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Technical Staff

*To be returned

RESEARCH DIVISION

CONDENSED MONTHLY SUMMARY REPORT

DECEMBER, 1942

PERSONNEL

D. Petruccelli, formerly on the research staff at Bridgeport, was transferred to Department DRF on December 15.

T. W. Mullen, Jr., Davidson College, B.S. Chemistry, '39, was transferred from Spruance (Du Pont Rayon) to Lake City as Research Division Representative, effective December 21.

R.A.A. Hentschel, formerly Assistant Manager, Research Division, was appointed Assistant Superintendent, Product Engineering and Control Section, reporting to R. J. Seiler, Superintendent, effective December 28.

L. R. Crittendon, formerly Development Engineer, Ilion Works, was appointed Assistant Manager, Research Division, Ilion, reporting to W. O. Stauffer, Manager, effective December 28.

P. B. Rutherford, Section Head, Gun Design & Process Section, will report to L. R. Crittendon, Assistant Manager, effective December 28.

C. C. Loomis, formerly Development Supervisor, was appointed Mechanical Research Engineer, reporting to P. B. Rutherford,

Gun Design & Process Section, effective December 28.

Shadburn Marshall, formerly metallurgist on the Research Division staff at Bridgeport, was appointed Section Head, Chemical & Metallurgical Section, Research Division, Ilion, reporting to L. R. Crittendon, Assistant Manager, effective January 1.

* * *

PRIMERS

Non-Mercuric, Non-Corrosive Primers:

Additional work on the use of HMTD as a sensitizer in 1348 type mixture has shown that there is an unknown variable in different samples which has given variable sensitivity and stability results. This effect is being checked further.

An extensive cold barrel time test using 1348 mixture containing 5% sensol has been made and barrel time was satisfactory. This experiment will be repeated.

Premixtures containing calcium oxalate are being evaluated for mass detonation characteristics and ignition.

Study of New Priming Materials:

Lead oxalate, arsenic pentoxide, antimony pentoxide, zinc stearate, thymol and calcium oxalate are being investigated as constituents for premixtures.

Further work has been done to develop a drop test procedure for use in testing initiators.

Further results have been obtained from calorimeter tests on different priming mixtures.

A sample of the lead salt of nitroaminoguanidine has been prepared using the methods outlined in U. S. Patents 2,251,101 and 2,286,307. Drop test sensitivity and flash point are being measured.

Samples have been prepared according to Patent 2,292,956 and will be sent to the Experimental Station for X-ray diffraction and quantitative analyses to determine the presence of lead double salt.

Determination of Moisture Content of Priming Explosives:

Additional work with 1348 mixture and with sensol using ethanol as a solvent has shown that moisture can be de-

termined with a precision of ± 1.5% by the same method used on other priming mixtures. 1341F priming mixture is now being tested.

Plant Assistance (Bridgeport):

As a result of misfires and hangfires in caliber .30 and caliber .50, and misfires in caliber .45 ammunition and primers, considerable attention has been given to the extremes of bridge thickness and charge weight and the drying of these primers.

A method of removing empty cups from the charging plates without the use of wax is being developed as wax has been found as a cause of misfires in caliber .30 and .45 primers.

The increased number of rejections of batches of mercury fulminate has been thoroughly investigated. Constant contact has been maintained with Hazardous Area supervision, Quality Control, Process Section and the suppliers of this material, the Du Pont Explosives Plant at Pompton Lakes, New Jersey. Closer control of the screening operation and more frequent sampling of the material appear to be relieving the situation.

The procedure for routine sensitivity testing of TX-2, #125 and 20 M/M mixture has been modified. The procedure which is now in operation will show insensitive mixtures which would not have been detected by the method previously used.

The automatic priming machines used for #299-T mixture in caliber .22 shells have been thoroughly studied and a method has been devised which will make possible the satisfactory operation of these machines on this mixture. A formal report is being prepared on this subject.

Additional samples of coated foiling papers have been tested in the Bridgeport process but have not proved satisfactory. In a study of the effect of foiling paper the ignition characteristics of primers with and without foiling paper were found to be the same.

The possibility of incorporating wet PETN into the #125 mixture is still being studied. This development is now concentrated on the study of wetting agents which permit the PETN to pass through a plastic screen without clogging the holes in the screen.

Safety: Assistance has been given to the Bridgeport Plant on the following items:

(1) Procedures for mixing and handling shot shell tracer mixture, charging pellets, and handling and transporting the pellets to the loading

operation have been outlined in cooperation with the Bridgeport Safety Unit;

(2) Information has been obtained which will enable the Works Engineer to write a project for the purchase and installation of a vacuum cleaner to be used in removing explosive dust in connection with the tracer charging operations;

(3) Information was obtained from the Pompton Lakes Plant which will aid in reducing the hazard of mixing 20 M/M mixture;

(4) Work has been done in cooperation with the Kings Mills Plant and the Bridgeport Hazardous Area in developing a suitable method of packing polnol for shipment to Kings Mills which will prevent it from freezing during transportation or storage.

Plant Assistance (Military Division):

Lake City:

Tracer Manufacture: Magnesium has been received from a large number of vendors in small lots and this has led to variations in the performance of tracer, particularly the caliber .30 M2. Attempts are therefore being made to segregate lots for use in the M2.

Carbine: Difficulty has been encountered in obtaining correct velocity/pressure relationships and some work has been done in an attempt to check Bridgeport recommendations on primer pellet weight.

Caliber .50 Primers: Undue sensitivity is being experienced in the caliber .50 primers. Attempts have been made to correct this through slight changes in dimensions of components. A further attempt is being made to reduce sensitivity by using somewhat finer antimony sulfide.

Denver:

Incendiary: Experimental work on the lead core design, on which Denver is doing the original work on caliber .30, has been pushed. Results to date are very gratifying.

Tracer: Aside from difficulties introduced by small lots of magnesium from a large number of vendors, no particular trouble has been encountered. Caliber .30 M2 is being produced with no undue difficulty.

Standard Process Records: A final check has been made of Standard Process Records which are now almost ready for distribution.

Utah:

Caliber .50 Primer Sensitivity: Considerable difficulty has been encountered with caliber .50 primers which are unduly sensitive. While the cure to this problem is being sought a method has been investigated for using those primers which appear to be too sensitive.

Caliber .50 Priming Mixture: Production use of wet PETN continues and in conjunction with this a wet screening of PETN, prior to mixing, has been instituted. This has required minor changes in the composition of the gum solution.

Tracer: The same difficulty has been encountered at Utah as at Lake City and is requiring considerable work, particularly with respect to the caliber .30 M2.

Caliber .50 Lead Core Incendiary: In cooperation with the Process Section and the Manufacturing Department a new design has been developed which appears to show considerable improvement over the original design with respect to accuracy and "keyholing".

Lowell:

Caliber .50 Primers: Although primed case sensitivity has been good, dimensions of some components have shown excessive variation. Attempts are being made to reduce these variations before they show up in the completed primer drop test.

Explosives Laboratory: A full time chemist is now available in the Explosives Laboratory and laboratory equipment is being assembled and testing procedures are being devised.

Kings Mills:

Serious sensitivity difficulty in the carbine primer has been traced to large variations in the dimensions of metallic components. There are no particular difficulties with the mixture except the problem of maintaining constant moisture content. This is influenced by the moisture content of polnol. New methods of packing polnol are being investigated at Bridgeport and Lake City.

STEEL AMMUNITION

Corrosion Resistance:

Promising results have been obtained on caliber .45 steel cases which were given the following corrosion resistant finish:

Parkerized;

Tumbled in furfuryl alcohol with a resinifying agent;

Removed from the alcohol and, while still being tumbled, heated for 5 minutes to 250°F to resinify the furfuryl alcohol.

The resulting finish is smooth, black and glossy, and, with no bullet inserted, has given promising salt spray resistance up to 48 hours. With a bullet inserted promising 24-hour salt spray resistance has been obtained. Attempts to apply the finish to caliber .50 have just been started. Because of the necked-down shape and larger size, a tumble application does not appear as easy for this case as it does for caliber .45. Work, however, is being continued.

Caliber .50 Steel Case:

The main effort during the past month has been the setting up of a tentative process record and the attempt to produce by means of it 50,000 cases by the end of the year to meet the requirements of the current contract. It appears at this time that this requirement will be met.

SHOT SHELLS

Piston Plus:

In order to isolate the powder from the running of paper body wax which is partially absorbed by conventional wads, a new basewad is being evaluated which utilizes a high skirt to completely enclose the powder. Such a means would make possible the use of Piston Plus wadding with accompanying ballistic advantage and also provide better storage stability than the present shell.

Molded Wads:

Asplund 12 Gauge: The supply of scrap felt will

shortly be exhausted and it is planned to change early next month to a 13K formulation (beaten kraft and unbeaten Asplund) and recirculation of the drainage water. A discussion was had with the manufacturer of the Vortex beaters and he agreed to take whatever steps were necessary to provide satisfactory operation for use on the 13K wad.

A cost quotation is being obtained on secondhand beater equipment for use on 100% Asplund formulation and a study will be made of the economics to decide whether this wad should replace 13K.

16 and 20 Gauge: An extensive series of tests on the 20 gauge Molded Wads made last month has been completed and entirely satisfactory performance on all counts has been secured. Tools are currently being made up for the 16 gauge experimental run.

New Crimp:

A project has been authorized which will attempt to determine whether variations in body diameter and/or corrugation are of controlling importance in the often-alleged claim that Peters New Crimp eject more readily than Remington New Crimp.

A production quantity of the new scuff resistant tape is being prepared. A part of this will be used for extensive firing tests at Bridgeport. If this test is successful, the tape will be used on shells going to Army camps.

INTERIOR AND EXTERIOR BALLISTICS

Study of Small Arms Powders:

A series of nomographs has been constructed which speed up the interior ballistics calculations. These calculations involve taking bomb test data on powders, cartridge case volumes, weight and cross section of bullet, etc. and predicting pressure curves and velocities. Experiments concerning friction and engraving forces will be undertaken.

Primer-Powder Relationship:

Powder ignition temperatures from bomb test analysis were predicted to be about 180°C. Actual test under atmospheric pressure gave a flash temperature of 200°C.

.22 Plant Assistance:

Revisions are in progress on the experimental Mann barrel mount to make it less sensitive to changes in mounting.

Preliminary use of the laboratory crimper indicates that variations in crimp lead to variations in velocity. Accuracy, however, has been surprisingly insensitive to small changes in crimper knife position and orientation.

ARMS

Model 760:

An aluminum receiver for this model is now being made in the model shop. This receiver incorporates all design revisions and will provide a better example of the finished product than does the present model with brass receiver.

Model 740:

Design work on this model has been started. It is planned to use the present brass Model 760 for experimental work in developing satisfactory gas operating means for the Model 740, and work is progressing along this line.

Model 800:

The Ilion Design and Development Section submitted rough sketches of a revised design for this arm. After the elimination of certain features this revised design will probably deserve serious consideration including a careful cost estimate.

Model 500:

Work on this design has been resumed and it appears that the difficulties formerly encountered with excessive friction can be overcome without any increase in cost of production.

Bore and Sight Aligner:

The bore and sight aligner designed for use with the Model RS03A3 rifle is nearly completed and should be ready for trial operation early next month.

Two Groove Rifling:

A relatively simple means of converting a four groove rifling machine to two groove operation has been tried. Trials indicate that the conversion is entirely satisfactory, and the plant is now seeking quotations on the work.

Draw Rifling:

Investigation of this method of rifling barrels has been started. Results have been extremely gratifying. The only barrel that has been built into a gun shot satisfactory groups.

Low Cost Deburring:

Experimental rumbling of RS03 components is being continued. Projects for the procurement of tumbling equipment for tumbling the RS03 ejector and cutoff have been written. Several visits to other concerns have been made for information on tumbling equipment and methods.

Application of the Browning Solution:

Felt and cellulose sponges have been substituted for natural sponges as the medium of application of the browning solution to arms components. Work on other methods of applying the solution has been temporarily suspended because of the urgency of other projects.

Gun Stocks:

Drastic Drying Schedule: Examination of the run of 8,000 Springfield urea-treated blanks which was accomplished from the green state to commercial dryness in an unprecedented 28½ days was found on examination to have resulted in a surprisingly low percentage of rejects. This is indicated by the following data:

Drying Schedule	Percent Rejects
Standard Ilion drying (not urea treated)	12 - 15
Urea-treated run	8
Untreated standards with urea run	24

Project: In view of the encouraging results obtained in the accelerated urea-treated run, a project to establish completely the advantages and operating conditions of urea-treated gun blank drying was authorized.

Moisture Measurement: Electrical measurements have shown high sensitivity to the moisture content of wood. Measurement of the dissipative factor of a cube of wood at 1,000 cycles per second shows some promise of estimating the conditions at both high and low moisture content. Work is continuing.

Pattern Control:

Rotary Variable (Omni) Choke: Critical limits have been established for the length of the vent section in the Cutts-Poly combination. These data were obtained for patent purposes.

Longitudinal Variable (Trombone) Choke: A modified slide was tested and to date has shown no evidence of binding. There is, however, some evidence of buildup on the vent section which is believed to originate from molten lead spray melted from the pellets by the powder gases. Steps to overcome this are being considered.

Force Measurements on Springfield Rifles:

Construction of apparatus is complete. Preliminary tests of the force on the bolt face showed spurious pulsations which were traced to magnetic action from the moving firing pin. A non-magnetizing gauge was constructed and these spurious effects have disappeared.

Magnetic Tester:

Hardness tests on rough forged rifle barrels can be correlated with behavior in the magnetic tester. Further work on these lines is being done at Ilion.

Springfield Rifle Accuracy Study:

Preliminary investigation indicates that the bedding of the rifle in its stock is an important variable affecting accuracy. A Part II is being prepared to cover a detailed study.

Plant Assistance (Ilion):

Production chrome plating is progressing satisfactorily. Several new racks have either been made or procured to increase the plating capacity. Continued assistance has been rendered to the plant on tool metallurgy including low temperature cyaniding and over-tempering to increase tool life. Substitution of the 1.5% high carbon, high chrome tool steel for the 2.5% type in several gauges indicates improved ease of machinability. Preliminary results with carboloy tipped turning tools and barrel drills indicate an increased life of 300-500% per grind.

TRAPS

Rite Flite Traps:

Certain alterations in the trap model have been made

and appear to yield satisfactory results, subject to confirmation by outdoor trapping tests.

MISCELLANEOUS

Raw Materials Specifications:

Work on this project has been completed and a report is being prepared.

WOS:MDB
1/19/43

BARBER - PRESALE R 0099122

PROJECTS WRITTEN THIS MONTH:

Cathode Ray Oscillograph - Part II

PROJECTS BEING WRITTEN OR PROPOSED:

Novel Variable Pattern Device

PROGRESS REPORTS WRITTEN THIS MONTH:

Bullet Lubricants (RDR-42-19)

Williams Autoloading Shotgun (RDR-42-25)

Caliber .50 Steel Cases (RDR-42-24)

Bore and Sight Aligner (RDR-42-23)

LIBRARY ACCESSIONS:

Controlled Atmospheres - A.S.M.

Heat Transmission - McAdams

Shop Theory - Shop Theory Dept. of Henry Ford School

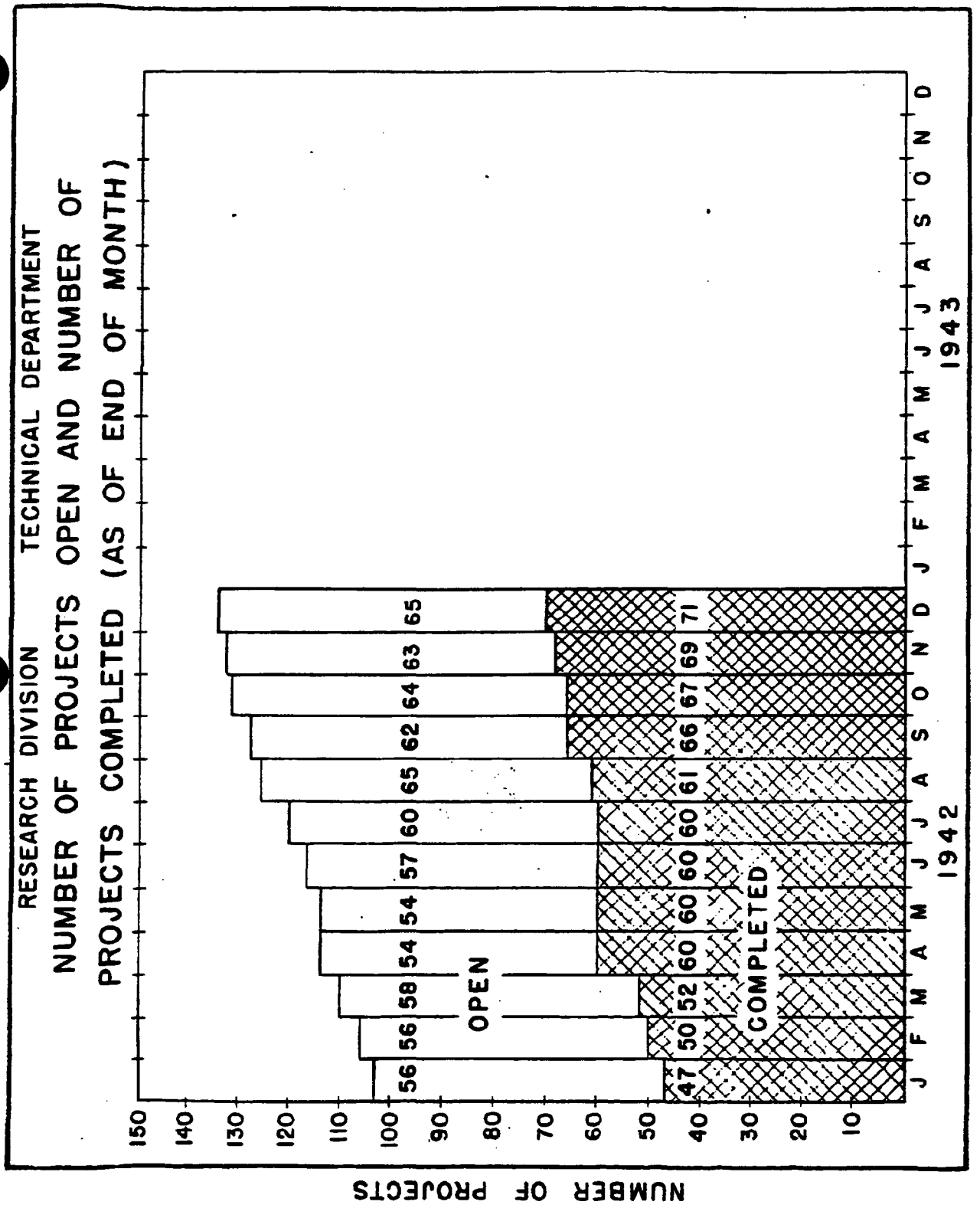
Theory of Gaseous Conduction and Electronics - Maxfield and Benedict

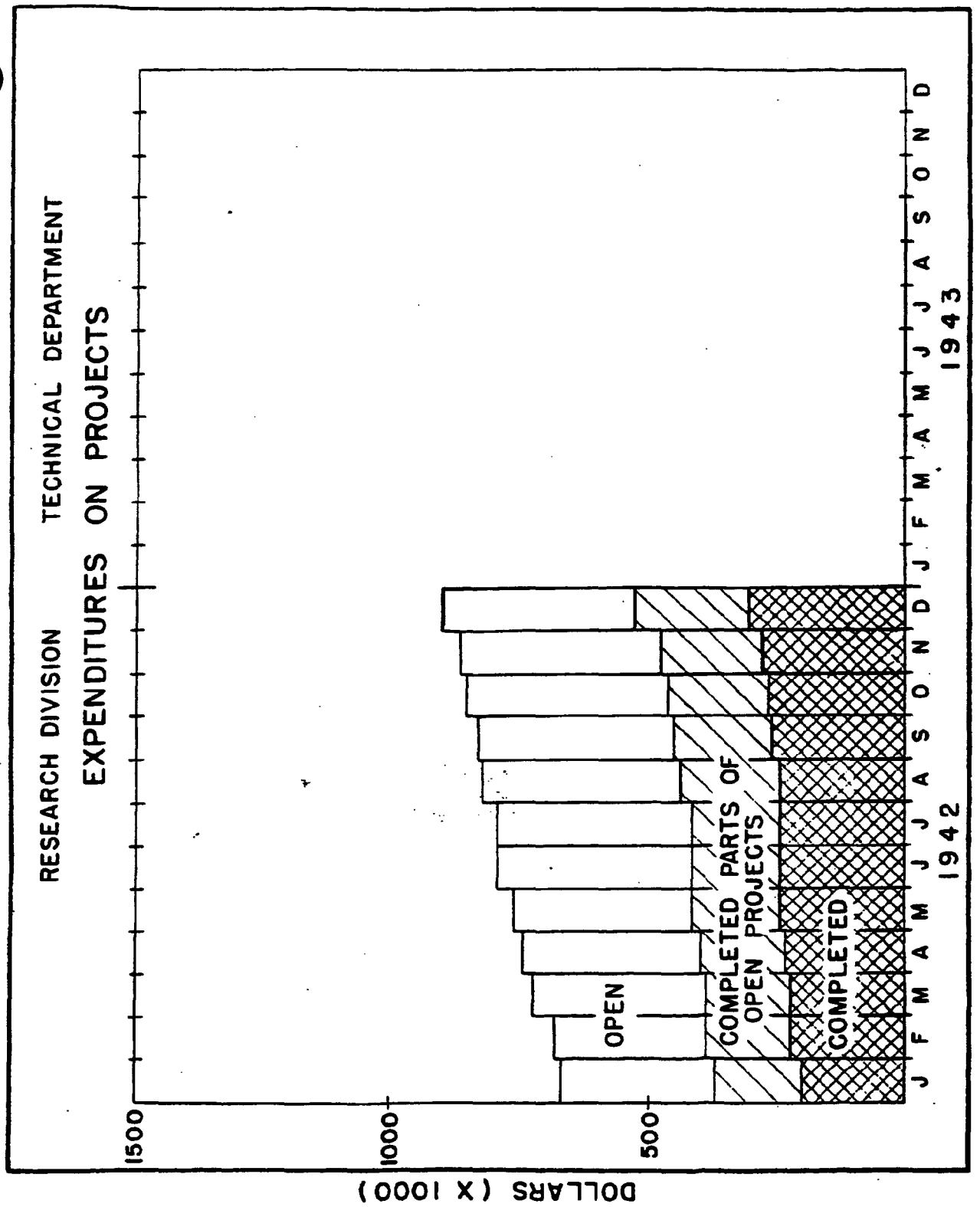
Walls Dictionary of Photography - Mortimer

The Physical Examination of Metals (Vol. II) - Chalmers and Quarrell

The Construction of Nomographic Charts - Mavis

Plastics for Industrial Use - Sasso


RESEARCH DIVISION TECHNICAL DEPARTMENT
NUMBER OF PROJECTS OPEN AND NUMBER OF PROJECTS COMPLETED (AS OF END OF MONTH)
NUMBER OF PROJECTS
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
OPEN
COMPLETED
56 56 58 54 54 57 60 65 62 64 63 65
47 50 52 60 60 60 60 61 66 67 69 71
J F M A M J J A S O N D
1942
J F M A M J J A S O N D
1943


RESEARCH DIVISION TECHNICAL DEPARTMENT
EXPENDITURES ON PROJECTS
1500
1000
500
DOLLARS (X 1000)
OPEN
COMPLETED PARTS OF OPEN PROJECTS
COMPLETED
J F M A M J J A S O N D J F M A M J J A S O N D
1942
1943

SUMMARY REPORT OF RESEARCH PROJECTS

$500 AND OVER

	Number Of Projects	Amount Authorized*
New projects authorized during December, 1942.....	4	$ 6,200
New parts of old projects authorized during December, 1942.....	3	126,800
Completed during December, 1942....	2	39,035
Completed to date.....	71	310,941
Open (December 31, 1942).....	65	582,748
Completed parts of open projects...	-	204,598

*Not including Plant Increase and associated Operations items.

EXPLANATION OF THE TERMS USED ON SCHEDULE

"Urgency"

D	- Dormant
N	- Normal activity
A	- Urgent
AA	- Highest practical urgency

"Section"

C & M	- Chemical and Metallurgical

"Amount Authorized" - Refers to last part

"Balance" - Refers to end of previous month

"% Spent" - Refers to end of previous month and is for last part

"Completion Dates" - Refers to scheduled and revised completion dates

"% Complete" - Estimated in terms of work under current part

SCHEDULE OF RESEARCH PROJECT

TITLE & CATEGORY	P.O. NUMBER	PROJECT NUMBER	URGENCY	SECTION	ACTIVE PART	DATE AUTH.	AMOUNT AUTH.	BALANCE NOVEMBER	% SPENT	COMPLETION DATES				PERCENT COMPLETE JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
AMMUNITION _ SHOT SHELLS																									
MOLDED FELT WADS	J 3082	B 10	N	CAN DPT	10	3/40	8800	2821	67	1/41	12/41	8/42	12/42							66	90	90	70	90	70
STEEL SHOT SHELL HEADS	F 184	B 64	D	CAN DPT	8	8/42	4400	6182	0											15	14	10	10	10	10
NEW REMINGTON PETERS CRIMP	J 3044	B 105	D	CAN DPT	13	9/41	2100	475	117	8/42	11/42									90	95	90	95	95	95
ALL METAL SHOT SHELLS	F 334	B 70	D	CAN DPT	2	7/41	7500	6940	81	7/42	1/43									20	20	20	20	20	20
STEEL PRIMER CUPS	J 3040	MCD 1012	N	PHYSICS	1	9/40	1 970	143	93	8/41	3/42	11/42	11/							85	90	90	92	95	95
PISTON PLUG WASHING	L 3001	B 329	N	CAN DPT	1	3/42	6 000	400	89	12/42										60	40	40	20	50	70
[illegible] SHOT SHELL [illegible]	L 3100	MCD 2000	N	PHYSICS	1	4/42	500	276	48	8/42	10/42									80	50	60	65	65	65
DEVELOPMENT OF [illegible] WAD	L 3145	B 481	N	CAN DPT	1	10/42	2700	2700	0	8/43															0
SHOT SHELL EJECTION COMPLAINTS	L 3146	MCD 2766	N	CAN DPT	1	12/42	6000	2000	0	3/43															0
AMMUNITION _ C.F.&R.F.																									
STEEL RIM FIRE	F 185	B 63	A	CAN DPT	4	8/41	10 000	3 340	66	1/42	8/42	9/42								60	60	60	60	60	60
TESTING OF NEW BULLET LUBRICANT MATERIALS	L 3148	MCD 2768	N	CAN DPT	1	11/42	900	900	0	9/43														0	0
DEVELOPMENT OF NON MERCURIC PRIMING	L 3088	B 313	AA	PRIMER	3	9/42	7 000	3 640	88	8/43												0	0	0	10
ALUMINUM C.F. CASES	E 3036	MCD 1070	D	CAN DPT	1	1/41	1 600	1 360	9	8/41	8/42	INDEF								0		0	0		0
STUDY OF BULLET TRAJECTORIES	E 2026	B 338	D	PHYSICS	3	11/41	8 000	3 410	60	10/42	5/43									30	30	35	35	35	35
STUDY OF LEAD BULLET LUBRICATION	E 3020	B 227	D	CAN & PHYSICS	1	3/41	7 500	1 010	86	8/42	3/43									30	30	30	30	30	30
ALUMINUM C.F. CASES	E 3034	B 237	D	CAN DPT	1	4/41	3 100	1 900	41	10/41	1/42	6/42	INDEF							30	30	30	30	20	30
COLORING BULLETS	E 3042	MCD 3010	D	CAN DPT	1	6/41	1 000	960	4	12/41	3/42	9/42								0		0	0		0
ACCURACY OF HARD LEAD BULLETS	E 3040	B 305	D	PHYSICS	1	9/41	3 000	1 790	40	7/42	2/43									30	30	30	30	30	30
PLANT ASSISTANCE ON .22 R.F.	L 3066	B 336	D	PRIMER	1	2/42	2 600	981	63	5/42	12/42									40	45	60	50	50	60
DEVELOPMENT [illegible] AMMN.	L 2090	B 368	A	PRIMER	1	4/42	18000	8881	84	10/42	8/43									25	25	40	45	45	60
.50 CALIBER STEEL CASE	87	B 410	AA	CAN DPT	3	8/42	26000	6493	75	12/42										15	20	25	35	40	60
.30 CALIBER ACCURACY	L 3112	MCD 2706	A	PHYSICS	1	7/42	900	1	100	9/42										5	15	95	100	100	100
STORAGE TESTS OF .22 MATCH AMMN.	L 3118	MCD 2753	N	CAN DPT	1	8/42	800	731	8	6/43												10	10	10	10
.30 CALIBER CARTRIDGE DEVELOPMENT	L 3126	MCD 2758	N	PHYSICS	1	8/42	1100	1337	68	7/43												0	5	5	5
AMMUNITION _ GENERAL																									
LEAD BASE ALLOYS	F 949	B 98	D	CAN DPT	1	10/37	4 120	900	82	12/39	1/43									75	75	75	75	75	75
STEEL DRAWING	C 289	B 100	D	CAN DPT	1	6/38	4 300	2 174	26	12/42										10	10	10	10	10	10
COLORING METHODS FOR STEEL AMMN.	J 3042	B 181	N	CAN DPT	2	7/41	1 000	1 060	34	10/41	6/42	11/42	1/43							60	60	60	80	80	60
ELECTROLYTIC POLISHING OF TOOLS	L 3140	B 482	N		1	10/42	6000	5934	1	8/43														0	5
RAW MATERIALS SPECIFICATIONS	E 1835	B 136	D	CAN DPT	1	3/39	10 000	(77)	101	3/40	1/42									95	95	95	95	95	100
NEW PRIMING MATERIALS	E 1040	B 170	N	PRIMER	2	2/40	9 200	925	90	2/41	11/42	8/42	1/							90	90	90	90	90	90
EVALUATION OF NEW [illegible] EXPLOSIVES	E 2022	B 214	D	PRIMER	1	1/41	4 600	1036	65	12/42	8/43									10	25	40	40	40	45
SMALL ARMS POWDERS	E 3048	MCD 2140	N	PHYSICS	2	11/41	5 000	1 068	71	12/42	6/43									35	40	60	60	60	70
ASSISTANCE TO PLANT ON EXPLOSIVES	L 2133		A	PRIMER		10/42																			
IMPROVEMENT IN TOOL MFG.	L 2072	B 341	D	CAN DPT	1	5/42	4000	1 347	18	8/43										5	5	5	5	5	5
COMPETITIVE PRODUCTS	L 3095	B 365	D	CAN DPT	1	4/42	2000	1 523	24	4/43										10	10	10	10	10	10
MOISTURE OF PRIMING EXPLOSIVES	L 3126	B 416	N	PRIMER	1	8/42	2900	1948	33	3/43											0	20	20	40	10
MECHANISM OF PRIMER INITIATION	L 3135	MCD 2760	N	PHYSICS	1	10/42	1000	749	25	10/43													0	25	50
ARMS																									
DESIGN FOR LOW COST C.F. ARMS	H 1007	B 130	A	DESIGN	4	6/40	11 800	7 696	35	2/41	INDEF	10/42	6/43							5	5	5	10	10	10
NEW ALLOYS FOR GUNS	H 1081	B 149	D	CAN ILION	4	7/40	30 400	14 706	55	6/40	8/42	1/43								60	60	60	60	60	60
MODEL 600	J 3026	B1 94	N	DESIGN	7	9/40	8 000	1 082	92	4/40	9/42	1/43								60	60	60	60	60	60
CHOKE PATTERN RELATIONSHIP	J 3039	B 171	N	CAN DPT	1	2/40	5 100	340	91	1/42	1/42	9/42	12/42							85	85	85	85	85	85
IMPACT TESTING	J 3036	B 209	D	CAN DPT	2	12/40	5 300	435	87	8/42	11/41	4/42	1/43							65	65	65	65	65	65
WALNUT BLANK	E 3042	B 200	N	CAN METALLURGY ILION	2	12/41	2 300	2 167	101	1/43										60	60	65	75	80	95
[illegible] STEEL AND [illegible]	E 3084	B 219	N	CAN DPT	1	6/41	5 300	4 583	10	6/42	9/42	12/42								10	10	10	15	15	15
SINGLE BARREL SHOT GUN	E 3090	B 273	N	DESIGN	1	7/41	6 000	408	93											90	90	90	90	90	90
LOW COST FINISHING METHODS	E 3094	MCD 2180	D	CAN ILION	1	8/41	3 000	3 008	0	1/42	9/42	INDEF								0		0	0		0
LOW COST .22 RIFLE [illegible]	E 3087	B 260	N	DESIGN	1	9/41	6 000	5 104	40	7/42	4/42									40	40	40	40	44	40
LOW COST [illegible]	E 3060	B 281	N	CAN ILION	1	9/41	4200	2644	37	7/42	6/42	1/43								0	0	15	35	35	40
LOWER COST ALTERNATE RIFLE C.F.	L 3122	B 423	N	DESIGN	2	11/41	10900	10929	0	11/42														0	0
METALLURGICAL PLANT ASSISTANCE	L 3080	MCD 2366	A	CAN ILION	2	10/41	7040	6129	13	2/43													0	5	10
BORE AND SIGHT [illegible]	L 3077	MCD 2000	A	PHYSICS	2	11/40	1400	1365	9	3/43											95	95	95	95	95
RECOIL REDUCING ROTARY CHOKE	E 3080	B 398	N	CAN DPT	2	6/42	7360	646	92	12/43										5	5	10	10	15	20
CONSTRUCTING CHOKE [illegible]	E 3083	B 300	N	CAN DPT	2	6/42	3680	3715	0	6/43										0		0	0		0
[illegible] LONGITUDINAL CHOKE	L 3110	B 377	D	CAN DPT	1	6/42	6 260	6 037	4	12/43										0	5	10	15	20	20
APPLICATION OF BROWNING SOLUTION	L 3120	MCD 2786	N	CAN ILION	1	8/42	2 000	1 720	14	8/43											0	10	25	25	35
FORCE MEASUREMENTS ON SPRINGFIELD RIFLES	L 3124	B 417	N	PHYSICS	1	9/42	4000	2710	32	1/43										0	0	0	15	25	30
G.L. DEVICE	L 3127	B 417	N	DESIGN	1	8/42	4000	1087	73	11/42	1/43												75	90	95
BARREL PROCESSING METHODS	L 3132	B 430	N	CAN ILION	1	8/42	10 000	10 000	0	9/43															0
LOW COST BOLT ACTION RIFLE M. 721	L 3131	B 425	N	DESIGN	2	12/42	11 600	11 600	0	11/43															0
MISCELLANEOUS																									
ELECTRICAL CHRONOGRAPHS	C 133	B 130	D	PHYSICS	3	11/38	8 000	941	91	7/39	1/42	3/43								80	80	80	80	80	80
[illegible] OSCILLOGRAPH	E 3031	B 311	A	PHYSICS	1	12/40	3 800	(396)	115	8/41	11/41	10/42	1/43							65	65	70	65	65	85
[illegible] GAUGES	J 3030	B 312	D	PHYSICS	3	1/41	8 000	1 064	47	12/41	6/42	3/43								5	10	30	22	30	61
LONG RANGE PLAN	E 3072	MCD 2240	N	CAN DPT	1	11/41	800	429	48	1/42	3/42	6/42	12/42							50	50	50	50	75	80
MAGNETIC TESTERS FOR ILION	L 3110	MCD 2750	N	PHYSICS	1	6/42	630	278	60	6/42	9/42	3/43								5	75	95	95	95	95
PLANT ORDERS UNDER $500																									
POWDER LEVEL INDICATOR FOR 30 CAL. MACH.	E 3077		N	PHYSICS	1	6/42	300	135	55	8/42	7/42	11/42	1/43							50	90	90	95	95	95
MANUAL OF STATISTICAL METHODS	L 3160		D	PHYSICS	1	7/42	400	200	44	10/42	8/42									0	15	30	10	40	40
SURE SIGHT ALIGNER FOR G.M.	L 3130	MCD 2767	A	DESIGN	1	9/42	350	170	51	10/42	12/42											95	95	95	100
TRAPS																									
LOWER COST TRAP	E 3030	B 350	N	DESIGN	2	6/42	1200	307	88	11/41	3/42	8/42	12/42							20	50	60	60	70	75
[illegible] TRAP DESIGN	L 3147	MCD 2784	N	DESIGN	1	12/42	1000	1000	0	3/43															0
TARGETS																									
ELIMINATION OF CRACKS IN LIMESTONE TARGETS	L 3090	MCD 2891	D	CAN DPT	1	3/42	1000	130	80	8/42	9/42	1/43								50	90	90	90	90	90