	6				
Post girdle coal			1	0			
Blue stone band coal			3	0		60	4 5 {Busty Bank Seam}

Fireclay		2	0 {BB seam}			
Coal		2	10 {BB seam}			
Fireclay coal (clean)		1	8 {BB seam}			
Fireclay with large iron balls	1	0	0			
Grey metal		3	6	63	2	5
Busty Seam						
Fireclay with iron balls		4	8			
White post	6	0	0			
Blue metal			8			
White post		2	10	7	2	2
Coal ¾ Seam		2	11			
Carried forward	71	1	6			
[ZB-10-p162]						
Section continued						
Brought forward	71	1	6			
Black shale band			4			
Coal			5			
Fireclay		2	0			
Coal coarse			5			
Fireclay and iron balls		2	0			
White post	6	0	1			
Coal Brockwell Seam						
Good coal		2	4			
Stone band			4 1/2			
Good coal			8			
Post girdle		1	0			
Grey metal iron balls		6	0			
Post		4	0			
	80	3	11 1/2			

[ZB-10-163-167 are blank]

[ZB-10-p168]

The Gas Light & Coke Co. and the South Garesfield Colliery

A SS "Merthyr" loaded Feb.21st 1895

Lintz 373.2

Garesfield 566.1 (of which 9t 10cwt were Bank Foot Busty)

939.3

B SS "Merthyr" loaded Feb. 27th

Lintz 542.0

Garesfield 376.0

918.0

C SS "Vernon" Loaded Feb. 28th

Lintz 558.2

Garesfield 524.18

1083.0

D SS Burshaw loaded March

Lintz 490

Garesfield 433

923

The following are additional tests resulting in further stoppage 14 March 1895

A 25th Feb	"Merthyr"	10.125 feet	14.50 candle	503 lbs sperm	51 coke	13.4% ash
B 2nd Mar	do	10.346	14.99	532	48	19.2%
C 4th Mar	"Vernon"	10.404	14.45	515	49	13.2%
D	"Burshaw"	10.829	13.32	495		

The conditions of our contract viz 10300 ft. gas of 15 1/2 candles mean an equivalent of 547lbs of sperm

E March " Medway" – Lintz 653 S. Garesfield 334.13 Bank foot 115.12 = 1103.5

[ZB-10-169-174 are blank]

[ZB-10-175]

Section of Strata at Aykley Heads Pit, Framwellgate Colliery

	Fms	ft	in	Fms	ft	in
Soil and sand		5	0			
Quicksand			.10			
Gravel and stones		10.	0			
Post		40.0				
Metal and post girdles		1.8				
Post		2	0	9	5	6
Coal (Low Main)		2	2			
Fireclay		6	0			
Metal and post girdles		18	6			
Grey metal		12	3	6	0	9
Coal		1	1			
Fireclay			5			
Coal		1	3			
Fireclay		4	0			
Coal			6			
Blue metal		8	10			
Post		2	0			
Blue metal		19	0	22	3	6
Coal (Hutton Seam)		3	10			
Blue Metal		14	8			
Post	12		0			
Coal			9			
Blue metal	18		0			
Coal			6			
Post	4		0			
Blue metal	4		0			
Post	11		6	32	4	9

Dark grey metal			4	0		
Post				9		
Coal				8 1/3		
Carried forward	35	0		2 1/3		
[ZB-10-p176]						
Brought forward	Fms	ft	in	Fms	ft	in
	35	0	2 1/3			
Post		18	0			
Blue metal		20	5 1/2	40	0	3
Bastard Fireclay		2	7			
Grey post		4	3			
Post		7	1			
Blue metal		7	5 1/2			
Coal			2 1/2			
Blue metal		10	3	46	4	6
Coal		1	8			
Blue metal		11	9			
Grey post		2	6			
Fireclay		2	2			
Grey post		4	3			
Blue metal	9	4				
Grey post	7	8				
Coal	1	0 1/3				
Fireclay	6	8				
White post	13	11				
Fireclay	4	7				
Blue metal	2	0				
Grey post	4	8				
Blue metal and post girdle	3	6		61	3	2 1/2

Coal			1	6			
Dark grey post		29	6		66	2	8½
FmsCoal				1	11½		
Band			1	3			
Coal			2	0			
Bottom coal			1	3½			
Blue metal			15	0	70	0	2½
	70	0	2½		2	4	3½
					67	1	11

[ZB-10-177-179 are blank]

[ZB-10-p180]

		Fms.	Ft.	in.
Five Quarter Seam			2	7
Strata		12		
Main coal seam			3	
Strata (part outcrop	24			
Low Main Seam (varies)			2 to 3	
Strata			6	3
Brass Hill Seam		2	4	
Strata	1			
10” Seam			8”	
Strata	4			
Hutton Seam		2	2 to 3	

There is also a Shield Row on the top of Hindon hill above the Five Quarter inferior quality

W Blackett May 24th 1895

[ZB-10-p 181 is blank]

[ZB-10-p182]

Durham Main Colliery

Section of Strata Sunk through

Particulars	Fms	ft	in	Fms	ft	in
Sand	4					
Blue Clay	10	5	0			
Hutton Seam Good Coal 3.0						
Hutton Seam Bottom Coal . 6	0	3	6	17	5	11
Hanging on below Hutton Seam	1	0	3	19	0	2
Walling no particulars	2	1	6			
Walling do.						
Post	1	3	0			
Walling	0	4	0			
Post	6	3	0			
Walling	7	1	6	37	1	2
Sump	1	0	0	38	1	2
Linking in 1893-						
Hard Grey Metal with iron girdles	1	0	0			
Qty. of dark grey post with wtr. 250 g per hr.	1	0	6			
Soft grey stone	0	0	6			
Coal	0	0	2			
Seggar	0	1	0			
Dark grey post	1	1	0			
Grey metal	0	4	0			
Black Stone	0	0	9			
Coal Harvey Seam	0	1	9	42	4	10
Seggar	0	2	11			
Grey metal	1	1	8			
Very dark grey post with metal partings	0	5	0			
Coal	0	0	2			
Seggar	0	3	0			
Forward	45	5	0	45	5	0

[ZB-10-p183 is blank]

[ZB-10-p184]

Durham Main Section (cont.)

	Fms.	Ft.	In.	Fms.	Ft.	In.
Forward	45	5	0	45	5	0
15. Grey metal	0	3	6			
16. Hard Grey post	0	3	0			
17. Grey Metal	0	5	2			
18. Hard Grey metal with dark girdles	4	5	6			
19. Blue Stone	0	0	4			
20. Coal	0	0	2			
21. Grey Metal	0	1	6			
22. Hard white post 600 gals p h water	1	1	0			
23. Coal	0	0	3			
24. Seggar	0	0	6			
25. Hard Grey metal	0	3	0			
26. White post and metal partings	0	2	0			
27. Dark metal	0	1	0			
28. White post	1	0	0			
29. Black stone	0	0	6			
30. Coal	0	1	2			
31. Seggar	0	1	0			
32. Hard grey metal post girdles	3	5	0			
33. Hard white post	0	3	3 1/2			
34. Grey metal	0	1	1			
35. Coal Busty Seam 1’ 10”						
36. Band	1	1				
37. Coal	0	4				
38. Band	1	1				

39. Coal	1	10	0	6	2	62	5	1 1/2
40. Hard Seggar iron balls			0	4	0			
41. Coal			0	0	8			
42. Hard Seggar			0	1	0			
43. Very hard post girdle			1	1	5	65	0	2 1/2

[ZB-10-p185 is blank]

[ZB-10-p186]

July 20th 1895

Hindson's Analyses

Garesfield Coke

	From unwashed coal	washed coal
Ash	9.21	6.62
Sulphur	1.09	.76

Messrs. Pattinson & Steads's analyses of South Garesfield's Coke (see Mr Cowper's letter of Aug 7th 1895

	No1	No2
Sulphur	1.43	0.8
Ash	9.1	7.20

No P187/ 189

ZB10 p190

Mr. Shiel

Oxford 10/11

Owner's wagons only

Forest Hill 12/-

GN Wagons

[ZB-10- p190]

Upper Lintz Seam

Particulars of outgoings due to David Kirkup

Hugh Munro Seed bills for 1894 £4.15.0

George Hobson do. £1.3.0

Away going crops

Field No 574 sown with barley 12 acres @ 12/- £7.4.0

½ of " 566 " " Oak 11 @12/- £6.12.0

½ of " lying in fallow & potatoes

Say 2 tons of potatoes planted @90/- £9.0.0

" 7 acres ploughed @ 10/- £3.10.0

……£26.6.0

Hay and Straw

6 Loads of wheat straw @30/- per load £9.0.0

10 tons hay @ 4/- per ton £22.10.0

……. £31.10.0

There is about 100 load of manure on the farm when giving the farm up this quantity will have to be left or the deficiency paid for @ 6/- per ton. Hugh Munro's seed bill for 1895 will be about £6.

Summary

Seeds £5.18.0

Crops £26.6.0

Hay & straw £31.10.0

……. £63.14.0

[ZB-10-p200]

Description of land sold to Wm. Braidford snr.

762 7/12 sq. yds. Of freehold land bounded on north by main road from Newcastle to Shotley on south and west by land belonging to vendors & on east by private road belonging vendors £76.5.2

Allowance consequent on your position as an official of the Coy. @ 1/- per sq. yd.} £57.3.0

William Braidford Jnr.

270 2/3 sq. yds. Of freehold land bounded on north by land belonging vendors adjoining main road to Shotley on south and west also by land belonging vendors & on east by other land belonging vendors adjoining private road leading to Lintz as per conveyance indenture dated 1895. }

Joseph Unwin

129 3/4 sq. yds. Of freehold land bounded on north by main road to Shotley, on south and west by land belonging vendors & on east by other land belonging vendors and contracted to be sold to Wm. Braidford senr. } £12.19.6

ENDS