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VARIOUS RGPF
ANNUAL REPORTS

1935-1936 Annual Report

MINUTES SHOULD BE NUMBERED CONSECUTIVELY.

Supplies 5 446

SUBJECT: Annual Report 1935-36

Supply

5

(F.P.)

W.O. Etc. NUMBERS

Separate Sub-numbered sections are provided where there are two or more distinguishable sections or interests in the correspondence. "Action Here" Slips will be inserted by the Registry as a guide in minuting.

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446

Wt. P. 1811/1369—1200—10/34—W. & S. Ltd. (T. 5690).

No. W 324/5

MINUTES SHOULD BE NUMBERED CONSECUTIVELY.

Supply 5 ~~F~~ 446

SUBJECT: Supply 5 Annual Report 1935-36

(F.P. .....)

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446

(38425) Wt. P. 1811/1368—1200—10/34—W. & S. Ltd. (T. 5690).

W. 325/15

D.O.F.

I forward herewith Annual Report on the Royal Gunpowder Factory, Waltham Abbey, for the year 1935-36, (two copies).

6.8.36.

Superintendent,
Royal Gunpowder Factory.

ANNUAL REPORT

OF THE

SUPERINTENDENT, ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY

FOR THE

YEAR 1935 - 36.

I N D E X.

I. GENERAL SURVEY.

II. TOTAL PRODUCTIONS.

APPENDICES.

I. Annual Turnover

II. Factory Expenses

III. Materials:-
Prices, Stocktaking, Sale of Surplus Stores.

IV. Ages of Employees

V. Total Strength

VI. Personnel.

ANNUAL REPORT
of the
SUPERINTENDENT, ROYAL GUNPOWDER FACTORY
for the Year 1935 - 36.

I. GENERAL SURVEY.

(a) Manufacture.

Emergency orders for 122 tons of Cordite received during the latter part of the year, in addition to the estimated output of 500 tons at the beginning of the year, brought the required output of issued Cordite to 622 tons. The achieved output was 623 tons.

The output of Cordite from the presses during the year was approximately 662 tons, an increase of 352 tons over last year's production, i.e. more than double last year's figure.

In addition to normal manufacture, 5.3 tons of Experimental Cordite were produced. The annual turnover is shown in Appendix I.

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

(i) Acids Sections. In the Nitroglycerine Acids Section manufacture of nitric acid from sodium nitrate, and sulphuric acid recovered from the spent acid of C.E. nitration, has recommenced.

In the Guncotton Section the denitration tower scheme referred to in last year's report has been shelved for the present, and it has been decided instead to arrange for emergency programme by using No. 1 Nitric Acid Factory mainly as a still house and No. 2 mainly as a retort house. The retort pots installed will, however, be available for either purpose.

The first aluminium nitric acid cooler was recently inspected after some eighteen months' running. Slight corrosion of the coil at the "wind and water line" was observed, but otherwise the condition was excellent.

In the Concentrator House the Calder Fox Scrubber, also mentioned in last year's report, has been subjected to lengthy tests, but has been finally abandoned as it appears impossible under any running conditions to produce an exit gas which complies with the

regulations of the Alkali Act, without reducing the output of the plant very considerably.

No.9 "Bowden" Concentrator has run throughout the year without trouble, and the construction of No.3 has been completed. Repairs to producers are either completed or well in hand.

(ii) Guncotton. Visits to manufacturers' works to supervise the production of cotton waste have continued, and the greatly decreased quantity of pickings in the cotton is evidence of the value of this arrangement.

In the Nitrating House the small central earthenware "biscuits" which protect the outlet of the nitrating pans are being replaced by stainless steel perforated plates made in the factory. An aluminium exhaust fan designed and made in the factory has been installed and has run for more than half the year with complete satisfaction.

No.2 Nitrating House has been completely overhauled, and special efforts are being made to ensure satisfactory ventilation by the use of enlarged fume pipes and stainless steel exhaust fans, while the waste acid pits are being enlarged to bring them into conformity with those in No.1 House.

All the vats in No.3 Vat House have now been fitted with Tellurium lead kier columns which seem very satisfactory, showing as yet no tendency to lean over as the ordinary lead columns did.

During the year a considerable amount of trouble has been encountered owing to varying alkalinity in the Guncotton. This is considered to have been caused mainly by leaks in those vats which have been lined with Tellurium lead. This material is found to crack very readily when used for vat linings.

Two vats are now fitted with recording thermometers, and it is hoped to complete the installation of these in all vats during the ensuing year.

Nearly all the vats in No.1 House have been repaired and rendered suitable for use under non-specification conditions, and work on No.2 House is in hand.

Reorganisation of the Pulping and Moulding Room, referred to in last year's report, has proceeded. The grit-runs, magnets and blanket runs are now laid out in a convenient and accessible manner with a steady fall, while the filling in of old save-alls, removal of stuff-chests and lime tanks, covering of floors and general improvement in the plant lay-out in this building have added greatly to working convenience and lessened chances of contamination of the Guncotton.

The development of the new type of Potcher is entering upon what, it is hoped, will be the final stages. The method of injecting the pulp tangentially into a circular vessel described in last year's report proved very successful on the small scale and, after experiments with a model holding 20 lb. of pulp, a half-ton machine of this type was constructed and is in regular use for Service Guncotton.

A second machine of the same size is now erected, and a two-ton machine is under construction. The method seems to give very thorough washing and blending, and the all-lead construction eliminates metallic contamination. The system is economical in power as compared with other types.

Extracts for Service Guncotton were considerably greater than in recent years. No trouble has been experienced with slabs or wet charges, but work on primers was seriously impeded by an explosion which occurred in No.9 press about the end of November. This was apparently due to a fault in the hydraulic system.

(iii) Cordite. The manufacture of M.D.T. 5-2 Cordite has proceeded quite normally, except for a period during March and April and another during November and December when heavy weights per 100" interfered considerably with production, giving irregular cords and increased waste. The reason for abnormal

weights could not be ascertained, but was probably connected with the physical and chemical characteristics of the Guncotton.

The introduction of 33% solvent instead of 36% for W. Cordite has resulted in a saving of Acetone, the consumption having been reduced from 35.5% for last year to 31.8%. This reduction of the quantity of solvent has produced much better working conditions during pressing and packing of the wet Cordite, as the cords are not so sticky. No reduction of Solvent could, however, be made for pressing in the small screw presses because they would not take the extra pressure required for extrusion.

The addition of 0.2% precipitated chalk at the incorporation stage was commenced on 5.12.35, and no difficulty was experienced in manufacture.

The proofs received during the year were satisfactory and no Cordite was rejected.

An improved system of planning and forecasting delivery dates has been installed to meet the need for close estimates required for the Filling Factories, etc., and this has resulted in exceptionally good adherence to delivery dates in the face of the disorganisation caused by acceptance of emergency orders.

Efficiency of pressing in the hydraulic presses has been improved by increased control. Last year the output of Cordite W. .057 was about 18.2 lb. per pressing; this has been increased by 15% to 21 lb. per pressing.

Improved supervision at the Lower Works has resulted in a marked increase in output of the blending and lotting operations.

Throughout the section, despite the large proportion of new and comparatively inexperienced workers, the accidents to plant, etc., were few and of a minor nature.

(iv) Picrite and R.D.N./A. The manufacture of Picrite and R.D.N./A. has proceeded satisfactorily.

The Picrite plant has been operated three shifts a day during a considerable part of the year, achieving during that

time the largest output from the process that has yet been attempted.

During 1934-35 production of R.D.N./A. Cordite was carried on at a steady rate of one to two weeks' work per period, but during the year 1935-36 output has been confined to the latter half of the year. Rate of production has, however, been raised from about 1600 lb. per week in 1934-35 to about 3000 lb. per week in 1935-36, while total output for these two years was 14 tons and 19 tons respectively.

Owing to increased output the procedure for pressing Cordite R.D.N./A. as laid down by C.S.R.D. has proved unsatisfactory, and certain modifications have had to be made in collaboration with C.S.R.D.

One lot of R.D.N./A. .042/29" was rejected for excessive variations in composition as found by C.I.A. This matter is being investigated by C.S.R.D. and R.G.P.F. as the material was found satisfactory when examined at R.G.P.F. at the time of issue.

(v) Tetryl. Repurification of material made during the War was suspended in order to commence nitration of fresh C.E.

Nitration and subsequent purification to crystal, ground and corned C.E. Grade I has been carried out during the year with an increasing rate of manufacture.

Work has proceeded with a view to modernising and increasing the capacity of the C.E. Factory. In this connection installation of the second large nitrator of 300 galls. capacity has been almost completed, and the capacity of the C.E. purification house has been doubled.

(vi) Composition R.D.202. Early in the year it was decided to renovate all the buildings in this section, and a type of construction using "Insulwood", which has a smoother surface than the "Celotex" previously used, and avoiding all internal projections, has been evolved which appears almost ideal for dusty work of this sort.

Immediately after restarting, a new batch of charcoal was brought into use which gave consistently low burning times, and, in spite of every effort, it has proved impossible to make material to give fast rates of burning. This has caused considerable difficulty in producing material complying with the specification to fulfil extracts. The matter is under further investigation.

(vii) Gunpowder. The work carried out during the year has consisted entirely of the production of Millcake for the manufacture of Fuze Powder S.R.227, the Millcake being transferred to C.S.O.F. for finishing.

The available plant is only suitable for very small outputs. For larger quantities the installation of a more efficient saw for cutting the dogwood, mechanical sieves for both wood and charcoal, and a more suitable mill for grinding charcoal are desirable.

The charcoal burner has worked very successfully, and all batches of charcoal have been burnt to specification for carbon content with excellent uniformity. The total quantity of charcoal burnt was 1348 lb.

(viii) Main Laboratory. The activities of the Main Laboratory have been very greatly increased during this year by the rising output of the factory.

The total number of routine samples analysed in connection with the inspection of raw materials, intermediate and finished products, was approximately 12,000 as compared with about 5,000 during 1934-35.

The field of experimental and research work has also been greatly increased, both in amount and in scope, and an unusually large number of investigations have been carried out into problems connected with the development of plant, processes and the general running of the factory.

Notable lines of investigation have been connected with the resistance to corrosion of many materials of construction

of plant for acids and explosives manufacture, new method for the sieving and washing of C.E., and the alkalinity of Guncotton during processing.

Plans were developed and prepared for re-arrangement of existing C.E. nitration plant, and the proposed new C.E. nitration plant was designed.

A considerable amount of experimental and research work was undertaken for the Supply Board Technical Establishment, including several investigations on raw materials for T.N.T. manufacture, an investigation of the commercial processes for Carbamite manufacture, and an experimental study of the economic aspects of the present manufacturing process for chloracetic ester.

(ix) Continuous Inspection of Cordite during Manufacture. Accommodation has now been provided for representatives of the Chief Inspector of Armaments who were posted in the factory on the recommendation of the Ordnance Committee.

(x) Danger Building Inspectorate. Inspection of Danger Buildings is now under the supervision of a resident Inspector, to whom Danger Building Visitors are directly responsible.

Prior to June 1935, when the new Inspector of Danger Buildings assumed duty, Danger Building Visitors were responsible to the Senior Inspector of Danger Buildings, Royal Arsenal, Woolwich.

The new system has resulted in very much more satisfactory and efficient supervision and co-ordination of the inspecting staff.

Moreover, I am able at once to deal with reports from the Danger Building inspection staff instead of, perhaps, having to wait for the fortnightly visit of an officer from Woolwich.

(b) SERVICES.

(i) Hydraulics. The hydraulic pumps have continued to give satisfactory service. A further 50 H.P. pump is to be provided next year to replace one of the old pumps.

(ii) Compressed Air Plant. Attention has been given to the oil supply to the air compressors, and this has been con-

siderably reduced by fitting a forced oil feed pump to the compressor. The amount of oil can be regulated very accurately, and the oil has been changed from light oil to a heavy cylinder oil. It is thought that this will lead to a cleaner air supply.

(iii) Refrigeration Plant. A new condenser for one of the refrigerators at Edmondsey has been taken up for next year (1936-37).

(iv) Air Heating.(Guncotton Store.) Guncotton Store services have been reconditioned and the hot air services of two stoves is being altered to give improved circulation of air.

(v) Telephones. Clearing of the trees, etc., in the vicinity of telephone wires has reduced the number of breakdowns in the service.

No further action has been taken concerning the installation of an Automatic Telephone system.

(vi) Transport. Nickel-iron batteries have been purchased to replace four of those originally supplied with the tractors. The capacity of the new batteries is 50% greater.

The new Guncotton lorry purchased last year for transport of Guncotton from Quinton Hill to Edmondsey continues to give satisfactory service.

(vii) Machinery Shop. A new lathe is being purchased to deal with hydraulic press cylinders, and similar heavy work.

(viii) Metropolitan Water Board Supplies. The cost of water consumed during the last five years has been:-

1931	1932	1933	1934	1935
£168	£182	£199	£192	£289

(ix) Lea Conservancy Board. The Board has undertaken weed cutting and clearance of shoals in the W.D. portion of the Small River Lea on repayment by the factory.

The flow of water through the factory has fluctuated between a minimum monthly average of 1,035 cu.ft. per min. during August of 1935 and a maximum of 11,583 cu.ft. per min. in December 1935.

The daily averages over the last five years have been:-

1931	1932	1933	1934	1935
9,973	8,675	2,766	2,405	4,976

(x) Fire Brigade. Inspections have been made of all fire appliances during the year, and they have been found in order. Fire rules and precautions have been well observed throughout the factory.

Three calls were received and the fires were extinguished without difficulty, the damage to property being slight.

An additional hydrant has been fixed, making a total of 65.

Two extra fire squads have been recruited during the year, one in the Guncotton Section and one in the Cordite, making a total of six fire squads.

(xi) Estate. An intensive programme of estate clearance has been carried on during the year.

A number of trees were condemned as being dangerous, and were felled. These trees, and a number of others which had fallen or had been felled on previous occasions, were removed.

The factory area generally has been cleared of undergrowth, etc., and grass has been kept under control.

(g) PROPERTY.

The gross returns from all property attached to the factory for the last five years are as follows:-

1931	1932	1933	1934	1935
£1,537	£1,524	£1,434	£1,241	£1,145

The expenditure on domestic property has amounted to £532 against an assessed annual value of £1,024. This does not include the special maintenance expenditure on account of the internal redecoration and installation of new fireplaces at 54 Highbridge Street.

II. TOTAL PRODUCTIONS.

A. GUNCOTTON SECTION.

Nitric Acid:-

Soda Nitrate Charges	243 at 2 tons 4 at 1 ton		= 490 tons
Total Soda Nitrate charged	548.80	s.tons	Crude
	= 544.68	,,	Pure
Equivalent HNO_3	403.63	,,	
Nitric Acid produced	441.10	,,	at 89.85%
	= 396.33	,,	HNO_3
Loss	7.30	,,	
Efficiency	98.20%		
Strong Sulphuric Acid used	533.44	s.tons	at 94.43%
	= 503.61	,,	H_2SO_4

Redistillation:-

Acid charged to Stills	2565.75	s.tons	- containing
	1559.33	,,	H_2SO_4
	456.57	,,	HNO_3
Strong Nitric Acid recovered	501.30	,,	at 89.03%
	= 446.27	,,	HNO_3
Loss	10.30	,,	
Efficiency	97.73%		
Weak Sulph. Acid recovered	1984.28	s.tons	at 77.47%
	= 1536.93	,,	H_2SO_4
Loss	22.40	,,	
Efficiency	98.60%		

Concentration of Weak Sulphuric Acid:-

Acid charged to Concentrator	1949.00	s.tons	at 77.35%
	= 1507.63	,,	H_2SO_4
Sulphuric Acid produced	1575.69	,,	at 94.3%
	= 1484.83	,,	H_2SO_4
Loss	22.8	,,	
Efficiency	98.55%		

Nitration:-

No. of sets of Guncotton	4,818
No. of sets of Nitrocotton	33
	4,851

Mixed Acid used	8,335.17	s.tons	
Cotton Waste used	298.16	,,	Gross
	= 270.23	,,	Nett
Guncotton produced	450.21	,,	
Save-all	10.18	,,	
Yield	166.6%		
Available for Cordite	162.9%		
Ratio - Mixed Acid/Cotton Waste	30 : 84		
Mixed Acid/Guncotton	18 : 51		

Guncotton, etc., Issued to Services (other than for Cordite manufacture).

1-lb. Slabs to C.O.O. Bramley and Woolwich	12,915	
1-lb. Charges to C.O.O. Woolwich	1,000	
1-oz. Primers to C.O.O. Bramley	14,560	
Guncotton Pulp to C.S.R.D.	100	lb.
Nitrocotton Pulp to C.S.R.D.	100	lb.
Guncotton Pulp to Messrs. Vickers'	10	lb.

Total - 15,035 lb. = 7.5175 s.tons.

Materials.

	T.	c.	lb.	
Oleum drawn from Store	677	0	20	= 758.25 s.tons
Difference in Stocks				133.10 ,,
Oleum consumed				625.15 ,,

= 1.3885 per lb. of Guncotton.

Nitrate of Soda drawn from Store	490	0	0	= 548.80 s.tons
Difference in Stocks				74.82 ,,
Nitrate of Soda consumed				473.98 ,,

= 1.053 per lb. of Guncotton.

Cotton Waste drawn from Store	266	4	21	= 298.16 s.tons
Deduct Oil and Moisture (.19% and H_2O 6.27%)				19.26 ,,
Deduct Pickings and Fly				8.67 ,,
Nett Cotton Waste used for Nitration				270.23 ,,

Foreign Matter removed in picking, etc.:-

Wood, string and metal	697 lb. =	.1169%
Grit	42 lb. =	.007%
Fly	1660 lb. =	2.785%

Cotton used per lb. of Guncotton:-
0.6622 Gross
0.6002 Nett.

Summary of Consumption and Losses.

	H_2SO_4 Actual	H_2SO_4 Per ton of G/C.	HNO_3 Actual	HNO_3 Per ton of G/C.
Manufacture of Nitric Acid	503.61	1.119	7.30	.0162
Redistillation	22.40	.0497	10.30	.0228
Concentration	22.80	.0506	-	-
Nitration	112.30	.2470	337.88	.7505
Washing out Plant	2.04	.0045	.38	.0008
	663.15	1.4708	355.86	.7903

B. NITROGLYCERINE SECTION.

(a) Manufacture of Nitric Acid.

The retorts used were:-
No. 10 - 123 runs at 30 cwts. of Nitrate of Soda
No. 11 - 123 runs at 30 cwts. of Nitrate of Soda.

Average time of distillation - 12 hours.

Materials and Results:-

Nitrate of Soda used	413.28	s.tons	at 99.39% $NaNO_3$
C.O.V. used	280.72	,,	at 86.7% H_2SO_4
Oleum used	150.75	,,	at 20% free SO_3
Coke used	48.88	,,	
Strong Nitric Acid made	281.80	,,	at 90.5% HNO_3
Weak Nitric Acid made	62.06	,,	at 60.1% HNO_3
Nitre Cake produced	495.94	,,	at 33.0% H_2SO_4
Efficiency Strong Nitric Acid	83.8%		
Total Efficiency	95.9%		

(b) Denitration of Waste Acid.

120 charges of Waste Acid were denitrated in No.1 Tower.

Output:-			
Waste Acid denitrated	366.00	s.tons	(261.94 s.tons H_2SO_4 (40.18 ,, HNO_3
Denitrated Sulphuric Acid made	367.51	,,	at 71.2% H_2SO_4
Weak Nitric Acid made	60.00	,,	at 57.6% HNO_3
Efficiency -			
Sulphuric Acid		100%	
Nitric Acid		86.0%	

(c) Concentration of Weak Sulphuric Acid.

Concentrators Nos. 2 and 3 were used.

Output:-			
Weak Acid concentrated	700.49	s.tons	at 67.8% H_2SO_4
Coke used	50.21	,,	
Strong Acid made	461.45	,,	at 89.3% H_2SO_4
Weak Acid made	107.58	,,	at 45.5% H_2SO_4
Efficiency - Strong Acid		86.7%	
Total Efficiency		97.0%	

(d) Redistillation of Weak Nitric Acid.

50 runs were carried out in No.4 Still.

Average time of distillation was 14 hours.

Output:-			
Weak Nitric Acid used	131.66	s.tons	at 59.1% HNO_3
Strong Sulphuric Acid used	179.55	,,	at 92.9% H_2SO_4
Coke used	33.20	,,	
Strong Nitric Acid made	58.98	,,	at 89.8% HNO_3
Weak Nitric Acid made	38.57	,,	at 56.3% HNO_3
Weak Sulphuric Acid made	227.79	,,	at 72.9% H_2SO_4
Efficiency - Strong Nitric Acid		68.2%	
Total Nitric Acid		96.0%	
Sulphuric Acid		99.5%	

(e) Acid Mixing.

Output:-			
Nitric Acid, new, mixed	214.90	s.tons	at 90.2% HNO_3
Nitric Acid, redistilled, mixed	51.17	,,	at 90.2% HNO_3
Oleum, 20% mixed	135.75	,,	at 20% SO_3 (free)
Oleum, 65% mixed	136.50	,,	at 65% SO_3 (free)
Total Mixed Acid made	538.32	,,	

(f) Manufacture of Nitroglycerine.

120 charges of 1470 lb. Glycerine each were nitrated.

Average time of nitration was 70 minutes, and separation 130 minutes.

Average brine temperature was -13°C.

Nitration was carried out in the early part of the year in Nitrator No.1. Nitrator No.2 was then used, and Nitrator No.1 completely rebuilt.

Output:-

Glycerine used	88.200	s.tons
Mixed Acid used	495.000	,,
Soda Ash used	6.720	,,
Waste Acid made	366.000	,,
Nitroglycerine made	206.736	,,
Nitroglycerine Yield	234.5%	

Summary of Tests.

	Max.	Min.	Average
Moisture	0.57%	0.10%	0.29%
Heat Test	14 min.	10 min.	12 min.
Alkalinity	All under 0.0005.		

Nitroglycerine Usage.

For Cordite M.D.	59.150	s.tons
For Cordite W.	137.566	,,
For Cordite Mark I	2.997	,,
For Cordite R.D.N./A.	5.720	,,
For Dynamite	0.780	,,
For Sundry Experiments	0.523	,,

Summary of Consumption and Losses of Acids.

	H_2SO_4		HNO_3	
	Actual s.tons	Per ton N/G	Actual s.tons	Per ton N/G
Manufacture of Nitric Acid	299.10	1.447	10.99	0.053
Denitration	1.99	0.010	6.45	0.032
Redistillation	0.72	0.003	10.61	0.051
Concentration	13.46	0.065	-	-
Acid Mixing	13.41	0.065	13.30	0.064
Nitration	9.73	0.047	176.59	0.853
	338.41	1.637	217.94	1.053

Raw Materials Used (s.tons per ton Nitroglycerine).

Nitrate of Soda	1.492
Oleum, 20%	0.875
Oleum, 65%	0.632
Glycerine	0.4266
Soda Ash	0.0325

(g) Drying and Weighing Guncotton and Nitrocotton.

Stoves 8 - 13 were used.

174 Stovings of Guncotton and 4 stovings of Nitrocotton were dried. The average time of drying was 68 hours.

Total amount dried was -

Guncotton	435.000	s.tons
Nitrocotton	5.545	,,

Guncotton was used as follows:-

Paste, M.D. and W.	421.141	s.tons
Paste, Mark I	1.883	,,
Experiments	1.064	,,

Nitrocotton was used as follows:-

Paste R.D.N./A.	4.010	s.tons
Issued to C.S.R.D.	0.200	,,

(h) Paste Mixing.

Paste Mixed -	M.D.	182.820 s.tons
	W.	435.037 ,,
	Mark I	4.880 ,,
	R.D.N./A.	25.622 ,,
	Experiments	1.586 ,,
	Dynamite	1.200 ,,

C. CORDITE SECTION.

(a) Raw Materials Used.

	W.	M.D.	Mark I	RDN/A	Exptl.	Total
Acetone	293,175	142,157	2,372	8,683	775	447,162
Min. J.	-	19,256	498	-	-	19,754
Carb.	55,404	-	-	3,901	138	59,443
Paste	867,725 7/16	362,235	9,761 4/16	47,175	3,834 14/16	1,290,731 9/16
Rework	-	14,040	375	-	1,447 8/16	15,862 8/16
	1,216,304 7/16	537,688	13,006 4/16	59,759	6,195 6/16	1,832,953 1/16
					Acetone	447,162
Total Incorporated Material (excluding Acetone)						1,385,791 1/16

(b) Raw Material Reference Numbers.

Nitroglycerine	Charge Nos. 734 - 857
Guncotton	Batch Nos. 1661 - 2105
Nitrocotton	Batch Nos. 23 - 35
Picrite	Batch Nos. 734 - 857
Acetone	Consignment Nos. 2425 - 2431
Mineral Jelly	Consignment Nos. 189 - 192
Carbamite	Consignment Nos. 14 - 23

(c) Material Incorporated.

		lb.
M.D. -	Dough	381,491
	Rework	14,040
Mark I -	Dough	10,259 4/16
	Rework	375
R.D.N./A. -	Dough	51,076
	Rework	-
W. -	Dough	923,129 7/16
	Rework	-
Experimental -	Dough	3,972 14/16
	Rework	1,447 8/16
		1,385,791 1/16

(d) Cordite Pressed.

(i) Small Screw Presses.

Small Arms - M.D.T.	5-2	376,592			
	7-2	1,290			
			377,882		
Mark I	1/.05	3,789			
	3	657			
	20 S.C.	5,440			
			9,886		
				387,768	
Cannon - RDN/A	.029	13,500			
	.034	3,700			
	.042	12,372 8/16			
	.052	16,700			
			46,272 8/16		
W.	.060	576			
	.046	1,900			
	.040	12,600			
	.036	13.330			
	.016	32,545			
	.134-.136	18,104			
			79,055		
				125,327 8/16	
Experimental and Proof Samples:-					
W., W.T. and W. chopped			2,206 6/16		
W. Modified			78		
M.D.T. and M.D.T. chopped			1,481 6/16		
M.D.T. rework			600		
H.P.			100		
R.D.N./A.			1,670		
F.551/27			2,830		
			8,959 12/16		
Less taken from normal manufacture			425		
				8,534 12/16	
				521,630 4/16	

(ii) Hydraulic Presses.

Cannon	W. .093	129,925		
	W. .057	680,700		
			810,625	
Experimental	W.	1,530		
	W. from Straw	237 7/16		
	M.D. reworked with Carbamite	200		
			1,967 7/16	
			812,592 7/16	

(iii) Summary.

Small Screw Presses	513,095 8/16	
Hydraulic Presses	810,625	
	1,323,720 8/16	
Experimental	10,502 3/16	
	1,334,223 11/16	

(e) Cordite issued (to Inspection).

Small Arms - M.D.T.	5-2	358,375		
	7-2	1,290		
			359,665	
	Mark I 1/.05	3,789		
	3	657		
	20 S.C.	5,408		
			9,854	
				369,519
Cannon - RDN/A	.029	10,527		
	.042	11,727		
	.052	15,951 8/16		
			38,206 8/16	
W.	.093	132,405		
	.060	576		
	.057	600,930		
	.046	1,900		
	.040	12,600		
	.036	26,475		
	.016	39,790		
	.154-.136	23,515		
			838,191	
				876,396 8/16

Experimental and Proof Samples.-

R.D.B. reworked with Carbamite	145	
M.D. reworked with Carbamite	5,595	
M.D., M.D.T. and chopped	981 6/16	
R.D.N./A.	1,670	
H.P.	100	
F.551/27	2,830	
W., W.T. and chopped	2,500 6/16	
W. from Straw	257 7/16	
W. Modified	46	
		14,105 3/16
		1,260,020 11/16

(f) Cordite Under Inspection by C.I.A.
(Not issued by Berge at 31.3.36).

	lb.
W. .057	19,225
W. .154-.136	830
	20,055

(g) Percentage Loss, etc.

	M.D.		W.		Mark I		RDN/A	
Paste Used	362,235		867,725 7/16		9,761 4/16		47,173	
Mineral Jelly or Carbamite Added	19,256		55,404		498		3,901	
Stock Rework 31.3.35	9,310		8,100		34 15/16		900	
		390,801		931,229 7/16		10,294 3/16		51,976
Cordite Produced	379,363 6/16		893,387 6/16		9,886		47,542 8/16	
Stock Rework 31.3.36	-		24,200		10		3,100	
		379,363 6/16		917,587 6/16		9,896		50,642 8/16
Loss		11,437 10/16		13,642 1/16		398 3/16		1,333 8/16
*Percentage Loss	2.89%		1.48%		3.74%		2.61%	
*Percentage Acetone used	35.14%		31.77%		22.30%		17.00%	
**Percentage Mineral Jelly or Carbamite used	5.03%		6.00%		4.85%		7.64%	

*Calculated on Material Incorporated - see C.(e).
**Calculated on Dough Incorporated.

). Manufacture of Tetryl.

(a) Manufacture of Nitric Acid.-
No.17 Retort - 30 runs at 1½ long tons Nitrate of Soda
No.18 Retort - 31 runs at 1½ long tons Nitrate of Soda

Average time of distillation 11 hours.

Output.-

Nitrate of Soda used	102.48 s.tons	at 99.5% HNO_3
Oleum, 20%, used	23.25 ,,	at 20% free SO_3
(C.O.V. recovered from C.E. Waste Acid also used).		
Strong Nitric Acid made	63.20 s.tons	at 88.1% HNO_3
Strong Nitric Acid issued to C.E. Nitration	56.00 ,,	at 88.1% HNO_3
Strong Nitric Acid from N/C manufacture of Nitric Acid issued to C.E. Nitration	49.59 ,,	at 90.4% HNO_3

(b) Nitration of C.E.
269 Nitrations at 96 lb. Dimethylaniline each were carried out in Nitrating House No.4

Tar Oil used	13.146 s.tons	
Nitric Acid used	105.59 ,,	at 89.2% HNO_3
C.O.V., 96%, used	201.75 ,,	at 96% H_2SO_4

(Waste Acid issued to coppers and then to Nitric Acid manufacture).

Crude C.E. made 20.200 s.tons (as purified C.E.)

(c) Purification and Finishing of C.E.

Crude C.E. purified	20.710	s.tons (as purified C.E.)
Acetone used	26.76	,,
Caustic Soda used	0.55	,,

Finished C.E. issued.-

Ground	0.500	s.tons
Crystal	2.800	,,
Corned	5.467.	

(d) Other Work.

Corned C.E. received for grinding	0.650	s.tons
Ground C.E. issued	0.636	,,
Crystal C.E. received for repurification in 1934/35. Acetone used 1935/36	0.050	,,
Crystal C.E. issued 1935/36	0.772	,,
C.E. received for repurification in 1934/35. Acetone used 1935/36	0.150	,,
C.E. corned and issued 1935/36	7.391	,,

E. Manufacture of Picrite.

Output:-

Calcium Cyanamide used	57.57	s.tons
Ammonium Nitrate used	21.26	,,
C.O.V., 98% H_2SO_4, used	51.37	,,
Finished Picrite made	16.917	,,

(Recovered Sulphuric Acid issued to Contractors).

Picrite was issued as follows:-

To C.S.R.D.	0.775	s.tons
To N.A.S.C. and R.N.C.F.	0.250	,,
To R.D.N./A. Paste Mixing	15.892	,,

F. Manufacture of T.N.T.

T.N.T. manufactured on the "Pilot" continuous nitrating plant was carried out during the first four periods of the year. After gaining further valuable experience in the running of this process the plant was closed down.

Output:-

M.N.T. used	15.695	s.tons
Nitric Acid, 98%, used	25.865	,,
C.O.V., 96%, used	23.340	,,
Recovered Waste Acid used (about 91% H_2SO_4)	91.405	,,
Sodium Sulphite Crystals used	3.898	,,
T.N.T. (Sulphited and Finished)	20.914	,,

G. Manufacture of Fuse Powder - R.D.Composition No.202.

Manufactured	1,294 lb.
Ammonium Perchlorate (Crude)	1,092 lb. (Refined)

III. MAIN PRODUCTIONS.

Summary.	Tons		
Cordite W.	444.8		
M.D.	188.9		
R.D.N./A.	23.1		
Mark I	4.9		
Experimental	5.3	667.0	tons
Composition R.D. 202		.647	,,
Tetryl - New manufacture	5.467		
Purified	20.710		
Ground	.500		
Crystal	2.800	29.477	,,

IV. NEW METHODS.

(a) Solvent Reduction. A reduction in the amount of Acetone used in the incorporation of Cordite W. has been made where the Cordite is to be pressed in the hydraulic presses with advantageous results. This is described under Section (a) (iii) of "General Survey".

(b) Blank Cutting. Improvements have been made in this plant by the installation of a transparent screen over the feeding end of the cutting machine, and by the provision of a cover for the sieves, reducing the amount of Cordite which falls on the floor.

(c) New System of Guncotton Potching. Service Guncotton is regularly being processed in the new type of potcher which was devised and developed at R.G.P.F. This type of machine possesses several notable advantages over the older type, and particulars of its present and proposed applications are given in Section (a) (ii) of "General Survey".

(d) Treatment of Carbamite before Sieving. A pair of small preliminary crushing rolls has been installed over the feed to the sieving machine in order to deal with Carbamite which becomes caked during storage. This caking has caused considerable inconvenience

in the past and, although the present installation is not an entirely satisfactory solution to the problem, it has led to improved processing.

V. URGENT ORDERS.

During the year 112 tons of Cordite were executed on emergency orders - 89.6 tons of Cordite W. .057 were manufactured for the Army, 5 tons of R.D.N./A for the Navy and 27.8 tons of M.D.T. 5-2 for the Air Ministry.

VI. EXPERIMENTAL ORDERS.

A considerable amount of experimental work has been carried out during the year, a summary of the quantities of each type of Cordite is appended.

For Service of Ordnance Committee.

	Size	Pressed lb.	Issued lb.
M.D. reworked with Carbamite	.057	300	5,595
R.D.B. reworked with Carbamite	8	-	145
W. from Straw Cellulose	11	237 7/16	237 7/16
H.P.	.045	100	100
W. various	.154-.136)		
	.144-.048)		
	.168-.056)	1,677	1,677
	.072)		
	.112)		
	.160)		
R.D.N./A	.040	250	250
F.551/27 various	.023)	275	275
	.045)		
		3,739 7/16	3,279 7/16

For Service of Small Arms Committee.

M.D.T.	6-2)	500	500
	9-2)		
W.T.	5-2	65 6/16	65 6/16
		565 6/16	565 6/16

For Service of Army.

W.T.	.144-.048	925	575
M.D.T.	9-2	325 6/16	325 6/16
R.D.N./A.	.034	920	920
F.551/27	.023	2,020	2,020
		4,690 6/16	3,840 6/16

For Service of Research Department.

	Size	Pressed lb.	Issued lb.
M.D.T. various	9-2 10-3 10-4 etc. Chopped	156	156
R.D.N./A. various	.042 .040 .020	500	500
F.Sol/27 various	.045 .023	535	535
N.T. and N. Chopped, various	-	110	110
Modified N. compositions for S.A.A., Tubular, chopped, var.	-	76	46
		1,377	1,347

R.G.P.Y. Experiments.

N. Acetone-Alcohol Solvent Trials	Var.	25	-
M.D.T. Rework Trials	5-2	600	-
N. Solvent Experiments	.057	360	50 (For Proof)
N. Rework Solvent Trials	.057	540	23
N. Trials with Reduced Dies	.093	30	-
		1,555	73

Total Experimental.

Authority	Pressed	Issued
Research Department	1,377	1,347
Army	$4,690\frac{6}{16}$	$3,840\frac{6}{16}$
Small Arms Committee	$865\frac{6}{16}$	$865\frac{6}{16}$
Ordnance Committee	$2,739\frac{7}{16}$	$8,279\frac{7}{16}$
Proof Samples	1,555	73
	$10,927\frac{3}{16}$	$14,105\frac{3}{16}$

T.N.T.

After completion of orders received for T.N.T. the plant was shut down.

During the year a total of 20.914 tons was manufactured.

Further valuable experience was gained, and this has been incorporated in a separate report on the working of the T.N.T. Pilot Plant.

VII. SERVICES.

(a) Steam. Tenders have been received for lagging the 8" steam main from Press House No.5 to Incorporating House No.3, and also for four boilers at No.7 Boiler House. Alterations have been made to supply steam from No.7 Boiler House to the Tray Stoves. Further alterations at No.7 Boiler House are necessary to make way for the proposed coal telpher and the removal of the old forced draught fans is necessary.

Considerable progress has been made with the boilers under repair at Nos. 1 and 9 Boiler Houses. These are almost completed save for a few minor parts. The brickwork, unfortunately, has suffered more than expected, and considerable work has to be done to put the plant in working condition. A new crane boiler has been purchased, erected and tested for the coal crane at No.9 Boiler House. Six of the nine reconditioned boilers at No.7 Boiler House have been under steam at 100 lb. per sq.in. pressure and a trial under working conditions is being carried out. The induced draught fan will increase the steaming capacity of these boilers. The installation of Economisers at Nos. 1, 7 and 9 Boiler Houses is being deferred until the emergency arises. There are seven boilers at No.7 Boiler House not reconditioned, and unless another rotary converter is installed to give 1918 capacity, these boilers should be put into working order.

No.3 Boiler House, which was shut down a few years ago, has been restarted to supply steam to Edmondsey Engine House only. The increased demand for steam from the Nitroglycerine Section necessitated opening up the Boiler House. Steam for process, heating and power for Nitroglycerine is still being supplied from No.5 Boiler House.

A considerable number of boiler tubes have had to be replaced in the boilers at No.5 Boiler House. Samples of tubes and water before and after treatment have been sent to Messrs. Babcock & Wilcox for report. A continuous blow-down system has been recommended to prevent scaling and mud deposit on tubes, which causes overheating and bulging.

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

	lb.	Cost per 1000 lb.
1933 - 34	116,033,000	30.09d.
1934 - 35	130,312,000	34.61d.
1935 - 36	149,292,000	39.46d.

(b) Electricity. The rotary converters removed from R.S.A.F. to the Guncotton Power House have been set to work and have given excellent service for several months. Provided R.S.A.F. policy permits, the removal of the third retary from R.S.A.F. to R.G.P.F. will be arranged.

It is proposed to continue the supply of electricity from the North Metropolitan Electric Power Supply Co.

The Bellis & Morcom sets are well in hand, and one set has been completed and tested under working conditions.

The repair of the condenser sets is being undertaken by factory labour.

It is considered that the cable serving a number of buildings in the Edmondsey area should be duplicated, and that several steam engine drives at C.E. and Picrite Factories should be replaced by motor drives.

The re-organisation of electric cables at the Pulping and Moulding Room requires attention, and the provision of a sub-station with adequate switching and fusing arrangements is necessary.

The consumption and cost per unit, as compared with the two previous years, is as follows:-

	Units	Cost per Unit
1933 - 34	462,470	2.92d.
1934 - 35	526,280	3.30d.
*1935-36	952,699	2.08d.

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

VIII. MAINTENANCE.

Four Guncotton stoves have been thoroughly overhauled and repaired, two of which have been almost entirely rebuilt.

A coke condenser has been rebuilt; also Nitroglycerine retorts, C.E. Packing House and Clearing Store have been reconditioned.

Various Guncotton stove traverses have been raised, and repairs to Guncotton buildings and porches have been carried out.

In the Cordite Factory, Nos. 2, 3, 4 and 7 Incorporating Houses have been reconditioned, and lined with insulating boarding, and hot water supply carried to the machines.

Nos. 2 and 3 Press Houses have been thoroughly repaired, and repairs and re-roofing, including internal and external painting, have been carried out in Nos. 5 and 6 Blending Houses.

The roof of No.4 Cordite Magazine has been renewed, and considerable progress made with the renewal of the roof of No.2 Magazine.

The traverse of No.1 Magazine has been raised, and general repairs carried out to Cordite Tray Stoves, Stores, Dining and Shifting Rooms, etc.

In the Guncotton Section the brickwork of six retorts and seven Producers in the Guncotton Acid Factory have been rebuilt, including the platforms and coil trays.

The absorption Tower piers and superstructure have been entirely replaced.

No.2 Nitrating House has been repainted and reconditioned.

No.1 Vat House floor has been largely renewed, the vats reconditioned and the building painted internally and thoroughly repaired.

Progress has also been made with the reconditioning of No.2 Vat House.

A foundation and base has been provided for a new 2-ton potcher, and a new waste acid tank foundation has been built.

A coke condenser at the Nitric Acid Factory has been rebuilt.

Throughout the factory the paths between buildings and the surrounds to buildings have been repaired and tar paved. Approximately 4,300 sq.yds. of sand carpet was laid by contract.

Dredging has been carried out continuously throughout the year. The Tray Stove cuts and the Black Ditch have been cleared

and the cuts in the Nitroglycerine area have been dredged.

In addition to the more important works already enumerated, repairs have been carried out to Shifting Rooms, Dining Rooms and Reeling Houses, Boiler House furnaces, bridges and trolley tracks. Approximately 3 miles of track have been renewed during the year.

Seven new boats have been supplied by contract during the year, two for the Cordite Section, one for the Nitroglycerine Section, two for Building Works Department and two for the Stores Department.

A programme of estate clearance has been carried out. Dangerous trees have been felled and these, and an accumulation of fellings, removed, and the factory area generally has been cleared of undergrowth, rubbish and debris.

Improvements in the Incorporating Houses has entailed a considerable amount of work in providing sealed entry and exit of steam pipes. All Incorporating Houses, except Nos. 1 and 6, have been provided with a hot water service, and considerable improvement has been made in lighting and switching facilities.

No.2 Vat House has been provided with a ring water main of ample capacity, although the main of the filter system requires to be considerably enlarged to prevent loss of head. The lighting service has been re-wired, and steam service prepared.

Stirring gear for Nos. 7, 8, 9 and 10 Acid tanks has been purchased and two tanks fitted up. A new weak waste acid tank with stirring gear is being erected at the Guncotton Factory, and six new retorts have been erected in No.2 Nitric Acid Factory. Beaters have now been put in good order. The service plant has been rearranged, and a new design of potcher has been erected and tried out. This has been followed by the 2-ton potcher, and pumps of suitable design and capacity are being purchased from Messers. Lee, Howl.

The reconditioning of No.2 Nitrating House has made progress and a modern lighting installation erected. The acid service pipes have been renewed and water service connections re-made.

A vacuum pump for Service moulding machines is necessary for emergency output and is being purchased this year.

Guncotton Stove services have been reconditioned and the hot air services of two stoves is being altered to give improved circulation of air.

A C.E. Nitrating House has been provided with a complete plant, including electric drive for the main shafting. External lighting for C.E. Purification House has been provided, and considerable improvement made in plant. A forced hot air drying system for a C.E. Stove has been provided.

The new sieving system for Cordite cylinders has been extended to all the small screw presses of No.10 Press House, and to the cylinders of the hydraulic press houses Nos. 2 and 3. Progress is being made with the cylinders of Press House No.5, but the construction of the cylinders renders necessary the insertion of a screwed bush to receive the recess for the sieving system.

Mantlets for Press Houses Nos. 5 and 6 are being erected. Bay No.1, No.10 Press House, has been completed by bringing and erecting presses from Quinton Hill.

IX. COST OF PRODUCTIONS.

Cost of Principal Productions for :-

	1935-36 Per lb.	1934-35 Per lb.
	s. d.	s. d.
Cordite:-		
M.D. 5 - 2.	3. 0¼.	3. 7⅛.
W.C. (W.054 & .057).	2.10¾.	3. 4⅛.
M.D.M./A.	5. 1.	6. 0¾.
Picrite.	6. 5¾.	6. 8.
Composition Exploding, Crystals, Grade I.	5. 1.	-
Composition Exploding, Ground, Grade I.	5.11½.	-
Composition Exploding, Corned, Grade I.	6. 2¾.	-

X. FACTORY EXPENSE.

The total F.E. as shown in Appendix II has increased over last year's total by some £38,000.

This increase is again mainly due to the accelerated maintenance programme, and in part, to increase in strength.

The percentage F.E. to direct labour has fallen from 64% to 47%.

XI. STORES.

The total value of stores held in stock on 31.3.36 was :-

Manufacturing Materials	£63,712
Other Items	£19,688
Total	£83,400

This compares with the value of 31.3.35 as follows :-

Manufacturing Materials	£56,272
Other Items	£16,360
Total	£72,632

Appendix III shows comparative prices paid for various items as between 1934-35 and 1935-36, also the result of Stocktaking and the sale of surplus stores.

XII. IMPERIAL RESERVE STOCKS.

The stock of glycerine at the end of the year amounted to some 510 tons, of which 450 tons represented Imperial Reserve.

XIII. GENERAL WAGES QUESTIONS.

During the year the remaining portion of the Morris Award was restored to Industrial employees, and the full consolidation of Civil Service Bonus for Non-Industrials was carried out.

XIV. AGES OF EMPLOYEES.

The numbers and average ages of employees on 1st April 1935 and 31st March 1936 are given in Appendix IV.

XV. ESTABLISHMENT.

(a) Staff.

Lt. Col. C.G.F. Davidson, D.S.O., was appointed Inspector of Danger Buildings (27/6/35).

Mr. M.H. Maggs was appointed Manager of Building Works Dept. (Joint) vice Mr. T.W. Watkins.

(b) Strength.

The total strength of the factory on 31st March, 1936, is shown in Appendix IV, and Appendix V shows the age gradation at that date as compared with the end of the previous year. It is satisfactory to record that the average age has fallen from 42.46 to 37.86. Appendix VI gives a detail of personnel on 31st March 1936 and 1935 respectively.

XVI. WAR EMERGENCY ACTIVITIES.

It will be evidenced from the remarks on maintenance that the factory generally is in a very good state of repair.

As a result of a visit to the factory by the Master General of Ordnance and the Director of Ordnance Factories, it has been decided (1) that there is no need in the present outlook to enlarge the Vat House; (2) that in the present outlook, Waltham will be maintained to produce 150 tons Cordite W. and 30 tons Cordite M.D.; (3) that, if anything should occur to modify the present proposals for removal, or to delay action, then the situation must be reviewed.

Also, certain matters on which action has been suspended pending a decision on removal are enumerated below:-

New lay-out for Tetryl Factory

Restoration of 2 Cordite Stoves

Further progress with Quinan Driers

Denitration Towers for spent acid

Automatic Telephone System

New Machinery Shop.

Collaboration with the Supply Board Technical Establishment continued throughout the year.

The action for the emergency supply of electricity at the Lower Works has been concluded as regards two converters.

XVII. CONCLUDING REMARKS.

The output programme for the year permitted of more regular and continuous working of plant, particularly in the manufacture of Gunnotton and ancillary operations.

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.

APPENDIX I.

1935 - 36.

ANNUAL TURNOVER.

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

	PARLIAMENTARY ESTIMATE. £	LATEST FORECAST. £
A. Establishments.	5,335	5,235
B. Wages.	101,800	110,535
C. Materials.	77,585	101,425
D. Machinery, Contract.	12,285	6,480
E. Works, Contract.	4,810	3,785
F. Miscellaneous.	6,500	7,630
G. Non-effective.	8,300	7,000
	216,615	242,090
Add - Net effect of Materials on I.D.D's	2,000	2,900
	218,615	244,990
H. Productions for Army, Navy, etc.	213,410	237,700
Miscellaneous Receipts.	2,400	2,760
Sale of Scrap, old stores and stores issued on repayment.	1,200	1,170
	217,010	241,630
Less - Net effect of I.D. Services	7,210	7,230
	209,800	234,400
Balance as shewn below.	8,815	10,590

INCOMINGS.	Parl'y Estimate.	Latest Forecast.
Estimated amounts recoverable in respect of:-		
Depreciation of:-		
Buildings.	3,375	3,290
Machinery.	3,975	3,280
Mains.	405	373
Written off:-		
Machinery	145	2
Buildings	-	160
Mains.	-	-
Land.	-	845
Transfer from Supplies Suspense Account	8,815	10,590
	16,715	18,540

OUTGOINGS.	Parl'y Estimate.	Latest Forecast.
Estimated expenditure on New Capital:-		
Buildings:-		
(a) Contract.	550	1,570
(b) Departmental.	3,700	900
Machinery:-		
(a) Contract	8,285	4,390
(b) Departmental.	3,480	1,900
Mains:-		
(a) Contract	500	525
(b) Departmental.	200	45
Land & other non-depreciated assets	-	-
Increase of Stores in Stock.	-	9,210
	16,715	18,540

APPENDIX II.

R.G.P.F. WALTHAM ABBEY.

FACTORY EXPENSES.

Description.	1935-36 Amount £	1934-35 Amount £
Process Expenses.		
Foremen, Asst. Foremen etc.	2,863	2,220
Miscellaneous Labour.	1,813	1,134
Consumable Stores.	994	708
Gas.	44	21
Water.	41	21
Steam (Process).	9,788	6,937
Power.	6,010	4,995
Refrigeration.	4,825	3,749
Compressed Air.	4,542	3,097
Maintenance of Plant.	16,815	15,589
Maintenance of Buildings.	2,917	4,461
Depreciation.	1,394	1,394
Rates.	201	192
Internal Transport.	1,770	990
Balance of Process Expenses.	2,875	2,537
Sectional Expenses.		
Management.	2,991	2,735
Electric Light	584	628
Gas.	102	74
Steam for heating.	2,616	2,540
Maintenance Services.	3,697	2,065
Miscellaneous Labour.	934	560
Laboratory Testing.	3,089	3,085
Care & Custody of Departmental Stores.	345	205
Allowances.	4,048	2,193
O.T. & N.S. Bonus.	450	190
Balance of Sectional Expenses.	3,349	1,772
Credit for Materials returned to store.	598	490
General Expenses.		
Superintendence.	699	546
Registry, Pay & Order Branches.	495	353
Worktakers, Wages and Accounts.	1,160	829
Central Stores.	3,064	3,010
Police, Fire Brigade and Wardens.	4,219	4,205
Maintenance of Grounds, Mains, Canal, Permanent Way &c.	13,431	9,712
Non-effective Charges.	6,436	5,493
Balance of General Expenses.	37,885	20,138
Total.	145,858	107,888
Less Subsidy.	14,875	14,875
Total Factory Expense.	130,983	93,013
Percentage to Direct Labour.	472.90	641.70
Direct Labour.	27,698	14,495

APPENDIX III.

M A T E R I A L S.

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

Material.	1934-35	1935-36
Acetone	£58 8 0	£57 8 0
Cotton Waste	56 14 0	59 2 6
Glycerine	50 0 0	56 10 0
Mineral Jelly	10 7 6	11 16 3
Sodium Nitrate	7 15 0	7 15 0
Ammonium Nitrate	17 18 6*	11 0 0
Carbamite	235 2 1**	228 19 10**
Sodium Sulphite	9 2 6	-
Calcium Cyanamide	9 0 0	9 0 0
Mono-nitrotoluene	45 0 0	-
Acid Sulphuric - 20%	6 1 0	5 16 0
65%	8 11 0	8 8 6
98%	6 1 0	5 16 0
96%	5 19 9	5 18 6
Nitric Acid 98%	19 10 0	-
Lead, Chemical - Sheet	16 16 8	21 3 4
Pipe	15 10 6	21 6 8
Coal, Mechanical Stoker	1 0 10½	1 0 5½

*Supply from Army Stocks
**Supply arranged by Director of Navy Contracts.

STOCKTAKING.

Value of Stock		Value of Stock Checked		Nett Surplus
This Year	Last Year	This Year	Last Year	
£	£	£	£	£
83,400	72,632	10,584	61,311	333

The surplus of £333 revealed in stocktaking is equivalent to 3.1% of the value of stock taken.

SALE OF SURPLUS STORES.

Total Amount Realised	Nett Loss
£13	£5

APPENDIX IV.

Age	Nos. on 1.4.35	Nos. on 31.3.36	Age	Nos. on 1.4.35	Nos. on 31.3.36
65	-	-	39	14	15
64	4	4	38	13	16
63	8	11	37	8	16
62	12	12	36	8	17
61	11	11	35	8	23
60	12	13	34	9	24
59	13	15	33	11	26
58	14	12	32	11	29
57	11	26	31	13	19
56	26	10	30	12	36
55	9	14	29	14	30
54	14	11	28	14	22
53	9	21	27	10	35
52	18	14	26	14	29
51	13	11	25	15	24
50	7	7	24	7	22
49	6	13	23	11	31
48	7	12	22	11	21
47	6	11	21	4	22
46	13	16	20	4	9
45	10	12	19	5	3
44	10	20	18	2	7
43	7	12	17	3	5
42	8	13	16	3	3
41	8	10	15	1	3
40	6	21	14	1	1
				488	819

av. age 39

APPENDIX V.

TOTAL STRENGTH on 31.3.36.

	Nos.	Percentage
60 and Over	51	6.23
Over 50 and under 60	141	17.22
Over 40 and under 50	139	16.97
Over 30 and under 40	221	26.98
Over 21 and under 30	256	28.82
Under 21	31	3.78
	819	100.

APPENDIX VI.

PERSONNEL - 31.3.36.

	Total this Year	Total last Year
Supervisory, etc.	63	49
Skilled	121	66
Semi-skilled	142	79
Unskilled	469	279
Women and Girls	1	-
Boys	23	15
	819	488
Highest	828	498
Lowest	488	398
Average	669	441
Entries during the year	392	133
Discharges during the year .	67	63
Transfers during the year ..	30	23
(Transfers "In"	(18)	(13)
"Out"	(12)	(10)

G.P. 1

ANNUAL REPORT - GUNPOWDER SECTION - 1935-36.

The work carried out during the year has consisted entirely of the production of Millcake for the manufacture of Fuze Powder S.R. 227, the Millcake being then transferred to C.S.O.F. for finishing.

The manufacture consists essentially of three processes:-

(1) Charcoal burning, grinding and sieving;

(2) mixing Saltpetre, charcoal and sulphur;

(3) milling.

(1) Charcoal Burning. The dogwood is cut into suitable lengths (about 3") in a small rotary saw, ground up in a Harrison-Carter disintegrator, sieved by hand, and burnt in a rotary burner. The Charcoal is ground in an edge runner mill and again hand sieved.

The plant is fit only for very small outputs, and hand-sieving of both wood and charcoal is very objectionable work. For larger outputs, the following plant is desirable - a more efficient saw, well confined mechanical sieves both for charcoal and wood, and a more suitable mill for grinding charcoal.

The charcoal burner has worked very successfully, and all batches of charcoal have been burnt to within the specification limits for carbon content. Quantity of charcoal burnt was 1348 lb.

(2) Mixing. All the mixing has been done by hand, and for larger outputs some kind of mechanical mixer should be installed.

(3) Milling. The conditions for milling are received from the Superintendent, Royal Filling Factories. These are being continually changed, and it is evident that the proper conditions for finishing the powder have not yet been arrived at. The charcoal supplied during the year has been exceedingly uniform, and the cause for the variations necessary in the milling should be looked for elsewhere.

Both Nos. 5 and 7 mills are being used alternatively, all trials being carried out in No.5, and an attempt made to arrive at the conditions in No.7 from these trials, but in spite of many trials, a definite time for No.7 has not yet been reached to give the necessary speed of burning. Millcake made in No.5 mill - 2,800 lb; and in No.7 mill - 5,040 lb.

19/5/36

LAB 1

WORK CARRIED OUT BY THE LABORATORY 1935 - 36.

Following is a summary of the work carried out by the Laboratory staff during the year.

Table "A" gives the inspection and routine testing undertaken and Table "B" all the other work executed, reports of most of which have been forwarded during the year.

A. Inspection of Raw Materials, intermediate and finished Products, etc. for year ending 31st Match 1936.

Raw Materials.

Cotton Waste	310 tons	Caustic Soda	10 cwt.
Glycerine	100 ,,	Saltpetre	2 tons
Acetone	340 ,,	Gum Arabic	3 cwt.
Mineral Jelly	13 ,,	Diethyldiphenyl-urea	30 tons
Nitrate of Soda	966 ,,	C.O.V.	252 ,,
Soda Ash	16 ,,	N.O.V.	1093 ,,
Chemical Lead	102 ,,	Nitric Acid	17 ,,
Calcium Carbonate	24 cwt.	Coke	503 ,,
Calcium Cyanamide	85 tons	Charcoal	12 cwt.
Ammonium Nitrate	37 ,,	Petrol	280 galls.
Ammonium Per-chlorate	14 cwts.	Dimethylaniline	30 tons

Intermediate Products.

Nitroglycerine - 120 nitrations = 360 washings = 207 tons
Guncotton - 433 batches) 450 tons
173 stovings)
18 service batches 9 tons
3 N.C. batches 3 tons
Product "C" - 137 batches 17 tons

Finished Products.

742 Samples representing -
Cordite M.D. - 151 lots
8 batches
Mk.I - 37 lots 370 tons

36 Samples representing -
R.D.N./A. - 10 lots
5 batches 38 tons

269 Samples reppresenting -
Cordite W. - 87 lots 838 tons

Experimental 14 tons.

Finished Products (Contd.)

259 R.D.N./A. Samples
517 W. Batch Samples
480 W. Blend Samples
269 W. Lot Samples

Fuze Powder	- 64 Samples	7,840 lb.
C. E.	- 300 Samples	20 tons
R.D. 202	- 144 Samples	1,300 lb.

Routine Inspection for the purpose of Process Control.

C.O.V. for Nitroglycerine manufacture	119	Samples
,, Guncotton ,,	100	,,
,, C. E. ,,	13	,,
Denitrated Acid for Guncotton manufacture	52	,,
,, N/G. ,,	233	,,
Nitric Acid for N/G manufacture	228	,,
,, G/C. ,,	90	,,
,, C.E. ,,	11	,,
Mixed Acid for N/G manufacture	19	,,
,, G/C ,,	70	,,
Waste Acid for N/G manufacture	47	,,
,, G/C ,,	43	,,
,, C.E. ,,	5	,,
Condensate Acid for G/C manufacture	100	,,
Nitre Cake from N/G manufacture	41	,,
,, G/C ,,	16	,,
,, C.E. ,,	14	,,
Soda Nitrate from G/C manufacture	13	,,
,, N/G ,,	45	,,
Cotton Waste	905	,,
Acetone	649	,,
Mineral Jelly	50	,,
Glycerine	50	,,
Filter Bed Waters	520	,,
Vat Boiling Waters	3,080	,,
G/C from stoves and Weighing House	692	,,
Experimental Acid	10	,,
Lime Waters	14	,,
Product "A"	61	,,
Product "C"	128	,,
Product "D"	17	,,
Sludge	33	,,

Routine Inspection (Contd.)

Numerous samples of miscellaneous stores, of which the following are typical, were also inspected:-

Asbestos Powder, Fibre, Packing, etc.	1½	tons
Machinery Oil, Cylinder	960	galls.
,, Light	600	,,
Kieselghur	1	ton
Barium Sulphate		
Spelter		
Paraffin Oil		
Non-absorbent Paper		

B. Experimental, Development and other Work carried out by Laboratory Staff during the year ending 31.3.36.

1. Analysis of purified Cotton Waste from Messrs. Spencer & Curedale.

2. Alkalinity of Guncotton from stuff-chest at beginning, middle and end of the run in Batch No. 1741.

3. Examination of dirt collected on the filter muslins during reworking of M.D. Cordite size 16. W.A. Lot 323.

4. Examination of Lanoline Rust Preventer and comparison with other rust-preventers.

5. Fractional Distillation and purification of large sample of crude Toluene from H.M. Fuel Research Station, Greenwich (part). *

6. Investigation of the corrosion of metals (copper, aluminium, mild steel and staybrite steel) during evaporation of sulphite effluent from T.N.T. washing house.

7. Investigation of the corrosion of Staybrite F.M.B. and F.D.P. steels by various nitric-sulphuric acid mixtures at room temperature and 100° C.

8. Examination and experimental nitration of two samples of Toluene SN.3526 and SN.3527 from National Benzole Association. *

9. Preparation of specification for complete installation of equipment and apparatus for control laboratory of plant manufacturing Trinitrotoluene. *

10. On the corrosion of certain samples of stainless steel by various nitric-sulphuric acid mixtures, and of samples of aluminium by concentrated nitric acid. *

LAB 4

B. Experimental Etc. Work (Contd.)

11. The corrosion of samples of lead and tellurium lead by nitric-sulphuric acid mixtures at various temperatures.

12. Analysis of Solka Alpha NN cellulose from Johnson Jorgensen and Wettre Ltd.

13. The corrosion of stainless steel FeCo 80 in various nitric-sulphuric acid mixtures at room temperature and 100° C. *

14. Investigation of the cresol content of a sample of crude Phenol from the Manchester Corporation Gas Works, and of the separation of the cresols therefrom. *

15. On the corrosive action of 98% sulphuric acid at ordinary temperatures and at the boiling point upon cast iron.

16. Preparation and maintenance of a chart showing the possible output of all available plant in the factory in terms of tons per week of Cordite.

17. Correlation of the results of a large number of corrosion tests on metals, especially alloy steels, carried out at R.G.P.F. and at R.N.C.F., Holton Heath.

18. On the corrosion of "Tantcopper" by dilute sulphuric acid at room temperature. *

19. A study of the esterification of monochloro acetic acid by ethyl alcohol with the object of improving the economics of the present manufacturing process. *

20. An investigation of the relation between the aniline content of crude Monoethylaniline and the setting point of the diethyldiphenylurea prepared from it. *

21. A comparison of the resistance to corrosion of chemical lead in a number of locations in the factory where lead is used (part).

tellurium lead and

22. Preparation of designs and drawings for proposed new C.E. nitrating plant.

23. Preliminary experiments on the wet-sieving of C.E.

24. Analysis pf metal gauze (nickel) suggested for use in cordite pressing.

25. Test of the resistance of certain blue bricks to the action of boiling acid (part).

26. Preparation of plans for rearrangement of existing C.E. nitration plant.

27. Preparation of sketches to assist co-operation of other departments in various factory constructional works.

LAB 5

B. Experimental Etc. Work (Contd.)

28. Operation, as required, of the Hospital X-Ray Installation.

29. Examination and experimental nitration of low-grade Trinitrotoluene from T.N.T. Pilot Plant.

30. Preparation of specification for Tellurium lead, and examination of methods of its analysis.

NOTE: Items marked thus * were undertaken for the Supply Board Technical Establishment.

H.H. Evans 4/5/36.

G.C. 1

REPORT OF WORK OF THE GUNCOTTON SECTION FOR THE YEAR 1935 - 1936.

ACIDS.

The denitration Tower scheme referred to in last year's report has been shelved for the present, and it has been decided instead to arrange for emergency programme by using No.1 Nitric Acid Factory mainly as a still house and No.2 mainly as a retort house, installing retort pots, however, so that they can be used for either. Work on this is well in hand.

The first aluminium Nitric Acid cooler was recently inspected after some 18 months' running. Slight corrosion of the coil at the "wind and water" line was observed, but otherwise the condition was excellent.

In the Concentrator House the Calder-Fox scrubber has been subject to lengthy tests and has been finally abandoned as it appears impossible, under any running conditions, to produce an exit gas complying with the regulations under the Alkali Act without reducing the output of the plant very greatly. No.9 "Bowden" concentrator has run throughout the year without trouble, and the construction of No.3 has been completed. Repairs to producers are either completed or well in hand.

Nos. 7, 8 and 9 Mixed Acid tanks are being prepared for use. Motors with suitable reducing gear for mechanical stirring are being fitted centrally on top of the tanks and this should prove a much more convenient arrangement than the old belt drive. The foundation has been erected for another waste acid tank.

COTTON PREPARATION.

Visits to manufacturers' works to supervise production of our raw material have continued and the greatly decreased quantity of pickings [redacted], is evidence of the value of this arrangement.

An aluminium guard has been fitted to the feed end of the bale breaking machine to prevent possible accidents due to men slipping when feeding the machine with cotton. All the machines

have been rendered fit for use and new bearings, etc., fitted where necessary. It was found in the course of this work that No.3 drying machine was set to run at about twice the normal speed. This has been corrected. Half-inch wire mesh grids have been placed over the bottoms of the tables on which the cotton falls from the drying machine, and from the brattice immediately before weighing. A surprisingly large amount of grit and small metal rings that would otherwise go forward for nitration is collected beneath these.

NITRATION.

During the year all overhead pipe work in No.1 Nitrating House has been coated with a mixture of tar and ozokerite. This appears to give satisfactory protection. The small central earthenware "biscuits" which protect the outlet of the nitrating pans are being replaced by stainless steel perforated plates made by the plumbers, contract prices for these items being excessively high. An aluminium exhaust fan designed and made in the factory has been installed and has run for more than half the year with complete satisfaction. The small Sturtevant stainless steel fan has failed several times, mainly on account of flimsy construction. Old tower sections have been used to construct new exit shafts with improved results both as regards draft on the pans and acid drips in the exit. No.2 House is being prepared for service, and special efforts are being made to ensure satisfactory ventilation. The fume pipes are being enlarged from 5" to 7" and stainless steel exhaust fans are to be used. The waste acid pits are being enlarged to bring them into conformity with those in No.1 House.

BOILING.

All vats in No.3 house have now been fitted with tellurium lead kier columns. They seem very successful and so far have shown no tendency to lean over in the way in which ordinary lead columns did. Tellurium lead linings, now fitted to about half the vats in this house, have been much less successful and crack

very readily. The large number of serious leaks that have occurred in this way appear to be mainly responsible for the considerable amount of trouble due to varying alkalinity that has been experienced.

Two vats are now fitted with recording thermometers and it is hoped to complete the installation of these in all vats during the ensuing year. Nearly all the vats in No.1 house have been repaired and rendered suitable for use under non-specification conditions, and work on No.2 house is in hand.

PULPING AND MOULDING ROOM.

Of the 15 beaters, 14 are now ready for use. Experiments have been carried out on the effect of variations in time of beating and in load on output. A mixture of tallow and ceresine is now used for lubricating purposes and it is found that the bearings run considerably cooler than with tallow only. The aluminium trucks in which the Guncotton is brought from the Vat House have been fitted with hinged aluminium flaps at the ends so as to form an apron during the loading of the beaters. This is a distinct improvement on the sail-cloth aprons previously used for this purpose.

The programme of improvements in the handling of Guncotton pulp has been largely completed. The grit runs, magnets and blanket runs are now laid out in a convenient and accessible manner and with a steady fall. The problem of potchers is now entering upon what, it is hoped, will be the final stages. The method of injecting the pulp tangentially into a circular vessel, referred to in last year's report, proved very successful on a small scale, and after experiments with a model holding 20 lb. of pulp, a ½-ton machine of the type was constructed and is in regular use for Service Guncotton. A second machine of the same size is now erected, and a 2-ton machine is under construction. The method seems to give very thorough washing and blending, and the all-lead construction eliminates metallic contamination. The system is economical in power as compared with

Ge. 4

other types.

The filling-in of old save-alls, removal of stuff chests and lime tanks, covering of floors and general tidying up of plant in this building have added greatly to working convenience and lessened chances of contamination of the Guncotton. Cotton for service work is now stored in aluminium bins before moulding, and the moulding machines have been moved to more convenient positions. Following on a small explosion in the Plumbers' Shop during the re-gauzing of moulding machine plungers, detachable perforated metal tops, to which the gauzes are soldered, have now been fitted to these machines.

SERVICE GUNCOTTON.

Extracts for Service Guncotton were considerably greater than in recent years. No trouble has been experienced with slabs or wet charges, but work on primers was considerably impeded by an explosion which occurred in No.9 press about the end of November. This was apparently due to a fault in the hydraulic system.

Primers are now stamped with the test number after acetoning. This gives a cleaner impression and avoids one handling of the primers in the very fragile state in which they are before acetoning.

R.D. COMPOSITION No. 202.

Early in the year it was decided to renovate all the buildings in this section, and a type of construction using "Insulwood" which has a smoother surface than the "Celotex" previously used, and avoiding all internal projections, has been evolved which appears almost ideal for dusty work of this sort. Immediately after restarting, a new batch of charcoal was brought into use which gave consistently slow burning times and, in spite of every effort, it has proved impossible to make material to give fast times. This has caused considerable difficulty in producing material that would comply with specification limits to fill extracts.

II TOTAL PRODUCTIONS

~~PARTICULARS OF MANUFACTURE.~~

Nitric Acid.

Soda Nitrate Charges	243 at 2 tons		
	4 at 1 ton		
	=	490 tons	
Total Soda Nitrate charged	548.80	s.tons	Crude
	= 544.68	,,	Pure
Equivalent HNO_3	403.63	,,	
Nitric Acid produced	441.10	,,	at 89.85%
	= 396.33	,,	HNO_3
Loss	7.30	,,	
Efficiency	98.20%		
Strong Sulphuric Acid used	533.44	s.tons	at 94.43%
	= 503.61	,,	H_2SO_4

Redistillation.

Acid charged to Stills - 2,565.75 s.tons containing:-

	1559.33	s.tons	H_2SO_4
	456.57	,,	HNO_3
Strong Nitric Acid recovered	501.30	,,	at 89.03%
	446.27	,,	HNO_3
Loss	10.30	,,	,,
Efficiency	97.73%		
Weak Sulphuric Acid recovered	1984.28	s.tons	at 77.47%
	= 1536.93	,,	H_2SO_4
Loss	22.40	,,	
Efficiency	98.60%		

Concentration of Weak Sulphuric Acid.

Acid charged to Concentrator	1949.00	s.tons	at 77.35%
	= 1507.63	,,	H_2SO_4
Strong Sulphuric Acid produced	1575.69	,,	at 94.3%
	= 1484.83	,,	H_2SO_4
Loss	22.8	,,	
Efficiency	98.55%		

G.C. 6

Nitration.

No. of sets of Guncotton	4,818	
,, ,, Nitrocotton	33	
	4,851	
Mixed Acid used	8335.17	s.tons
Cotton Waste used	298.16	,, gross
	270.23	,, nett
Guncotton produced	450.21	s.tons
Save-all	10.18	,,
Yield	166.6%	
Available for Cordite	162.9%	
Ratio - Mixed Acid/Cotton Waste	30 : 84	
Mixed Acid/Guncotton	18 : 51	

Guncotton etc. Issued to Services other than for Cordite Manufacture.

12,915 1 lb. Slabs to C.O.O. Bramley and Woolwich

1,000 1 lb. Charges to C.O.O., Woolwich

14,560 1 oz. primers to C.O.O., Bramley

100 lb. Guncotton Pulp to C.S.R.D., Woolwich

100 lb. Nitrocotton Pulp to C.S.R.D., Woolwich

10 lb. Guncotton Pulp to Messrs. Vickers.

Total - 15,035 lb. = 7.5175 s.tons.

G.C.7

Materials.

	T.	c.	lb.		
Oleum drawn from Store	677	0	20	=	758.25 s.tons
Difference in Stock					133.10 ,,
Oleum					625.15 ,,

= 1.3885 per lb. of Guncotton.

	T.	c.	lb.		
Nitrate of Soda drawn from Store	490	0	0	=	548.80 s.tons
Difference in Stocks					74.82 ,,
Nitrate of Soda consumed					473.98 ,,

= 1.053 per lb. of Guncotton.

	T.	c.	lb.		
Cotton Waste drawn from Store	266	4	31	=	298.16 s.tons
Deduct Oil and Moisture (.19% and H_2O 6.27%)					19.26 ,,
Deduct Pickings and Fly					8.67 ,,
Nett Cotton Waste used for Nitration					270.23 ,,

Foreign Matter removed in picking, etc.:-

Wood, string and metal	697 lb.	= .1169%
Grit	42 lb.	= .007%
Fly	1660 lb.	= 2.785%

Cotton used per lb. of Guncotton -

0.6622 Gross

0.6002 Nett.

Summary of Consumption ~~of~~ Losses.

	H_2SO_4		HNO_3	
	Actual	Per ton of G/C.	Actual	Per ton of G/C.
Manufacture of Nitric Acid	503.61	1.119	7.30	.0162
Redistillation	22.40	.0497	10.30	.0228
Concentration	22.80	.0506	-	-
Nitration	112.30	.2470	337.88	.7505
Washing out Plant	2.04	.0045	.38	.0008
	663.15	1.4708	355.86	.7903

N.G.1

ANNUAL REPORT - 1935 - 36.

NITROGLYCERINE SECTION.

The manufacture of Nitroglycerine, stoving of Guncotton, and Paste mixing has proceeded during the year without any difficulty being encountered. The yield of Nitroglycerine has increased slightly during the last two years and has reached the figure of 234.5%. This increase is probably largely due to increased rate of manufacture which entails, amongst other factors, a smaller proportion of water used for cleaning plant to Nitroglycerine made.

The erection and fitting up of the Quinan Guncotton Stove is proceeding.

Picrite manufacture has continued satisfactorily. THE Plant has been operated on a three-shift a day basis during a considerable part of the year, so getting the largest output from the process that has as yet been attempted.

Nitration of C.E. and subsequent purification to Crystal, Ground and Corned C.E. Grade I have been carried out during the year with an increasing rate of manufacture. Manufacture of nitric acid from sodium nitrate and sulphuric acid recovered from the waste acid from nitration, also recommenced.

The number of men employed on the section has been considerably increased. This has entailed some difficulty in training the new men to the required standard of working ability.

(b) Nitroglycerine Section

A. Manufacture of Nitric Acid.

The retorts used were:-

No.10 - 123 runs at 30 cwts. of Nitrate of Soda
No.11 - 123 ,, ,, ,,

Average time of distillation - 12 hours.

Materials and Results:-

Nitrate of Soda used	413.28	s.tons	at 99.39% $NaNO_3$
C.O.V. used	280.72	,,	at 86.7% H_2SO_4
Oleum used	150.75	,,	at 20% free SO_3
Coke used	46.88	,,	
Strong Nitric Acid made	281.80	,,	at 90.5% HNO_3
Weak Nitric Acid made	62.06	,,	at 60.1% HNO_3
Nitre Cake produced	495.94	,,	at 33.0% H_2SO_4
Efficiency Strong Nitric Acid	83.8%		
Total Efficiency	95.9%		

B. Denitration of Waste Acid.

120 charges of Waste Acid were denitrated in No. 1 Tower.

Output.			
Waste Acid denitrated	366.00	s.tons	(261.94 s.tons H_2SO_4 (40.18 s.tons HNO_3
Denitrated Sulphuric) Acid made)	367.51	,,	at 71.2% H_2SO_4
Weak Nitric Acid made	60.00	,,	at 57.6% HNO_3
Efficiency - Sulphuric Acid	100%		
Nitric Acid	86.0%		

C. Concentration of Weak Sulphuric Acid.

Concentrators Nos. 2 and 3 were used.

Output.			
Weak Acid concentrated	700.49	s.tons	at 67.8% H_2SO_4
Coke used	50.21	,,	
Strong Acid made	461.45	,,	at 89.3% H_2SO_4
Weak Acid made	107.58	,,	at 45.5% ,,
Efficiency Strong Acid	86.7%		
Total Efficiency	97.0%		

D. Redistillation of Weak Nitric Acid.

50 runs were carried out in No. 4 Still.
Average time of distillation was 14 hours.

Weak Nitric Acid used	131.66	s.tons	at 59.1% HNO_3
Strong Sulphuric Acid used	179.55	,,	at 92.9% H_2SO_4
Coke used	33.20	,,	
Strong Nitric Acid made	58.98	,,	at 89.8% HNO_3
Weak Nitric Acid made	38.57	,,	at 56.3% ,,
Weak Sulph.Acid made	227.79	,,	at 72.9% H_2SO_4
Efficiency Strong N/Acid	68.2%		
Total N/Acid Efficiency	96.0%		
Sulphuric Acid Efficiency	99.5%		

E. Acid Mixing.

Output.			
Nitric Acid, new, mixed	214.90	s.tons	at 90.2% HNO_3
Nitric Acid, redistil-) led, mixed)	51.17	,,	at 90.2% ,,
Oleum, 20%, mixed	135.75	,,	at 20% SO_3 (free)
Oleum, 65%, mixed	136.50	,,	at 65% free SO_3
Total mixed Acid made	538.32	,,	

F. Manufacture of Nitroglycerine.

120 charges of 1470 lb. glycerine each were nitrated.

Average time of nitration was 70 minutes, and separation 130 minutes.

Average brine temperature was -13°C.

Nitration was carried out in the early part of the year in Nitrator No. 1. Nitrator No. 2 was then used and Nitrator No. 1 completely rebuilt.

Output.

Glycerine used	88.200 s.tons
Mixed Acid used	495.000 ,,
Soda Ash used	6.720 ,,
Waste Acid made	366.000 ,,
Nitroglycerine made	206.736 ,,
Nitroglycerine yield	234.5%

Summary of Tests.

	Max.	Min.	Average
Moisture	0.57%	0.10%	0.29%
Heat Test	14 mn.	10 mn.	12 mn.
Alkalinity	All under 0.0005		

Nitroglycerine - Usage

For Cordite M.D.	59.150 s.tons
,, W.	137.566 ,,
,, Mark I	2.997 ,,
,, RDN/A	5.720 ,,
For Dynamite	0.780 ,,
For Sundry Experiments	0.523 ,,

Summary of Consumption and Losses of Acids.

	H_2SO_4		HNO_3	
	Actual s.tons	Per ton N.G.	Actual s.tons	Per ton N.G.
Manufacture of N/Acid	299.10	1.447	10.99	0.053
Denitration	1.99	0.010	6.45	0.032
Redistillation	0.72	0.003	10.61	0.051
Concentration	13.46	0.065	-	-
Acid Mixing	13.41	0.065	13.30	0.064
Nitration	9.73	0.047	176.59	0.853
	338.41	1.637	217.94	1.053

Raw Materials Used (s.tons per ton Nitroglycerine).

Nitrate of Soda	1.492
Oleum, 20%	0.875
Oleum, 65%	0.632
Glycerine	0.4266
Soda Ash	0.0325

NG.4.

G. Drying and Weighing Guncotton and Nitrocotton.

Stoves 2 - 13 were used.

174 stovings of Guncotton and 4 stovings of Nitrocotton were dried. The average time of drying was 68 hours.

Total amount dried was:-

Guncotton	435.000s.tons
Nitrocotton	5.545 ,,

Guncotton was used as follows:-

Paste, M.D. and W.	421.141 s.tons
Mark I	1.883 ,,
Experiments	1.064 ,,

Nitrocotton was used as follows:-

Paste, RDN/A	4.010 s.tons
Issued to C.S.R.D.	0.200 ,,

H. Paste Mixing.

Paste Mixed:-

M.D.	182.820 s.tons
W.	435.037 ,,
Mark I	4.880 ,,
RDN/A	25.622 ,,
Experiments	1.586 ,,
Dynamite	1.200 ,,

NG-4

I. Manufacture of ~~Pic~~. Tetryl

Manufacture of Nitric Acid.

No.17 Retort - 30 runs at 1½ long tons Nitrate of Soda
No.18 ,, - 31 ,, ,, ,,

Average time of distillation - 11 hours.

Nitrate of Soda used - 102.48 s.tons at 99.3% $NaNO_3$
Oleum, 20% used - 23.25 ,, at 20% free SO_3

C.O.V. recovered from C.E. Waste Acid also used

Strong Nitric Acid made - 63.20 s.tons at 88.1% HNO_3

Strong Nitric Acid issued to C.E. Nitration — 56.00 s.tons at 88.1% HNO_3

Strong Nitric Acid from N.G. manufacture of Nitric Acid issued to C.E. Nitration — 49.59 s.tons at 90.4% HNO_3

NG 5.

Nitration of C.E.

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

Tar Oil used	13.146	s.tons
Nitric Acid used	105.59	,, at 89.2% HNO_3
C.O.V., 96%, used	201.75	,, at 96% H_2SO_4

Waste Acid issued to coppers and then to Nitric Acid manufacture.

Crude C.E. made - 20.200 s.tons (as purified C.E.)

Purification and Finishing of C.E.

Crude C.E. purified 20.710 s.tons (as purified C.E.)

Acetone used 26.76 s.tons
Caustic Soda used 0.55 ,,

Finished C.E. issued as follows:-
Ground 0.500 s.tons
Crystal 2.800 ,,
Corned 5.467 ,,

Other Work.

(1) Corned C.E. received for grinding 0.650 s.tons
Ground C.E. issued 0.636 ,,

(2) Crystal C.E. received for repurification in 1934/35. Acetone used 1935/36 — 0.050 s.tons
Crystal C.E. issued 1935/36 0.772 ,,

(3) C.E. received for repurification in 1934/35. Acetone used 1935/36 — 0.150 ,,
C.E. Corned and issued 1935/36 7.391 ,,

J. Picrite.

N65

Output.

Calcium Cyanamide used	57.57 s.tons
Ammonium Nitrate used	21.26 ,,
C.O.V. 98% H_2SO_4., used	51.37 ,,
Finished Picrite made	16.917 s.tons

Recovered Sulphuric Acid issued to contractors.

Picrite was used as follows:-

To C.S.R.D.	0.775 s.tons
To N.A.S.O. and R.N.C.F.	0.250 s.tons
To RDN/A Paste Mixing	15.892 ,,

N.6.6

K. Manufacture of T.N.T.

T.N.T. manufactured on the "Pilot" continuous nitrating plant was carried out during the first four periods of the year. After gaining further valuable experience in the running of this process, the plant was closed down.

Output.

M.N.T. used	15.695 s.tons
Nitric Acid, 98% used	25.865 ,,
C.O.V., 96% used	23.340 ,,
Recovered Waste Acid used (about 91% H_2SO_4)	91.405 ,,
Sodium Sulphite crystals used	3.898 ,,

T.N.T. (Sulphited and Finished) - 20.914 s.tons.

Fuze Powder - R.D. Composition No.202.

Manufactured	1,294 lb.
Ammonium Perchlorate (crude)	1,092 lb. (Refined)

C 1

ANNUAL REPORT on the MANUFACTURE of CORDITE

1936 - 36.

OUTPUT.

The output of Cordite from the presses during the year was approximately 662 tons (2,000 lb.), over double last year's production, i.e. an increase of 352 tons.

Of this output, 39% was pressed on the small screw presses and 61% on the hydraulics. Last year the percentage was 61% on the small screw and 39% on the hydraulics.

In addition to normal manufacture, 5.3 tons of experimental Cordite was pressed.

The estimated output at the commencement of the financial year was 500 tons, but emergency orders for 123.3 tons were received during the latter part of the year, giving a required output of issued Cordite of 622 tons. The achieved output of issued Cordite was 623 tons.

An improved system of planning and forecasting of delivery dates was installed, due to the need for close estimates required for the Filling Factories, etc. Out of about 91 orders worked upon, only six delivery dates were not kept, two of these being for reasons outside the control of the section. This is considered an exceptionally good performance when the disorganisation of the plans, due to the acceptance of the emergency orders, is considered.

Improved efficiency has been obtained with respect to output per pressing from the hydraulic presses. Last year the output of Cordite W. .057 was about 18.2 lb. per pressing but, through increased control involving periodical weighings of a day's work, this was increased to 21 lb. per pressing, an increase in output of 15%.

Improved supervision at the Lower Works resulted in a marked increase in output of the blending and lotting operations. The cost of direct labour per pound of Cordite for W. .057 at

the

C 2

the beginning of the year and at the end of the year are as follows:-

	Blending	Lotting	Total
Average of Periods 1 and 2	0.38	0.43	0.81
Average of Periods 9 and 10 (latest costs available)	0.27	0.23	0.50

These cost figures show an improved efficiency of about 40% or a saving of £1,000 in a year with an output of 800,000 lb. (i.e. 1936-37 Estimate Year) for direct labour alone on this one size. The efficiency for other sizes has also been improved.

PERSONNEL AND ACCIDENTS.

The number of men employed has increased from a maximum of 110 last year to 203 at the end of the present year, due to doubling the output. The number of lads on the section has increased from 10 to 17.

The amount of indirect labour, i.e. cleaning and maintenance, was slightly increased, but this increase was more than offset by increase in the efficiency of the direct labour. A certain amount of labour was necessitated by work connected with the general factory repairs under the 240 P. scheme. Since over half the labour was new, having had considerably less than one year's experience, the output was exceptionally satisfactory.

Despite the large proportion of new labour, the accidents to plant, etc., were few. The following accidents were recorded during the year:-

(1) A tray truck overturned into the plantation and 600 lb. of Cordite had to be reworked and 20 lb. burnt. This accident was due to a faulty condition of the railway track. 9.8.35.

(2) A tray truck overturned at points East of unloading hood, Black Ditch. 7.6.35.

(3) Ignition of Cordite dust in cracks of wood capping of the pit of the hydraulic press, Bay 4, Press House No.3, during repair of asphalt surround. 7.8.35.

(4)

(4) Bracket of reeling gear broken, Press No. 144, small screw, Bay 5, Press House No.10. 14.12.35.

(5) Plunger jammed, press No. 103, small screw, Bay 2, Press House No. 10. 30.10.35.

(6) Plunger jammed, press No. 150, small screw, Bay 5, Press House No. 10. 11.10.35.

(7) Plunger of hydraulic press jammed, Bay 2, Press House No. 2. 10.2.36.

(8) Plunger of hydraulic press jammed, Bay 2, Press House No. 2. 30.3.36.

Sickness has been normal at about 2%.

INSPECTION.

During the year the visual inspection section of C.I.A. was transferred from Woolwich to Waltham Abbey. Blending House No.6 (Building No. 613) was passed to them for use as an Inspection Room. They now mark in the Blending Houses 20% of all cases lotted, and these cases are stored in one of the magazines until required for examination. The labour required for handling of such cases is supplied by the Cordite Section. No appreciable difficulty has been found with this arrangement.

The personnel of the Danger Building Inspection Department has been considerably increased.

BUILDINGS.

Considerable progress was made on the 240 P. scheme for the reconditioning of the factory, but there are several buildings and their plant yet to be overhauled.

MANUFACTURE.

M.D. Cordite. The manufacture of M.D.T. has progressed quite normally, except for a period during March - April and another during November - December when heavy weights per 100" interfered considerably with production and gave increased waste and irregular cords. Several lots had to be 42 or 43 stranded, and some cords were so heavy that they had to be put into rework.

C1

rework. The reason for heavy weights could not be ascertained, but was probably connected with the physical & chemical characteristics of the Guncotton.

14,040 lb. of rework were incorporated during the year, but difficulty was experienced in pressing. Previous experiments had indicated that 0.0520 - 0.022 dies were required instead of 0.0535 - 0.022 as normally used, but the weight of the resulting cord was very low, and necessitated 46 - 47 stranding when drumming. ~~[illegible]~~ It was decided in future to burn all rework arising from manufacture, and this has been done since the beginning of 1936. Rework Lots 13249.R, 13253.R - 13255.R were satisfactory in proof and were accepted.

W. Cordite. The introduction of 33% solvent for the hydraulics instead of 36% as used last year has resulted in a saving of acetone used. The consumption of acetone this year has been 31.8% for W. Cordite in comparison with 35.5% used last year. The reduction of the quantity of solvent has resulted in much better operating conditions during pressing and packing of the wet Cordite, as the cords are not so sticky.

No reduction of solvent could be made for pressing on the small screw presses, as they would not take the extra pressure required for extrusion.

The addition of 0.2% precipitated chalk at the incorporation stage was commenced on 5.12.35, and no difficulty was experienced from the manufacturing view point.

Difficulty was experienced as usual with caking of the powdered carbamite during storage, and a small pair of preliminary crushing rolls was installed over the feed to the sieving machine, but, although improved processing was obtained, the installation is not a satisfactory solution to the problem.

The proofs received during the year were satisfactory and no Cordite was rejected.

Mark I and R.D.N./A. Normal manufacture. An improvement

was made to the plant for blank cutting by the installation of a transparent screen over the feeding end of the cutting machine, and also a cover was made for the sieves to reduce the amount of Cordite getting on the floor.

C 6

For Service of Research Department.

	Size	Pressed lb.	Issued lb.
M.D.T. Various	9-2) 10-3) 10-4) etc.) Chopped)	156	156
R.D.N./A. various	.042) .040) .020)	500	500
F.551/27 Various	.045) .023)	535	535
W.T. and W.Chopped, various	-	110	110
Modified W. compositions for S.A.A., tubular, chopped, various.	-	76	46
		1,377	1,347

R.G.I.F. Experiments.

W. Acetone-Alcohol Solvent Trials	Various	25	-
M.D.T. Rework Trials	5-2	600	-
W. Solvent Experiments	.057	360	50 (For Proof
W. Rework Solvent Trials	.057	540	23
W. Trials with ~~reduced~~ radiused dies	.093	30	-
		1,565	73

Total Experimental

Authority	Pressed.	Issued
Research Department.	1377	1347.
~~Air Ministry.~~	4690 4/16	3840 5/16.
Army.	566 4/16	563 4/16.
Small Arms Committee.	2739 7/16	8279 7/16.
Ordnance Committee.	1053	73.
Prof. Samples		
Total	18927 3/16	14105 3/16

C7

(c) Cordite

TABLE I (a) - RAW MATERIALS USED.

	W.	M.D.	Mark I	RDN/A	Exptl.	Total
Acetone	293,175	142,157	2,372	8,683	775	447,162
Min.Jelly	-	19,256	498	-	-	19,754
Carbamite	55,404	-	-	3,901	138	59,443
Paste	867,725 7/16	362,235	9,761 4/16	47,175	3,834 14/16	1,290,731 9/16
Rework	-	14,040	375	-	1,447 8/16	15,862 8/16
	1,216,304 7/16	537,688	13,006 4/16	59,759	6,195 6/16	1,832,953 1/16

Acetone	447,162
Total Incorporated Material (not including Acetone)	1,385,791 1/16

TABLE I.A. (b) - RAW MATERIAL REFERENCE NOS.

Nitroglycerine	Charge Nos.	734 - 857
Guncotton	Batches	1661 - 2105
Nitrocotton	Batches	28 - 33
Picrite	Batches	734 - 857
Acetone	Consignment Nos.	2425 - 2431
Mineral Jelly	Consignment Nos.	189 - 192
Carbamite	Consignment Nos.	14 - 23

(c)

TABLE II - MATERIAL INCORPORATED.

	lb.
M.D. Dough	381,491
Rework	14,040
Mark I Dough	10,259 4/16
Rework	375
RDN/A Dough	51,076
Rework	-
W. Dough	923,129 7/16
Rework	-
Exptl. Dough	3,972 14/16
Rework	1,447 8/16
	1,385,791 1/16

TABLE III - CORDITE PRESSED.

A. Small Screw Presses.

Small Arms.	M.D.T.	5-2	376,592		
		7-2	1,290		
				377,882	
	Mark I,	1/.05	3,789		
		3	657		
		20 SC.	5,440		
				9,886	
					387,768
Cannon.	RDN/A	.029	13,500		
		.034	3,700		
		.042	12,372 8/16		
		.052	16,700		
				46,272 8/16	
	W.	.060	576		
		.046	1,900		
		.040	12,600		
		.036	13,330		
		.016	32,545		
		.154-.136	18,104		
				79,055	
					125,327 8/16
					513,095 8/16
Experimental and Proof Samples.	W., W.T. and W. chopped		2,202 6/16		
	W. modified		76		
	M.D.T. and M.D.T. chopped		1,481 6/16		
	M.D.T. Rework		600		
	H.P.		100		
	R.D.N./A.		1,670		
	F.551/27		2,830		
			8,959 12/16		
	Less taken from normal manufacture		425		
					8,534 12/16
					521,630 4/16

B. Hydraulic Presses.

Cannon	W.	.093	129,925	
		.057	680,700	
				810,625
Experimental	W.		1,530	
	W. from Straw		237 7/16	
	M.D. Reworked with Carbamite		200	
				1,967 7/16
				812,592 7/16

TABLE III - CORDITE PRESSED (Contd.)

C. Summary.

	lb.
Small Screw Presses	513,095 8/16
Hydraulic Presses	810,625
	1,323,720 8/16
Experimental	10,502 3/16
	1,334,222 11/16

TABLE IV - CORDITE ISSUED (To Inspection)

Small Arms.

M.D.T.	5-2	358,375		
	7-2	1,290		
			359,665	
Mark I	1/.05	3,789		
	3	657		
	20 S.C.	5,408		
			9,854	
				369,519

Cannon.

RDN/A	.029	10,527		
	.042	11,727		
	.052	15,951 8/16		
			38,205 8/16	
W.	.093	132,405		
	.060	576		
	.057	600,930		
	.046	1,900		
	.040	12,600		
	.036	26,475		
	.016	39,790		
	.154-.136	23,515		
			838,191	
				876,396 8/16
				1,245,915 8/16

TABLE IV - CORDITE ISSUED (Contd.)

	lb.	lb.
Bt.forward		1,245,915 8/16
Experimental and Proof Samples.		
R.D.B. Rework with Carbamite	145	
M.D. Rework with Carbamite	5,595	
M.D., M.D.T. and chopped	988 6/16	
R.D.N./A.	1,670	
H.F.	100	
F.551/27	2,830	
W., W.T. and chopped	2,500 6/16	
W. from Straw	237 7/16	
W. modified	46	
		14,105 3/16
		1,260,020 11/16

TABLE IV.A. - CORDITE UNDER INSPECTION BY C.I.A. NOT ISSUED BY BARGE AT 31.3.36.

		lb.
W.	.057	19,225
	.154-.136	830
		20,055

(2)

TABLE V - PERCENTAGE LOSS, ETC.

	M.D.		W.		Mark I		RDN/A
Paste Used	362,235		867,725 7/16		9,761 4/16	47,175	
Min.Jelly or Carbamite added	19,256		55,404		498	3,901	
Stock Rework 31.3.35	9,310		8,100		34 15/16	900	
		390,801		931,229 7/16		10,294 3/16	51,976
Cordite Produced	379,363 6/16		893,387 6/16		9,886	47,542 8/16	
Stock Rework 31.3.36	-		24,200		10	3,100	
		379,363 6/16		917,587 6/16		9,896	50,642 8/16
Loss		11,437 10/16		13,642 1/16		398 3/16	1,333 8/16
*Percentage Loss	2.84%		1.48%		3.74%		2.61%
*Percentage Acetone used	35.14%		31.77%		22.30%		17.00%
**Percentage Min.Jelly or Carbamite used	5.03%		6.00%		4.85%		7.64%

* Calculated on material incorporated, see Table II.

** Calculated on dough incorporated.

VII . SERVICES

(a) Steam

Tenders have been received for lagging the 3" steam main from Press House No. 5 to No. 3 Incorporating House and also for four boilers at No. 7 Boiler House. Alterations have been made to supply steam from No. 7 Boiler House to the Tray Stoves. Further alterations at No. 7 Boiler House are necessary to make way for the proposed coal telpher and the removal of the old forced draught fans is necessary.

Considerable progress has been made with the boilers under repair at Nos 1 & 9 Boiler Houses. These are almost completed save for a few minor parts. The brickwork unfortunately has suffered more than expected and considerable work has to be done to put the plant in working condition. A new crane boiler has been purchased erected and tested for the coal crane at No. 9 Boiler House. Six of the nine re-conditioned boilers at No. 7 Boiler House have been under steam at 100 lbs per square inch pressure and a trial under working conditions is being carried out. The induced draft fan will increase the steaming capacity of these boilers. The installation of Economisers at Nos 1, 7 & 9 Boiler Houses is being deferred until the emergency arises. There are seven boilers at No. 7 Boiler House not re-conditioned and unless another rotary converter is installed to give 1918 capacity, these boilers should be put into working order. See file on this subject.

No. 3 Boiler House which was shut down a few years ago has been re-started to supply steam to Edmondsey Engine House only. The increased demand for steam from the N.G. Section necessitated opening up the Boiler House. Steam for process, heating and power for N.G. is still being supplied from No. 5 Boiler House.

A considerable number of boiler tubes have had to be replaced in the boilers at No. 5 Boiler House. Samples of tubes and water before and after treatment have been sent to Messrs. Babcock & Willcox for report. A continuous blow down system has been recommended to prevent scaling and mud deposit on tubes which causes overheating and bulging.

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

	Steam.	Cost per 1000 lb.
1933 - 34	116,033,000 lbs.	30.09 d.
1934 - 35	130,312,000	34.61
1935 - 36		

(b) Electricity

The rotary converters removed from R.S.A.F. to the G/C Power House have been set to work and have given excellent service for several months. The removal of the 3 rd. rotary from R.S.A.F. to R.G.P.F. should be arranged as soon as possible. This depends on R.S.A.F. policy. It is recommended that the North Met Electric supply be continued if War Office approval can be obtained. The Belliss & Morcom sets are well in hand and one set completed and tested under working conditions. The repair of the condenser sets is being undertaken by factory labour. The cable from Daisys Island to Edmondsey should be duplicated. All the electrical power at Picrite, Quinan, No.s 1 & 14 G/C Steves, T.N.T. depends on the small overhead line from Daisy Island. Several steam engine drives at C.E. & Picrite should be replaced by motor drives. The re-organisation of electric cables at P & M Room requires attention and the provision of a substation with adequate switching and fusing arrangements necessary.

The cost per unit as compared with the two previous years is as follows:-

	Electricity.	Cost per Unit.
1933/34	462,470 units	2·92
1934/35	526,280	3·30
1935/36	[illegible]	[illegible]

BUILDING WORKS DEPARTMENT, R.G.P.F.

ANNUAL REPORT 1935-36.

PROPERTY.

The gross returns from all property attached to this factory for the last five years are as follows:-

1931	1932	1933	1934	1935
£1,537	£1,524	£1,434	£1,241	~~£998~~ £1145

The expenditure on domestic property has amounted to £532 against an assessed annual value of £1,024. This does not include the special Maintenance expenditure on account of the internal redecoration and installation of new fireplaces at 54 Highbridge Street.

M.W.B. SUPPLIES.

The cost of the water consumed for each of the last five years has been:-

1931	1932	1933	1934	1935
£168	£182	£199	£192	£289

LEE CONSERVANCY BOARD.

The Board has undertaken weed cutting and clearance of shoals in the W.D. portion of the Small River Lee on repayment by the factory.

The flow of water through the factory has fluctuated between a maximum monthly average of 11,583 cu.ft. per min. in December 1935, and a minimum of 1,035 cu.ft. per min. during August 1935. The daily averages over the past five years have been:-

1931	1932	1933	1934	1935
9,973	8,675	2,766	2,405	4,976

DEPARTMENTAL WORK.

The following are the more important works carried out during the financial year.

In the Nitroglycerine area the foundations of the new Quinan Stove were carried out departmentally and the main structure erected by contract.

Four Guncotton Stoves have been thoroughly overhauled and repaired, two of which have been almost entirely rebuilt.

A Coke Condenser has been rebuilt, also Nitroglycerine retorts, C.E. Packing House and Clearing Store have been re-conditioned.

Various Guncotton Stove traverses have been raised, and repairs to Guncotton buildings and porches have been carried out.

In the Cordite Factory, Nos. 2, 3, 4 and 7 Incorporating Houses have been reconditioned and lined with insulating boarding, and hot water supply carried to the machines.

Nos. 2 and 3 Press Houses have been thoroughly repaired, and repairs and re-roofing, including internal and external painting, have been carried out in Nos. 5 and 6 Blending Houses.

The roof of No. 4 Cordite Magazine has been renewed, and considerable progress made with the renewal of the roof of No. 2 Magazine.

The traverse of No. 1 Magazine has been raised, and general repairs carried out to Cordite Tray Stoves, Stores, Dining and Shifting Rooms, etc.

In the Guncotton Section the brickwork of six retorts and seven Producers in the Guncotton Acid Factory have been rebuilt, including the platforms and coil trays.

The Absorption Tower piers and superstructure have been entirely replaced.

No. 2 Nitrating House has been repainted and reconditioned.

In No. 1 Vat House the flooring has been largely renewed, the vats reconditioned and the building painted internally and thoroughly repaired.

Progress has also been made with the reconditioning of No. 2 Vat House.

A foundation and base has been provided for a new 2-ton Potcher, and a new Waste Acid Tank foundation has been built.

A coke condenser at the Nitric Acid Factory has been rebuilt.

Throughout the factory the paths between buildings and the surrounds to buildings have been repaired and tar paved. Approximately 4,300 sq.yds. of sand carpet was laid by contract.

Dredging has been carried out continuously throughout the year. The Tray Stove cuts and the Black Ditch have been cleared and the cuts in the Nitroglycerine area have been dredged.

In addition to the more important works already enumerated, repairs have been carried out to Shifting Rooms, Dining Rooms and Reeling Houses, Boiler House furnaces, bridges and trolley tracks. Approximately 3 miles of track have been renewed during the year.

Seven new boats have been supplied by contract during the year, two for the Cordite Section, one for the Nitroglycerine Section, two for B.W.D. and two for the Stores Department.

A programme of Estate clearance has been carried out. Dangerous trees have been felled and these and an accumulation of fellings removed and the factory area generally has been cleared of undergrowth, rubbish and debris.

FIRE BRIGADE.

Inspections have been made of all fire appliances during the year, and they have been found in order.

Three calls were received and attended and the fires were extinguished without difficulty, the damage to property being slight.

An additional hydrant has been fixed, bringing the total number available to 85.

Two extra fire squads have been recruited during the year, one in the Guncotton and one in the Cordite Sections, making a total of six fire squads.

Generally throughout the factory fire rules and precautions have been well observed.

B.W. D. 1

BUILDING WORKS DEPARTMENT, R.G.P.F.

ANNUAL REPORT 1935-36.

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The cost of the water consumed for each of the last five years has been:-

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The flow of water through the factory has fluctuated between a maximum monthly average of 11,583 cu.ft. per min. in December 1935, and a minimum of 1,035 cu.ft. per min. during August 1935. The daily averages over the past five years have been:-

1931	1932	1933	1934	1935
9,973	8,675	2,766	2,405	4,976

DEPARTMENTAL WORK.

The following are the more important works carried out during the financial year.

In the Nitroglycerine area the foundations of the new Quinan Stove were carried out departmentally and the main structure erected by contract.

III — Maintenance

Four Guncotton Stoves have been thoroughly overhauled and repaired, two of which have been almost entirely rebuilt.

A Coke Condenser has been rebuilt, also Nitroglycerine retorts, C.E. Packing House and Clearing Store have been re-conditioned.

Various Guncotton Stove traverses have been raised, and repairs to Guncotton buildings and porches have been carried out.

In the Cordite Factory, Nos. 2, 3, 4 and 7 Incorporating Houses have been reconditioned and lined with insulating boarding, and hot water supply carried to the machines.

Nos. 2 and 3 Press Houses have been thoroughly repaired, and repairs and re-roofing, including internal and external painting, have been carried out in Nos. 5 and 6 Blending Houses.

The roof of No. 4 Cordite Magazine has been renewed, and considerable progress made with the renewal of the roof of No. 2 Magazine.

The traverse of No. 1 Magazine has been raised, and general repairs carried out to Cordite Tray Stoves, Stores, Dining and Shifting Rooms, etc.

In the Guncotton Section the brickwork of six retorts and seven Producers in the Guncotton Acid Factory have been rebuilt, including the platforms and coil trays.

The Absorption Tower piers and superstructure have been entirely replaced.

No. 2 Nitrating House has been repainted and reconditioned.

In No. 1 Vat House the flooring has been largely renewed, the vats reconditioned and the building painted internally and thoroughly repaired.

Progress has also been made with the reconditioning of No. 2 Vat House.

A foundation and base has been provided for a new 2-ton Potcher, and a new Waste Acid Tank foundation has been built.

A coke condenser at the Nitric Acid Factory has been rebuilt.

Throughout the factory the paths between buildings and the surrounds to buildings have been repaired and tar paved. Approximately 4,300 sq.yds. of sand carpet was laid by contract.

Dredging has been carried out cpntinuously throughut the year. The Tray Stove cuts and the Black Ditch have been cleared and the cuts in the Nitroglycerine area have been dredged.

In addition to the more important works already enumerated, repairs have been carried out to Shifting Rooms, Dining Rooms and Reeling Houses, Boiler House furnaces, bridges and trolley tracks. Approximately 3 miles of track have been renewed during the year.

Seven new boats have been supplied by contract during the year, two for the Cordite Section, one for the Nitroglycerine Section, two for B.W.D. and two for the Stores Department.

A programme of Estate clearance has been carried out. Dangerous trees have been felled and these and an accumulation of fellings removed and the factory area generally has been cleared of undergrowth, rubbish and debris.

Improvements in the Incorperating Houses has entailed a considdrable amount of work in providing sealed entry and exit of steam pipes. All Incorporating Houses except No.~~5~~ 6 have been provided with a hot water service and considerable improvement has been made in lighting and switching facilities.

No. 2 Vat House has been provided with a ring water main of ample capacity although the main of the filter system requires to be considerably enlarged to prevent loss of head. The lighting service has been re-wired and steam service prepared.

Stirring gear for No.s 7, 8, 9 & 10 Acid Tanks has been purchased and two tanks fitted up. A new Weak Waste Acid tank with stirring gear is being erected at the G/C and six new reterts have been erected in No. 2 N.A.F., G/C. Beaters have now been put in good order. The service plant has been re-arranged and a new design potcher has been erected and tried out. This has been followed by the 2 Ton potcher and pumps of suitable design and capacity are being purchased from Messrs. Lee, Howl.

The re-conditioning of No. 2 Nitrating House has made progress and a modern lighting installation erected. The acid service pipes have been renewed and water service connections re-made.

A vacuum pump for service moulding machines is necessary for emergency output and is being purchased this year.

G/C Stoves services have been reconditioned and the hot air services of two stoves is being altered to give improved circulation of air.

A C.E. Nitrating House has been provided with a complete plant, including electric drive for the main shafting. External lighting for C.E. Purification house has been provided and considerable improvement made in plant. A forced hot air drying system for a C.E. Steve has been provided.

The new sieving system for Cordite cylinders has been extended to all the Small Screw presses of No. 10 Press House and to the cylinders of the hydraulic press houses No.s 2 and 3. Progress is being made with the cylinders of Press House No. 5 but the construction of the cylinders renders necessary the insertion of a screwed bush to receive the recess for the sieving system.

Mantlets for Press Houses 5 and 6 are being erected. Bay 1 No. 10 Press House has been completed by bringing and erecting presses from Quinton Hill.

FIRE BRIGADE.

Inspections have been made of all fire appliances during the year, and they have been found in order.

Three calls were received and attended and the fires were extinguished without difficulty, the damage to property being slight.

An additional hydrant has been fixed, bringing the total number available to 85.

Two extra fire qquads have been recruited during the year, one in the Guncotton and one in the Cordite Sections, making a total of six fire squads.

Generally throughout the factory fire rules and precautions have been well observed.

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

Cost of Principal Productions for:-

Cordite:-	1935-36 Per lb. s. d.	1934-35 Per lb. s. d.
M.D. 5-2	3. 0¾	3. 7¼
W.8. (W.054 & .057)	2.10¾	3. 4½
R.D.N.a.	5. 1.	6. 0¾
Picrite.	6. 3¾	6. 8.
Composition Exploding, Crystals, Grade I.	5. 1.	-
Composition Exploding, Ground, Grade I.	5.11½	-
Composition Exploding, Corned, Grade I.	6. 2¼	-

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

Cost of Principal Productions for:-

Cordite:-	1935-36 Per lb.	1934-35 Per lb.
	s. d.	s. d.
M.D. 5-2	3. 0¾	3. 7¼
W.8. (W.054 & .057)	2.10¾	3. 4½
R.D.N.a.	5. 1.	6. 0¾
Picrite.	6. 3¾	6. 8.
Composition Exploding, Crystals, Grade I.	5. 1.	-
Composition Exploding, Ground, Grade I.	5.11½	-
Composition Exploding, Corned, Grade I.	6. 2¼	-

XVI. WAR EMERGENCY ACTIVITIES.

It will be evidenced from the remarks on maintenance that the factory generally is in a very good state of repair.

As a result of a visit to the factory by the Master General of Ordnance and the Director of Ordnance Factories, it has been decided (1) that there is no need in the present outlook to enlarge the Vat House; (2) that in the present outlook Waltham will be maintained to produce 150 tons Cordite W. and 50 tons Cordite M.D.; (3) that, if anything should occur to modify the present proposals for removal, or to delay action, then the situation must be reviewed.

Also, certain matters on which action has been suspended pending a decision on removal are enumerated below:-

New lay-out for Tetryl Factory

Restoration of 2 Cordite Stoves

Further progress with Quinan Driers

Denitration Towers for spent acid

Automatic Telephone System

New Machinery Shop

Collaboration with the Supply Board Technical Establishment continued throughout the year.

The action for the emergency supply of electricity at the Lower Works has been concluded as regards two converters.

XVII. CONCLUDING REMARKS.

Appendix 1

1935 - 36.

ANNUAL TURNOVER.

ROYAL GUNPOWDER FACTORY, WALTHAM ABBEY.

	PARLIAMENTARY ESTIMATE. £	LATEST FORECAST. £
A. Establishments.	5,335	5,235
B. Wages.	101,800	110,535
C. Materials.	77,585	101,425
D. Machinery, Contract.	12,285	6,480
E. Works, Contract.	4,810	3,785
F. Miscellaneous.	6,500	7,630
G. Non-effective.	8,300	7,000
	216,615	242,090
Add - Net effect of Materials on I.D.D's	2,000	2,900
	218,615	244,990
H. Productions for Army, Navy, etc.	213,410	237,700
Miscellaneous Receipts.	2,400	2,760
Sale of Scrap, old stores and stores issued on repayment.	1,200	1,170
	217,010	241,630
Less - Net effect of I.D.Services.	7,210	7,230
	209,800	234,400
Balance as shewn below.	8,815	10,590

INCOMINGS.	Parl'y Estimate.	Latest. Forecast
Estimated amounts recoverable in respect of:-		
Depreciation of:-		
Buildings.	3,375	3,290
Machinery	3,975	3,280
Mains.	405	373
Written off:-		
Machinery	145	2
Buildings.	-	160
Mains.	-	-
Land.	-	845
Transfer from Supplies Suspense Account.	8,815	10,590
	16,715	18,540

OUTGOINGS.	Parl'y Estimate.	Latest Forecast.
Estimated expenditure on New Capital:-		
Buildings:-		
(a) Contract.	550	1,570
(b) Departmental	3,700	900
Machinery:-		
(a) Contract.	8,285	4,390
(b) Departmental	3,480	1,900
Mains:-		
(a) Contract.	500	525
(b) Departmental	200	45
Land & other non-depreciated assets	-	-
Increase of Stores in Stock.	-	9,210
	16,715	18,540

APPENDIX 1.

ANNUAL TURNOVER - 1935 - 36.

	Parliamentary Estimate	Latest Forecast
A. Establishments		
B. Wages		
C. Materials		
D. Machinery, Contract		
E. Works, Contract		
F. Miscellaneous		
G. Non-effective		
Add Net effect of Materials on I.D.D.'s		
H. Productions for Ar,y Navy, etc.		
Miscellaneous Receipts		
Sale of Scrap, Old Stores, and Stores issued on repayment		
Less Net effect of I.D. Services		
Balance as shewn below		

Incomings	Parly. Est.	Latest F'cast		Parly. Est.	Latest F'cast
Estimated amounts recoverable in respect of:-			Estimated Expenditure on new Capital:-		
Depreciation of Buildings			Buildings -		
Machinery			Contract		
Mains			Departmental		
Write Offs -			Machinery -		
Machinery			Contract		
Decrease of Stores in Stock			Departmental		
Transfer from Supplies Suspense Account			Mains -		
			Contract		
			Departmental		
			Land		
			Increase of Stores in Stock		

Appendix II

R.G.P.F. WALTHAM ABBEY.

FACTORY EXPENSES.

Description.	1935-36. Amount. £.	1934-35 Amount. £.
Process Expenses.		
Foremen, Asst. Foremen etc.	2,863	2,220
Miscellaneous Labour.	1,813	1,134
Consumable Stores.	994	708
Gas.	44	21
Water.	41	21
Steam (Process).	9,758	6,937
Power.	6,010	4,995
Refrigeration.	4,825	3,749
Compressed Air.	4,542	3,097
Maintenance of Plant.	16,815	15,589
Maintenance of Buildings.	2,917	4,461
Depreciation.	1,394	1,394
Rates.	201	192
Internal Transport.	1,770	990
Balance of Process Expenses.	2,875	2,537
Sectional Expenses.		
Management.	2,991	2,755
Electric Light.	584	628
Gas.	102	74
Steam for heating.	2,616	2,540
Maintenance Services.	3,697	2,065
Miscellaneous Labour.	934	560
Laboratory Testing.	3,089	3,085
Care & Custody of Departmental Stores.	345	805
Allowances.	4,048	2,193
O.T. & N.S. Bonus.	450	190
Balance of Sectional Expenses.	3,349	1,772
Credit for Materials returned to store.	598	490
General Expenses.		
Superintendence.	699	546
Registry, Pay & Order Branches.	495	353
Worktakers, Wages and Accounts.	1,160	829
Central Stores.	3,064	3,010
Police, Fire Brigade and Warders.	4,219	4,205
Maintenance of Grounds, Mains, Canal, Permanent Way &c.	13,431	9,712
Non-effective Charges.	6,436	5,493
Balance of General Expenses.	37,885	20,138
Total.	145,858	107,888
Less Subsidy.	14,875	14,873
Total Factory Expense.	130,983	93,015
Percentage to Direct Labour.	472.90	641.70
Direct Labour.	27,698	14,495

APPENDIX II.

FACTORY EXPENSE.

Description	1935-36 Amount	1934-35 Amount
Process Expenses		
Sectional Expenses.		
General Expenses		
Total		
Less Subsidy		
Total Factory Expenses		
Percentage to Direct Labour		
Direct Labour.		

Appendix.
III

STOCKTAKING.

Value of Stock		Value of Stock Checked		Nett Surplus
This Year	Last Year	This Year	Last Year	
£	£	£	£	£
83400	72,632	~~61,311~~ 10 6'84	61311	~~410~~ 333

The surplus of £ ~~410~~ 333 revealed in stocktaking is equivalent to ~~3·8%~~ 3·1% of the value of stock taken.

Sale of Surplus Stores.

Total Amount Realised	Nett Loss.
£	£
13	5

Embodied in Report.

Total value of stores held in stock on 31.3.36:-

Manufacturing Materials	£ 63-412
Other Items	£ 19 688
Total	£ 83,400

This compares with the value of 31.3.35 as follows:-

Manufacturing Materials	£56,272
Other Items	£16,360
Total	£72,632

Appendix. III

MATERIALS.

Price per ton of Main Items (Average Prices given if more than one contract).

Material	1934-35	1935-36
Acetone	£ 58 8 0	
Cotton Waste	56 14 0	
Glycerine	50 0 0	
Mineral Jelly	10 7 6	
Sodium Nitrate	7 15 0	
Ammonium Nitrate	* 17 18 6	
Carbamite	ϕ235 2 1	
Sodium Sulphite	9 2 6	—
Calcium Cyanamide	9 0 0	
Mono-nitrotoluene	45 0 0	
Acid Sulphuric - 20%	6 1 0	
65%	8 11 0	
98%	6 1 0	
96%	5 19 9	
Acid Nitric 98%	19 10 0	
Lead Chemical - Sheet	16 16 8	
Pipe	15 10 6	
Coal, Mechanical Stoker	1 0 10½	

*Supply from Army Stocks

ϕSupply arranged by Director of Navy Contracts.

APPENDIX IV

Nos. and Average of R.G.P.F.

Employees on 1-4-35 and 31-3-36.

Age.	Nos. on 1-4-35.	Nos. on 31-3-36.
65	-	-
64	4	4
63	8	11
62	12	12
61	11	11
60	12	13
59	13	15
58	14	12
57	11	26
56	26	10
55	9	14
54	14	11
53	9	21
52	18	14
51	13	11
50	7	7
49	6	13
48	7	12
47	6	11
46	13	15
45	10	12
44	10	20
43	7	12
42	8	13
41	8	10
40	6	21
39	14	15
38	13	16
37	8	16

Age.	Nos. on 1-4-35	Nos. on 31-3-36.
36	8	17
35	8	23
34	9	24
33	11	26
32	11	29
31	13	19
30	12	36
29	14	30
28	14	22
27	10	35
26	14	29
25	15	24
24	7	22
23	11	31
22	11	21
21	4	22
20	4	9
19	5	3
18	2	7
17	3	5
16	3	3
15	1	3
14	1	1
	488	819

Average age = 42.46

Average age = 37.86

APPENDIX V

R.G.P.F.

Total strength on 31/3/36.

	Nos.	%
60 and over.	51	6.23
Over 50 and under 60.	141	17.22
" 40 " " 50.	139	16.97
" 30 " " 40	221	26.98
" 21 " " 30.	236	28.82
Under 21.	31	3.78
	819	100.

APPENDIX VI

R.G.P.F.

Personnel. 31-3-36.

	Total this year.	Total last year.
Supervisory &c.	63	49
Skilled.	121	66
Semi-Skilled.	142	79
Unskilled.	469	279
Women & Girls.	1	-
Boys.	23	15
	819	488
Highest.	828	488
Lowest.	488	398
Average.	689	441
Entries during the year.	392	133
Discharges " " "	67	63
Transfers " " "	30	23
	(Transfers "in" - 18 "Out"- 12)	(Transfers "in" - 13 "Out" - 10)

7086. Wt.P1811/1368. 10M. 10/34. Wy.L.P.Co.,Ltd. Gp. 656. Enfield Form 98.

Departmental Memo. No.

Minutes to be numbered consecutively. Sheet No.

To be left blank

C.R.

Herewith notes and data arranged for Annual Report, as far as is possible at present. Further information is required before the following Sections can be completed :-

~~III - Main Productions (Totals required)~~

~~VI - Total amount of Experimental material produced is required~~

VII - Cost and Total of electricity and steam.

* IX - Cost of production.

* X - Factory Expense.

* XI - Stores.

* XII - Imperial Reserve stocks.

* XIII - General Wages questions.

* XV - Establishment.

* Appendix 1. Annual Turnovers

* Appendix 2. Factory Expenses.

* Appendix 3. Materials, Stocktaking and Sale of Surplus stores.

In sections marked thus - * - we have as yet no information whatever, and the whole sections remain to be done.

Section XVI - War Emergency Activities is not complete. I have put in M.G.O.'s decisions as requested by Supt., but nothing more.

Section XVII - Concluding Remarks - I have left this.

C.R. 26.6.36.

Account

The ~~Dept~~ increased
activities coupled with
difficulties in transportation
& maintenance staff has
sadly affected the efficiency
of this section. Whilst the
usual returns have been
prepared they have not
been up to time table
The budgetary control
which was introduced
this year proved of genuine
~~[illegible]~~ the budgeted
quantity of fuel was produced
for the budgetted expenditure.
in + this could not be achieved
helped by the production
of ~~[illegible]~~ progress charts for
statistics throughout the
year.

Dear Sir, a note A.A.R.
Stores
Stores
~~Sir Stockholders last beam~~
~~vacation~~ Sir, Fitch
the Stockholders returned in
our absence. At the Opening
was taken fully the vacancy
with an Official who
knows from acquired of technical
knowledge so far as Report
proceedings is assured.
Sir. Hopkins, a perfect Salvation
Asst was duly appointed
+ the ~~Inspection~~
~~Stockholders~~ has ordered
result of this
~~Sir~~ Fitch ~~appointed~~
has undoubtedly proved
Special benefit to the dept.

wnatsoever I shall be snowed under
for the next few weeks.

Under emergency measures
x/ Mgo's decisions as recorded i "Vat
House" should be inserted.

Yrs [illegible]

L. R.

Will you not x for me in

I. GENERAL SURVEY.

(a) MANUFACTURE

(i) Acids sections

(ii) Guncotton

(iii) Cordite

(iv) Picrite and R.D.N.A.

(v) Tetryl

(vi) Composition R.D. 202

(vii) Gunpowder

(viii) Main Laboratory.

(ix) Continuous inspection of cordite during manufacture

(b) SERVICES

(i) Hydraulics

(ii) Compressed air plant

(iii) Refrigeration plant

(iv) Air Heating (Guncotton stores)

(v) Telephones

(vi) Transport

(vii) Machinery shop

(viii) M.U.B. Supplies

(ix) Lea Conservancy Catchment Board

(x) Fire Brigade

(xi) Estate

(c) PROPERTY.

II TOTAL PRODUCTIONS

(a) GUNCOTTON SECTION

(1) Manufacture of Nitric Acid
(2) Redistillation
(3) Concentration of weak H_2SO_4.
(4) Nitration
(5) Guncotton etc. ~~[illegible]~~ issued to services other than for cordite manufacture
(6) Raw Materials
(7) Summary of consumption + losses of acids.

(b) NITROGLYCERINE SECTION

(1) Manuf. of Nitric Acid.
(2) Denitration of waste acid.
(3) Concentration of weak H_2SO_4.
(4) Redistillation of weak HNO_3
(5) Acid mixing
(6) Manufr of nitroglycerine
(7) Drying + weighing guncotton and nitroc otton
(8) Mixing paste.

(c) CORDITE

(1) Raw materials
(2) Material incorporated
(3) Cordite pressed
(4) Cordite issued
(5) Percentage Loss etc.

(d) TETRYL

Repurification of C.E. to crystal C.E.
Repurification of C.E. to corned C.E.
Manuf. of new C.E.

(e) PICRITE

(f) T.N.T.

(g) COMPOSITION R.D. 202

III MAIN PRODUCTIONS

Summary

IV NEW METHODS

(a) Straining of cordite
(b) Solvent reduction
(c) Pulping of guncotton

V URGENT ORDERS

VI EXPERIMENTAL ORDERS

VII SERVICES

(a) Steam

(b) Electricity

VIII MAINTENANCE

IX COST OF PRODUCTIONS

FACTORY EXPENSE

STORES

IMPERIAL RESERVE STOCKS

GENERAL WAGES QUESTIONS

AGES of EMPLOYEES

ESTABLISHMENT

(a) Staff
(b) Strength
(c) Personnel

WAR EMERGENCY ACTIVITIES

CONCLUDING REMARKS

APPENDIX I

ANNUAL TURNOVER

APPENDIX II

	1935-36 Amount.	1934-35 Amount
ren Expenses		
tional Expenses		
eral Expenses		

1934-35. 1935-36.

STOCKTAKING.

SALE OF SURPLUS STOCKS

APPENDIX IV

Age. Nos. on 1.4.35. Nos. on 31.3.36. Age.

APPENDIX I

Total Strength on 31. 3. 36

APPENDIX VI

Personnel 31. 3. 35.

This year. Last Year

ANNUAL REPORT
of the
SUPERINTENDENT, ROYAL GUNPOWDER FACTORY.
for the year 1935-36.

1. GENERAL SURVEY

(a) Manufacture.

Emergency orders for 123 tons of cordite received during the latter part of the year in addition to the estimated output of 500 tons at the beginning of the year brought the required output of issued cordite to 622 tons. The achieved output was 623 tons.

The output of cordite from the presses during the year was approximately 662 tons, an increase of 352 tons over last years production; i.e. more than double last years figure.

In addition to normal manufacture, 5.3 tons of experimental cordite were produced. The annual throughputs is shown in Appendix 1.

The following is a general survey of the manufacturing activities of the factory:

(i) Acids Section.

In the Nitroglycerine Acids Section, manufacture of nitric acid from sodium nitrate and sulphuric acid ~~has~~ recovered from the spent acid of nitration has recommenced.

In the Concentration Section, the Denitration Towers Scheme referred to in last years report has been shelved for the present, and it has been decided instead to arrange for emergency programme by using No. 1. Nitric Acid Factory mainly as a Still House and No. 2 mainly as a Retort House. The retort-pots installed will, however, be available for either purpose.

The first Aluminium Nitric Acid cooler was recently inspected after some eighteen months running. Slight corrosion of the coil at the "wind and water line" was observed but otherwise the condition was excellent.

In the Concentrators House, the Calder Fox Scrubber, also mentioned in last year's report, has been subjected to lengthy tests but has been finally abandoned, as it appears impossible, under any running conditions, to produce an exit gas which complies with the regulations of the Alkali Act, without reducing the output of the plant very considerably.

No. 9 "Bowden" Concentrator has run throughout the year without trouble, and the construction of No. 3 has been completed. Repairs to producers are either completed or well in hand.

(ii) Ammonium

~~The joining of~~ Visits to manufacturers' works to supervise the production of cotton waste ~~raw material~~ have continued and the greatly decreased quantity of pickings in the cotton is evidence of the value of this arrangement.

In the Nitrating House the small central earthenware "biscuits" which protect the outlet of the nitrating pans are being replaced by stainless-steel perforated plates made in the factory. An aluminium exhaust fan designed and made in the factory has been installed and has run for more than half the year with complete satisfaction.

No. 2 Nitrating House is being completely overhauled and prepared for service and ~~the~~, special efforts are being made to ensure satisfactory ventilation by the use of enlarged fume pipes and stainless-steel exhaust fans, while the waste-acid pits are being enlarged to bring them into conformity with those in No. 1 House.

All the vats in No. 3 Vat House have now been fitted with tellurium lead Kier-columns which seem very satisfactory, showing as yet no tendency to lean over as the ordinary lead columns did.

During the year a considerable amount of trouble has been encountered owing to varying alkalinity in the Sumotton mainly this is considered to have been caused by leaks in those vats which have been lined with tellurium lead. This material is found to crack very readily when used for vat linings.

Two vats are now fitted with recording thermometers and it is hoped to complete the installation of these in all vats during the ensuing year. Nearly all the vats in No. 1 House have been repaired and rendered suitable for use under non-specification conditions, and work on No. 2 House is in hand.

Reorganisation of the Sweeping and Moulding Room referred to in last year's report has proceeded. The grit-runs, magnets and blanket runs are now laid out in a convenient and accessible manner with a steady fall, while the filling-in of old save-alls, removal of stuff-chests and lime tanks, covering of floors and general improvement in the plant lay-out in this building have added greatly to working convenience and lessened chances of contamination of the Gunnotton.

The development of the new type of patches is entering upon what it is hoped will be the final stages. The method of injecting the prep tangentially into a circular vessel described in last year's report, proves very successful on the small scale and after experiments with a model holding 20 lb. of prep, a ½ ton machine of this type was constructed and is in regular use for Service Gunnotton.

A second machine of the same size is now erected and a 2-ton machine is under construction. The method seems to give very thorough washing and blending and the all-lead construction eliminates metallic contamination. The system is economical in power as compared with other types.

Exports for Service Gunnotton were considerably greater than in recent years. No trouble has been

Experienced with slabs or wet charges, but work on primers was seriously impeded by an explosion which occurred in No. 9 press about the End of November. This was apparently due to a jamet in the hydraulic system.

(iii) Cordite

The manufacture of M.D.T. 5-2 Cordite has proceeded quite normally except for a period during March and April and another during November and December when heavy weights per 100" inlisfered considerably with production, giving irregular cords and increased waste. The reason for abnormal weights cannot be ascertained but was probably connected with the physical and chemical characteristics of the junction.

It was decided in future to burn all rework arising from manufacture, and this has been done since the beginning of 1936.

The introduction of 33% solvent instead of 36% for W Cordite has resulted in a saving of acetone, the consumption having been reduced from 35.8% for last year to 31.8%. This reduction of the quantity of solvent has produced much better working conditions during pressing and packing of the wet Cordite, as the cords are not so sticky. No reduction of solvent cannot however be made for pressing in the small screw presses because they would not take the extra pressure required for extrusion.

The addition of 0.2% precipitated chalk at the incorporation stage was commenced on 5.12.35, and no difficulty was experienced in manufacture.

The proofs received during the year were satisfactory and no Cordite was rejected.

(iv) Manufacture of Mark I and L.O. N.C. has proceeded normally.

Throughout the section, despite the large proportion of new and comparatively inexperienced workers, the accidents to plant etc. were few and of a minor nature.

End of (iii)

An improved system of planning and forecasting delivery dates has been installed to meet the need for close estimates required for the filling factories etc., and this has resulted in exceptionally good adherence to delivery dates in the face of the disorganisation caused by acceptance of emergency orders.

Efficiency of pressing in the hydraulic presses has been improved by increased control. Last year the output of Cordite W. .057 was about 18.2 lb. per pressing. This has been increased by 15%, to 21 lb. per pressing.
Improved supervision at the Lower works has resulted in a marked increase in output of the blending and lotting operations.

Throughout the section, despite the large proportion of new and comparatively inexperienced workers, the accidents to plant etc. were few and of a minor nature.

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

The manufacture of Picrite and R.D.N./A. has proceeded satisfactorily.

The Picrite plant has been operated three shifts a day during a considerable part of the year, achieving during that time the largest output from the process that has yet been attempted.

During 1934-35, production of R.D.N./A. Cordite was carried on at a steady rate of one to two week's work per period, but during the year 1935-36, output has been confined to the latter half of the year. Rate of production has, however, been raised from about 1600 lbs. per week in 1934-35 to about 3000 lbs. per week in 1935-36, while total output for these two years was 14 tons and 19 tons respectively.

Owing to increased output, the procedure for pressing Cordite R.D.N./A. as laid down by C.S.R.D. has proved unsatisfactory and certain modifications have had

to be made in collaboration with C.S.R.D.

One lot of R.D.N.A. .042/29" was rejected for excessive variations in composition as found by C.I.A. This ~~matter~~ is being investigated by C.S.R.D., and R.G.P.F., as the material was found satisfactory when examined at R.G.P.F. ~~prior~~ at the time of issue.

(V) Tetryl

Repurification of material made during the war was suspended in order to commence nitration of fresh C.E.

Nitration and subsequent purification to crystal, ground and corned C.E. Grade I has been carried out during the year with an increasing rate of manufacture.

Work has proceeded with a view to modernising and increasing the capacity of the C.E. factory. In this connexion, installation of the second large nitrator of 300 gals. capacity has been almost completed and the capacity of the C.E. purification house has been doubled.

(VI) Composition R.D. 202

Early in the year it was decided to renovate all the buildings in this section and a type of construction using "Insulwood" which has a smoother surface than the "Celotex" previously used, and avoiding all internal projections has been evolved which appears almost ideal for dusty work of this sort.

Immediately after restarting, a new batch of charcoal was brought into use which gave consistently low burning times and, in spite of every effort it has proved impossible to make material to give fast rates of burning. This has caused considerable difficulty in producing material complying with the specification to fulfil ~~extracts~~ The matter is under further investigation.

(vii) Cinnpowder

The work carried out during the year has consisted entirely of the production of Millcake for the manufacture of Ingo Powder S.R. 224, the Millcake being transferred to C.S.O.F. for finishing.

The available plant is only suitable for very small outputs. For larger quantities the installation of a more efficient saw for cutting the dogwood, mechanical sieves for both wood and charcoal, and a more suitable mill for grinding charcoal are desirable.

The charcoal burner has worked very ~~satisfactorily~~ successfully, and all batches of charcoal have been burnt to specification for carbon content, the total quantity of charcoal burnt was 1348 lb.

(with excellent uniformity)

(viii) Main Laboratory.

The activities of the Main Laboratory have been very greatly increased during this year by the rising output of the factory.

The total number of routine samples analysed in connexion with the inspection of raw materials, intermediates and finished products was approximately 12,000 as compared with about 5,000 during 1934-35.

The field of experimental and research work has also been greatly increased both in amount and in scope and an unusually large number of investigations have been carried out into problems connected with the development of plant processes and the general running of the factory.

Notable lines of investigation have been connected with the resistance to corrosion of many materials of construction of plant for acids and explosives manufacture, new methods for the sieving and washing of C.E., and the alkalinity of Guncotton during processing.

Plans were developed and prepared for rearrangement of existing C.E. nitration plant and the proposed new C.E. nitration plant was designed.

A considerable amount of experimental and research work was undertaken for the Supply Board Technical Establishment, including several investigations on raw materials for T.N.T. manufacture, an investigation of the commercial processes for carbamite manufacture, and an ~~study of the~~ experimental study of the economic aspects of the present manufacturing process for chloractic ester.

(IX) Continuous Inspection of Cordite during Manufacture

Accommodation has now been provided for representatives of the Chief Inspector of Armaments who make posted in the factory on the recommendation of the Ordnance Committee.

(X) Danger Building Inspectorate

Inspection of Danger Buildings is now under the ~~direct~~ supervision of a resident Inspector, to whom Danger Building visitors are directly responsible.

~~This system has enabled~~

Prior to June 1938, when the new Inspector of Danger Buildings assumed duty, Danger Building visitors were responsible to the Senior Inspector of Danger Buildings, Royal Arsenal, Woolwich.

Supervision and) The new system has resulted in very much more satisfactory and efficient co-ordination of the Inspecting Staff. ~~and~~

Moreover, I am able at once to deal with reports from the Danger Building Inspection Staff instead of perhaps having to wait for the fortnightly visit of an ~~staff~~ Officer from Woolwich.

(b) Services

(i) Hydraulics.

The hydraulic pumps ~~[illegible]~~ have continued to give satisfactory service. A further 50 HP pump is to be provided next year to replace one of the old pumps. ~~[illegible]~~

(ii) Compressed Air Plant

~~[illegible]~~ Attention has been given to the oil supply to the air-compressors and this has been considerably reduced by fitting a forced oil feed pump to the compressor. The amount of oil can be regulated very accurately and the oil has been changed from light oil to a heavy cylinder oil. It is thought that this will lead to a cleaner air supply.

(iii) Refrigeration Plant

A new condenser for one of the refrigerators at Edmondsey has been taken up for this next year (1926-27).

(iv) Air Heating (Gunnothon's Stove)

The stove services have been reconditioned and the hot air services of two ~~[illegible]~~ stoves is being altered to give improved circulation of air.

(v) Telephones

Clearing of trees etc. in the vicinity of telephone wires has reduced the number of breakdowns in the service.

No further action has been taken concerning the installation of an Automatic Telephone system.

(vi) Transport

~~Four of the original accumulators supplied with the tractors have been finally discarded. Have been replaced by Nickel-iron batteries, ~~[redacted]~~ having a~~

Nickel-iron batteries have been purchased to replace four of those originally supplied with the tractors. The capacity of the new batteries is 50% greater.

The new Guinotton lorry purchased last year for transport of guinotton from Quinton Hill to Edmondsey continues to give satisfactory service.

(vii) Machinery Shop

A new lathe is being purchased to deal with hydraulic press cylinders and similar heavy work.

(viii) Metropolitan Water Board Supplies The cost of water consumed during the last five years has been:

1931	1932	1933	1934	1935.
£168	£182	£199	£192	£289.

(IX) Lea Conservancy Board

The board has undertaken weed cutting and clearance of shoals in the L.D. portion of the Small River Lea on repayment by the factory.

The flow of water through the factory has fluctuated between a minimum monthly average ~~in Aug~~ of 1,035 cub. ft/min during August of 1935 and a maximum of 11,583 cu. ft./min in December 1935.

The daily average over the last five years have been:

1931	1932	1933	1934	1935
9,973	8,675	2,766	2,405	4,976.

(X) Fire Brigade

Inspections have been made of all fire appliances during the year & they have been found in order; ~~factory~~ fire rules and precautions have been well observed throughout the factory.

Three calls were received and the fires were extinguished without difficulty, the damage to property being slight.

An additional hydrant has been fixed making a total of 85.

Two extra fire squads have been remitted during the year, one in the Quinton Section and one in the Cordite, making a total of six fire squads.

(XI) Estate

An intensive programme of Estate clearance has been carried on during the year.

A number of trees were condemned as being dangerous, and were felled. These trees and a number of others which had fallen or had been felled on

previous occasions were removed.

The factory area generally has been cleared of undergrowth etc., and grass has been kept under control.

(c) Property

The gross returns from all property attached to the factory for the last five years are as follows:-

1931	1932	1933	1934	1935
£1,537	£1,524	£1,434	£1,241	£1,145.

The expenditure on domestic property has amounted to £532 against an assessed annual value of £1,024. This does not include the special Maintenance Expenditure on account of the internal redecoration and installation of new fireplaces at 54, Highbridge Street.

III Main productions

Summary.

Cordite	W.	44 4·8	
	M.D.	188·9.	
	R.D.N./A.	23·1	
	Mark. I.	4·9	
	Experimental	5·3	667·0 Tons

Composition R.D. 202

·647 -

Tetryl	New Manufacture		
	Repurified	20·7·0	
	~~Ground~~ Ground	·000	
	~~Crude~~ Crystal	2·8	
	New Manufacture	5·467.	

~~New Methods~~ IV. NEW METHODS

(b) Blank cutting

Improvements have been made in this plant by the installation of a transparent screen over the feeding end of the cutting machine and by the provision of covers for the sieves ~~which minimise~~ reducing the amount of cordite which falls on the floor.

(a) Solvent Reduction

A reduction in the amount of acetone used in the incorporation of Cordite W has been made where the cordite is to be pressed in the hydraulic presses, with advantageous results. This is described under section (a) (iii) of this General Survey.

(c) New system of Ammonium Picrate

Service production is regularly being processed in the new type of pellet which was devised and developed at R.G.P.F.

This type of machine possesses several notable advantages over the older type and particulars of its present and proposed applications are given in section (a) (ii) of this General Survey.

(d) Treatment of carbamite before sieving

A small pair of preliminary crushing rolls has been installed over the feed to the sieving machine in order to deal with carbamite which becomes caked during storage. This caking has caused considerable inconvenience in the past and although the present installation is not an entirely satisfactory solution to the problem, it has led to improved processing.

V URGENT ORDERS

During the year 112 tons of cordite were executed as Emergency orders.
89.6 tons of Cordite W.056 were manufactured for the Army, 5 tons of R.D.N./A for the Navy and 27.8 tons of M.D.T. 5-2 for the Air Ministry.

VI EXPERIMENTAL ORDERS

~~for the Cordite section~~

Experimental: A considerable amount of experimental work has been carried out during the year, a summary of the quantities of each type of Cordite is appended.

Experimental Batches 1934 - 35.

For Service of Ordnance Committee.

	Size	Pressed lb.	Issued lb.
M.D. Reworked with carbamite	.057	200	5,595
R.D.B. Reworked with carbamite	8	-	145
W. from straw cellulose	11	237 7/16	237 7/16
H.E.	.045	100	100
W. various	.154-.136) .144-.048) .168-.056) .072) .112) .180)	1,677	1,677
R.D.N./A.	.040	250	250
F.551/27 various	.023) .045)	275	275
		2,739 7/16	8,279 7/16

For Service of Small Arms Committee.

M.D.T.	8-2) 9-2)	500	500
W.T.	5-2	65 6/16	65 6/16
		565 6/16	565 6/16

For Service of Army.

W.T.	.144-.048	925	575
M.D.T.	9-2	825 6/16	325 6/16
R.D.N./A.	.034	920	920
F.551/27	.023	2,020	2,020
		4,690 6/16	3,840 6/16

T.N.T.

Short note on the experimental work carried out on the pilot plant.

After completion of orders received for the T.N.T. the plant was shut down

During the year ending 30.9.14 no T.N.T. was manufactured.

Further valuable experience was gained and this has been incorporated in a report upon the working of the T.N.T. Pilot plant.

IX. COST OF PRODUCTIONS.

Total m m

See Appendix giving costs which can be used as desired. Put all the figures in.

A. FACTORY EXPENSE.

The total F E as shown in Appendix II has increased over last year's total by some £ 38 000. ~~The increase~~ This increase is ~~again mainly~~ due to the accelerated maintenance programme run fast to increase in strength The percentage F E to direct labour has fallen from 64.2% to 47.3%.

Total	£83,400

This compares with the value of 31.3.35 as follows:-

Manufacturing Materials	£56,272
Other Items	£16,360
Total	£72,632

Appendix III shows comparative prices paid for various items as between 1934-35 and 1935-36, also the result of Stocktaking and the sale of surplus stores.

MC.

I think all the information you require is now enclosed. I have given a list of Prod^{n} Costs from which you can select those req^{d}. The costs of 1934-5 now shown are final costs which may not tally exactly with those in last year's report which were "expected costs".

20/1/36

XII. IMPERIAL RESERVE STOCKS.

The stock of glycerine at the end of the year amounted to some 510 tons of which 450 tons represented Imperial Reserve

During the year the remaining portion of the Rennie Award was restored to Industrial employees & the full consolidation of Civil Service Bonus ~~was~~ for Non Industrials was carried out.

XIV. AGES OF EMPLOYEES.

The numbers and average ages of employees on 1st April 1935 and 31st March 1936 are given in Appendix IV.

XV. ESTABLISHMENT.

(a) Staff Lt-Col B G F Davidson OBE was appointed Inspector of Danger Buildings (27/6/35)

W H H Hogge was appointed Ranger of Building Works Dept (Init) vice W T W Watkins.

(b) Strength The total strength of the factory on 31st March 1936 is shown in Appendix IV. Appendix V shows the age gradation at that date as compared with the end of the previous year. It is satisfactory to record that the average age has fallen from 42.46 to 37.86 Appendix VI gives a detail of personnel on the 31st March 1934 & 1935 respectively

XVI WAR EMERGENCY ACTIVITIES

As a result of a visit to the factory by the Master General of Ordnance and the Director of Ordnance Factories, it has been decided

(1) There is no need in the present outlook to enlarge the vat house.

(2) In the present outlook, Waltham will be maintained to produce 150 tons Cordite W and 50 tons Cordite MD.

(3) If anything should occur to modify the present proposals for removal or to delay action, then the situation must be reviewed.

[illegible] for Explosives [illegible] the factory generally [illegible] of repair

Also [illegible] matter on which notice has been suspended pending a decision on removal re examination below:—

Working out for Tetryl Factory

Enlargement of 2 Bond Store

Tunnels proposed Power Drive

Enlargement of Power for Spent Acid

Enlargement Telephone exchange.

New Packing Shop.

[illegible] and the Supply Board Technical Committee [illegible] year.

Re-roofing of the Supply of clothing [illegible] has been excluded as regards 2 convicts.

Appendix V

Sheet 1

Nos. and Average of R.G.P.F.

Employees on 1-4-35 and 31-3-36.

Age.	Nos. on 1-4-35.	Nos. on 31-3-36.
65	-	-
64	4	4
63	8	11
62	12	12
61	11	11
60	12	13
59	13	15
58	14	12
57	11	26
56	26	10
55	9	14
54	14	11
53	9	21
52	18	14
51	13	11
50	7	7
49	6	13
48	7	12
47	6	11
46	13	15
45	10	12
44	10	20
43	7	12
42	8	13
41	8	10
40	6	21
39	14	15
38	13	16
37	8	16

Appendix V
Sheet 2

Age.	Nos. on 1-4-35	Nos. on 31-3-36.
36	8	17
35	8	23
34	9	24
33	11	26
32	11	29
31	13	19
30	12	36
29	14	30
28	14	22
27	10	35
26	14	29
25	15	24
24	7	22
23	11	31
22	11	21
21	4	22
20	4	9
19	5	3
18	2	7
17	3	5
16	3	3
15	1	3
14	1	1
	488	819

Average age = 42.46

Average age = 37.86

Appendix IV

R.G.P.F.

Total strength on 31/3/36.

	Nos.	%
60 and over.	51	6.23
Over 50 and under 60.	141	17.22
" 40 " " 50.	139	16.97
" 30 " " 40	221	26.98
" 21 " " 30.	236	28.82
Under 21.	31	3.78
	819	100.

Offences VI

R.G.P.F.

Personnel. 31-3-36.

	Total this year.	Total last year.
Supervisory &c.	63	49
Skilled.	121	66
Semi-Skilled.	142	79
Unskilled.	469	279
Women & Girls.	1	-
Boys.	23	15
	819	488
Highest.	828	488
Lowest.	488	398
Average.	689	441
Entries during the year.	392	133
Discharges " " "	67	63
Transfers " " "	30 (Transfers "in" - 18 "Out"- 12)	23 (Transfers "in" - 13 "Out" - 10)

I.D.B's Notes in R.G.R.F. Annual Report.

Approval having been granted for the appointment to my staff of an Inspector of Danger Buildings, Lieut-Colonel C.G.F. Davidson D.S.O. M.C. (late) Royal Artillery assumed duty on 27th June 1935.

The two Danger Building Visitors, who had till then been responsible for the efficient performance of their duties to the Senior Inspector of Danger Buildings, Royal Canal, Woolwich as well as, in matters of urgency, to me, were placed directly under the new Inspector who, living on the spot, has been able to supervise and coordinate their activities to a far greater degree and more satisfactorily than could ever have been possible under the former arrangement.

Moreover, I am able at once to deal with reports from the Danger Building Inspecting Staff visits of perhaps two to visit by the fortnightly visit of an Officer from Woolwich.

On 4th January 1936 D.-B.V. G. Wraight retires on attaining the age of 65: He has served for 49 years in this Factory.
He was succeeded by D-B.V. A.J. Wright an ex-Regt Sergt Major of Royal Artillery.

Owing to the increased and fresh demands of the Factory the number of Danger Buildings in use has increased. To meet this two additional Danger Building Visitors have been appointed with effect from .....

7086. Wt.P1811/1368. 10M. 10/34. Wy.L.P.Co.,Ltd. Gp. 656.

Enfield Form 98.

Departmental Memo. No.

Minutes to be numbered consecutively. Sheet No.

To be left blank

W.B.

I shall be glad to have your notes for my Annual Report for 1935-36 ~~1936-37~~ as early as possible after the 31st March.

2.3.36

Supt

Notes on the progress of works in the Building Works Dept for 1935-36 attached ℔.

20/3

7086. Wt.P1811/1368. 10M. 10/34. Wy.L.P.Co.,Ltd. Gp. 656. Enfield Form 98.

Departmental Memo. No.

Minutes to be numbered consecutively. Sheet No.

To be left blank

M.L.

I shall be glad to have your notes for my Annual Report for 1935-36, as early as possible after the 31st. March.

2.3.36

for C. R. L.B.
W.G. H.
for Cor noted. H.L. 3/3/36.
H/C
Pse arrange.
E.H/6 3.3.36

B/F 15.4.36

M.L. / Brot fwd. G.H. 15/4

for C.R. W.L.B.
W.G. H
for Cor H.
H/C
Pse let me have your notes as soon as possible
G.H/5 15.4
Copies forwarded notes from meeting M.G.

7086. Wt.P1811/1368. 10M. 10/34. Wy.L.P.Co.,Ltd. Gp. 656.

Enfield Form 98.

Departmental Memo. No.

Minutes to be numbered consecutively. Sheet No.

To be left blank

M.S.

I shall be glad to have your notes for my Annual Report for 1935-36, as early as possible after 31st. March.

2.3.36

Sir.

Will you let me have some general notes of interest.

4/3

M.S.

Annual Report h/w. The figures for the amount of steam & electricity distributed & the cost has not yet been received. Spoke to who will forward particulars early.

Copy of report for your retention attached

29/5/36

Supt:

Forwarded.

2/6/36.

23/5/36.

Dear Knapman.

Re Annual Report you will remember that DOF requires it in a certain form which I adhered to last year. I shall be very glad if you could arrange for the attached reports to be sorted out in this way. N.S. & N.B. must be pressed to complete their annual reports for inclusion. Do you think Evans would be best to put on this possibly with some technical assistance. Time is pressing and among is the new

Mr Parsons

Herewith 2 copies of Annual Report for 1935-36 as requested. Please return when done with

W.T.
30/3

R

Thank you

G.H.
28/5/37

Dear Kuahman

Herewith

Some statistics

for the A.R.

1970

2/7

R

Our first word

a. r.