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VARIOUS RGPE
ANNUAL REPORTS

1936 – 1937 Annual Report

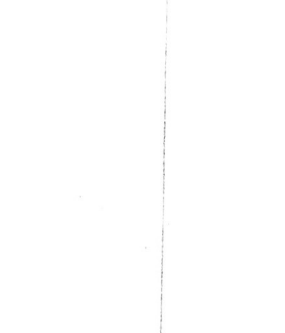
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No. V37416

Supply

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(F.P.)



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No. W32416

Supply

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Annual Report
1936-37

W.O. Etc. NUMBERS

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(211340) Wt. P. 8366/1559-1900-2/36-W. & S. Ltd. (T. 7410).

W.324/16

S.R.G.P.F.

With reference to my minute of 23.4.37, relative to the Annual Report on the Factories, I should be glad if you would kindly say at approximately what date the report is likely to be furnished.

C.S.O.F.'s report is expected early in July, and I would therefore be glad if you could endeavour to arrange for your report to be furnished about the same time.

R. Townsend,

25.6.37.

D.O.F.

D.O.F.

Herewith two copies of my Annual Report for 1936-37.

R.C. Bowden,

Superintendent,
Royal Gunpowder Factory.

29.6.37.

C.S.C.F.
S.R.C.P.F.
S.R.C.P.F.
Supt. Harford
Supt. Irvine
Supt. Nottingham
Supt. Dingley (for information only)

In view of the present pressure of work I should be glad if you would make your annual report for the year ended 31.3.37 as brief as practicable and forward it at the earliest practicable date.

Would you kindly say at approximately what date the report is likely to be furnished.

W. Lawrence

REGISTRY
SALAMONDER FACTORY
WALTHAM ABBEY
Recd. 20 APR. 1937
REG. No. 324/6

25.4.37.

D.O.P.

ANNUAL REPORT
OF THE
SUPERINTENDENT, ROYAL GUNPOWDER FACTORY,
WALTHAM ABBEY
FOR THE YEAR 1936 - 37.

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ANNUAL REPORT

of the

SUPERINTENDENT, ROYAL GUNPOWDER FACTORY,

for the year 1936 - 37.

I. GENERAL SURVEY.

(a) Manufacture.

Owing to emergency orders and to orders on the Mandate programme, the requirements for cordite were increased from the original figure of 885 tons to 1,425 tons. Of this quantity, 1,385 tons were promised and pressed and 1,300 tons were issued.

The output of 1,385 tons from the presses was more than double that of the previous year's production, being an increase of about 725 tons. *le 35-36 660*

In addition to normal manufacture, 11.4 tons of experimental cordite were made.

The following is a general survey of the manufacturing activities of the Factory:-

(1) Acid Sections. The Composition Exploding, Picrite and associated acids were separated from the Nitroglycerine Section from 1st September 1936. Reconstruction has been carried out with the object of increasing the output to 4½ tons of Composition Exploding per week in the first instance.

In the Guncotton Nitric Acid Factory during the closed period in August, 1936, the whole of the framework carrying condensing coils, acid mains and fume mains, was renewed in such a way as to provide greater accessibility.

Sulphuric Acid Concentration. ~~Earthenware vessels have, in the past, been used for Denitration Acid Store Tanks.~~ One concentrator (No. 8) has been rebuilt with a final concentration chamber, 5 feet longer than usual, and with the tower containing two more arches. A special large fan

is on order and it is hoped that when this arrives, a greatly increased output will be obtained. A number of the old Kestner fans have been fitted with ball bearings and found to give improved running.

A 24-hour output trial of a Bowden Tower was carried out, with a view to ascertaining what output might be expected under favourable conditions. Some 20 tons of 95% acid was produced in ^{the} period. Allowing for time taken for clinkering, this represents about 1.1 tons per hour. It is clear that these towers, fired with producer gas, would give considerably better service than the present coke-fired installations. Ball bearing fans running at a good speed and carefully maintained are also essential for the best running.

(11) Gunsotton Section. Visits to manufacturers' works to supervise the preparation of cotton waste have been continued.

The Picking, Teasing and Drying rooms have been rearranged to allow of running all three sets of machines with adequate picking accommodation.

A strip paper cutting machine has been installed for experiments on nitration of straw paper.

No.2 Nitrating House has been equipped for running and stainless steel ventilating fans have been installed.

No.1 Vat House - A non-specification house, has had to be brought into use during the year. Special precautions have been taken to avoid possible contamination. Several vats have been fitted with linings of 12 lb. antimony lead and, so far, none of these has developed any fault.

For Pulping, a 550 lb. beater charge is now the standard practice.

The outstanding item of interest during the year was the completion of the two-ton vortex potcher referred to last year as being under construction. It was taken into

use and has functioned very satisfactorily, and so far no maintenance has been required. The mixing obtained is particularly thorough. Blending tanks of much greater capacity, working on the same principle, are now under consideration.

Service Gunotton. An explosion took place in a primer press on the first day of the present year, and while no definite evidence of the exact cause was forthcoming, a number of further precautions have been introduced, and although, owing to shortage of packages, comparatively little pressing has taken place, there has been no further cause for anxiety. A new design of hydraulic control valve has been installed on a primer press but so far there has been no opportunity for trial under service conditions.

(iii) Nitroglycerine Section.

Chemists Grade II, have been trained so that chemical supervision during the whole three shifts of manufacture can now be made available. This is a most important factor in connection with safety and increased output.

The building and equipment of the Quinan Stove has now been completed in readiness for the commencement of manufacture.

The yield of Nitroglycerine has gradually increased during the last few years, owing mainly to the reduced consumption of water in washing the plant in proportion to the increasing output; the average yield for the year was 234.85%.

(iv) Cordite.

Of the total output, 55% was pressed on Small Screw Presses and 65% on the Hydraulics.

There were three accidents at the incorporating houses, two in which the safety catch and bracket were damaged, and one which resulted in serious injury to a man's arm, due to

a machine being emptied without the safety catch being properly on.

M.D. Cordite. The manufacture of M.D.T. 5 - 2 has been increased from 5 to 8 tons per week by the end of the year.

W. Cordite. Manufacture proceeded normally.

The reworking of W. Cordite has been entirely satisfactory and three lots of rework were issued during the year, pressed into size .059, a ballistic size corresponding to .057 manufactured from paste. The lots, a total of 22.9 tons, were accepted.

Mark I Cordite. Some difficulty was experienced during the year with composition. Current manufacture had to be watched very carefully and an adjustment to the Nitroglycerine content of the paste had to be made to ensure the composition of the resulting cordite being within specification.

(v) Picrite and R.D.N./A.

The manufacture of Picrite has been carried out on three shifts throughout the year. Two stoves for drying Product "D" and Ammonium Nitrate have been constructed and a fresh lining put in the Nitrator, and the ebonite lined basket of the centrifuge in the Nitrating House has been renewed. A new mill ("The Rema") of the pinned disc type has been taken into use for Picrite grinding. A platform for the evaporators used for the concentration of Picrite waste acid has been put up to allow reconstruction of Composition Exploding coppers.

A large proportion of the output of R.D.N./A Cordite was on size .029, a very small size and rather difficult to handle, but output was otherwise normal.

About 6 tons of R.D.H./A Cordite was manufactured, and no appreciable difference from R.D.N./A was noticed from the manufacturing viewpoint.

The total output of R.D.N./A and R.D.H./A. cordites during

the year was about 57 tons.

(vi) Tetryl.

No.5 Nitrating House has been completely reconditioned and a lead sulphonator and nitrator with air agitation and a lead filter installed. No.4 Nitrator House has been completely rebuilt with non-inflammable material. The nitric acid charge house has been reconditioned and taken into operation. Experiments on vat stirring during boiling have been made on a semi-large scale and it is now proposed to go forward to full scale operations. Several derelict Composition Exploding buildings have been demolished for complete rebuilding.

Detetrylation. Four waste acid settling pots and filters have been taken into use, and a centrifugal pump installed to pump the clear acid to the detetrylating plant. A new lead lined waste acid store tank has been constructed. Two pairs of Composition Exploding coppers have been demolished and completely rebuilt with new foundations and roof. Two absorption towers and pipe runs have been put up to absorb the sulphuric fumes from the coppers.

Purification has been carried on on three shifts during the year. Preparation has been made for increasing the output of the acetone purification house to 5 tons per week.

Buildings. The Clearing House (No. 95.C and D), has been converted into a Drying Stove by the addition of a fan and air heater.

Composition Exploding Stores 1 and 2, have been reconditioned. Building No.107 has been completely reconditioned and taken over as a Package House.

(vii) R.D. Composition No.202.

Output of this material has been considerably greater than in previous years but not so high as it might have been if packages for extracts had been available.

- 6 -

It has been definitely shown that different materials are required to meet the Army and the Navy Specifications and it is also understood that modifications are being made to the Army Specification which will remove the anomalies shown to exist between rest and gun proofs but which require a material differing more widely than ever from that required by the Naval Specification.

(viii) Gunpowder.

Apart from the production of charcoal both for Gunpowder and R.D. 202, the work of the section has been entirely on the manufacture of Millcake.

32,100 lb. Millcake has been produced for S.R. 227

840 lb. Millcake has been produced for S.R. 304

900 lb. of charcoal has been burnt for R.D. 202

Owing to the increased activity of the Cordite section, the charcoal burning plant was removed from the C.M.J. House to the Cylinder House, and now both the Rotary Carbonising plant and the old method of burning in cylinders are housed in the same building.

Charcoal grinding is now being carried out in a disintegrator instead of a Gunpowder Mill.

The mechanical sieving of the charcoal will, in the near future, replace the present hand sieving.

A Blending Drum has been installed, capable of dealing with 200 lb. of charcoal at one time.

Four Gunpowder mills are now in working order and an output of 2,400 lb. can be attained.

The old mills (Nos. 2 and 3) and a Blending House have been demolished during the year.

(ix) Main Laboratory.

The activity, due to expansion of output in the factory, has increased very considerably during the year and the number of routine samples analysed has increased from 12,000 last

year to 17,000 this year.

A considerable amount of experimental and research work has been carried out during the year and a summary is given in Appendix I.

(x) Continuous Inspection of Cordite during manufacture has been carried out by C.I.A. Additional accommodation has been provided both for the inspection and for Shifting and Dining for the examiners.

(xi) Danger Building Inspectorate. The work of the Inspectorate continues to give valuable assistance in maintaining a high order of Danger Building practice, especially at a time when so many new employees are being engaged.

(b) Services.

(i) Machinery. During the year an additional wooden building was built on to the machinery shop to form a store, the space previously occupied being utilised to instal a new lathe to enable work on the Hydraulic Press cylinders of No.5 Press House to be completed to the modified design, and also to provide room for additional sheet metal work and soldering work on Cordite press sieves.

A particularly interesting piece of work carried out was the rebuilding of the Guncotton Primer Press, after the accident in which it was smashed, to the increased degree of accuracy recommended as the result of the enquiry into the accident. The result of this was highly satisfactory in view of the lack of really suitable machinery and reflects great credit on the shop staff. The second press is now being dealt with in the same way and is nearing completion.

(ii) Property. The returns from property attached to the Factory for the last five years are as follows:-

<u>1932</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>
£1524	£1434	£1241	£1145	£1155

The amount expended on maintenance of domestic property during the year was £295.

The demolition of Nos. 60 to 68 Highbridge Street, due to their condemnation, has been carried out and the vacant lands leased to the Territorial Association.

Owing to demands of Production sections, essential features only have been carried out in Maintenance. The external painting of quarters has just been completed.

(iii) Estate. The cutting and clearing of undergrowth and removal of dangerous trees has been carried out to programme. The gang (38 in number) has been divided into 3 sections with a ganger in charge of each section.

Mowing continues throughout the Factory as required.

(iv) Rivers and Cuttings. Weed cutting and clearing of the Small River Lea was carried out by the Lea Conservancy Catchment Board on repayment. The Factory cuts were cut and cleared by the factory weed-cutting launch.

The dredging of shoals was carried out at Nitroglycerine Quinan Stove Cut, No.5 Boiler House and entrances from Mill Head, Cobbins Brook, New Cut, Black Ditch and opposite Main Office.

The maximum monthly average flow of water was 23,991 c.ft. per minute (in January 1936) and the minimum was 2,757 c.ft. per minute (in September 1936). The daily averages over the last five years are:-

<u>1932</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>
8675	2768	2405	4976	9276

(v) Metropolitan Water Board. The cost of water supplied by the Metropolitan Water Board during the last five years was:-

<u>1932</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>
£182	£199	£192	£289	£381

(vi) Hospital. Reconditioning of rooms, providing X-ray room, Doctor's Office and waiting hall, have been completed.

(vii) Cycle Racks. New cycle racks have been provided at Nitroglycerine Section, Main Gate and Guncotton Gate to accommodate an additional 240 cycles.

(viii) Fire Brigade. During the year inspections have been made of all fire appliances and equipment and they were found to be in good working condition.

Five fire calls were received during the year, viz:-

No.5 Guncotton Press House (explosion).

Bldg. No.37K C.E. Nitrating House (fire) extinguished
1 Hydrant.

Bldg. No.37C " " " " "

Wood-wool Dump, Quinton Hill " "

Long walk fire-alarm, false alarm, electrical defect.

The fires were extinguished without difficulty.

The London County Council's bi-annual inspection of fire appliances and fire prevention of the Factory took place on the 9th June 1936. Tests of various fire appliances were carried out in the Inspector's presence with satisfactory results. His recommendation that a 30 gallon foamite fire extinguisher be added to the fire appliances in connection with the electricity transformer plant, Power House Lower Works, has been complied with.

All fire hose (256 lengths) has been tested. 20 lengths were condemned and renewed.

84 fire hydrants were tested and inspected half yearly. One hydrant was condemned and renewed.

20 fire alarms were tested twice weekly and generally found in good working order.

Petrol fire pumps have been subjected to pumping tests and found in a satisfactory condition.

Water mains appear to be in good condition. No serious trouble has been experienced during the year.

Factory fire squads have been increased, making a total of 18 fire squads - one squad allocated to each working shift.

Generally, throughout the factory, fire rules and precautions are well observed.

An agreement was concluded providing for the co-operation of the Enfield Fire Brigade with the Factory organisation in the event of an outbreak of fire.

II. TOTAL PRODUCTIONS.

A. GUNCOTTON SECTION.

Nitric Acid:-

Soda Nitrate Charges	517 at 2 tons		
	= 1034 tons.		
Soda Nitrate Charged (Crude)	1158.08 s.tons.		
Soda Nitrate Charged (Pure)	1152.89 "		
Equivalent HNO_3	854.56 "		
Nitric Acid Produced	929.40 "	@ 89.75%	
	= 834.25 "	HNO_3	
Loss	20.11		
Efficiency	97.65%		
Strong Sulphuric Acid used	1137.00 "	@ 94.30%	
	= 1071.68 "	H_2SO_4	

Redistillation:-

Acid charged to stills	5482.25 "	-containing	
	5360.45 "	H_2SO_4	
	976.83 "	HNO_3	
Strong Nitric Recovered	1066.60 "	@ 89.82%	
	= 957.61 "	HNO_3	
Loss	18.72		
Efficiency	98.10%		
Weak Sulphuric Acid Recovered	4211.80 "	@ 78.67%	
	= 3314.65 "	H_2SO_4	
Loss	45.80 "	"	
Efficiency	98.60%		

Concentration of Weak Sulphuric Acid:-

Acid Charged to Concentrator	3872.88 "	@ 79.04%	
	= 3060.94 "	H_2SO_4	
Strong Sulphuric Acid Recovered	3198.08 "	@ 93.98%	
	= 3005.74 "	H_2SO_4	
Loss	55.20 "		
Efficiency	98.50%		

Nitration of Guncotton:-

No. of Sets of Guncotton	10,043	
No. of Sets of Nitrocotton.	<u>132</u>	
	<u>10,175</u>	

Mixed Acid Used	17,421.20 s.tons	
Cotton Waste used	630.103 "	gross
	= 564.712 "	nett
Guncotton Produced	940.12 "	
Save-all	18.19 "	
Yield	166.5%	
Available for Cordite	163.3%	
Ratio - Mixed Acid/Cotton Waste	30.86 : 1	
Mixed Acid/Guncotton	18.55 : 1	

Guncotton, etc. issued to services (other than for Cordite manufacture.

1 lb. Slabs to Bramley & Woolwich	20,897
1 lb. Charges to Bramley & Woolwich	9,600
1 oz. Primers to Altrincham & Bramley	33,807
Nitrocotton Pulp to C.S.R.D.	170 lb.
Guncotton Pulp to C.S.R.D.	100 lb.
Guncotton Pulp to Messrs Vickers Armstrong Ltd.	19 lb.
Unstabilised Guncotton to C.S.R.D.	276 lb.
Total - 33,175 lb. = 16.5875 s.tons.	

Materials.

	T.	c.	lb.	
Oleum drawn from store	1550	4	52	= 1736.25 s.tons
Increase in stock				378.10 "
Oleum consumed				1358.15 "

= 1.445 per lb. of Guncotton.

Nitrate of Soda drawn from Store.	1034	0	0	= 1158.08 "
Increase in stock				144.58 "
Nitrate of Soda consumed				1013.50 "

= 1.078 per lb. of Guncotton.

Cotton Waste Drawn from Store.	562	11	94	= 630.103 "
Deduct Oil and Moisture (.21% & H ₂ O 7.17%)				47.490 "
Deduct pickings and fly				17.901 "
Nett Cotton Waste Used for Nitration				564.712 "

Foreign matter removed in Picking etc:-

Wood, String and Metal	1,064 lb.	= .0844%
Grit	484 lb.	= .0384 %
Fly	34,253.5 lb.	= 2.7180%

Cotton used per lb. of Guncotton:-

0.6703 Gross
0.6007 Nett

Summary of Consumption and Losses.

	H ₂ SO ₄		HNO ₃	
	Actual	Per ton of G/C.	Actual	Per ton of G/C.
Manufacture of Nitric Acid	1071.68	1.1400	20.11	.0214
Redistillation	45.80	.0487	18.72	.0199
Concentration	55.20	.0587	-	-

Summary of Consumption and Losses. (Contd.)

	<u>H₂SO₄</u>		<u>HNO₃</u>	
	<u>Actual</u>	<u>Per ton of G/C.</u>	<u>Actual</u>	<u>Per ton of G/C.</u>
Nitration	226.46	.2410	699.17	.7440
Washing out Tanks, etc.	26.36	.0280	9.76	.0104

B. NITROGLYCERINE SECTION.

(a) Manufacture of Nitric Acid.

Charges in retorts:-

150 at 1½ long tons each; average time of distillation 11 hours.
 176 at 2 long tons each; average time of distillation 15½ hours.

Materials and Results:-

Nitrate of Soda used	646.240 s.tons at 99.53%	
C.O.V. used	526.545 s.tons at 90.47%	NaNO ₃
Oleum used.	150,000 s.tons at 20% free SO ₃	H ₂ SO ₄
Coke used.	88.51 s.tons	
Strong Nitric Acid made	428.153 s.tons at 91.25%	HNO ₃
Weak Nitric Acid made	113.799 s.tons at 58.29%	HNO ₃
Nitre Cake produced	775 s.tons	
Efficiency of Strong Nitric Acid	82.0%	
Total Efficiency	95.9%	

(b) Denitration of Waste Acid.

238 Charges of waste acid were denitrated.

Output:-

Waste Acid denitrated	732.750 s.tons	{ 527.144 s.tons H ₂ SO ₄ 82.720 s.tons HNO ₃
-----------------------	----------------	---

Denitrated Sulphuric Acid made	736.025 s.tons at 71.7%	H ₂ SO ₄
Weak Nitric Acid made	127.539 " " 55.8%	HNO ₃

Efficiency:-

Sulphuric Acid	100%
Nitric Acid	86.0%

(c) Concentration of Sulphuric Acid.

Concentrators No.1, 2 and 3 were used.

Output:-

Weak acid concentrated	1410.643 s.tons at 70.6% H ₂ SO ₄
Coke used	121.9 s.tons
Strong acid made	892.028 s.tons at 91.9% H ₂ SO ₄
Weak acid made	257.363 s.tons at 56.8% H ₂ SO ₄
Efficiency strong acid	82.6%
Total efficiency	97.26%

(d) Redistillation of Weak Nitric Acid.

95 redistillations were carried out; the average time of distillation was 14 hours.

Results:

Weak nitric acid used	229.675 s.tons at 56.8% HNO ₃
Strong sulphuric acid used	347.800 " " 93.9% H ₂ SO ₄
Coke used	76.4 "
Strong nitric acid made	103.320 " " 89.5% HNO ₃
Weak nitric acid made	57.724 " " 56.8% HNO ₃
Weak sulphuric acid made	426.982 " " 76.1% H ₂ SO ₄
Efficiency strong nitric acid	70.9%
Total nitric acid efficiency	95.78%
Sulphuric acid efficiency	0.52%

(e) Acid Mixing.

Output.

Nitric Acid, new, mixed	427.298 s.tons at 91.3% HNO ₃
Nitric Acid, redistilled, mixed.	107.320 s.tons at 89.5% HNO ₃
Oleum, 20%, mixed.	267.750 " " 20% free SO ₃
Oleum, 65%, mixed.	249.750 " " 65% free SO ₃
Total mixed acid made	1052.118 "

(f) Manufacture of Nitroglycerine.

242 Charges of 1,470 lb. glycerine each were nitrated. Average time of nitration was 75 minutes, and of separation 143 minutes. The average brine temperature was - 12½°C.

Output:-

Glycerine used	177.870 s.tons nett.
Mixed acid used	998.250 "
Soda ash used	23.520 "
Waste acid made	738.100 "
Nitroglycerine made	418.213 "
Nitroglycerine yield	234.85%

Summary of Tests.

	Max:	Min:	Average.
Moisture	0.69%	0.11%	0.30%
Heat test	23 mm.	10 mm.	14 mm.
Alkalinity	0.001 <	0.0005 <	0.0005

Nitroglycerine Usage.

For Cordite M.D.	89.763 s.tons
" " W.	311.852 "
" " Mk.I.	2.895 "
" " R.D.N./A.	11.876 "
" " R.D.H./A.	1.174 "
" Dynamite	0.423 "
" Sundry experiments	0.233 "

Summary of Consumption and Losses of Acids.

	<u>H₂SO₄.</u>		<u>HNO₃.</u>	
	<u>Actual</u> <u>s.tons.</u>	<u>Per ton</u> <u>N.G.</u>	<u>Actual</u> <u>s.tons.</u>	<u>Per ton</u> <u>N.G.</u>
Manufacture of Nitric Acid	635.40	1.519	15.75	0.033
Denitration	-	-	25.46	0.061
Redistillation	1.70	0.004	19.70	0.047
Concentration	29.42	0.070	-	-
Acid Mixing	18.21	0.044	58.71	0.093
Nitration	15.59	0.037	360.82	0.862
	700.12	1.674	458.44	1.096

Raw Materials used (s.tons per ton of Nitroglycerine).

Nitrate of Soda	1.550
Oleum, 20%	0.948
Oleum, 65%	0.595
Glycerine	0.4253
Soda Ash	0.0562

(g) Drying and Weighing Guncotton and Nitrocotton.

Stoves 1 to 11, 13 and 14 were used and G/C Weighing Houses No. 1 and 2.

350 Stovings of guncotton and 6 stovings of nitrocotton were carried out; the average time of drying for the guncotton being 66 hours.

Output:-

Guncotton	875.0 s.tons.
Nitrocotton	12.2 s.tons.

Usage:-

Guncotton for Paste, M.D.	187.742 s.tons
Guncotton for Paste, W.	673.795 s.tons
Guncotton for Paste, Mk.I.	1.815 s.tons
Nitrocotton for Paste, RDN/A	9.360 s.tons
Nitrocotton for Paste, RDN/A	1.584 s.tons
Nitrocotton for Issue C.S.R.D.	0.050 s.tons

(h) Paste Mixed.

Output:-

M.D.	277.504 s.tons
W.	985.646 "
Mk.I	4.708 "
RDN/A	51.953 "
Experiments	6.282 "
Dynamite	0.700 "

C. CORDITE SECTION.

(a) Raw Materials Used.

	<u>W.</u>	<u>M.D.</u>	<u>RDN/A.</u>	<u>Mk.I.</u>	<u>RDN/A</u>	<u>RDN/B.</u>	<u>M.D.C.</u>	<u>Total.</u>
Acetone	671,120	214,982	20,468	2,079	2,183	50	3,600	914,482
Min.Jelly	-	30,110	-	499	-	-	-	30,609
Carbamite	123,899	-	8,646	-	386	27	200	133,158
Paste	1,955,378	553,299	105,949 $\frac{8}{16}$	9,405	12,232 $\frac{8}{16}$	332 $\frac{1}{16}$	10,286 $\frac{1}{16}$	2,646,882 $\frac{2}{16}$
Rework	65,751 $\frac{6}{16}$	-	-	175	3,550	-	-	69,476 $\frac{6}{16}$
	2,816,148 $\frac{6}{16}$	798,391	135,063 $\frac{8}{16}$	12,158	18,551 $\frac{8}{16}$	409 $\frac{1}{16}$	14,086 $\frac{1}{16}$	3,794,607 $\frac{8}{16}$

Acetone 914,482

Total Incorporated material (not including acetone).

2,880,125 $\frac{8}{16}$

(b) Raw Material Reference Numbers.

Nitroglycerine	Charge Nos.	854 - 1000	VI - 99
Gun cotton	Batches	2101 - 2990	
Nitrocotton	Batches	33 - 45	
Picrite	Batches	541 - 815	
Acetone	Consignment Nos.	2431 - 2437	
Mineral Jelly	"	192 - 195	
Carbamite	"	23 - 36	

(c) Material Incorporated.

W. - Dough	2,079,377
Rework	65,751 $\frac{6}{16}$
	583,409
M.D. - Dough	114,595 $\frac{8}{16}$
RDN/A - Dough	9,904
Mark I - Dough	175
Rework	12,618 $\frac{8}{16}$
RDN/A - Dough	3,550
Rework	359 $\frac{1}{16}$
RDN/B - Dough	10,486 $\frac{1}{16}$
M.D.C. - Dough	2,880,125 $\frac{8}{16}$

(d) Cordite Pressed.

(i) Small Screw Presses.

	lb.	lb.	lb.
Small Arms - M.D.T. 5 - 2	556,775		
7 - 2	<u>8,550</u>		
		565,125	
Mark I 1/.05	2,985		
5	100		
20 S.C.	<u>6,288</u>		
		<u>9,573</u>	
			574,498
Cannon - RDN/A .029	69,490		
.034	5,430		
.040 & .042	12,885		
.052	<u>15,866$\frac{1}{2}$</u>		
		101,641 $\frac{1}{2}$	
RDH/A .025	9,289		
.045	<u>2,225</u>		
		<u>11,514</u>	
		<u>113,155$\frac{1}{2}$</u>	
W. .046	85		
.040	149,700		
.016	110,860		
15 - 13	15,500		
14 - 4	<u>6,150</u>		
		<u>282,095</u>	
			<u>595,250$\frac{1}{2}$</u>
			<u>969,748$\frac{1}{2}$</u>

Experimental, etc. -

RDH/A	350		
RDH/A	1,453 $\frac{1}{2}$		
RDH/B	268		
M.D. & M.D.T. Various	346		
Mk. I Flake	23		
W. & W.T. Various	<u>635</u>		
		<u>3,077$\frac{1}{2}$</u>	
			972,826

(ii) Hydraulic Presses.

Cannon - W. .057	1,586,030		
.093	79,780		
.112	298,360		
W.T. 14 - 4	<u>38,500</u>		
		1,802,610	
Experimental -			
W.T. 206-100	626		
W. .112	200		
.124	3,955		
.155	150		
.145	1,480		
.220	<u>5,500</u>		
	9,911		
M.D.C. .057	<u>9,774</u>		
		<u>19,685</u>	
			<u>1,822,295</u>
			2,795,121

(111) Summary.

	lb.	lb.	lb.
Small Screw Presses	969,748½		
Hydraulic Presses	<u>1,802,610</u>		
			2,772,358½
Experimental	<u>22,762½</u>		
			2,795,121

(e) Cordite issued (to Inspection).

Small Arms - M.D.T. 5-2	534,865		
7-2	<u>5,000</u>		
		539,865	
Mark I 1/.05	2,760		
5	100		
20 S.C.	<u>2,921</u>		
		5,781	
			545,646
Cannon - RDN/A .029	63,000		
.034	9,170		
.040 & .042	14,016		
.052	<u>14,615</u>		
		100,801	
RDN/A .023	9,289		
.045	<u>2,225</u>		
		11,514	
			112,315
W. 15 - 13	12,500		
14 - 4	31,090		
.016	82,340		
.040	128,525		
.046	85		
.057	1,306,684		
.093	79,720		
.112	<u>298,560</u>		
		1,939,304	
			2,051,619

Experimental etc.-

W. 15 - 13	100		
14 - 14	505		
206 - 100	626		
.016	30		
.112	200		
.124	3,955		
.135	150		
.145	300		
.220	<u>3,500</u>		
		9,366	
RDN/A .023 & .045	350		
RDN/A .029, .040	1,453½		
& .052	<u>268</u>		
RDN/B			
M.D.T. 6-2, 7-2 & 8-2.	200	2,071½	
M.D. .037	146		
M.D.C. .057	<u>2,774 (Re-issue)</u>		
		10,120	
Mk. I Flake		<u>25</u>	
			21,589½
			<u>2,618,647½</u>

(f) Percentage loss, etc.

	<u>V.</u>	<u>M.D.</u>	<u>EDN/A</u>	<u>Mk. I.</u>
Paste Used	1,955,378	553,299	105,949½	9,405
M/J or Carb: added	123,899	30,110	8,646	499
Stock Rework 31.3.36. (Lot W.A.C.17)	24,300 18,498½ 16	-	3,100	10
	<u>2,121,975½</u>	<u>583,409</u>	<u>117,695½</u>	<u>9,914</u>
Cordite Produced	2,095,351	565,471	105,095	9,398
Stock Rework 31.3.37.	20,200	1,000	10,450	450
	<u>2,115,451</u>	<u>566,471</u>	<u>115,545</u>	<u>9,848</u>
Loss	6,524½	16,938	4,150½	66
Loss % (calc. on Incorp.)	0.30%	2.90%	3.62%	0.66%
Acetone Used % (Calc. on Incorp.)	31.29%	36.85%	17.86%	20.63%
M/J or Carb. used (Calc. on Dough)	5.96%	5.11%	7.53%	5.04%

D. Manufacture of Tetryl.

(a) Manufacture of Nitric Acid.

No.17 Retort - 144 runs at 1½ long tons NaNO₃.

No.18 Retort - 139 runs at 1½ long tons NaNO₃.

No.19 Retort - 4 runs at 1½ long tons NaNO₃.

Average time of distillation 11½ hours.

Output:-

Nitrate of Soda used 482.16 s.tons at 99.65%

Oleum used (20% SO₃) 103.5 s.tons at 99.65%

Oleum used (65% SO₃) 9.0 s.tons at 99.65%

transferred from T.N.T.

C.O.V. received from waste acid also used.

Strong Nitric acid made 301.3 s.tons.

Strong Nitric acid issued to C.E. Nitration 301.2 s.tons.

(b) Nitration of C.E.

116 Nitrations at 96 lb. dimethylaniline each were carried out in Nitrating House No.4.

635 Nitrations at 96 lb. dimethylaniline each were carried out in Nitrating House No.5.

2 charges were destroyed by fire.

Tar oil used 35.644 s.tons.

Nitric Acid used 301.2 s.tons at 89.11%

C.O.V. used 564.75 s.tons at 96%

Waste acid issued to coppers and then to nitric acid manufacture.

Crude C.E. made 56.555 s.tons (as purified C.E.)

(c) Purification and finishing of C.E.

Crude C.E. purified	56.813 s.tons (as purified C.E.)
Acetone used	62.17 s.tons
Caustic Soda	1.425 s.tons
Gum arabic	0.420 s.tons

Finished C.E. issued:-

Ground	3.724 s.tons
Crystal	15,299 s.tons
Corned	36.592 s.tons

E. Manufacture of Picrite.

Calcium cyanamide used	125.216 s.tons
Ammonium nitrate used	43.683 s.tons
C.O.V. 98% H_2SO_4 used	103.125 s.tons

Finished Picrite made 35.389 s.tons
(Recovered sulphuric acid issued to contractors).

Picrite was used and issued as follows:-

To C.S.R.D., Woolwich	0.297 s.tons
" R.N.C.F., Holton Heath	0.285 s.tons
" RDN/A., Paste Mixing	31.459 s.tons
" RDN/B., Paste Mixing	0.099 s.tons
" RDN/A., Paste Mixing	2.854 s.tons

F. Manufacture of Fuse Powder R.D. Composition No.202.

Manufactured	1,932 lb.
Ammonium Perchlorate, Crude	2,240 lb.
" " Refined	1,475 lb.

III. MAIN PRODUCTIONS.

Summary.

	<u>Tons.</u>
Cordite W.	1042.55
" M.D.	282.56
" RDN/A & RDN/A	56.58
" Mk.I	4.68
" Experimental	11.58
	<hr/>
	1397.55
Composition R.D. 202	.966

Tetryl - Nitrated & Purified 56.515 tons

Ground	3.784	"
Crystal	15.899	"
Corned	36.592	"
	<hr/>	
Pierite	55.589	"
Milleake	16.5	"

IV. NEW METHODS.

- (a) The installation of the 2-ton Vortex Potcher described in the General Survey.
- (b) Nitration of Tetryl in an air agitated lead nitrator.
- (c) Quinan Stove for drying Gun cotton.

V. URGENT ORDERS & THE MANDATE PROGRAMME.

During the year 415 tons of Cordite were issued on the above.

VI. EXPERIMENTAL ORDERS.

A considerable amount of experimental work has been carried out.

11.4 tons of experimental cordite was pressed during the year, about 10 tons of this being on hydraulic presses.

10,080 lb. of old M.D. cordite was incorporated with 3% carbamite. No difficulty was experienced during manufacture and 9,875 lb. of size .057/22" was issued, but was returned for re-blending. After re-blending, 9,774 lb. was re-issued and accepted.

VII. SERVICES.

(1) Machinery and Plant.

During the year the loads on all services have considerably increased, and at times, it has been necessary to have four boiler houses under steam, while the maximum

demand on the Rotary Converters at the Guncotton Factory has risen to the maximum capacity of the two machines at present installed and the transfer of the third machine from R.S.A.F. must be carried out before next winter.

As the result of tendering for the replacement of the tubes and repair of the condenser of one refrigerator at Edmondsey, it was decided that a new type of condenser should be installed, since this was not only cheaper, but offered considerable mechanical advantages. Installation of the new condenser is now nearing completion.

The erection of the new weak acid tank with stirring gear at the Guncotton Factory has been completed.

The Quinan Plant was delivered and erected during the year, though unfortunate delays occurred, due, in the main, to difficulties experienced by the contractor in meeting specification conditions; it is now believed that these have been overcome and the plant will soon be put into regular service.

A second lorry for carrying Guncotton has been ordered from Vauxhall Motors, a repeat of the previous order, and delivery is expected early next year.

Towards the end of the year, it became particularly noticeable that delivery dates for machinery were getting very long, and that delivery dates quoted were not at all reliable. As the result of this, the new refrigerator for Picrite and the new Hydraulic Pump for the Guncotton Section, mentioned in last year's report, have not yet been delivered, though the latter is now overdue.

(11) Boiler Houses. Considerable progress has been made during the year on reconditioning Nos. 1 and 9 Boiler Houses and these are nearly ready for steaming. At No. 7 Boiler House, the nine boilers have been completed and four of them lagged and the house is now in regular use for

supplying steam to the Vat House.

No.3 Boiler House has been in use throughout the year. During the year it has been necessary to replace more tubes in the Babcock & Willcox Boilers owing to bulging, and it has been decided to instal a continuous blow-down system in Nos.5 and 6 Boiler Houses during 1937/8 to overcome this trouble.

The question of the supply of steam coal for Lancashire Boilers has been prominent during the year, considerable difficulties having been experienced during the latter part in getting sufficient supplies for No.3 Boiler House off the Woolwich contract. This trouble was in common with R.S.A.F. At No.7 Boiler House, it was found possible to arrange a favourable contract for deliveries by road, thus saving the necessity for the provision of means of unloading from barges.

The amount and cost of Steam produced as compared with the previous two years is as follows:-

	lb.	Cost per 1000 lb.
1934 - 35	130,312,000	34.61d.
1935 - 36	149,292,000	39.46d.
1936 - 37	223,614,000	* 44.12d.

(111) Steam Mains. Several contracts for lagging steam mains were arranged and carried out as fresh plant was required to be used for increased output. Owing to the large increase in steam required for Vat Boiling it became necessary to consider the installation of a larger main to replace the 4" main from No.7 Boiler House to the Vat House, this main having been erected after the war to replace a large main for the sake of steam economy. An order for a 12" main has now been placed and erection will shortly be started.

^H Due to increase in cost of coal (see Appendix V), also to commissioning non-mechanically stoked boilers.

(iv) Electricity. The electrical load has increased considerably, both at Guncotton and Upper Works Power Houses. The overhaul of the Bellis & Morcom sets was completed early in the year and these sets were run regularly during the winter months during the "peak" hours when energy was not available from the Rotary Converters. All generator plant has given satisfactory service.

The consumption and cost of Electricity produced as compared with the previous two years is as follows:-

	<u>Units.</u>	<u>Cost per Unit.</u>
1934 - 35	526,280	3.30 d.
1935 - 36	" 952,699	2.08 d.
1936 - 37	" 1,764,300	1.77 d.

" Includes power supplied by the North Metropolitan Electric Power Supply Co.

VIII. MAINTENANCE.

The general programme of arrears of maintenance has again provided a large amount of Machinery and Building Works Department work and the progress made has been satisfactory, the bulk of the work being now completed and the arrears overtaken.

Boats. Four new boats are now under construction for Cordite Section. Delivery of the first boat off the contract is expected during week-ending 10th April.

One new open boat for Nitroglycerine Section is under construction and delivery expected in June.

Two new open boats for Stores Section are under construction and delivery expected in July.

Two new Quinan Stove Boats have been supplied during the past year, as well as one N.G. Paste Boat, two Cordite Paste Boats, and two B.W.D. open boats.

Extensive repairs have been carried out to Cordite Tray boats and all N.G. and C.E. Boats.

Tram Lines. Renewal of defective metals has been carried out in both the Upper and Lower Works, including the fixing of points and turntables.

Wharfs and Waling. Renewal of Wharfing in concrete piling outside No.6 Guncotton Stove, and on West bank opposite Plumbers Shop, has been carried out satisfactorily.

The walings in Nitroglycerine area have been renewed to the extent of 25%.

At Lower Works the Tray Stove cuts and Black Ditch walings have been 50% renewed.

Paths and Roads. Throughout Upper and Lower Works re-surfacing of paths and roadways has been in progress during the past year. About 75% of the work scheduled has been completed.

Cordite Buildings. Reconditioning, lining with Insulwood and complete renovation ready for Manufacture, has been carried out in Incorporating Houses Nos. 1, 2, 4 and 5, also Press Houses 5 and 6.

The roofs of Land Stoves Nos. 593, 594, 600, 601, 602 and 603 have been renewed, internal painting completed and the erection well in hand. Five other stoves are now in process of completion.

Dining and Shifting Room (Building No. 521A) has been reconditioned and brought into use.

Building No. 515 has been converted, overhauled and conditioned, for use as a Cordite Shifting Room.

In all, 23 tray stoves have been reconditioned and put into working order.

Building No. 244 has been conditioned, after conversion from a timber store, and is now in use as a shifting room.

Hoppit Canteen has been repaired and put in order.

Quinan Stove. The building of new stove, Fan House and necessary traverses, has been completed.

Guncotton Buildings. The construction of foundations and structural work and platforms for a two-ton potcher has been completed, together with the foundations etc. for a Waste Acid Tank.

In the P. & M. Room, a new sludge tank has been constructed, as well as a renewal extension of Blanket Runs platforms. A shoe hole under the Beater stage has been provided.

In the Vat Houses Nos 1, 2 and 3, reconditioning has been carried out.

Building No. 440 has been converted and reconditioned for use as a Plumbers' Shop with work in connection with C.E.D. preparations.

The rebuilding of absorption towers, platforms for cooling, coils, retorts 6 and 8, and stills 5 and 7, has been carried out.

The Concentrator House brickwork has been demolished and rebuilt, together with the rebuilding of brickwork of producers and coke condenser, and renewal of acid platforms.

Nitroglycerine Buildings. The Cascade House has been reconditioned, including the building of a concentrator, rebuilding of coke condensers, and the renewal of brickwork of Acid Retorts and Concentrators.

The rebuilding of coppers and towers has been carried out, as well as the provision of numerous foundations for plant.

No.14 Guncotton Stove has been reconditioned.

The building and repairs of traverses have been carried out at Buildings 7, 8, 12, 15, 98A, 96A, 95A, 96B, 74A and 92A.

Additional washing accommodation has been provided in Nitroglycerine Shifting Room; Building 68A has been extended 6 ft. East and Building 53A (Bag Store) has been reconditioned.

The roof of Wash Water Settling House has been renewed, and No.1 Guncotton Stove reconditioned.

C.E. Buildings. The sides and roof of Building No.57 have been renewed and reconditioned for use. In Building No. 57K new steel structure has been provided and a C.E. stove on "Daisy Island".

The conditioning has been carried out in C.E. Purification Houses, (Building 107 and 108), and C.E. Drying Stoves rebuilt.

Reconditioning of Picrite Milling House and Packing House, together with the lining of this building in "Insulwood", and the reconditioning of clearing stores and the provision of Fan House.

Gunpowder Buildings. The reconditioning of Building Nos. 182, 184, 202 and 211 has been carried out, also the demolition of Buildings Nos. 148, 181 and 183.

R.D. 202 Buildings. The reconditioning and renewal of sides and roofs of all buildings with "Insulwood" was carried out.

C.I.A. Examination Room. An extension of Building No.457 has been carried out with the resulting provision of a shifting room.

Machinery Section Buildings. The reconditioning and rebuilding of boiler seatings and flues has been carried out in Boiler House Nos. 1, 4, 7 and 9, and a Shifting Room provided at No.5 Boiler House.

IX. COST OF PRODUCTIONS.

The cost of principal productions is shown in Appendix VIII.

X. FACTORY EXPENSE.

The total F.E. compared with last year shows an increase of £65,000 and Direct Labour an increase of £36,800. The percentage of expense to direct labour has fallen from 473 in 1935 - 36 to 304 in 1936 - 37. See Appendix II.

The increase in F.E. is again due to the maintenance programme and the increased strength necessary to meet orders.

The annual turnover is shown in Appendix III.

XI. STORES.

The total value of stores held in Stock at 31/3/37 was:-

Manufacturing materials	£64,474
Other items	<u>£225,612</u>
	<u>£288,086</u>

as compared with the value at 31/3/36 of:-

Manufacturing materials	£63,712
Other items	<u>£19,688</u>
	<u>£83,400</u>

The value of raw materials received during 1936 - 37 amounted to £233,954, as compared with £111,324 for 1935 - 36. Appendix IV indicates the chief items purchased.

The prices paid for various items compared with the previous year, together with the results of stocktaking and the sale of old stores, are given in Appendix V.

Running contracts for a period of 12 months, based on an output programme of 75 tons Cordite per week, have been placed for the principal raw materials, and it is hoped that much benefit will be derived from this method of provision.

XII. IMPERIAL RESERVE STOCKS.

The stock of Glycerine held on 31/3/37 was 492.4/20 tons, of which 450 tons represented the Imperial Reserve.

XIII. GENERAL WAGES QUESTIONS.

The rates of Industrial Bonus for both skilled and semi

and unskilled employees, was increased by 3/- to 19/- and 18/- respectively. The increase was effected in three stages, viz:- 1/- on 29/6/36, 1/- on 28/9/36 and 1/- on 28/12/36.

As from 29/6/36 night shift allowances were altered from Time and one sixth to Time and one fifth, and for the first two hours overtime on night shift, a rate of Time and one third was fixed instead of Time and one quarter.

XIV. AVERAGE AGE.

The average age of employees at 31/3/37 was of the order of 34 as compared with 39 last year.

XV. ESTABLISHMENT.

(a) Staff.

Mr. R.P. Evans (Chemist Research) and Mr. H. Sellick (Chemist 1/c Nitroglycerine) were transferred to the C.E.D., the former being afterwards appointed to the post of Superintendent, H.M. Factory, Irvine. The vacancies resulting from these transfers were filled by the following changes and promotions:- Mr. A.H. Roberts from Chemist Cordite to Chemist Research; Mr. H. Lewis from Chemist Class II to Chemist 1/c Cordite; Dr. W.B. Kentish from Chemist Class II to Chemist 1/c Nitroglycerine.

In addition to the above, Mr. J.D. Parsons was promoted from Chemist Class II to Chemist Class I and given control of C.E. manufacture, which had previously formed a part of the charge of Chemist 1/c Nitroglycerine.

The Chemical staff was further augmented, in view of the increased manufacturing programme, by the recruitment of four Chemists Class II and the upgrading of Foreman Laboratory to Chemist Class II. Three Junior Assistant Chemists were also engaged.

(b) Strength.

The total strength of the factory on 31/3/37, together with that of the C.E.D. is given in Appendix VI

which also shows the age gradation at that date as (except in respect of C.E.D.) compared with the end of the previous year.

A detail of personnel for both the factory generally and the C.E.D. is given in Appendix VII.

(c) Labour Recruitment.

The enormous increase in output necessitated a very large increase in labour and the strength increased from some 350 to 1,700. Conferences were held by Superintendent, R.G.P.F. with the Labour Exchange officials and a carefully devised programme of recruitment arranged. It was agreed, subject to the prior claims of unemployed ex-service men, to engage the sons of fathers already employed in the factory, in order to ensure continuance of danger building tradition, sons of tradespeople and others in Waltham Abbey, local unemployed, and finally unemployed recruited from distressed areas. These arrangements have worked very smoothly and, thanks to the care taken by the Labour Exchange in interviewing likely applicants in distressed areas, on the whole a satisfactory supply of labour has been ensured.

XVI. WAR EMERGENCY ACTIVITIES.

As a result of the recommendations of the "Hacking" Committee in 1934, D.O.F. requested Superintendent, R.G.P.F. (1/11/34) to submit an estimate to him for the removal of the existing facilities at the R.G.P.F. This estimate, amounting to £2,156,000, based upon the maximum commitment of the factory for a war production of 240 tons R.D.B. was forwarded on 20/12/34. A revised estimate, amounting to an additional £209,000, for a maximum production of 240 tons W. Cordite, was forwarded on the 6th March 1935.

A further estimate, amounting to £5,000,000, was prepared by 31/8/35, based upon a production of 500 tons W. Cordite per week.

In November 1935, D.O.F. requested the Superintendent, R.G.P.F., in company with the Scottish Command Land Agent, to survey the distressed areas of Renfrewshire, Lanarkshire, etc. over a prescribed area, with a view to recommending a site suitable for the manufacture of Cordite. The area which was prescribed by the "Robinson" Committee covered some 4,000 square miles.

The survey was carried out as expeditiously as possible and with the utmost secrecy. A report upon the survey was submitted on the 6th January 1936 in which the recommendation was made that only one site in the area surveyed offered a possibility for the establishment of a factory for the manufacture of Cordite. This site consisted of some 2,000 acres at Bishopton on the south side of the Clyde, some 12 miles from Glasgow. It is to be emphasised that climatic conditions are a preponderating factor in the choice of such a site and the areas surveyed in Scotland were found in general to be unfavourable, chiefly on account of altitude.

The recommendation was endorsed by D.O.F. and confirmed by the "Robinson" Committee, and Treasury sanction was given for the purchase of the site on the 1st May 1936.

The work of planning the removal of the R.G.P.F. was commenced and towards the end of February 1936, D.O.F. requested Superintendent, R.G.P.F. to convene and preside over a Committee comprising:- Dr. R.C. Bowden (Chairman), Mr. W. Newton Booth, Mr. P.G. Knapman, Mr. P.G. Bennett-Powell, Mr. H.A. Phillips, Mr. P.B. Roberts, Mr. T.A. Smith and Mr. R.P. Evans (Secretary), to advise on matters affecting layout, types of buildings and plant, expenditure, etc.

A special department under Superintendent, R.G.P.F. was set up to undertake the work of planning, and the majority of this design staff were engaged, assembled and housed at Waltham Abbey by the beginning of October 1936. In the middle of November 1936, D.O.F. approved amendments to the composition of the Removal Committee providing for the inclusion of Mr. Napier-Clavering, Mr. E.W. Asprey, and Mr. W.E. Wood (Secretary) in place of Mr. Booth, Mr. Roberts and Mr. Evans.

The first important investigation to be carried out in connection with the site immediately the stringency of the secrecy ban was relaxed was that of water supply. As the result of the first preliminary investigations indicated that the water supply would be very costly it was considered desirable, while further investigations were proceeding, to have an alternative site in view, even though it might not be situated in a distressed area. Accordingly, the site of the former war time factory at Gretna was examined. In the meantime, however, a comprehensive examination of water supply was carried out in the Bishopton area with reference also to the factories situated at Ardeer and Irvine and it was decided that a complete scheme was economically practicable.

In July 1936, it became apparent that serious difficulty was to be expected in obtaining the necessary draughtsmen for the planning department and, as a result, His Majesty's Office of Works undertook to arrange the actual construction of the factory by utilising their own Draughtsmen and relegating work of other natures to lower orders of priority.

At the end of January 1937, a Cabinet decision was recorded to proceed with the construction of the factory at Bishopton to the extent of £3,000,000 expenditure, allowing for the construction of 1/3rd of the 500 ton

factory and provision for rapid expansion to the maximum 500 tons.

Negotiations are now in progress for the acquisition of the land and release by tenants as and when required. A detailed layout of the factory has been prepared and considerable progress made with the design of the buildings themselves. The question of providing aircraft protection to buildings has been fully investigated in order to obtain a reasonable balance between protection from hostile aircraft and the requirements of process working.

Specifications for the majority of the items of plant have been prepared and discussions have taken place with Messrs. Imperial Chemical Industries Ltd. on items which are comparable. By the end of the year the majority of specifications were ready for issue to tender.

It is anticipated that actual construction will commence in the Autumn of 1937 and be completed early in 1940.

XVII. PASSIVE DEFENCE.

Consideration has been given to the Passive Defence of the factory against attack by hostile aircraft. A co-ordinating Committee consisting of Superintendent, R.G.P.F., Superintendent, R.S.A.F. and C.I.S.A. was set up to discuss the general problem affecting the Royal Small Arms & Gunpowder Factories. A sub-committee was appointed for each factory, the medical officer of each being a member.

A comprehensive scheme was drafted at Waltham for the defence of explosives factories in general and the R.G.P.F. in particular. This scheme has been submitted to the Gas Defence Officer (Colonel Bond), of Woolwich Arsenal, and agreed, subject to a few amendments. Many points of major importance are still, however, awaiting decision. At the moment plans are being evolved for a nucleus unit both as regards shelters and personnel for training purposes.

Under present conditions, no staff from the R.G.P.F. is available to undertake courses of training in Gas Defence and it will be necessary for the staff required for the purpose to be appointed separately.

XVIII. CONCLUDING REMARKS.

After the long period of comparative idleness the output programme for the year was such as to necessitate a rigorous overhaul of plant and buildings, particularly from the point of view of modern danger building practice. The complete overhaul has been carried through in advance of the requirements of output.

Clerical staff difficulties have proved a severe handicap to clerical service. For 6 months the services of a Senior Clerk were not available, due to sickness. It was not until the end of December 1936 that additional clerks became available and it will be some time before the value of such addition becomes evident, owing to the need for training.

A change in organisation which has proved most efficient was effected by splitting off from the Accounts and Stores Branches the work in connection with issues of production, involving the chasing of service packages, the charting of output and control of actual issues by rail or factory barge. This has fully justified itself.

The relations with labour continue to be satisfactory. Meetings with the Shop Stewards have been held, when considered necessary, for the discussion of questions affecting local conditions and employment.

Investigational and Development work undertaken
during the year ending 31.3.37.

Work Completed.

- (1) Examination of Lanoline Rust Preventer and comparison with other rust preventers - further work.
- (2) Investigation of the economic recovery of Acetone from Cordite Stoves with special reference to the utilization of the existing facilities.
- (3) Works trial of a "Bowden" Concentrator, heat and acid balance, with special reference to the determination of design data for acid coolers.
- (4) Examination of the acid resisting properties of "Santex" cement. (Rubber latex base cement).
- (5) Examination of samples of drinking water from suspected sources.
- (6) Examination of samples of M.N.T. for H.M. Factory, Irvine.
- (7) Preliminary work on the denitration of C.E. Waste Acids.

Work in Hand.

- (1) An investigation of a method of testing acid resisting bricks.
- (2) Examination of the wet C.E. filtration process.
 - (1) Preliminary investigation to determine the particle size of C.E. in waste acid during boiling and completed crude.
 - (11) Examination of the acid resisting properties of "Staybrite" steel gauze (500 hours test completed).
- (3) An examination of the relationship of particle size of ground charcoal to the rate of burning of the fuze powder manufactured therefrom.

Investigation of the methods for the determination of particle size of charcoal.

- (4) An examination of the process of drying Cordite W.

C

APPENDIX I (Contd.)

(5) Design and determination of optimum operating conditions of Quinan type Guncotton drying plant.

(6) Synthesis of Chloracetophenone.

(7) An examination of the variations occurring in the supply of cotton waste, by the Clibben and Ceake method of viscosity determination, with a view to the ultimate elimination of these variations.

NOTE. The work in connection with the organisation of the Passive Air Defence of the R.G.P.F. is also being undertaken by the Laboratory Staff.

APPENDIX II.

R.G.P.F. WALTHAM ABBEY.

FACTORY EXPENSES.

Description.	1936-37 Amount £	1935-36 Amount £
<u>Process Expenses.</u>		
Foremen, Asst. Foremen etc.	4,048	2,865
Miscellaneous Labour.	3,954	1,813
Consumable Stores.	1,733	994
Gas.	95	44
Water.	63	41
Steam (Process).	19,365	9,753
Power.	10,126	6,010
Refrigeration.	6,174	4,825
Compressed Air.	5,942	4,542
Maintenance of Plant.	28,862	16,815
Maintenance of Buildings.	3,854	2,917
Depreciation.	1,715	1,594
Rates.	247	201
Internal Transport.	4,415	1,770
Balance of Process Expenses.	4,700	2,875
Sub Total.	95,293	56,862
<u>Sectional Expenses.</u>		
Management.	3,599	2,991
Electric Light.	911	534
Gas.	130	102
Steam for Heating.	2,789	2,616
Maintenance Services.	4,172	3,697
Miscellaneous Labour.	1,827	934
Laboratory Testing.	3,823	5,089
Care & Custody of Departmental Stores.	723	345
Allowances.	8,843	4,048
O.T. & N.S. Bonus.	2,756	450
Balance of Sectional Expenses.	7,883	5,349
	37,456	22,205
Credit for Materials returned to Store.	1,341	598
Sub Total.	36,115	21,607
<u>General Expenses.</u>		
Superintendence.	870	699
Registry, Pay & Order Branches.	990	495
Worktakers, Wages & Accounts.	2,016	1,160
Central Stores.	5,385	3,064
Police, Fire Brigade & Warders.	4,938	4,219
Maintenance of Grounds, Mains, Canal, Permanent Way etc.	13,517	13,431
Non-effective Charges.	8,924	6,436
Balance of General Expenses.	42,788	37,885
Sub Total.	79,428	67,389
Total.	210,836	145,858
Less Subsidy.	14,875	14,875
Net Factory Expense.	195,961	130,983
% to Direct Labour	303.85	472.90
Direct Labour.	64,492	27,698

1956 - 57

ANNUAL TURNOVER.

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

	Parliamentary Estimate. (includes supplementary). £	Latest Forecast. £
A. Establishments.	6,005	5,875
B. Wages.	169,000	184,600
C. Materials.	124,647	176,895
D. Machinery, Contract.	11,940	7,595
E. Works, Contract.	2,148	630
F. Miscellaneous.	9,435	12,000
G. Non-effective.	8,300	7,630
	331,475	395,225
Add - Net effect of Materials on I.D.D's	1,500	6,350
	332,975	401,575
H. Productions for Army, Navy, etc.	328,915	395,000
Miscellaneous Receipts.	2,260	2,200
Sale of scrap, old stores & stores issued on repayment.	1,200	460
	332,375	397,660
Less - Net effect of I.D. Services.	7,300	1,400
	325,075	396,260
Balance as shewn below.	7,900	5,315

INCOMINGS.	Parl'y Estimate £	Latest Forecast £	OUTGOINGS.	Parl'y Estimate £	Latest Forecast £
Estimated amounts recoverable in respect of:- Depreciation of:- Buildings.	4,500	3,210	Estimated expend- iture on New Capital:- Buildings.		
Machinery.	3,300	3,625	(a) Contract.	248	175
Mains.	410	390	F.E. on Contract.	2	10
Written off:-			(b) Departmental	685	2,900
Machinery.	200	50	Machinery.		
Buildings.	500	1,060	(a) Contract.	9,940	3,965
			(b) Departmental.	935	1,500
			Mains.		
			(a) Contract.		100
			(b) Departmental.		
Transfer from supplies suspense account.	7,900	5,315	Increase of Stores in Stock.	5,000	5,000
	16,810	13,650		16,810	13,650

D

Appendix IV.

Chief items purchased during 1936/37.

	Tons	cwts.	qrs.	lb.	£	s.	d.
Sulphuric Acid 20%	1987	10	0	0	11,008.	16.	2.
Sulphuric Acid 65%	222	19	3	8	1,850.	17.	0.
Sulphuric Acid 95 - 96%	535	0	3	16	2,991.	2.	4.
Sulphuric Acid 98%	91	1	1	20	517.	10.	2.
Acetone	550	0	0	0	25,670.	0.	0.
Ammonium Nitrate	20	0	0	0	252.	10.	0.
Ammonium Perchlorate.	-	-	-	-	-	-	-
Calcium Cyanamide.	120	0	0	0	1,130.	3.	4.
Carbamite.	65	0	0	0	14,761.	7.	8.
Cotton Waste.	611	7	3	2	37,654.	6.	5.
Dimethylaniline	35	0	0	25	3,219.	11.	7.
Mineral Jelly	12	5	0	22	122.	1.	2.
Saltpetre	19	0	0	0	544.	0.	0.
Soda Nitrate	2146	18	0	0	16,638.	9.	6.
Glycerine	150	0	0	0	9,337.	10.	0.
Coal (large & nuts)	20657	0	0	0	26,402.	2.	8.
Lead	196	7	3	19	4,815.	6.	7.

£ 156,890. 14. 2.

APPENDIX V.

M A T E R I A L S.

Price per ton of Main Items (Average prices given if more than one Contract).

<u>Material.</u>	<u>1935/36</u>			<u>1936/37.</u>		
	£.	s.	d.	£.	s.	d.
Acetone.	57.	8.	0.	47.	3.	0.
Cotton Waste	59.	2.	6.	62.	0.	0.
Glycerine.	56.	10.	0.	62.	5.	0.
Mineral Jelly.	11.	16.	3.	10.	12.	6.
Sodium Nitrate.	7.	15.	0.	7.	15.	0.
Ammonium Nitrate.	11.	0.	0.	11.	15.	6.
Carbamite.	228.	19.	10. ^{HH}	224.	19.	10. ^{HH}
Calcium Cyanamide.	9.	0.	0.	9.	0.	0.
Acid Sulphuric - 20%	5.	16.	0.	5.	9.	0.
85%	8.	8.	6.	8.	6.	0.
96%	5.	18.	6.	5.	11.	2.
98%	5.	16.	0.	5.	8.	6.
Lead, Chemical - Sheet	21.	3.	4.	27.	3.	4.
Pipe	21.	6.	8.	29.	0.	0.
Coal, Mechanical Stoker	1.	0.	5½.	1.	1.	11.

^{HH} Supply arranged by Director of Navy Contracts.

STOCKTAKING.

<u>Value of Stock.</u>		<u>Value of Stock Checked.</u>		<u>Net adjustment</u>
<u>This Year.</u>	<u>Last Year.</u>	<u>This Year.</u>	<u>Last Year.</u>	
£	£	£	£	£
88,086		9,935		309 Deficient
	83,400		10,584	335 Surplus

The deficiency is equal to 3.1% of the stock taken.

SALE OF SURPLUS STORES.

<u>Total amount realised.</u>	<u>Net loss</u>
£12	£1

APPENDIX VI.

ROYAL GUNPOWDER FACTORY.

Age Groups - showing % of Total Strength
on 31/3/37.

	%
Over 50 years	11.46
40 - 50 years	16.12
30 - 40 years	33.94
21 - 30 years	36.34
Under 21 years	2.14

CHIEF ENGINEER'S DEPARTMENT.

Total Strength on 31/3/37.

	%
60 and over	5.85
over 50 and under 60	15.38
Over 40 and under 50	15.38
Over 30 and under 40	19.23
Over 21 and under 30	34.62
Under 21	11.54

D

APPENDIX VII.

ROYAL GUNPOWDER FACTORY.

PERSONNEL - 31/3/37.

	<u>Total this year.</u>	<u>Total last year.</u>
Supervisory, etc.	112	63
Skilled	148	121
Semi-skilled	194	142
Unskilled	1302	469
Women and Girls	1	1
Boys	34	23
	<u>1691</u>	<u>819</u>
Highest	1691	898
Lowest	816	489
Average	1148	689
Entries during the year.	1012	392
Discharges " " "	141	67
Transfers In during the year	44	18
Transfers Out during the year	43	12

CHIEF ENGINEER'S DEPARTMENT.

	<u>Total this year.</u>	<u>Total last year.</u>
Supervisory, etc.	23	Nil
Skilled	-	
Semi-skilled	-	
Unskilled	-	
Women and Girls	3	
Boys	-	
	<u>26</u>	
Highest	28	Nil
Lowest	19	
Average	26	
Entries during the year.	24	
Discharges " " "	4	
Transfers In during the year	11	
Transfers Out during the year	5	

APPENDIX VIII.

COST OF PRODUCTIONS.

	<u>1936 - 37</u>	<u>1935 - 36</u>
	s. d.	s. d.
Cordite M.D.T. 5 - 2	2. 7½.	3. 0½.
W. 016	5. 1.	■
W. 036	2. 9½.	■
W. 8 (057)	2. 4½.	2. 10½.
W. 112	2. 2.	■
W. 15 - 13	6. 3½.	■
W. 15	2. 2½.	■
W.T. 144 - 048	2. 5½.	■
R.D.N./A.	4. 9.	5. 1.
Picrite.	5. 2½.	6. 5½.
Fuze Powder Mill Cake.	1. 2½.	■
R.D. 203.	17. 5½.	■
Composition Exploding, Grade I Crystal	4. 3.	5. 1.
Ground	4. 6.	5. 11½.
Corned	4. 8.	6. 2½.

■ Small quantities only produced during 1935 - 36.

Departmental Memo. No. *W. 354/16*

Minutes to be numbered consecutively.

Sheet No.

D.O.F. min. dt. 22/4/37

pe

me

ms

mm

Please say as to the earliest date by which reports will be available.

20/4/37.

*Heads of Sections
to send report
under heading
as above in Index.*

D.O.F. min. dated 7/8/37.

MS

Can you answer the two queries

*ms
9.8*

To be left blank

Supt.

2

①

The increase in cost of steam is made up as follows:—

- 3^d due to increase cost of coal
- 1st due to commissioning hand-fired boilers
- balance due to incidentals.

It should be appreciated that the above figures are approximate only, as the increased cost of coal was greater in the case of hand-fired boilers (2/8^d per ton) than in the case of mechanical stoker coal (1/5^d per ton).

② Electricity generated by factory 789,457 units
cost 3.31^d per unit.

Electricity purchased on "limited" service from the
Northwest Co. 974,843 units
cost 0.526^d per unit.

Spoke shown re 3. Ans. on 18/8.

G.L.G.
13/8/37

R.H. 18/8/37 rec.

NEB. 17/8.

Supt.
Re for
17/8.
18/8

Departmental Memo. No.

Minutes to be numbered consecutively.

Sheet No.

Chief Engr.

4
 Repe item 3. ~~SHOWN~~ have promised
 to supply a date for completion of factory
 after ^{at} next Weddays meeting. Will you
 hold paper & reply at earliest possible

Met. 27/8
 J

Superintendent.

The question of the completion date of the factory was raised at the meeting with H.M.O.W. on the 23rd of August. The minutes of this meeting have not yet been received but the result of the discussion was as follows:-

Mr. Dyke was of opinion that the earliest date was August 1939, I was unable to agree with this date for reasons which will take too long to explain here, but under the present conditions I think it would be most unwise to assume that the factory will be ready for production before January 1940.

I gathered that the H.M.O.W. mechanical engineers were in agreement with me and they pointed out that we were being asked to building a factory "in an emergency" time without the conditions of an emergency legislation. They reported that they anticipated difficulty with manufacturers because the manufacturers were full up with work for the Admiralty and the Air Force and that times of delivery seemed to be hardening from day to day.

I suggest therefore that we should assume that the starting date of the factory is January 1940 at the present time but that it will be necessary to review this date from time to time in the light of other information with regard to contractors' delivery dates and also the supply of labour on the site.

Meeting agreed that the probable
 date was Jan 1940

30.8.37.

3/9/37

Weg.

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H 324/16

S.R.G.P.F.

D.O.F. would be glad of further information with regard to the Annual Report.

Page 23 - bottom of page. What is the cost per 1000 lb.

1. increase on account of cost apart from the commissioning non-mechanically stoked boilers?

Page 24 - Consumption and cost of Electricity. Will you

2. please give cost per unit of own manufacture and the cost per unit of power supplied and the number of units from each source.

Last line of paragraph on War emergency activities. D.O.F.

3. would be glad if you would confirm completion "early in 1940".

M.C.Power.

7.8.37

for PA/D.O.F.

2.

P.A./D.O.F.

- (1) The increase in cost of steam is made up as follows:-

5d. due to increased cost of coal.

1d. due to commissioning hand-fired boilers.

Balance due to incidentals.

It should be appreciated that the above figures are approximate only, as the increased cost of coal was greater in the case of hand-fired boilers (2/1d. per ton) than in the case of Mechanical Stoker Coal (1/5½d. per ton).

- (2) Electricity generated by factory - 789,457 units

Cost - 3.31d. per unit.

Electricity purchased on "Limited" Service from the

Northmet Co. - 974,843 units

Cost - 0.526d. per unit.

- (3) Completion "early in 1940" is confirmed with H.M.O.W.

6/9/37.

R.C.Bowden.
Superintendent,
Royal Gunpowder Factory.

Departmental Memo. No.

Minutes to be numbered consecutively.

Sheet No.

P.C.

I shall be glad to have your notes for my Annual Report for 1936-37, as early as possible after the 31st March.

W.H.
Superintendent,
4/8/37.

R
na

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Departmental Memo. No. *W 324/16*

Minutes to be numbered consecutively.

Sheet No.

M.B.

I shall be glad to have your notes for my Annual Report for 1936-37, as early as possible after the 31st March.

M.B.
Superintendent,
4/3/37.

Supt.

Notes attached.

W.B.H.
19/5/37.

A. B. with remainder pce.

M.B.
19/5/37.

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Departmental Memo. No.

Minutes to be numbered consecutively.

Sheet No.

I.D.B.

I shall be glad to have your notes for my Annual Report for 1936-37, as early as possible after the 31st March.

W.H.
Superintendent,
4/2/37.

2.

Supr.

Notes, in separate sheet, herewith.

1.3.37.
1.4.37.

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I.D.B. note in Annual Report - 1937.

Two additional Dangu Building Visitors were appointed with effect from 1st April 1936, bringing the total to four.

Owing to the increasing activity in the factory and the number of new and inexperienced hands engaged, I consider that supervision from the point of view of the safety of the workers is of the utmost importance, and this can only be obtained by having a sufficient number of Dangu Building Visitors available for frequent visits to Dangu Buildings at irregular hours throughout the day and night.

1937.

1.4.37.

I.D.B's NOTES FOR ANNUAL REPORT 1936 - 37.

Two additional Danger Building Visitors were appointed with effect from 1st April 1936, bring^g the total to four.

Owing to the increasing activity in the Factory and the number of new and inexperienced hands engaged, I consider that supervision from the point of view of the safety of the workers is of the utmost importance, and this can only be obtained by having a sufficient number of Danger Building Visitors available for frequent visits to Danger Buildings, at irregular hours throughout the day and night.

