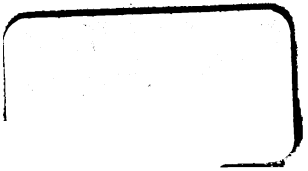

REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FIFTIETH CONGRESS.

IN FOUR VOLUMES.

VOLUME III.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1888.

REPORT OF THE CHIEF OF ORDNANCE.

WAR DEPARTMENT, ORDNANCE OFFICE,
Washington, September 1, 1888.

SIR: I have the honor to submit the following report of the principal operations of the Ordnance Department during the fiscal year ended June 30, 1888, with such remarks and recommendations as the interests of this branch of the military service seem to require.

The fiscal resources and expenditures of the department during the year were as follows, viz:

Amount in the Treasury to the credit of the appropriations on June 30, 1887	$233,969.33
Amount in the Treasury not reported to the credit of the appropriations on June 30, 1887	4,761.50
Amount in Government depositories to the credit of disbursing officers and others on June 30, 1887	209,356.34
Amount of appropriations for the service of the fiscal year ended June 30, 1888	1,541,097.75
Amounts refunded to ordnance appropriations in settling accounts during the fiscal year ended June 30, 1888	278.03
Gross amount received during the fiscal year ended June 30, 1888, from sales to officers; from rents; from collections from troops on account of losses of, or damage to, ordnance stores; from Chicago, Rock Island and Pacific Railroad Company; from powder and projectiles (proceeds of sales); from sales of condemned stores; from testing machine, and from all other sources not before mentioned	50,706.55
Total	2,040,169.50

Amount of expenditures during the fiscal year ended June 30, 1888, including expenses attending sales of condemned stores, exchange of powder, etc	1,507,382.37
Amount deposited in Treasury during the fiscal year ended June 30, 1888, as proceeds of sales of Government property	21,141.38
Amount turned into the "surplus fund" on June 30, 1888	5,290.47
Amount in Government depositories to the credit of disbursing officers and others on June 30, 1888	157,850.89
Amount transferred from ordnance appropriations in settling accounts during the fiscal year ended June 30, 1888	5,709.34
Amount in the Treasury not reported to the credit of appropriations on June 30, 1888	1,020.48
Amount in the Treasury to the credit of appropriations on June 30, 1888	341,774.57
Total	2,040,169.50

STATIONS AND DUTIES.

The stations and duties of the officers of the Ordnance Department are as follows: Five at the Ordnance Office; thirty-five at the arsenals, armory, and powder depots; nine on the Ordnance Board and at the foundries; six at the several military headquarters and ordnance depots; two at the Military Academy; one under the orders of the Secretary of the Interior; one in the Life-Saving Service, under the Secretary of the Treasury.

The Ordnance Department provides the armament for our sea coast defenses, and arms and other ordnance stores for the Army, the militia, the Marine Corps, all other Executive Departments to protect public money and property, and the colleges authorized by law to receive them for instruction.

SMALL-ARMS.

During the fiscal year ended June 30, 1888, 41,130 rifles and carbines have been manufactured at the National Armory. Repairing arms, providing spare parts, making swords, sabers, and miscellaneous articles must be mentioned among its operations.

During the past year the investigations have been completed relative to the determination of the charge and projectile, rifling, chamber, etc., for an arm of smaller caliber than the present service piece. It is the intention to use compressed and perforated cartridges, but as yet the powder makers have not succeeded in producing a satisfactory powder, the desired velocity being accompanied by too great a pressure. This matter of a suitable powder is still under study and trial. The results obtained in France with the Lebel rifle seem to point to a radical innovation in the manufacture of powder for small-arms.

COLUMBIA ARSENAL.

During the present session of Congress a law was passed (approved May 1, 1888) authorizing "the construction of an arsenal for the repair, storage, and distribution of ordnance and ordnance stores for the use of the Government of the United States, at Columbia, Tenn.," and appropriating $200,000 for its establishment. The law provides that without cost to the United States not less than 50 acres of suitable land is to be conveyed in fee to the United States, and that exclusive jurisdiction over said land by the United States Government is ceded by the State of Tennessee. A tract of land covering about 70 acres immediately outside the city limits has been thoroughly examined and accepted and the title to the same is now being investigated by the Department of Justice. As soon as these provisions of law have been complied with, steps will at once be taken to construct the arsenal.

PROCURING SUPPLIES.

All ordnance supplies are to be procured after due advertisement and competitive bidding, under section 3709, Revised Statutes. But

there are cases constantly occurring at our manufacturing establishments where small supplies are required, and under the present system of advertising for proposals experience has shown that such purchases entail loss upon the Government by reason of the higher prices asked when sealed proposals are required as well as the general disinclination of dealers and manufacturers to go through the formality of competitive bidding for small purchases, to say nothing of the additional loss by the consequent delay in this mode of purchase. I refer now to the minor supplies, the necessity for which can not be economically anticipated.

To meet such cases, and in the interest of a true public economy, I would recommend that section 3709, Revised Statutes, be amended by inserting after the word "services" on the first line the words "in excess of two hundred dollars," so that the section shall then read:

SEC. 3709. All purchases and contracts for supplies or services *in excess of two hundred dollars*, in any of the Departments of the Government, except for personal services, shall be made by advertising a sufficient time previously for proposals respecting the same, when the public exigencies do not require the immediate delivery of the articles or performance of the service. When immediate delivery or performance is required by the public exigency, the articles or service required may be procured by open purchase or contract, at the places and in the manner in which such articles are usually bought and sold, or such services engaged between individuals.

The Interior Department makes purchases in open market to the amount of $500, under existing law.

ARMAMENT OF FORTIFICATIONS.

No regular appropriation has been available for this purpose during the past fiscal year. The Department has been enabled, however, by means of the small permanent appropriation accruing from the proceeds of sales of unserviceable and obsolete material, to proceed with the manufacture of one 8-inch B. L. gun, composed entirely of American steel; of one 10-inch B. L. gun, of which the tube, jacket, and trunnion-hoop were obtained in England, and twenty-five 3.2-inch steel field guns. These guns are all under manufacture at the Watervliet Arsenal, West Troy, N. Y., and should be completed during the coming winter. The gun plant at this arsenal was established last year in pursuance of the recommendations of a board of ordnance officers convened by the Secretary of War for the purpose of selecting a suitable site for a gun factory, with a view to concentrating there the available gun machinery on hand in the Department. One of the large timber store-houses at this arsenal—a two-story brick building, 392 feet by 50 feet, and which cost $19,860—was deemed suitable for the purpose of a gun-shop. This building is located close to the site selected by the Gun Foundry Board. The timber was removed, a shrinking-pit excavated in the rock, and suitable foundations for the machines and floors and a railway track laid, all at an expense of about $20,000. The machines and tools taken from other arsenals, notably from the

Watertown Arsenal, and a large gun-lathe from the South Boston foundry, were set up in this building. The value of the machinery is estimated at about $50,000, though much of it is adapted only to the manufacture of smaller calibers, as field-guns, and most of it is more or less worn. The present capacity of the establishment is about 50 field-guns, and one 8-inch and one 10 inch gun per annum. Work was actively begun in this shop last November, the installation of the plant having been pushed to completion with unflagging energy and zeal by the commanding officer, Colonel Whittemore, and the ordnance officers on duty as his assistants. Estimates have been submitted to complete this plant so as to make type guns of 12-inch caliber, and to increase the present facilities for handling the work and for moving and shipping guns. In the event of Congress making an appropriation for a gun factory at this point, the present shop, with the smaller tools, would be devoted to the manufacture of field and siege guns.

TESTS OF ORDNANCE.

The firing of the 8-inch B. L. gun has been continued during the past year as rapidly as it was possible to procure suitable powders and as other important work would permit. Much delay has occurred from the failure of the powder makers to reproduce or duplicate powders which had been accepted as satisfactory. The gun has been fired 203 rounds, and is in a sound and serviceable condition. This firing has produced light but d stinctly visible erosion marks on the front slope of the powder chamber, the shot chamber, and the bottom of the rifled bore. The firing will be continued until the endurance is thoroughly tested. Experience indicates that the erosion increases rapidly as the pressures increase, and the pressures during the test of this 8-inch gun have averaged over 16 tons, and reached as high as 22 tons per square inch of powder chamber. The gun is in the hands of the Board for Testing Rifled Cannon and Projectiles, and its report will be rendered during the coming year.

THE 12-INCH B. L. RIFLED MORTAR, CAST-IRON, HOOPED WITH STEEL.

This piece has been subjected to preliminary firings by the Ordnance Board, with the object of determining suitable kinds and weights of charge, in order to cover all ranges from 1 to 6 miles, without exceeding the prescribed limit of pressure and to ascertain the best form of banding for the projectiles. These firings are not yet completed, and the results thus far obtained can hardly be accepted as fully representative of the best that is to be expected from this piece. In all about 193 rounds have been fired, of which 78 rounds were with charges of from 50 to 80 pounds, with an average pressure of about 28,000 pounds, but reaching as high as 33,000 pounds per square inch. The maximum charge is not less than 80 pounds brown prismatic powder; density of loading, 1.113; weight of shell, 630 pounds; maximum velocity, 1,152 feet; energy,

5,796 foot-tons. The range attained with this charge and weight of shell under an angle of 45° was 10,480 yards, or 5.95 miles. It is the intention to subject the mortar to a fire of endurance of not less than 400 rounds, of which 200 shall be with the maximum charge, or in which the pressure shall be a maximum. It is also the intention to use a stronger powder for the maximum charge, so as to give a pressure of about 30,000 pounds, with the attainment of a velocity of about 1,175 feet. The present mounting of the mortar, as regards both carriage and platform, is so unsatisfactory that the firings for accuracy at long range will have to be postponed until at least a new platform can be laid. No firings for rapidity have as yet been made, and at this date it may be said that the accuracy of fire, endurance, and power are not definitely determined except as to the minimum limit.

5-INCH B. L. SIEGE RIFLE.

Preliminary firings have been made with this piece to determine the kind and charge of powder. The following ballistic results have been obtained:

Powder.		Density of loading.	Weight of projectile.	Muzzle velocity.	Pressure per square inch of powder chamber.	Muzzle energy.
Kind.	Weight.					
	Pounds.		*Pounds.*	*Feet.*	*Pounds.*	*Ft. tons.*
Du Pont's sphero hexagonal, density 1.728	10	0.721	43	1,628	25,000	791
	12	0.805	43	1,803	32,050	969
	12.5	0.901	43	1,829	34,961	997
Du Pont's black prismatic, density 1.800	14	1.009	45	1,860	35,000	1,079
	15	1.081	45	1,960	39,400	1,198

The black prismatic powder has not given very uniform results, as appears from comparing the firings made on different days. The weight of the 5-inch siege-gun is 3,660 pounds; length of bore, 27 calibers. The firings were made on the new steel overbank carriage, 47 rounds having been fired to June 30.

THE 7-INCH B. L. RIFLED HOWITZER, STEEL.

The only firings with this piece have also been preliminary for the purpose of working up a suitable powder. The results obtained are as follows:

Powder.		Density of loading.	Weight of shell.	Initial velocity.	Pressure per square inch of powder chamber.	Muzzle energy.
Kind.	Weight.					
	Pounds.		*Pounds.*	*Feet.*	*Pounds.*	*Ft. tons.*
L. X. B., density 1.706. Gr. 270	6	0.530	105	840	15,000	514
	7	0.618	105	922	19,275	619
	8	0.706	105	994	23,000	719
	8.5	0.750	105	1,038	25,300	784
	9	0.794	105	1,074	26,775	840
	9.25	0.817	105	1,053	28,400	870
I. K. K., density 1.725. Gr. 200	9	0.794	105	1,027	23,900	768
	9.5	0.839	105	1,070	26,800	833
	9.75	0.861	105	1,085	28,200	857

This piece weighs 3,750 pounds; length of bore, 12.4 calibers. No special carriage has as yet been provided.

12-INCH B. L. RIFLES, CAST-IRON, TUBED, AND CAST-IRON HOOPED AND TUBED.

The manufacture of these two guns, after being suspended for nearly two years, owing to the failure of the contractors to complete them within the life-time of the appropriation, was resumed this spring, Congress having reappropriated the money to pay for them, and having also extended the contracts. The 12-inch B. L. rifle, cast-iron, hooped, and tubed, has been completed and sent to the Proving Ground; the other gun, the 12-inch B. L. rifle, cast-iron, tubed, will probably be completed by next December.

I have the honor to submit the following papers, heretofore referred to:

Appendix 1.—Statement of principal articles procured by fabrication during the year ended June 30, 1888.

Appendix 2.—Statement of principal articles procured by purchase during the year ended June 30, 1888.

Appendix 3.—Statement of ordnance, ordnance stores, etc., issued to the military establishment, including the national homes for soldiers of the Volunteer and Regular Army, and exclusive of the militia, during the year ended June 30, 1888.

Appendix 4.—Statement of ordnance, ordnance stores, etc., distributed to the militia from July 1, 1887, to June 30, 1888, under section 1667, Revised Statutes.

Appendix 5.—Statement of ordnance, ordnance stores, etc., distributed to colleges from July 1, 1887, to June 30, 1888, under section 1225, Revised Statutes.

Appendix 6.—Statement of arms and ammunition issued to the Executive Departments during the year ended June 30, 1888, under the provisions of the act of March 3, 1879.

Appendix 7.—Report of action taken during the year ended June 30, 1888, under the provisions of the act approved March 3, 1881.

Appendix 8.—Showing the stations and duties of the officers of the Ordnance Department.

Appendix 9.—Annual Report of the Inspector of Ordnance at Midvale Steel Works.

Appendix 10.—Report on the Maxim gun—2 plates.

Appendix 11.—Ranges, etc., of 15-inch gun—2 plates.

Appendix 12.—Inspecting glass for small-arms—1 plate.

I have the honor to be, very respectfully, your obedient servant,

S. V. BENÉT,
Brigadier-General, Chief of Ordnance.

The SECRETARY OF WAR.

APPENDIX 1.

STATEMENT OF PRINCIPAL ARTICLES PROCURED BY FABRICATION AT THE ARSENALS DURING THE FISCAL YEAR ENDED JUNE 30, 1888.

CLASS I.

1	7-inch breech-loading steel siege howitzer.

CLASS II.

25	carriages for 3.2-inch guns.
1	carriage for 5-inch siege gun.

CLASS III.

13	breech-sights for 3.2-inch gun.
2	brakes, inelastic, for field carriages.
2	covers, breech and muzzle, for Hotchkiss mountain gun.
6	fuse blocks.
2	fuse wrenches.
2	gunners' haversacks.
3	gun-covers for Gatling gun.
25	gunners' reamers.
13	sets artillery harness for 2 wheel-horses.
26	sets artillery harness for 2 lead-horses.
46	harness sacks.
16	harness hooks, double.
100	lanyards.
34	muzzle or front sights for 3.2-inch gun.
4	quoins.
100	securing stakes.
12	scrapers for shells.
2	sponges and rammers for 10-pounder Parrott guns.
9	sponges and rammers for 24-pounder Coehorn mortar.
44	sponges and rammers for 3 inch rifled gun.
5	sponges and staves for 13 inch mortar.
110	thumb-stalls.
1	tompion for 3-inch rifle.
12	tompions for 15 inch guns.
2	tompions for 6-pounder gun.
7	vent covers.
27	vent pieces.
4	wiper stakes.
1	vent bushing, steel, for 3.2-inch gun.

4	pairs gunners' sleeves.
4	mauls.
12	pointing stakes.
53	feed guides for Gatling guns.
21	hoppers for Gatling guns.
111	feed cases for Gatling guns.
1	front sight, bronze, for 3.2-inch gun.
1	rear sight, bronze, for 3.2-inch gun.
100	paulins, 12 by 15 feet.
50	paulins, 11 by 11 feet.

CLASS IV.

154	5-inch shell for breech-loading steel rifle.
150	7-inch shell for breech-loading steel howitzer.

CLASS V.

25	6-pounder canister, filled.

CLASS VI.

5,000	Springfield carbines, caliber .45.
1	Springfield carbine, 24-inch barrel, caliber .45.
35,025	Springfield rifles, model 1884, caliber .45.
1,000	Springfield cadet rifles, caliber .45.
3	Springfield rifles, rod bayonet.
100	Springfield rifles, model 1884, caliber .45, with positive cams.
1	Springfield rifle, model 1884, caliber .45, not rifled or chambered.
3	swords, general officer's.

CLASS VII.

ARTILLERY ACCOUTERMENTS.

136	knapsacks for light batteries.

CAVALRY EQUIPMENTS.

4,953	cartridge belts fitted for cavalry.
3,000	carbine slings.
3,000	carbine-sling swivels.
2,000	pistol holsters.
2,000	saber belts.
3,000	saber-belt plates.
8	carbine slings, "Kelton's" device.
24	metal-bound packs, "Kelton's."
24	paper-bound packs, "Kelton's."
200	pistol-pack boxes, "Kelton's."
4,369	carbine slings, altered (G. O. 73).
20	pairs saber slings.

INFANTRY EQUIPMENTS.

10,105	bayonet-scabbard bodies.
6,322	bayonet scabbards.
5,000	blanket bags.

5,000	pairs blanket-bag shoulder-straps.
9,264	cartridge boxes, "McKeever," pattern 1874.
37	cartridge-belt plates.
10,000	canteens.
7,341	canteen straps.
6,386	pairs coat straps.
519	frogs, sliding.
5,601	gun-slings.
5,800	haversacks.
5,000	haversack straps.
17,500	tin cups.
10,434	waist belts.
10,233	waist-belt plates.
5,000	waist-belts and plates (without loops).
11,350	meat cans.
3,154	scabbards for hunting-knives, loops enlarged.

APPENDAGES.

38,208	headless-shell extractors.
8,669	screw-drivers.
31,950	wiping-rods, wooden.
16	pistol-grips, metallic.
235	pistol-grip screws.
500	cleaning-rods for shot-guns.

HORSE EQUIPMENTS FOR CAVALRY.

2,076	bridles, curb, cavalry.
3,265	bridles, watering.
3,000	halters and straps.
5,000	horse brushes.
1,055	horse covers.
2,000	nose-bags.
1	saddle-bag, leather.
107	side lines.
1,415	carbine boots and straps, altered to conform to G. O. No. 73.
1	crupper.
1,108	carbine boots and straps.
429	spur-straps.
179	saddle cloths, hair.
124	saddle cloths, line officers'.
16	saddle cloths, staff officers'.
7	saddle cloths, felt.
2	housings for brigadier-generals' saddle.

CLASS VIII.

5,796	blank cartridges, 3-inch gun.
47	blank cartridges, 3.2-inch gun.
2,630	blank cartridges, 6-pounder gun.
3,100	blank cartridges, 12-pounder gun.
5,386,547	rifle-ball cartridges, caliber .45, reloading.
183,660	rifle and carbine blank cartridges, caliber .45, reloading.
16,000	rifle-ball cartridges, caliber .45, reloading, solid head, 405 grain bullet.

1,000	carbine ball cartridges, caliber .45, reloading.
240,657	revolver blank cartridges, caliber .45, reloading.
300	paper fuses, ten seconds to the inch.
75	paper fuses, thirty seconds to the inch.
700	base fuse plugs for shells.
2,484,000	carbine bullets, caliber .45, 405 grains.
4,322,100	rifle bullets, caliber .45, 500 grains.
592,700	round balls, caliber .45.
58,985	friction primers for cannon.
700	electric primers for cannon.
200	obturator primers.

CLASS IX.

2	platforms for mortars.
2	sets marking outfits.
2	marksman's buttons.
50	sets reloading tools, bench.
2	chargers.
2	wrenches, powder charger.
2	extractors, primer (pins).
190	dies, reloading and crimping.
25	priming tools.
50	punches, reloading.
50	punches, resizing.
337	dies, resizing.
50	dies, crimping.
3	gauges, length.
50	spindles, reloading.
50	spindles, resizing.
1	wrench, die.
25	priming tool spindles.
2	primer inserting tools.
1	base resizing tool.
1	reloading tool, "Morse."
15	disks, with staves.
25,131,500	pasters, black and white.
119	signal flags.
72	streamers for rifle ranges.
55	targets, "Brinton."
203	targets, "Laidley" revolving.
55,523	targets, paper.
10	targets, truck, Texas.
1,295	target frames.
1	target, sectional, "Patten's."

CLASS X.

28	gas check cups, De Bange.
12	gas check pads, De Bange.
1	bottom cup of De Bange gas check
12	sets gas checks, De Bange.
2	screw studs for 3.2-inch rifle.
3	staves for marking disks.
2	spring obturators. De Bange, 15-inch rifle.
50	parts of field carriages.

48	poles for field or siege carriages.
25	caisson rails.
4	axle bodies.
18	foot-boards.
34	parts of field limbers.
24	bolts and nuts.
20	linchpins.
2	retraction ropes.
6	tuyere irons.
50	portable forge boxes, "Empire."
1	pair brakes for 5-inch siege carriage.
29	collars.
77	saddles.
24	brass staples for saddles.
16	saddle seats.
200	stirrup bars.
5	rammer heads, 3-inch guns.
15	sponge heads, 3-inch rifle guns.
18	sponges, 3-inch rifled guns.
100	sabots, 15-inch.
1,525	shanks for projectiles for Life-Saving Service.
1,595	stocks (wood part).
269	tips.
295	tip screws.
289	ramrod stops.
182	band springs.
191	side-screw washers.
211	butt plates.
469	butt-plate screws.
6	cover springs.
6	cover-spring screws.
6	cover friction springs.
136	stocks, complete.
106	guard plates.
110	guard bows.
537	guard-bow swivels.
437	guard-bow swivel screws.
43	guard-bow nuts.
476	triggers.
60	trigger screws.
790	guard screws.
23	rear-sight leaves.
11	rear sight leaf slides.
1,279	rear-sight screws, front and rear.
31	rear sight joint pins.
2,457	rear-sights, complete.
12	barrels.
1	receiver.
5,241	extractors.
547	hinge pins.
3,895	ejector springs.
6,072	ejector-spring spindles.
126	ejector studs.
75	cam latches.
12	breech-block caps.
10	thumb pieces.

52	breech blocks
2,063	breech-block cap screws.
10,491	firing pins.
2,929	firing-pin screws.
1,767	cam-latch springs.
4	breech screws.
897	front-sight cover screws.
1,804	front sights.
2,403	front-sight covers.
100	hinge pin studs.
2,283	front-sight pins.
749	tang screws.
7	carbine bands.
195	bands, upper.
37	band swivels.
1,792	bands, lower.
162	lock plates.
1,315	mainsprings.
1,241	mainspring swivels.
605	mainspring swivel rivets.
478	hammers.
1,469	tumblers.
3,965	tumbler screws.
1,135	bridles.
2,817	bridle screws.
1,778	sears.
2,386	sear screws.
1,656	sear springs.
748	sear-spring screws.
838	side screws.
364	ramrods.
5,000	ramrods, jointed.
304	bayonet clasps.
66	bayonet-clasp screws.
100	bayonet-clasp stop screws.
374	bayonets, complete.
312	swivel rings.
412	swivels, complete.
204	locks, complete.
1	windage-screw head.
1	windage-screw-head pin.
1	stock, wood part, Springfield shotgun.
6	stocks, Colt's revolver.
290	ejector heads, Colt's revolver.
1	receiver, Springfield shotgun.
1	barrels, Springfield shotgun.
4	plunger springs, Parker shotgun.
254	extractors, Springfield shotgun.
58	tumblers, swiveled.
80	stocks, assembled.
100	stocks, Hotchkiss navy rifle.
8	check-rein attachments, "Kelton's."
68	slides and hooks for saber belts.
1,467	saber straps.
3	sections of picket ropes, 1¼ inch.
959	cincha straps.

50	curb straps.
70	girth straps.
30	girth billets.
5,000	halter straps.
355	coat straps for saddles.
610	rings, brass, 1¼ inch.
543	rings, brass, 2¼ inch.
3	base plates, 12-inch (for armor plate).
184	silver bars for sharpshooter's badges.
1	pendant for sharpshooter's badge.
56	parts of reloading tools.
1	shell scraper.
2	shell scrapers, "Morse."
200	safety straps.
4,480	staples for rings.
3,100	stirrups with hoods, G. O. 73.
1	pair stirrups without hood.
143	cartridge bags, empty, 3-inch gun.
2,700	cartridge bags, empty, 3.2 inch gun.
150	cartridge bags, empty, 4.5-inch siege gun.
280	cartridge bags, empty, 8 inch converted gun.
500	cartridge bags, empty, 10 inch Rodman gun.
200	cartridge bags, empty, 15-inch Rodman gun.
25	cartridge bags, empty, 12-inch mortar.
75	cartridge bags, empty, 8-inch steel rifle.
72	cartridge bags, empty, 5-inch siege rifle.
70	cartridge bags, empty, 7-inch howitzer.
3,854,000	cartridge primers.
10,100	cartridge shells, rifle.
45,000	cartridge shells, revolver.
475	cartridge shells, Morse.
62	parts of "Brinton" targets.
1,418	parts of "Laidley" revolving target.
81	parts of "Cushing" targets.
19	parts of "Texas" targets.
10,650	cloth silhouettes.
21,410	paper silhouettes.
266,250	strings for skirmish targets.
3	channel beams, 12-inch (armor plate).

TOOLS AND MISCELLANEOUS.

258	arm chests.
2,611	packing boxes.
100	boxes for small-arm ammunition.
249	tin cans.
1	case.
100	boxes cleaning material.
50	packing boxes, "Williston's."
1	wardrobe.
10	boxes, reloading tools.
1	packing crate.
74	smiths' aprons.
559	brushes.
62	bits, assorted.
22	quarts blacking for leather.

356	chisels, various.
638	dies, various.
1,179	drills.
3	dies, complete for gas-check pads.
1,445	files, assorted.
262	files, rotary.
54	gauges.
500	gas-checks.
10	gauges, crusher pressure.
12	gauges, ring for setting star gauges.
12	sets star gauge points.
4	measuring-rods, adjustable.
1	gauge, verifying.
34	hammers.
2	handles.
250	boxes ingredients for leather blacking.
4	knife-blades.
16	mallets.
1	milling machine.
1	cartridge-priming and spreading machine.
1,466	mills, armorers'.
126	mandrels.
1,398	pounds harness oil.
1	power press.
5	punches, assorted.
25	pounds black paint.
180	pounds olive paint.
120	pounds green paint.
2	watering-pots.
1	plate, cleaning, sheet-iron.
5	plugs, screw.
32	pincers.
100	pressure-gauge cylinders.
50	pounds polishing materials.
144	ounces polish for leather.
100	portable arm-racks.
356	reamers.
123	arm-racks, altered.
3	stamps, seal.
20	sets stencil plates.
29	boxes stencil paste.
600	brass springs, with copper tongues.
600	upper cores, with hollow pins.
88	ounces scouring material.
1	sluice-gate, cast iron.
1	table.
241	taps, various.
877	tools for current service.
1	pin-driver.
1,000	truncated paper bands.
600	truncated paper cores.
1	wrench.
1	wire-scratch brush.
21	castings, various.
32	creasers and taps.

300 hawser cutters.
300 hawser cutter knives.
25 pounds hektograph composition.
10 blocks, punching, lead.
96 bottles indelible ink.
1 water boiler, cast iron.
12 posts, iron for military reservation.
4 button brushes.
4 button sticks.
4 pans, ash.
1 hektograph.

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APPENDIX 2.

STATEMENT OF PRINCIPAL ARTICLES PROCURED BY PURCHASE DURING THE YEAR ENDED JUNE 30, 1888.

CLASS I.

1	12-inch breech-loading rifle.
1	12-inch breech-loading rifled mortar.
4	3.2-inch steel field guns.

CLASS II.

50	portable forges.

CLASS IV.

3,000	8-inch "Eureka" chilled cored shot.
4	7-inch "Stevens" dynamite shells.
50	3.2-inch "Sawyer" canister.
50	steel case shot.

CLASS VI.

10	Spencer repeating shot-guns.

CLASS VII.

2,000	artillery saddle blankets.
2,000	cavalry saddle blankets.
13,994	woven cartridge belts, caliber .45.
6	currycombs.
10,000	knives.
10,000	forks.
10,000	spoons.
24	tin cups.

CLASS VIII.

137,020	pounds small-arms powder.
20,882¼	pounds brown prismatic powder.
128,400	pounds hexagonal powder.
300	pounds square powder.
100	pounds giant powder.
700,000	rifle ball cartridges, caliber .50.
200	giant-powder caps.

250,000 wads.
16,000 cartridge primers.
1,000 cannon primers.
500 feet safety-fuse.

CLASS IX.

2 double blocks.
2 single blocks.
2 differential pulley blocks.
8 tackle-blocks.
4 pulley blocks.

CLASS X.

8,259 parts of Colt's revolver.
76 parts of shotguns.
17 parts of Gatling guns.
26,767 gun-stocks.
183 "Archibald" wheels for artillery carriages.
106⅝ pounds escutcheon pins.
15,132 bar buckles.
11,500 iron rings.
7,124 halter squares.
4,320 halter bolts.
3,024 spring snaps.
200 copper bands for 8-inch shot.
2,468 staves for stirrups.
1,872 brass grommets.
6 horse collars.
621 parts of saddles.
25 wrought-iron axles for gun-carriages.
2 parts of 12-inch rifle.
32 parts of mortar carriage.

PART SECOND.

CLOTH, ROPE, THREAD, ETC.

96⅓ yards carpeting.
208⅓ yards cloth, woolen.
19 yards cloth, asbestos.
32 yards cloth, oiled and enameled.
80,465 yards cotton cloth.
957 yards felt.
7,795½ pounds cotton waste.
928¾ pounds cord and twine.
410 yards cord.
151¾ yards canton flannel.
350 yards flannel.
10 pounds flock.
785 pounds hair.
40 yards linoleum.
19 mats.
193 pounds oakum.
4,208½ pounds rope.

1,277⅜	pounds thread.
72	spools thread.
18	towels.
6	yards toweling.
51,220	yards webbing.
79	window shades.
1,150	yards tape.

FORAGE.

14,882	pounds barley.
13,295	pounds bran.
775	bushels corn.
18	barrels flour.
171½	bushels grass-seed.
2,610	pounds grass-seed and lawn dressing.
13 138/2000	tons hay.
5,500	pounds ground feed.
22,150	pounds meal.
7,366	bushels meal.
7,036	bushels oats.
21	barrels salt.
3,022	pounds salt.
45 1298/2000	tons straw.

IRONMONGERY.

53½	pounds babbitt metal.
7	bath tubs and fixtures.
127,345	pounds I and channel beams.
2	boilers.
7,507	bolts.
79	pounds bolts.
100	pounds brads.
50	feet brass rods.
683¾	pounds brass rod.
2,603	pounds brass, sheet.
72	pounds burs.
41.496	buttons.
354	pounds bronze and brass castings.
210,550	pounds iron castings.
749	pounds steel castings.
1,890	feet chain.
360	cocks, assorted.
98¾	pounds bar copper.
229,167⅞	pounds cartridge copper.
1,476½	pounds sheet copper.
3	sets coupling.
43	door catches and fixtures.
337,125	eyelets.
60	gas-burners.
35	gas-fixtures.
5,286	pounds grate bar.
60	papers glazier's points.
806	pairs hinges.
1,272	hooks, assorted.
8,552	horseshoes.

880	pounds horseshoe nails.
2	hose fittings.
3,179	pounds hoop-iron.
102$\frac{228}{2000}$	tons pig-iron.
14,410	pounds sheet-iron.
80,116$\frac{1}{2}$	pounds wrought-iron.
550	feet lightning rod.
6	lightning rod points.
156	knobs, assorted.
312	keys and blanks.
505,524	pounds lead.
720	locks, assorted.
3	pounds mica.
46,838$\frac{1}{4}$	pounds nails.
8,640	saddler's nails.
1,704$\frac{1}{4}$	pounds nuts.
1,864	nuts.
808$\frac{1}{2}$	pounds lead pipe.
7,505$\frac{7}{8}$	feet iron pipe.
20	feet brass pipe.
318$\frac{1}{4}$	pounds pipe fittings.
3,187	pipe fittings, assorted.
985	pulleys.
8	pumps.
4	radiators.
28,401$\frac{1}{2}$	pounds rivets, assorted.
76,678	rivets, assorted.
593	pounds rivets and burs.
1,100	feet metallic roi
2,381	gross screws.
246	gross screw-pins and eyes.
5	pounds staples.
11	staples.
4	sinks.
9,580	pounds sash-weights.
175	pounds solder.
11,767	pounds spikes.
154	springs, assorted.
953,886	pounds bar and plate steel.
14,633	pounds steel forgings.
14,743	pounds sheet steel.
1,802,000	tacks, assorted.
280$\frac{3}{4}$	pounds tacks, assorted.
47,846	pounds block-tin.
750	pounds tin-foil.
107	boxes sheet-tin.
1,314$\frac{1}{4}$	feet sheet-tin.
95$\frac{7}{8}$	pounds tubing.
121$\frac{7}{8}$	pounds washers.
14	water closets and fixtures.
1	urinal and fixtures.
1,194$\frac{1}{2}$	pounds brass wire.
355$\frac{1}{4}$	pounds copper wire.
111	pounds copper-covered wire.
4,382$\frac{1}{2}$	pounds copper cartridge wire.
20	pounds insulated copper wire.

12,477¼ pounds iron wire.
7,950 pounds steel wire.
147½ pounds steel music wire.
800 feet copper wire.
500 feet copper-covered wire.
7 feet gun-screw wire.
3,339 pounds zinc.
68 feet zinc.
3,607 square feet wire-cloth.
169 square yards wire-cloth.
48 feet wire grating and netting.
444 window fixtures.
42 sets window fixtures.
68,391 pounds steel rails.

LEATHER.

335 pounds black wax.
12,912 feet leather belting.
1,323½ pounds bridle leather.
36 pounds bull-neck leather.
29 pounds belt leather.
223 pounds buff leather.
56,158¼ pounds harness leather.
310 pounds lag leather.
393¼ pounds lace leather.
39½ pounds polishing leather.
1,535 pounds strap leather.
54 pounds walrus leather.
74 pounds sole leather.
18½ square feet belt leather.
637¼ square feet calf-skin leather.
61,331½ square feet collar leather.
52 square feet enameled leather.
50 square feet lace leather.
586 sides bridle leather.
1,665 sides collar leather.
1 side calf-skin leather.
12 sides lace leather.
25 sides rawhide.
1,500 feet belt lacings.
1,178⅛ pounds bristles.
2 skins morocco.
60 sheepskins.
5 buckskins.
18 drop belts, leather.

LUMBER.

399,719⅞ feet boards.
30,300 laths.
482,047⅛ feet plank.
318 posts and rails.
85,417 feet scantling.
63,115 shingles.
7,100 feet strips.
115,679¼ feet timber.

BUILDING MATERIAL.

75¼	pounds asbestos.
130	square feet asbestos.
653,713	bricks.
2,062	barrels cement.
156	feet cement pipe.
82	barrels clay.
4	cubic yards clay.
21	doors, wood.
2,170	feet drain-pipe.
25	drain pipes.
6,122¼	cubic feet flagging.
268⅖	square feet flagging.
7,773½	feet window-glass.
459	lights window-glass.
1	load gravel.
4⅙	cubic yards gravel.
80½	bushels plastering-hair.
85	pounds plastering-hair.
1,535	barrels lime.
1,012⅜	bushels lime.
21	barrels plaster of paris.
1,331$\frac{56}{100}$	cubic yards sand.
1,448½	bushels sand.
1,100$\frac{622}{1000}$	cubic yards stone.
7	mantels.
17,852	slates.
20	barrels stucco.
34,121	pounds roofing iron.
4,320	feet tarred paper.
3,576	feet moldings.
53	rolls wall-paper.
3	rolls bordering-paper.
496	feet terra-cotta pipe.
7	terra-cotta traps, etc.
518	tiles.
48	pairs window blinds.
100	pairs window sash.
1	transom.
112	feet water spouts.
48	water-spout elbows and hooks.
1,191	feet weather strips.

HEATING, LIGHTING, ETC.

94	gallons anti-corrosive fluid for boilers.
511	brooms.
158	brushes, dusting, etc.
52	pounds candles.
6	chandeliers.
151$\frac{11}{36}$	square feet card-clothing.
28,672½	bushels charcoal.
148	barrels charcoal.
351	chamois-skins.
2,302$\frac{1020}{2240}$	tons anthracite coal.

2,815 $\frac{1566}{2240}$ tons bituminous coal.
72,900 pounds coke.
939 bushels coke.
554 pounds corundum.
359 corundum and emery wheels.
67 reams crocus and emery cloth.
25 cărats diamond powder.
2,573 pounds emery.
14,750 fire-brick.
16 sets fire-brick.
46 cords fire-wood.
60 grates and fixtures.
1 heating furnace and car.
6,720 pounds fluorspar.
8 lanterns.
22 lamps.
540 lamp fixtures.
51$\frac{1}{2}$ pounds lamp wick.
12 lamp wicks.
43$\frac{1}{2}$ gross matches.
27 mops and handles.
740 pounds polishing compound.
135 pounds pumice stone.
19 registers.
333 pounds rotten-stone.
125 pounds rosin.
51 reams sand-paper.
92 cakes sapolio.
3,658$\frac{7}{8}$ pounds soap.
799 gallons soft soap.
4 $\frac{720}{2000}$ tons molding sand.
216$\frac{3}{8}$ pounds sponge.
9 stoves.
11 stove fixtures.
25 pounds stove-polish.
30 papers stove-polish.
22 stove-pipe elbows.
129 feet stove-pipe.
155 pounds stove-pipe.
132 feet steam-pipe covering.
66 barrels sea-coal facings.
412 papers tripoli.
50 pounds tripoli.
25 pounds quartz.
9 wash-stands and fixtures.
3 wash-tubs, basins, etc.

OFFICE USE.

5 baskets, waste.
17 books of reference.
1 book-case.
1,060 sheets card-board.
11 pounds card-board.
3 clocks.
17 chairs, stools, etc.

12	chair-bottoms.
3	cuspidors.
106	drawing instruments.
47	pans drawing material.
56	bottles drawing material.
1,095	dials for watch clock.
28,650	envelopes.
4	electrotypes.
4	pieces India rubber.
4	pieces India ink.
51	bottles ink.
27	pounds printer's ink.
24	leads for pencil.
2	bottles mucilage.
15 3/20	reams paper.
517	sheets paper.
92	pads.
630	pencils.
15	boxes paper fasteners.
3,076	paper fasteners.
95	gross pens.
6	boxes pins.
36	pencil and pen holders.
3	type-writers, hektograph, etc.
5	ribbons for type-writer.
5	fonts of type.
49 1/2	pounds type metal.
18	spools tape.
16	gross rubber bands.
73	rubber stamps.
51 1/4	pounds roller composition.
34	boxes seals.
50	sheets stencil boards.
243	pounds sealing wax.
108	thumb-tacks.
8,000	tags.
1	McGill's staple press.

LABORATORY USE.

144	bottles and vials.
14	barometers and thermometers.
2,160	corks.
104	crucibles.
8	carboys.
6	gauge glasses.
24	glass tubes.
30	level glasses.
200	pounds zinc batteries.
127	parts electric batteries.
28,835 1/2	pounds acid.
8	gallons acid.
352 3/4	gallons alcohol.
1	gallon tincture of arnica.
40	pounds alum.
10	pounds aqua ammonia.

26	pounds beeswax.
100,686	pounds ground bone.
15	pounds borax.
2	pounds camphor.
25	pounds chalk.
15	pounds chlorides, various.
100	pints Pratt's chloride.
150	grains chloride of gold and sodium.
25	pounds copper and its preparations.
46	cans concentrated lye.
2,955	pounds glue.
286	pounds glycerine.
10	pounds gelatine.
160	pounds ground glass.
14	pounds gum arabic.
45	pounds gum tragacanth.
48	hand grenades.
150	pounds glauber salts.
284	gallons isinglass.
64¼	pounds iron and its preparations.
1	pound laudanum.
9	bottles liniment.
4½	gallons molasses.
118½	pounds mercury and its salts.
51	pounds spirits of niter.
37½	pounds nickel salts.
3	ounces nitrate of silver.
150	pounds oxides, various.
12,287	pounds sal soda.
3,156	pounds soda and its preparations.
21,800	pounds straw boards.
8	pounds sulphur.
115	pounds sal ammoniac.
2	barrels pitch.
2,636½	pounds potash, various.
419	reams paper.
34,471½	pounds paper.
8	rolls paper.
418	yards paper.
6	barrels tar.
5	pounds prepared tar.
1,238½	pounds tallow.

PAINTS, OILS, ETC.

4	pounds asphaltum.
162	⅕ gallons benzine.
2	pounds bronze copper.
8	gallons coal tar.
60	gallons drier.
36,493	gallons gasoline.
353	pounds kalsomine.
94	pounds lampblack.
290	pounds lubricating compound.
92	pounds black lead.
20	pounds red lead.

15,238 pounds white lead.
45 pounds extract of logwood.
50 gallons lacquer.
621 gallons naphtha.
54 pounds nut-galls.
14½ gallons castor oil.
55 gallons cod-liver oil.
102 gallons dressing oil.
10 pounds dressing oil.
2,739½ gallons illuminating oil.
5,107½ gallons lubricating oil.
6 bottles lubricating oil.
1,398¼ gallons oil, mixing paints.
3,373⅝ pounds paint, dry.
5,813⅓ pounds paint, in oil.
6 gallons paint, in oil.
4,072 gallons petroleum and its products.
175½ pounds putty.
514 pounds shellac.
772½ gallons spirits of turpentine.
20 pounds turpentine.
157 gallons varnish.
4,663 pounds whiting.
250 pounds zinc.

MISCELLANEOUS.

1 row-boat.
2 barrels.
24 baskets.
785 paste-board boxes.
3,004 packing boxes.
1,714 tin boxes.
128 tin cans.
73½ pounds gutta percha.
222 boxes axle grease.
506½ pounds axle grease.
2 horses.
2 hose carts, reels, etc.
1,637 feet rubber hose.
8,005¼ pounds Japan wax.
571¾ pounds packing, various.
98 feet packing, various.
100 powder canisters, 2-pound.
250 powder canisters, 5-pound.
4 rubber aprons.
8 pairs rubber gloves.
10 rubber gaskets.
8 pairs rubber boots.
8 pairs rubber shoes.
298 rubber rings, etc.
58 pounds rubber valves.
⅓ pound rubber tubing.
136⅞ pounds rubber, sheet.
1,100 tickets, railroad and street car.
2 lap-robes.
6 whips.

10	parts of wagons.
24	finger cots.
1	mirror.
1,080	screw-tops for cans.
5,500	pounds fertilizers.
49	loads manure.
1	flag-staff.
1	wrought-iron water tank.
1	marble slab.

MACHINES.

3	lawn mowers.
4	steam boilers.
6	lathes.
1	lathe chuck.
4	steam engines.
1	lawn sprinkler.
1	gas-fitters' test pump, with gauge.
3	feed pumps.
1	feed-water heater.
1	wind-mill.
1	automatic knife grinder.
2	emery wheel tool grinder.
2	mortising and boring machines.
1	slotting-machine.
1	center grinder.
1	shaping machine.
1	pipe-cutting and threading machine.
1	drill machine.
1	gear-cutting machine.
1	paper-cutter, with extra knife.
1	type-writing machine, complete.
16	machines, various.
84	parts of machines.
232	parts of mowing-machines.

TOOLS, ETC.

206	awls.
1	ax.
80	bits.
1	set bits.
1	brace.
160	buckets.
1,553	brushes and sash tools.
416	carpenters' tools, various.
760	pounds chalk-lines.
14	coal-hods.
209	drills.
4	dies.
2,340	files.
40	forks (hay and manure).
4	gauges.
3,601	pounds grindstones.
1	grindstone, mounted.
71	hatchets and hammers.

797 handles, various.
27 hoes.
120 knives, saddlers', etc.
3 ladders.
4½ sets ladders.
11 machinists' tools, various.
87 pairs nippers.
150 papers needles.
95 oil-stones.
137 oil cups and oilers.
5 planes.
9 plows.
150 pounds plow points.
26 picks.
79 punches.
95 rakes.
594 rasps.
24 rivet-sets.
25 rules.
165 saddlers' tools, various.
28 sandstones.
85 spades and shovels.
60 stamps.
7 sets of stamps.
59 saws.
21 saw-blades.
6 sieves and sifters.
2 scales.
110 pairs of shears.
64 screw-drivers.
3 spirit levels.
53 scythes.
16 scythe-snaths.
89 scythe-stones.
3 tape-lines.
3 sets of taps.
2 trowels.
51 utensils, various.
123 wrenches.
38 wheelbarrows.
3 tinners' tools, various.
1 paint burner.
1 set tools for milling-machine.

APPENDIX 3.

STATEMENT OF ORDNANCE, ORDNANCE STORES, ETC., ISSUED TO THE MILITARY ESTABLISHMENT, INCLUDING THE NATIONAL HOMES FOR SOLDIERS OF THE VOLUNTEER AND REGULAR ARMY, AND EXCLUSIVE OF THE MILITIA, DURING THE FISCAL YEAR ENDED JUNE 30, 1888.

CLASS I.

14	Gatling guns, long, 10 barrel, caliber .45-inch.
3	Hotchkiss mountain guns, caliber 1.65-inch.
3	3-inch rifled guns.
6	3.2-inch B. L. steel rifled guns.
2	4.5-inch rifled siege guns.
1	12-pounder bronze gun.
1	5-inch breech-loading steel siege gun.
1	7-inch breech-loading steel siege howitzer.
1	15-inch Rodman gun.
2	10-inch siege mortars.

CLASS II.

7	Gatling gun carriages and limbers, metallic.
7	Gatling gun carriages and limbers, wood.
3	Hotchkiss mountain gun carriages.
9	3-inch gun carriages.
4	3.2-inch gun, steel carriages.
3	12-pounder gun carriages.
2	4.5 inch gun carriages.
1	5-inch gun steel carriage.
1	15-inch gun barbette carriage and chassis.
8	3-inch gun caissons and limbers.
1	battery wagon "C" and limber.
3	mortar beds.
1	mortar wagon and limber.

CLASS III.

42	harness bags.
2	budge-barrels.
2	elevating bars.
5	baskets for mortar implements.
1	forge bucket, wood.
2	sponge buckets, wood.
1	tar bucket, iron.
134	watering buckets, gutta-percha.

9 water buckets, iron.
6 water buckets, leather.
8 water buckets, papier maché.
10 water buckets, rubber.
6 cannon spikes.
1 breech cover, Hotchkiss gun.
3 dredging boxes.
3 fuse blocks.
2 fuse gauges.
9 fuse gouges.
1 fuse plug reamer.
9 fuse plug wrenches.
5 gunners' gimlets.
6 gunners' haversacks.
3 gunners' levels.
18 gunners' pincers.
3 gunners' quadrants.
22 gunners' sleeves.
14 handspikes, maneuvering.
19 handspikes, trail.
8 handspikes, shod, for mortar.
29 sets harness, 2 lead horses.
18 sets harness, 2 wheel horses.
1 set harness, Laidley cavalry forge.
1 set harness, mountain howitzer carriages.
4 common lanterns.
3 dark lanterns.
1 magazine lantern.
20 lanyards.
1 muzzle cover.
10 packing outfits.
39 paulins, 12 by 15 feet.
4 powder funnels.
32 powder measures.
12 powder scoops.
6 plummets.
15 plummet cords.
8 priming wires, field guns.
4 priming wires, siege guns.
29 prolonges.
2 quoins.
2 rammers and staves, 3.2-inch gun.
7 rammers and staves, 4.5-inch gun.
12 scrapers for shot.
100 securing stakes.
2 shell hooks.
2 breech sights, 4.5-inch gun.
4 breech sights, 8-inch rifle.
1 breech sight, 8-inch howitzer.
1 muzzle sight, 3.2-inch rifle.
2 muzzle sights, 4.5-inch gun.
4 muzzle sights, 8-inch rifle.
21 sponge covers, 3 inch rifle.
4 sponge covers, 3.2-inch rifle.
9 sponge covers, 12 pounder gun.
19 sponges and rammers, 3-inch rifle.

2	sponges and rammers, 3.2-inch rifle.
1	sponge and rammer, 6-pounder gun.
5	sponges and rammers, 12-pounder gun.
2	sponges and rammers, 24-pounder mortar.
14	sponges and staves, 4.5-inch gun.
19	thumbstalls.
14	tompions, 3-inch rifle.
3	tompions, 4.5-inch gun.
2	tompions, 24-pounder mortar.
6	tompions, 10-inch mortar.
4	tow hooks.
7	tube pouches.
33	vent covers.
14	vent pieces.
8	vent punches.
2	wipers for mortar.
13	worms and staves.

IMPLEMENTS FOR GATLING GUN.

7	cam extractors.
13	drifts.
23	feed guides.
28	feed magazines.
4	gun covers.
8	handspikes.
6	headless shell extractors.
7	pointing levers.
14	lock screw-drivers.
14	small screw-drivers.
14	T screw-drivers.
7	shell drivers.
14	wiping rods.
4	pointing-lever axis pin nuts.
14	oilers.
1	hopper.
3	sight cases.
7	cascabel plate wrenches.
3	lever nut wrenches.
13	pin wrenches.
7	rear-guide nut wrenches.
3	sets accessories for Hotchkiss ammunition wagon.
1	set reloading tools for Hotchkiss revolving gun.

CLASS IV.

50	30-pounder shot.
140	4.5-inch shot.
204	8-inch shot.
30	11-inch shot.
16	15-inch shot.
90	1.5-inch Hotchkiss cartridges.
800	1.5-inch Hotchkiss shell.
300	1.65-inch Hotchkiss shell.
565	3-inch shell.
1,100	3.2-inch shell.

250 12-pounder shell.
20 24-pounder shell.
150 5-inch shell.
150 7-inch shell.
211 8-inch shell.
82 10-inch mortar shell.
300 12-inch mortar shell.
48 13-inch shell.
315 3-inch case shot.
200 3.2-inch case shot.
60 3-inch canister.
40 3.2-inch canister.
250 12-pounder canister.

CLASS VI.

2,781 Springfield carbines, caliber .45.
1,132 Colt's revolvers, caliber .45.
20 Chaffee-Reece magazine rifles, caliber .45.
20 Hotchkiss magazine rifles, caliber .45.
20 Lee magazine rifles, caliber .45.
2,252 Springfield rifles, caliber .45.
10 Spencer repeating shotguns.
36 Springfield shotguns.
6 artillery officers' sabers.
15 artillery sabers.
290 cavalry sabers.
20 field and cavalry officers' sabers.
101 musicians' swords.
36 non-commissioned officers' swords.
269 hunting knives.

CLASS VII.

ARTILLERY ACCOUTERMENTS.

136 knapsacks.
97 saber belts.
99 saber-belt plates.

CAVALRY EQUIPMENTS.

2,998 canteen straps.
2,136 cartridge belts.
1,242 carbine slings.
947 carbine-sling swivels.
321 pistol cartridge pouches.
2,100 pistol holsters.
200 pistol pack boxes.
600 spring bands, brass.
1,000 truncated paper bands.
1,200 wooden upper cores.
858 saber attachments.
2,949 saber belts.
2,735 saber-belt plates.
1,049 saber knots.
271½ pairs saber straps.

INFANTRY EQUIPMENTS.

1,299	bayonet scabbards.
1,640	blanket bags.
24	blanket and coat straps.
751½	pairs blanket bag coat straps.
1,477	pairs blanket bag shoulder straps.
6,749	canteens.
1,106	canteen covers.
355	canteen corks and chains.
3,124	canteen straps.
6	carrying braces.
2,090	cartridge belts.
1,386	cartridge-belt plates.
2,770	cartridge boxes.
2	cartridge blocks.
2,311	clothing bags.
2,303	clothing-bag straps.
2,959	forks.
3,109	knives.
3,888	spoons.
13	frogs, bayonet scabbard.
44	frogs, sliding.
5,319	gun slings.
3,482	haversacks.
1,000	haversacks with web straps.
2,769	haversack straps.
20	magazine belts.
4,459	meat cans.
309	hunting-knife scabbards.
12	intrenching-tool scabbards.
4,433	tin cups.
26	non-commissioned officers' waist belts and plates.
2,805	waist belts.
2,376	waist-belt plates.

APPENDAGES.

4	brushes and thongs.
3,338	headless shell extractors.
2,130	jointed ramrods.
12	cleaning rods, shotgun.
2,208	screw-drivers, carbine and rifle.
410	screw-drivers, revolver.
20	screw-drivers, Lee rifle.
10	screw-drivers, shotgun.
5	wire scratch brushes.
20	wiping brushes, Lee rifle.
99	spring vises.
365	tumbler punches.
1	wiper, rod bayonet.
2,062	wiping rods, wood, carbine.
6,232	wiping rods, wood, rifle.
2	wiping rods, shotgun.

HORSE EQUIPMENTS FOR CAVALRY.

1,144	curb bridles.
2,007	watering bridles.
1,009	carbine boots and straps.
678	cinchas.
2,640	curry-combs.
273	cruppers.
31	forage sacks.
19	girths.
3,972	halters.
6,194	halter straps.
3,658	horse brushes.
599	horse covers.
2,222	lariats.
749	links.
65	mane combs.
3,899	nose bags.
1,472	picket pins.
430	saber straps for saddles.
1,084	saddles.
166	saddle-bags, canvas.
1,164	saddle-bags, leather.
4,732	saddle blankets.
20	saddle cloths.
873	side lines.
6	side-line fasteners.
2,636	spurs.
4,800	spur straps.
3,638	stirrups.
4	stirrups with guidon sockets.
972	stirrup straps.
2,404	surcingles.

CLASS VIII.

SMALL-ARM AMMUNITION.

1,004,400	carbine ball cartridges, caliber .45.
392,836	revolver ball cartridges, caliber .45.
252,490	revolver blank cartridges, caliber .45.
2,900,790	rifle ball cartridges, caliber .45.
251,080	rifle blank cartridges, caliber, .45.
20,000	rifle blank cartridges, caliber .50.
626,000	round balls, caliber .45.
2,350,512	carbine bullets, caliber .45.
312,000	revolver bullets, caliber .45.
4,586,451	rifle bullets, caliber .45.
76,687	pounds small-arms powder.
10,147,300	cartridge primers.
8,150	cartridge shells.
14,300	pounds shot.
22	shot-gun outfits, except tools and cases.
183,250	cartridge wads.

AMMUNITION FOR CANNON.

7,345	blank cartridges, 3-inch gun.
100	blank cartridges, 12-pounder gun.
74	1.5-inch cartridge cases.
875	metallic fuses.
751	paper fuses.
25	percussion fuses.
32	wooden fuses.
700	pounds cannon powder.
24,100	pounds hexagonal powder.
15	pounds mealed powder.
3,500	pounds mortar powder.
1,000	electric primers.
98,525	friction primers.

CLASS IX.

107	arm racks.
463	sharpshooters' badges.
183	bars for sharpshooter badges.
1	sling chain.
22	chocks.
1	crane.
231	signal flags.
1	gun lift.
129	haliards.
12	intrenching tools.
6,106	marksman's buttons.
2,680	marksman's pins.
3	marking rods, disks, and brushes.
246	shot marks and staves.
2	rail platforms, mortar.
6	rollers.
160	streamers.
2	trace ropes.

BRINTON TARGET AND PARTS.

15	targets, complete.
58	frames.

CUSHING TARGET AND PARTS.

21	targets, complete.
2	car frames.
4	cross pieces and uprights.
134	frames.
2	fish plates with bolts and nuts.
12	rails.
4	truck wheels and axles.

LAIDLEY TARGET AND PARTS.

228	targets, complete.
96	axles.
6	center blocks and pins.

296	cross pieces.
865	frames.
154	journal boxes.
36	journal-box pins.
20	journal posts.
186	keys for frames.
40	levers.
91	lever blocks.
196	nave boxes.
4	spring stops.
424	rails.
481	uprights.
70,040	paper targets.
1	sectional target.
10	Texas targets.
16	Texas target centers.
3	Texas target cross pieces.
6,192	target centers.
171	steel target frames.
954	wood target frames.
14,464,500	target pasters.
4	target plates for gallery practice.
10,666	cloth silhouettes.
63,187	paper silhouettes.
222,641	strings for skirmish target.

PARTS OF SHOT-GUN OUTFIT.

8	brush wipers.
86	powder canisters.
8	drifts.
7	field cases.
8	funnels.
8	powder and shot chargers.
8	priming tools.

RELOADING TOOLS, ETC.

32	sets bench tools.
16	sets hand tools.
24	combination anvils.
6	ball molds.
37	brush wipers.
11	adjustable chargers.
3	bench powder chargers.
9	crimping and reloading dies for revolver cartridges.
85	crimping and reloading dies for rifle cartridges.
1	cap for crimping die.
11	bench resizing dies.
8	resizing dies for revolver shell.
124	resizing dies for rifle shell.
27	drifts.
1	primer extractor.
65	primer extractor pins.
31	funnels.
3	gauges, total length.

22 ladles.
34 mallets.
35 oil cans.
55 priming tools.
9 priming-tool spindles.
8 reloading punches for revolver cartridges.
59 reloading punches for carbine and rifle cartridges.
90 resizing punches.
3 safety sockets.
8 shell extractors.
7 shell scrapers.
8 strainers.
30 wiping rods.
1 die wrench.

PRIMER-INSERTING TOOLS AND PARTS.

2 primer inserting tools, complete.
3 bushings.
1 pinion lever.
2 primer setters.
2 screws.

PRIMER-EXTRACTING TOOLS AND PARTS.

2 primer extracting tools, complete.
45 extractor pins.
1 spindle.
6 pin screws.

SHELL-RESIZING TOOLS AND PARTS.

2 shell resizing tools, complete.
1 base.
1 lower cross-bar.
43 dies, lower, rifle.
279 dies, upper, rifle.
10 dies, revolver.
1 ejecting wire.
2 lever-pin screws.
2 link-pin screws.
13 rings.
16 spindles.
1 spindle screw.
1 spindle-screw nut.
2 rod wrenches.

POWDER-CHARGING TOOLS AND PARTS.

2 chargers.
1 receiver and funnel.
1 receiver nut.
2 wrenches.

ASSEMBLING AND CRIMPING TOOLS AND PARTS.

1 assembling and crimping tool, complete.
17 dies.

1 die-lever pin.
1 shell rest.
1 shell-rest set screws.
12 stems.
2 stem screws.
2 stem-lever pin screws.
7 spindle screws.
1 check-lever spring.

CLASS X.

PARTS OF CLASS I.

12 sets DeBangs gas checks.
5 cups for gas check.
11 firing pins for Gatling gun.
1 obturator plate.
2 screw studs for rifle gun.
2 spindles and nuts for gas-check pad.
2 pairs of trunnion rings.
3 vent pieces.

PARTS OF CLASS II.

24 bolts and nuts.
24 bolts for pole-yoke collar.
8 spring brakes for field gun.
2 limber chests.
1 elevating screw.
5 keys for ammunition chest.
48 linchpins.
4 nave bands.
16 nuts for carriage.
23 poles.
5 pole yokes.
4 pole-prop sockets.
1 rail.
2 retraction ropes.
1 pair shafts.
6 stakes for mortar wagon.
29 stay pins.
26 stay-pin keys and chains.
1 stock, caisson.
1 stock, carriage.
2 tire bands.
20 tire bolts.
40 washers.
8 wheels, carriage.

PARTS OF CLASS III.

97 bridles, artillery.
13 bridle ornaments.
614 brass-plated buckles.
226 iron roller buckles.
31 collars.

4 girths for drivers' saddles.
105 halters, artillery.
80 halter chains.
50 halter straps.
1 pair hames.
25 hame straps.
52 double S hooks.
4 leg guards.
50 cold shut links.
20 pole pads.
26 pole straps.
10 rammer heads.
70 rosettes for artillery bridles.
1 drivers' saddle.
16 drivers' saddle seats.
6 sponge heads.
139 woolen sponges.
24 staples for valise saddles.
4 brass stirrups.
20 stirrup straps.
11 lead traces.
13 wheel traces.
233 whips.

PARTS OF CLASSES IV AND V.

700 base plugs for shell.
100 sabots for 15-inch shot and shell.

PARTS OF CLASS VI.

Springfield carbine.

7 bands.
15 band springs.
146 bridles.
156 bridle screws.
132 breech-block cap-screws.
105 butt-plates.
5 butt-plate covers.
12 butt-plate screws.
140 cam latch springs.
31 cover springs.
26 cover-spring screws.
31 cover-friction springs.
25 cover stud pins.
306 ejector springs.
306 ejector-spring spindles.
60 extractors.
262 firing pins.
140 firing-pin screws.
152 front sights.
245 front-sight covers.
30 front-sight cover-screws.
8 hammers.
2 lock plates.
60 mainsprings.

16	mainspring swivels.
20	mainspring swivel-rivets.
25	pistol-grip screws.
692	rear sights.
146	rear sight base-screws.
20	rear sight-leaves.
12	rear sight-leaf slides.
42	sears.
152	sear-screws.
92	sear springs.
32	sear-spring screws.
12	side screws.
328	stocks, assembled.
42	stocks, spring-fitted.
696	stocks, wood part.
207	swivels.
32	swivel-bars.
44	swivel-bar rings.
20	tang screws.
79	tumblers.
194	tumbler-screws.

Springfield rifle.

351	lower bands.
79	upper bands.
180	band springs.
145	bayonets.
20	bayonet clasps.
48	bayonet-clasp screws.
100	bayonet-clasp stop-screws.
12	breech-block caps.
153	breech-block cap screws.
262	bridles.
757	bridle screws.
103	butt plates.
254	butt-plate screws.
6	butt-plate cover screws.
477	cam-latch springs.
1,965	ejector springs.
1,373	ejector spring spindles.
306	ejector studs.
5,195	extractors.
5,327	firing pins.
1,575	firing-pin screws.
62	front-sights.
90	front-sight covers.
181	front-sight cover screws.
114	front-sight pins.
126	guard bows.
170	guard bow nuts.
341	guard bow swivels.
269	guard bow swivel screws.
123	guard plates.
959	guard screws.
302	hammers.
475	hinge pins.

77	locks.
131	lock plates.
326	mainsprings.
644	mainspring swivels.
424	mainspring swivel rivets.
118	pistol-grips.
393	pistol-grip screws.
36	ramrods.
232	ramrod stops.
467	rear sights.
121	rear sight base screws.
20	rear sight slide screws.
319	rear sight screws.
588	sears.
379	sear screws.
527	sear springs.
482	sear spring screws.
576	side screws.
194	side-screw washers.
332	stocks, wood part.
520	tang screws.
263	tips.
307	tip screws.
594	triggers.
212	trigger screws.
753	tumblers.
417	tumblers, swiveled.
864	tumbler screws.
1	windage screw-head.
1	windage-screw head pin.

Springfield shotgun.

1	barrel.
268	extractors.
5	mainsprings.
1	receiver.
1	stock.
2	tumblers.

Spencer repeating shotgun.

1	cartridge stop.
2	cartridge stop-pin screws.
1	extractor.
1	firing pin.
1	firing-pin spring.
1	magazine spring.
1	mainspring.
1	sear spring.
2	slide-plate screws.

Parker shotgun.

5	mainsprings.
16	plungers.
14	plunger springs.
4	tumbler screws.

Hotchkiss magazine rifle.

20	extractors.
20	mainsprings.

Lee magazine rifle.

4	extractors.
4	extractor-springs.
4	firing pins.
100	magazines.
20	magazine springs.
4	mainsprings.
4	sear springs.

Colt's revolver.

111	back straps.
880	back-strap screws.
997	bolts.
985	bolt screws.
1	barrel.
515	center pins.
347	center-pin bushings.
375	center-pin catch-screws.
659	center-pin screws.
21	cylinders.
661	ejector heads.
582	ejector rods.
931	ejector springs.
369	ejector tubes.
820	ejector-tube screws.
332	firing pins.
326	firing-pin rivets.
51	frames.
169	front sights.
109	gates.
105	gate catchers.
304	gate-catch screws.
344	gate springs.
105	guards.
1,322	guard screws.
1,108	hammers.
148	hammer-cams.
286	hammer rolls.
396	hammer-roll rivets.
815	hammer-screws.
696	hands.
792	hand-springs.
773	mainsprings.
705	mainspring screws.
76	recoil plates.
32	sear springs.
38	sear-spring screws.
1,548	sear and stop-bolt springs.
1,477	sear and stop-bolt spring screws.
350	stocks.

291	stop-bolts.
937	triggers.
875	trigger screws.

Schofield-Smith & Wesson revolver.

1	hammer.
1	hand-spring.
1	strain-screw.
26	triggers.

12	mouth pieces for cavalry saber scabbard.
1	scabbard for musician's sword.
2	scabbards for non-commissioned officers' swords.

PARTS OF CLASS VII.

98	curb-bits.
24	bridle headstalls.
24	pairs bridle-reins.
162	bridle ornaments.
7,931	brass-bar buckles.
2,620	brass-wire buckles.
1,573	iron-bar buckles.
1,927	iron-roller buckles.
198	cincha straps.
1,108	coat-straps.
617	curb-straps.
10,620	brass escutcheon-pins.
364	halter-bolts.
3	halter-chains.
245	halter-rings.
650	halter-squares.
430	japanned nails.
938	ovals.
1,306	brass rings.
224	iron D-rings.
896	iron rings.
25	brass shields.
518	double-spring lariat-snaps.
72	canteen-strap snaps.
89	link-snaps.
10	side-line chains.
372	side-line fasteners.
126	saber-belt slides and hooks.
20	pairs saber-belt slings.
44	saddle-bag studs.
1,088	brass foot-staples.
2,684	brass staples for rings.
$10\frac{1}{3}$	yards webbing, $3\frac{1}{2}$ inches wide.
$59\frac{1}{3}$	yards webbing, 4 inches wide.

PARTS OF CLASS VIII.

1,530	cartridge bags, 6-pounder gun.
500	cartridge bags, 12-pounder gun.
2,787	cartridge bags, 3-inch gun.

500	cartridge bags, 3.2-inch gun.
1,500	cartridge bags, 4.5-inch gun.
485	cartridge bags, 8-inch gun.
500	cartridge bags, 10-inch gun.
20	cartridge bags, 10-inch mortar.
300	cartridge bags, 15-inch gun.
110	fuse plugs, brass.
100	fuse plugs, wood.
50	water caps.

PART SECOND.

CLOTH, ROPE, THREAD, ETC.

20,092⅓	yards cotton cloth.
5	pounds cotton cord.
50	pounds cotton waste.
32¾	pounds sash cord.
200	feet braided sash cord.
10	pounds curled hair.
10	pounds marline.
40	pounds rope.
605	pounds thread.
635	pounds tow.
47	pounds twine.

IRONMONGERY.

19¾	pounds sheet brass.
2	brass clamps.
37½	pounds copper.
15,694	horse-shoes.
644	pounds bar iron.
1,448	pounds horse-shoe nails.
940	pounds iron nails.
305	padlocks.
60	brass rivets and burrs.
147½	pounds brass rivets and burrs.
618½	pounds copper rivets and burrs.
85½	pounds iron rivets and burrs.
134	gross brass screw pins.
203 7/12	gross brass screws.
29½	gross iron screws.
421	pounds steel.
11,200	copper tacks.
1	paper copper tacks.
33¼	pounds copper tacks.
3,196,400	iron tacks.
12	papers iron tacks.
99 11/48	pounds iron tacks.
40	pounds toe-calks.
40	pounds copper wire.
10	pounds iron wire.
70	pounds zinc.

LEATHER, ETC.

800 sides bridle leather.
20½ feet collar leather.
23,589 pounds harness leather.
171½ quarts leather blacking.
28½ pounds leather polish.
303¾ pounds black wax.
13 ounces bristles.
102 boxes ingredients for leather blacking.

LUMBER, ETC.

1,600 feet boards.
1,482 feet scantling.
491 feet timber.

CLEANING, HEATING, AND LIGHTING.

12 bath bricks.
108 corn brooms.
9 dusting brushes.
5 feather dusting brushes.
122 button brushes.
52 button sticks.
37 pounds candles.
113 chamois skins.
10 boxes cleaning material.
20 cleaning plates.
14,250 pounds coal.
45½ quires crocus cloth.
5 pounds emery.
1,035⅚ quires emery cloth.
3½ quires emery paper.
2 lanterns.
104½ ounces scouring material.
6 pounds pomade.
426 pounds rottenstone.
62½ quires sandpaper.
25 pounds bar soap.
2,483½ pounds castile soap.
275 pounds sponge.
610 papers tripoli.
298 ounces whiting.
195 pounds whiting.

MATERIAL FOR OFFICE USE.

8 half-boxes blacking for stencil outfit.
78 instruction books.
1 stencil brush.
25 pounds hektograph composition.
352 ounces indelible ink.
1 hektograph.
6 door mats.
2 marking outfits.
2 sets marking outfit screws.

25 boxes stencil paste.
2 seal stamps.
110 pounds sealing-wax.
20 stencil plates, letters, and figures, sets.
3 stencil outfits (sets).

LABORATORY STORES.

13 gallons alcohol.
81½ pounds beeswax.
10 pounds borax.
5 pounds chalk.
15 pounds glue.
23 pounds straw board.
50 pounds tallow.
1,172 pounds Japan wax.
5 gallons whisky.

OILS, PAINTS, ETC.

3 quarts browning mixture.
65 gallons coal-tar.
25 quarts cosmolubric.
20 gallons Japan drier.
50 gallons lacker.
20 pounds lampblack.
25 pounds black lead.
125 pounds white lead.
12 pounds extract logwood.
121⅝ gallons cosmoline oil.
4,418 pounds harness oil.
20 gallons kerosene oil.
5 gallons lard oil.
268⅜ gallons linseed oil.
95½ gallons neat's-foot oil.
40 gallons neutral oil.
568¾ gallons sperm oil.
517½ pounds black paint.
890 pounds brown paint.
75 pounds green paint.
637½ pounds lead-color paint.
1,764 pounds olive paint.
5 pounds vermillion paint.
10 pounds putty.
202 gallons turpentine.
5 pounds umber.

MISCELLANEOUS.

6 tool bags.
12 metallic powder barrels.
12 chair bottoms.
5 cleaning material boxes.
9 boxes for forge and battery wagon stores.
14 packing boxes.
8 reloading tool boxes.
7 tin cans.

22 chamois skin saber cases.
289 arm chests.
2 tool chests.
184 cans axle grease.
130 pounds axle grease.
215 pounds wheel grease.
12 halliards.
450 barrel hoops.
3 powder kegs.
300 pounds packing paper.
177 pounds petroleum paper.
110 pounds stencil paper.

MACHINES AND PARTS OF MACHINES.

6 crusher pressure gauges.
100 cylinder pressure gauges.
1 star gauge.
1 engine lathe.
1 milling machine.
1 planing machine.
1 profiling machine.
1 inspecting mirror.
3 dies for gas-check pad.

TOOLS.

11 anvils.
149 aprons.
8 augers.
1,144 awls.
219 awl handles.
24 patent awl handles.
19 axes.
48 ax handles.
69 assorted bits.
25 sets of bits.
5 lead-punching blocks.
1 iron boiler.
5 shoeing boxes.
10 braces.
246 assorted brushes.
10 assorted buckets.
7 buttresses.
1 calipers.
7 chalk lines.
102 assorted chisels.
7 saddlers' clamps.
23 claw tools.
6 clinching irons.
40 compasses.
13 iron creasers.
87 wooden creasers.
12 dies.
1 die stock with dies.
5 dust pans.

63 edged tools.
1,147 files.
193 file handles.
6 cavalry forges.
2 forge chests.
4 fullers.
1 funnel.
3 gauges.
16 draw gauges.
24 gimlets.
2 glue pots.
2 gouges.
2 grindstones.
1 grindstone arbor and crank.
1 grindstone stand.
220 assorted hammers.
13 sledge hammers.
39 hammer handles.
10 hatchets.
19 hardies.
8 saddlers' horses.
367 assorted knives.
13 gauge knives.
15 splitting knives.
78 mallets.
7 mauls.
1 nail claw.
5,928 needles.
96 nippers.
4 oil cans.
3 oil droppers.
34 oil stones.
1 sewing palm.
12 carpenters' pencils.
2 pickaxes.
8 pickax handles.
81 pincers.
16 planes.
33 pliers.
12 pointing stakes.
2 pokers.
26 pricking carriages.
83 pricking wheels.
19 pritchels.
153 assorted punches.
5 nail punches and clinch knives.
49 spring punches.
1,003 rasps.
7 reaping hooks.
2 riveting irons.
5 rivet sets.
2 rounding irons.
64 rules.
62 sandstones.
14 sash tools.
10 saws.

3	saw-sets.
2	scrapers.
50	screw-drivers.
1	scriber.
16	scythes.
4	scythe snaths.
12	scythe stones.
67	shears.
2	pairs rubber shoes.
19	shovels.
15	slickers.
18	pairs magazine slippers.
12	spades.
2	spokeshaves.
24	squares.
28	taps.
38	thimbles.
15	ticklers.
106	tongs.
6	tuyere irons.
35	vises.
2	watering pots.
2	wheelbarrows.
54	wrenches.

APPENDIX 4.

STATEMENT OF ORDNANCE, ORDNANCE STORES, ETC., DISTRIBUTED TO THE MILITIA FROM JULY 1, 1887, TO JUNE 30, 1888, UNDER SECTIONS 1661 AND 1667, REVISED STATUTES UNITED STATES.

CLASS I.

7	3-inch wrought-iron guns.
6	Gatling guns, 10 barrels, long, caliber .45.

CLASS II.

7	carriages and limbers for 3-inch guns.
6	carriages and limbers for Gatling guns, caliber .45.
2	carriages and limbers (metallic) for Gatling guns, caliber .45.
2	caissons and limbers for 3-inch guns.

CLASS III.

6	fuse blocks.
6	fuse cutters.
2	fuse gouges.
2	fuse wrenches.
29	gunners' haversacks.
7	gunners' gimlets.
6	gunners' pincers.
25	handspikes, trail.
4	harness sacks.
84	lanyards.
47	priming wires.
6	prolonges.
12	pole-pads.
15	paulins, 12 by 15 feet.
6	pendulum hausses.
6	pendulum hausse pouches.
4	pendulum hausse seats.
21	sets artillery harness, 2 horses, lead.
34	sets artillery harness, 2 horses, wheel.
8	sponge-buckets, iron.
10	sponges and rammers, 6-pounder gun.
22	sponges and rammers, 3-inch rifle.
10	sponge covers, 6-pounder gun.
32	sponge covers, 3-inch rifle.
12	sponge heads, 3-inch rifle.
2	sponge heads, 12-pounder mountain howitzer.

84 thumbstalls.
1 tar bucket, iron.
33 tube-pouches.
6 tow hooks.
15 tompions.
17 vent-covers.
6 vent-punches.
24 worms and staves.
2 water buckets.

IMPLEMENTS FOR GATLING GUNS.

111 feed cases.
66 feed magazines.
12 gun covers.
8 handspikes.
6 hammers, riveting.
8 oilers.
4 sight cases.
6 screw wrenches.

CLASSES IV AND V.

70 10-inch shot.
34 10-inch shell.
25 10-inch mortar shell.
13 12-pounder canister, filled and fixed.
12 12-pounder case-shot, filled and fixed.
25 6-pounder case-shot, filled and fixed.
25 6-pounder canister, filled and fixed.
20 3-inch shot.
20 3-inch shot, fully prepared.
20 3-inch time shell, fully prepared.
25 3-inch case-shot, filled and fixed.
20 3-inch case-shot, fully prepared.
25 3-inch canister, filled and fixed.
20 3-inch canister, fully prepared.
100 3-inch shell.
200 3-inch Parrott shell.
100 3-inch percussion shell, fully prepared.
145 3-inch Hotchkiss time fuse shell.
25 3-inch Hotchkiss percussion shell, fully prepared.
80 3-inch Hotchkiss case shot.

CLASS VI.

8,526 Springfield rifles, caliber. 45.
216 Springfield cadet rifles, caliber. 45.
371 Springfield carbines, caliber. 45.
218 Colt's revolvers, caliber. 45.
201 officers' swords.
14 non-commissioned officers' swords.
4 musicians' swords.
56 sabers, light artillery
528 sabers, light cavalry.
26 sabers, cavalry officers.

1	sword, major-general.
1	sword, brigadier-general.
170	bayonets.

CLASS VII.

7,903	combination screw-drivers.
7,903	headless shell extractors.

HORSE EQUIPMENTS FOR CAVALRY.

649	curb bridles, cavalry.
255	pairs spurs and straps.
500	cavalry saddles, leather.
80	cavalry saddles, rawhide.
347	artillery saddle blankets.
364	cavalry saddle blankets.
30	saddle cloths, hair.
31	saddle cloths, officers.
75	pairs sweat-leathers.
211	halters and straps.
161	pairs saddle-bags.
1	bridle, watering.
6	horse brushes.
41	nose-bags.
41	lariats.
41	picket-pins.
1	crupper.
1	horse-cover.
1	link and snap.
1	side-line.
1	stirrup with hood.
50	bridle reins.

INFANTRY EQUIPMENTS.

5,277	bayonet scabbards.
2,500	blanket bags.
2,500	pairs blanket-bag shoulder straps.
2,500	pairs coat straps.
1,450	canteens and straps.
150	cartridge belts and plates.
5,468	cartridge boxes.
295	cartridge belts, woven.
9,556	gun slings.
6,650	haversacks and straps.
7,145	waist belts and plates.
700	waist belts.
10	waist belts and plates, non-commissioned officers.
7	shoulder belts and plates, non-commissioned officers.
2,200	meat cans.
720	tin cups.
920	knives.
920	forks.
1,108	spoons.

ARTILLERY ACCOUTERMENTS.

90	artillery saber belts and plates.

CAVALRY EQUIPMENTS.

571	carbine slings.
571	carbine sling swivels.
200	carbine boots and straps.
155	pistol holsters.
52	pistol cartridge pouches (cap pouches).
890	saber belts and plates.
158	saber knots.
136	saber attachments.
400	cartridge belts.
24	sword belts and plates, officer's.

CLASS VIII.

125	blank cartridges, 12-pounder gun.
300	blank cartridges, 10-pounder gun.
800	blank cartridges, 6-pounder gun.
2,000	blank cartridges, 3-inch rifle.
1,258,000	rifle ball cartridges, caliber .45.
714,000	rifle ball cartridges, caliber .50.
425,000	rifle blank cartridges, caliber .45.
9,000	rifle blank cartridges, caliber .50.
14,000	carbine ball cartridges, caliber .45.
56,000	revolver ball cartridges, caliber .45.
1,000	revolver blank cartridges, caliber .45.
1,000	primed cartridge shells, caliber .45.
20,000	lubricated rifle bullets.
90,000	round balls (140 grains) caliber .45.
20,500	cartridge primers.
14,920	friction primers.
25	fuses, time, metallic.
300	fuses, time, paper.
150	fuses, time, wood.
125	fuse plugs, time.
105	fuse plugs, percussion.
25	cartridge bags, 10-inch siege mortar.
50	cartridge bags, 10-inch Rodman gun.
500	pounds cannon powder.
600	pounds mortar powder.
7	pounds musket powder.
200	pounds small-arms powder.

MISCELLANEOUS.

466	arm-chests.
25	adjustable chargers.
40	boxes cleaning material.
12	chamois-skins.
371	jointed ramrods.
200	marksman's buttons.
301,000	pasters.

4,600	paper targets.
12	padlocks for limbers and chests.
2	pounds browning mixture.
5	pounds harness oil.
10	pounds polish for leather.
2	pounds scouring material.
2	quires emery-cloth.
2	quires emery-paper.
2	quires sand-paper.
10	sharpshooters' badges.
1	set reloading tools.
8,557	wiping-rods, wooden.
2	resizing dies, extra.

PARTS OF SPRINGFIELD RIFLE, CALIBER .45.

75	bridles.
75	bridle screws.
4	breech screws.
42	breech-blocks.
20	breech-block cap-screws.
5	butt plates.
220	butt-plate screws.
6	band springs.
40	bayonet-clasp screws.
70	cam latches.
512	cam-latch springs.
600	ejector springs.
450	ejector-spring spindles.
1,300	extractors.
1,420	front sights.
1,400	front-sight covers.
1,420	front-sight pins.
3,050	firing pins.
700	firing-pin screws.
10	guard bows.
20	guard-bow nuts.
250	guard-bow swivels.
225	guard-bow swivel screws
3	guard plates.
7	guard screws.
235	hammers.
236	hinge pins.
100	hinge-pin studs.
1,431	lower bands.
143	locks.
45	lock-plates.
235	mainsprings.
275	mainspring swivels.
210	mainspring swivel rivets.
1,518	rear sights.
36	rear-sight slides.
30	rear-sight base screws.
20	rear-sight joint screws.
40	rear-sight leaf screws.
311	ramrods.

60	ramrod stops.
37	stacking swivels.
1,175	sears.
100	sear screws.
650	sear springs.
500	sear-spring screws.
523	side screws.
100	side-screw washers.
444	spring vises.
81	stocks, complete.
200	stocks (wood part).
22	stocks, assembled.
573	tumblers.
906	tumbler screws.
2,448	tumbler punches.
307	tang screws.
35	thumb-pieces.
150	upper bands.
25	upper-band screws.

PARTS OF SPRINGFIELD CARBINE, CALIBER .45.

5	swivel bars.
5	swivel rings.

PARTS OF COLT'S REVOLVER, CALIBER .45.

210	bolt springs.
10	firing pins.
10	gate springs.
10	gate catches.
25	hands.
25	hand-springs.
10	hammers.
10	hammer cams.
10	hammer screws.
210	sear springs.

TOOLS, ETC.

1	anvil, smiths'.
2	aprons, leather.
4	axes, felling.
6	shovels, smiths'.
6	shovels, long-handled.
6	spades.

APPENDIX 5.

STATEMENT OF ORDNANCE, ORDNANCE STORES, ETC., DISTRIBUTED TO COLLEGES FROM JULY 1, 1887, TO JUNE 30, 1888, UNDER SECTION 1225 REVISED STATUTES UNITED STATES, AS AMENDED BY ACT APPROVED JULY 5, 1876.

CLASS I.

1	6-pounder bronze gun.

CLASS VI.

500	Springfield cadet rifles, caliber .45.
15	swords, non-commissioned officers'.

CLASS VII.

700	bayonets cabbards.
700	cartridge boxes.
700	waist belts and plates.
20	waist belts and plates, non-commissioned officers'.
24	shoulder belts and plates, non-commissioned officers'.
23	frogs, sliding, non-commissioned officers'.

CLASS VIII.

250	blank cartridges for 12-pounder gun.
400	blank cartridges for 10-pounder gun.
500	blank cartridges for 6-pounder gun.
1,250	blank cartridges for 3-inch gun.
28,000	carbine ball cartridges, caliber .45.
29,000	carbine blank cartridges, caliber .45.
1,000	carbine ball cartridges, caliber .50.
1,000	carbine blank cartridges, caliber .50.
1,000	rifle ball cartridges, caliber .50.
3,000	rifle blank cartridges, caliber .50.
6,900	friction primers.

APPENDIX 6.

STATEMENT OF ORDNANCE STORES ISSUED TO THE EXECUTIVE DEPARTMENTS DURING THE YEAR ENDED JUNE 30, 1888, *UNDER THE PROVISIONS OF THE ACT OF MARCH* 3, 1879.

TO THE TREASURY DEPARTMENT.

2	Gatling guns, caliber .45.
5	carriages, without limbers, for Gatling gun, caliber .45.
10	Springfield rifles.
8	Springfield carbines.
10	bayonet scabbards.
10	cartridge boxes.
10	gun slings.
10	waist belts and plates.
16,600	rifle ball cartridges.
600	carbine ball cartridges.
500	hand grenades.
1	arm chest.

TO THE POST-OFFICE DEPARTMENT.

409	Colt's revolvers.
4,800	revolver ball cartridges.
4	arm chests.

APPENDIX 7.

REPORT OF ACTION TAKEN UNDER THE ACT OF MARCH 3, 1881, *DURING THE FISCAL YEAR ENDED JUNE* 30, 1888.

SOLD TO E. I. DU PONT DE NEMOURS & CO.

1887.
Sept. 20. 103 pounds brown prismatic powder (scrap), at 8 cents per pound.. $8.24

PURCHASED FROM E. I. DU PONT DE NEMOURS & CO.

1887.
Nov. 29. 300 pounds square powder, at 25 cents per pound 75.00

APPENDIX 8.

SHOWING STATIONS AND DUTIES OF THE OFFICERS OF THE ORDNANCE DEPARTMENT ON OCTOBER 1, 1888.

Rank and name.	Duty.	Address.
BRIGADIER-GENERAL.		
Stephen V. Benét	Chief of Ordnance	Washington, D. C.
COLONELS.		
1. S. Crispin, brevet	Commanding the Benicia Arsenal	Benicia, Cal.
2. T. G. Baylor, brevet	Commanding the Rock Island Arsenal	Rock Island, Ill.
3. J. M. Whittemore	Commanding the Watervliet Arsenal	West Troy, N. Y.
LIEUTENANT-COLONELS.		
1. A. R. Buffington	Commanding the National Armory	Springfield, Mass.
2. D. W. Flagler, brevet	Commanding the Frankford Arsenal	Philadelphia, Pa.
3. A. Mordecai, brevet	Commanding the New York Arsenal, President of the Ordnance Board, and President of Board for Testing Rifled Cannon, etc.	Governor's Island, New York City. Post-office box 1449.
4. F. H. Parker, brevet	Commanding the Watertown Arsenal, and Member of Board for Testing Rifled Cannon, etc.	Watertown, Mass.
MAJORS.		
1. J. P. Farley	Member of the Ordnance Board, and Member of Board for Testing Rifled Cannon, etc.	Governor's Island, New York City. Post-office box 1449.
2. L. S. Babbitt	Commanding the San Antonio Arsenal, and Chief Ordnance Officer Department of Texas.	San Antonio, Tex.
3. W. A. Marye	Assistant National Armory	Springfield, Mass.
4. I. Arnold, jr	Commanding the Fort Monroe Arsenal	Fort Monroe, Va.
5. C. Comly	Commanding the Indianapolis Arsenal	Indianapolis, Ind.
6. J. R. McGinness, brevet	Assistant, Rock Island Arsenal	Rock Island, Ill.
7. G. W. McKee, brevet	Commanding the Allegheny Arsenal	Pittsburgh, Pa.
8. F. H. Phipps	Commanding the U. S. Powder Depot	Dover, N. J.
9. J. W. Reilly	Commanding the Augusta Arsenal	Augusta, Ga.
10. J. A. Kress, brevet	Assistant, Benicia Arsenal	Benicia, Cal.
CAPTAINS.		
1. O. E. Michaelis, brevet	Commanding the Kennebec Arsenal	Augusta, Me.
2. C. E. Dutton	On duty under the Interior Department.	Geological Survey, Washington, D. C.
3. J. G. Butler	Commanding the Saint Louis Powder Depot.	Jefferson Barracks, Mo.
4. C. Bryant	Assistant, Frankford Arsenal	Philadelphia, Pa.
5. A. L. Varney	Assistant, Rock Island Arsenal	Rock Island, Ill.
6. J. C. Clifford	Assistant, National Armory	Springfield, Mass.
7. J. E. Greer	Member of the Ordnance Board, and Member of Board for Testing Rifled Cannon, etc.	Governor's Island, New York City. Post-office box 1449.
8. J. Pitman	Commanding the Fort A. Lincoln Ordnance Depot, and Chief Ordnance Officer Department of Dakota.	Fort A. Lincoln, Dak.
9. C. Shaler	Assistant, Watervliet Arsenal	West Troy, N. Y.
10. H. Metcalfe	Instructor of Ordnance and Gunnery, U. S. Military Academy.	West Point, N. Y.

SHOWING STATIONS AND DUTIES OF THE OFFICERS OF THE ORDNANCE DEPARTMENT—Continued.

Rank and name.	Duty.	Address.
11. W. S. Starring	Commanding the Vancouver Barracks Ordnance Depot, and Chief Ordnance Officer Department of the Columbia.	Vancouver Barracks, Wash. Ter.
12. C. S. Smith	Principal Assistant in the Ordnance Bureau.	Washington, D. C.
13. S. E. Blunt	Inspector of Rifle Practice at the headquarters of the Army.	Washington, D. C.
14. F. Heath	Assistant, Watervliet Arsenal	West Troy, N. Y.
15. D. M. Taylor	On special duty in the office of the Adjutant-General.	Washington, D. C.
16. D. A. Lyle	On foundry duty; Member of Board on Life-Saving Apparatus, etc., under the Secretary of the Treasury, and Member of Board for testing Rifled Cannon, etc.	Boston, Mass. Post-office box 2253.
17. J. Rockwell, jr	Assistant, Rock Island Arsenal	Rock Island, Ill.
18. J. C. Ayres	Assistant, Watervliet Arsenal	West Troy, N. Y.
19. M. W. Lyon	Commanding the Cheyenne Ordnance Depot, and Chief Ordnance Officer Department of the Platte.	Cheyenne, Wyo. Ter.
20. C. W. Whipple	Commanding the Fort Leavenworth Ordnance Depot, and Chief Ordnance Officer Department of the Missouri.	Fort Leavenworth, Kans.
21. A. H. Russell	Assistant, Frankford Arsenal	Philadelphia, Pa.
22. R. Birnie, jr	On duty in the office of the Chief of Ordnance.	Washington, D. C.
23. I. MacNutt	Assistant, Watertown Arsenal	Watertown, Mass.
24. C. C. Morrison	Assistant to the Ordnance Board	Governor's Island, New York City. Post-office box 1449.
25. F. Baker	Assistant, Frankford Arsenal	Philadelphia, Pa.
26. O. B. Mitcham	Assistant Instructor of Ordnance and Gunnery, U. S. Military Academy.	West Point, N. Y.
FIRST LIEUTENANTS.		
1. H. D. Borup	On foundry duty	Boston, Mass. Post-office box 2253.
2. L. L. Bruff	Assistant, Watervliet Arsenal	West Troy, N. Y.
3. C. H. Clark	Assistant, National Armory	Springfield, Mass.
4. William Crozier	On duty in the office of the Chief of Ordnance.	Washington, D. C.
5. W. B. Gordon	Assistant, Watervliet Arsenal	West Troy, N. Y.
6. F. E. Hobbs	On foundry duty	Station G, Philadelphia, Pa.
7. D. A. Howard	Assistant to the Ordnance Board	Governor's Island, New York City. Post-office box 1449.
8. S. E. Stuart	On foundry duty	Station G, Philadelphia, Pa.
9. J. Walker Benét	Assistant, National Armory	Springfield, Mass.
10. W. W. Gibson	On foundry duty	Station G, Philadelphia, Pa.
ORDNANCE STOREKEEPERS—CAPTAINS.		
A. S. M. Morgan	On duty, Allegheny Arsenal	Pittsburgh, Pa.
W. H. Rexford	On duty, Indianapolis Arsenal	Indianapolis, Ind.
D. J. Young	On leave	Washington, D. C.
M. J. Grealish	On duty, Augusta Arsenal	Augusta, Ga.
V. McNally	On duty in the office of the Chief of Ordnance.	Washington, D. C.

APPENDIX 9.

ANNUAL REPORT OF INSPECTOR OF ORDNANCE AT MIDVALE STEEL WORKS.

MIDVALE STEEL WORKS,
Philadelphia, Pa., July 30, 1888.

SIR: I have the honor to submit the following report upon the work done for the Ordnance Department by The Midvale Steel Company during the fiscal year ending June 30, 1888:

During this period the company continued the fabrication of forgings for 3.2-inch steel breech-loading field guns, under their contract of February 19, 1887, for twenty-five sets of such forgings; and, in addition, furnished the Department a few small forgings for parts of breech mechanism which were required for immediate use.

The forgings for field guns have been completed and the contract closed; they are similar to those which have heretofore been made for such guns, and which have been so frequently described in former reports that no further account of them seems necessary at this time. The physical qualities of the accepted forgings have been excellent, as will be seen by examination of the subjoined tables giving the results of test of specimens from those forgings accepted during the fiscal year.

Results of tensile test of tangential specimens from ends of tubes for 3.2-inch steel breech-loading field guns.

[Length of specimen, 2 inches; sectional area, 0.2 of a square inch.]

Number of tube.	Breech of muzzle.	Number of specimen.	Elastic limit per square inch of original section.	Elongation per inch under strain at elastic limit.	Tensile strength per square inch of original section.	Elongation after rupture.	Reduction of area after rupture.
			Pounds.	*Inch.*	*Pounds.*	*Per cent.*	*Per cent.*
30	Breech.....	3	48,000	.001600	86,300	25.00	37.1
30	....do.....	4	47,000	.001450	85,450	27.00	49.1
30	Muzzle.....	3	47,000	.001750	86,900	22.50	49.1
30	....do.....	4	49,000	.001800	85,850	20.50	49.1
31	Breech.....	*1	49,000	.001850	86,050	18.00	27.4
31	....do.....	*2	50,000	.001800	87,400	15.00	23.9
31	Muzzle.....	*1	48,000	.001650	85,800	23.50	37.1
31	....do.....	*2	48,000	.001650	87,050	21.00	43.3
31	Breech.....	3	50,000	.001700	84,600	24.50	37.1
31	....do.....	4	49,000	.001650	82,550	24.50	43.3
31	Muzzle.....	3	50,000	.001750	85,900	21.00	46.2
31	....do.....	4	48,000	.001500	84,900	21.00	49.1
34	Breech.....	3	48,000	.001550	86,550	19.00	43.3
34	....do.....	4	50,000	.001850	89,000	23.00	43.3
34	Muzzle.....	3	52,000	.001800	90,550	20.50	46.2
34	....do.....	4	45,000	.001650	84,850	20.50	46.2
36	Breech.....	1	43,000	.001400	80,100	25.50	46.2

* Not accepted on these results; retempered and annealed.

Results of tensile strength of tangential specimens from ends of tubes, etc.—Continued.

Number of tube.	Breech of muzzle.	Number of specimen.	Elastic limit per square inch of original section.	Elongation per inch under strain at elastic limit.	Tensile strength per square inch of original section.	Elongation after rupture.	Reduction of area after rupture.
			Pounds.	*Inch.*	*Pounds.*	*Per cent.*	*Per cent.*
36	Breech	2	43,000	.001400	81,950	25.50	40.3
36	Muzzle	1	48,000	.001550	84,500	24.50	43.3
36	....do	2	47,000	.001500	81,900	20.00	46.2
37	Breech	1	47,000	.001550	88,900	22.00	43.3
37	....do	2	48,000	.001650	87,600	21.50	43.3
37	Muzzle	1	43,000	.001500	80,700	25.00	49.1
37	....do	2	44,000	.001550	82,950	22.50	49.1
38	Breech	3	49,000	.001600	88,550	20.50	34.0
38	....do	4	48,000	.001700	87,900	20.00	30.7
38	Muzzle	3	47,000	.001650	82,300	24.00	40.3
38	....do	4	46,000	.001500	82,100	24.00	40.3
39	Breech	3	44,000	.001500	84,050	25.00	49.1
39	....do	4	44,000	.001500	83,050	26.50	51.9
39	Muzzle	3	44,000	.001500	80,400	26.50	46.2
39	.. .do	4	45,000	.001450	81,000	25.50	46.2
40	Breech	*1	50,000	.001700	87,150	20.00	30.7
40	....do	*2	49,000	.001650	86,050	22.50	46.2
40	Muzzle	*1	46,000	.001700	87,900	20.00	37.1
40	....do	*2	42,000	.001550	81,850	23.00	37.1
40	Breech	*3	43,000	.001500	83,450	25.00	43.3
40	....do	*4	44,000	.001600	82,550	19.50	30.7
40	Muzzle	*3	43,000	.001500	83,700	19.50	43.3
40	....do	†4	46,000	.001600	87,850	19.00	37.1
40	Breech	†5	55,000	.001800	87,350	19.00	37.1
40	....do	†6	53,000	.001750	87,550	17.50	37.1
40	Muzzle	†5	50,000	.001600	90,400	17.00	37.1
40	....do	6	50,000	.001650	89,900	18.00	43.3
41	Breech	1	50,000	.001800	92,050	19.50	40.3
41	....do	2	51,000	.001750	89,300	23.50	43.3
41	Muzzle	1	45,000	.001500	83,800	26.50	46.2
41	....do	2	45,000	.001450	85,100	23.00	37.1
43	Breech	9	47,000	.001400	88,200	21.50	46.2
43	....do	10	47,000	.001550	85,450	26.00	46.2
43	Muzzle	9	48,000	.001450	89,800	20.50	46.2
43	....do	10	47,000	.001550	88,650	21.00	49.1

* Not accepted on these results; retempered and annealed.
† Not accepted on these results; reannealed and then accepted without further test.

Results of tensile test of tangential specimens from jackets for 3.2-inch steel breech-loading field guns.

[Length of specimen, 2 inches; sectional area, 0.2 of a square inch.]

Number of jacket.	Number of specimen.	Elastic limit per square inch of original section.	Elongation per inch under strain at elastic limit.	Tensile strength per square inch of original section.	Elongation after rupture.	Reduction of area after rupture.
		Pounds.	*Inch.*	*Pounds.*	*Per cent.*	*Per cent.*
27	5	52,000	.001800	100,100	20.50	37.1
27	6	52,000	.001750	99,150	21.00	37.1
40	*1	48,000	.001700	96,450	21.50	37.1
40	*2	48,000	.001650	95,400	20.00	37.1
40	3	55,000	.001950	107,050	18.50	34.0
40	4	54,000	.001950	104,450	19.00	37.1
44	*1	46,000	.001500	91,350	20.00	40.3
44	*2	51,000	.001750	95,600	15.00	20.5
44	†3	54,000	.001800	101,200	20.00	40.3
44	†4	55,000	.001950	101,950	15.00	20.5
44	5	52,000	.001750	94,050	19.00	40.3
44	6	52,000	.001800	95,050	17.00	27.4

* Not accepted on these results; retempered and annealed.
† Not accepted on these results; reannealed.

Results of tensile test of tangential specimens from trunnion-hoops for 3.2-inch steel breech-loading field-guns.

[Length of specimen, 2 inches; sectional area, 0.2 of a square inch.]

Number of trunnion-hoop.	Number of specimen.	Elastic limit per square inch of original section.	Elongation per inch under strain at elastic limit.	Tensile strength per square inch of original section.	Elongation after rupture.	Reduction of area after rupture.
		Pounds.	*Inch.*	*Pounds.*	*Per ct.*	*Per ct.*
33	*1	47,000	.001650	91,800	21.50	37.1
33	*2	46,000	.001550	89,100	25.00	37.1
33	3	53,000	.001700	100,900	16.00	27.4
33	4	50,000	.001750	97,500	18.50	23.9
34	*1	47,000	.001500	89,950	21.50	34.0
34	*2	47,000	.001700	90,250	22.00	34.0
34	†3	55,000	.001900	100,300	18.00	27.4
34	†4	52,000	.001600	99,000	15.00	23.9
34	5	54,000	.001800	96,050	18.50	30.7
34	6	52,000	.001750	92,200	23.00	37.1
35	*1	47,000	.001600	92,550	19.50	34.0
35	*2	49,000	.001850	94,600	21.00	37.1
35	3	56,000	.001950	102,600	21.00	37.1
35	4	54,000	.001800	100,150	16.00	23.9
36	*1	49,000	.001650	92,750	21.00	40.3
36	*2	47,000	.001650	90,400	19.50	40.3
36	3	52,000	.001800	95,550	20.50	37.1
36	4	57,000	.001900	98,400	18.00	34.0
44	*1	46,000	.001600	88,800	21.50	37.1
44	*2	47,000	001500	89,850	19.50	40.3
44	3	51,000	.001800	97,300	18.50	34.0
44	4	55,000	.001850	100.450	17.00	34.0
48	5	52,000	.001700	95,850	24.50	34.0
48	6	53,000	.001650	96,400	23.00	43.3

* Not accepted on these results; retempered and annealed.
† Not accepted on these results; reannealed.

The small breech mechanism forgings referred to were produced promptly, and were of satisfactory quality. The following list shows their nature:

Two forgings for gas-check cups for 5-inch rifle and two forgings for gas-check cups for 7-inch howitzer.

Two steel forgings for pressure gauges.

One gas-check cup forging for 3.2-inch steel field-gun.

One steel forging for spindle and head for 3.2-inch steel field-gun.

Five forgings for gas-check cups for 3.2-inch steel field-guns.

Steel forgings for breech mechanism of 8-inch and 10-inch steel rifles, viz, one hinge block, one segmental gear, and eighteen bolts.

Some of these forgings were accepted without test, the metal and treatment being satisfactory to the Department. So many of them as were tested showed the following results:

Name of forging.	Number of specimen.	Position in which specimen was taken.	Elastic limit per square inch of original section.	Elongation per inch under strain at elastic limit.	Tensile strength per square inch of original section.	Elongation after rupture.	Reduction of area after rupture.	Specific gravity.	Hardness.
			Pounds.	*Inch.*	*Pounds.*	*Per ct.*	*Per ct.*		
Gas-check cups for 5 and 7 inch guns.	1	Tangentially ..	85,000	.003000	145,250	11.00	23.9	.....	.....
	2	...do	84,000	.002850	145,400	10.00	23.9	.....	.....
Pressure gauges	2	Longitudinally.	62,000	.002050	131,900	11.50	13.2	7.8389	26.51
Gas-check cups for 3.2-inch field guns.	3	Tangentially ..	75,000	.002550	126,800	12.50	23.9	.....	.....

No new contracts for gun material have been made during the year, there having been no funds available for that purpose on account of the non-passage by Congress of any bill making appropriation for the armament of fortifications.

There has consequently been comparatively little to do at this place in the way of constant daily inspection work; the time available for other work has been well employed, it is thought, in the preparation of the first draught of specifications governing the manufacture of forgings for steel guns of all calibers; in completing the record of the manufacture of all the steel forgings which have been purchased by the Department, and in preparing the blank forms for future records. The draught of specifications has been submitted to you for such revision as may be deemed advisable or necessary; the experience of the Department and of this office during the past five years, as well as the information on file in the Ordnance Office, in respect to the requirements of other countries have all been considered in drawing up these specifications, while the strength and security of the built-up structures have been kept in mind. It is thought that under these specifications the United States will, with intelligent inspection of the manufacture, be reasonably certain to obtain reliable material for gun construction; that the guns themselves will possess sufficient strength and power, while at the same time steel manufacturers possessing a suitable plant will be able to fairly fill the specifications with very little difficulty and at a reasonable price. The amount of testing required has been reduced to a minimum.

F. E. HOBBS,
Lieutenant, Ordnance Department, U. S. Army.

The CHIEF OF ORDNANCE, U. S. ARMY,
Washington, D. C.

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APPENDIX 10.

REPORT ON THE MAXIM GUN.

(2 plates.)

ORDNANCE BOARD, U. S. ARMY,
New York Arsenal, June 20, 1888.

SIR: In accordance with instructions contained in letter of March 1, 1888, from your office, to test the Maxim Machine Gun, the Board has the honor to submit the following report:

In company with Mr. Broderick Clote, a director of the Maxim Gun Company, the Board proceeded to the proving ground at Sandy Hook, where the operation of the gun was explained by Mr. Clote. The piece was then operated by him to substantiate the claim for its simplicity of construction, and the certainty and rapidity of its action. The cartridges used were made by the Winchester Repeating Arms Company and were furnished by the Maxim Gun Company. The supply having been exhausted, the gun was formally turned over to the Board for trial. With the gun tested by the company there was turned over another differing from it only in having a shorter barrel and being without a water jacket.

DESCRIPTION.

This gun may properly be described as automatic, no force other than that of the recoil developed by the discharge being required for its complete operation, that is, for opening the breech, extracting the empty shell, withdrawing a cartridge from the belt in which the cartridges are delivered to the gun, cocking the piece, inserting the cartridge in the chamber, closing the breech, and placing a cartridge in position to be utilized at the next round. The first four operations are performed directly by the recoiling barrel and its connections, which, at the same time, place a heavy coiled spring under a strain of extension. The spring by its re-action returns the barrel to its original position and performs the last three of the above-mentioned operations. The barrel is screwed into a metal frame, which has a reciprocating motion in a rectangular casing inclosing the breech mechanism. The lock—which is also the breech-block—has a reciprocating motion in the frame independent of that of the latter in the casing. An eccentric crank is journaled in the sides of the frame near its rear. A link connects the crank with a fork, the branches of which are pivoted in the sides and near the front of the lock. When the breech is closed the link and fork are in the prolongation of the axis of the bore and the axes of crank and bore are in the same plane. The lock or breech-block is thus supported at the instant of fire. The crank extends clear through both sides of the casing and

has a motion of translation in slots cut in its sides. Its left extremity terminates in an eccentric cam over which a small chain connecting with the spiral recoil spring is wound. The spring is attached at its front to the exterior of the casing. To the right extremity of the crank there is attached a curved arm or lever which, when the barrel and frame recoil, comes in contact with another lever firmly secured to the casing. The curvature of these levers is such as to cause the crank to rotate slowly at first, but with a gradually accelerated motion, and to wind up the chain at the left, thus putting a strain of extension on the recoil spring. This rotation of the crank depresses the link and with it the body of the fork. A rearward motion is at the same time communicated to the fork by which the lock is withdrawn from the face of the breech with an accelerated motion corresponding to that of the crank. A spring-stop on the side of the breech-casing limits the forward rotation of the crank-handle and by its elasticity causes the handle to rebound, thus relieving the recoil spring from the work of rotating it backward. Another stop combining with it the functions of a catch limits the rearward rotation of the handle and prevents it from rebounding to the front. This catch readily yields when the system recoils and leaves the crank free to rotate.

THE LOCK.

The lock consists of a box or casing containing a tumbler, sear, mainspring and firing-pin and an additional or safety sear. The tumbler is a bent lever pivoted near its middle. The upper arm engages in a notch cut on the under surface of the firing-pin and serves as a retractor. By means of the other arm the lock is cocked as the rear end or body of the fork before referred to, which now performs the functions of a cocking-lever, comes in contact with it in its descent and rotates the tumbler until the nose of the sear drops into the notch on its face. This rotation of the tumbler at the same time retracts the firing-pin. The mainspring, is of the V pattern, one branch being somewhat shorter than the other. The longer branch enters a notch cut on the under surface of the firing-pin while the other bears against the tumbler.

The retraction of the firing-pin has the effect of compressing the mainspring, and the release of the tumbler by the sear causes the pin to move under the action of the spring. In order, however, that there may be no accidental explosion before the breech is closed a safety sear is provided. This sear is pivoted at its front above the firing-pin and is kept in contact with it by a flat spring. A shoulder on the upper surface of the pin comes in contact with a lug on the under surface of the sear. When the breech is completely closed the fork or cocking-lever is in line with the axis of the bore. Just before reaching this position it comes in contact with the lower surface of the safety sear and raises it so as to free the lug from the shoulder on the pin. The piece is then ready to be fired.

The trigger consists of a lever pivoted to the rear of the breech-casing and connected with a grooved slide at its bottom. A spiral spring connects the front end of the slide with the front of the casing and returns the slide to position when it has been withdrawn. When the trigger-lever is pressed in toward the casing the slide is drawn to the rear and the shoulder forming the front end of the groove comes in contact with the sear, which extends into the groove, and trips it. If the trigger-lever be held pressed in by the hand or by any attachment the firing is continuous.

The extractor, which is external to the casing of the lock and has a vertical sliding motion along its face, is an under cut or flanged slide of a width sufficient to take in the head of a cartridge. It is automatically operated by two bent levers pivoted near their centers to the sides of the lock. One arm of each lever engages in grooves cut on the exterior of the extractor. The other arms in the forward movement of the lock are depressed by arms on the fork at right angles to it, which strike against lugs on the interior of the breech-casing.

THE FEED.

The cartridges are carried side by side in belts made of two pieces of water-proofed tapes riveted together, leaving spaces large enough for single cartridges. The belts in general resemble the service cartridge-belts, though they are longer, each containing 334 cartridges. They are carried automatically through the feed-box by a bell-crank lever, one arm of which engages in a notch cut in the upper surface of the left side of the sliding-frame near its junction with the barrel, while the other engages with a slide moving through the feed-box at right angles to the barrel, and provided with two fingers which, as the barrel recoils, move back and drop behind a cartridge. When the barrel is returned to its original position the slide moves forward and the fingers by bearing against the cartridge carry it forward, and with it the belt, until the cartridge is in position parallel to but above the axis of the bore. As the barrel completes its forward movement the extractor rises, its face sliding over the base of the cartridge and its under-cut grooves embracing the rim of the cartridge head. In the completion of its vertical motion a spring on the inside of the breech-casing enters a notch cut in the right side of the extractor and holds it in position. If the lock be now withdrawn, which can be done by means of a handle on the eccentric crank, the extractor will draw the cartridge from the belt. If a shell be in the chamber it will also be withdrawn. In its rearward motion the extractor is prevented from falling by two projecting arms which rest on guide-lugs on the inner sides of the breech-casing. Near the end of its backward motion the arms on the extractor pass over the lugs and the extractor falls, partly under the influence of gravity and partly under that of a light spring in the upper part of the breech-casing, through a distance equal to that of the axis of the cartridge in the belt above the axis of the barrel. Shell and cartridge are securely held in their relative positions by lugs, beveled on their upper edge, on springs attached to the rear face of the extractor, the lugs projecting through openings beyond its front face.

On the return of the block to its first position the cartridge enters the chamber and the empty shell the ejecting tube, the axis of which is as much below the axis of the barrel as that of the cartridge in the belt is above it.

On the completion of the forward movement of the block the extractor again rises, sliding over the head of the empty shell, which is now released, and along the head of the cartridge in the chamber, and engages with another in the belt which, unless the piece has been fired, must first be pulled forward by hand to bring the cartridge in position above the axis of the barrel.

WATER JACKET.

For those guns intended for long-continued firing a water jacket is provided. This is a brass casing surrounding the barrel, except for a short distance from the muzzle, and provided with a stuffing-box at each

end to admit of motion of the barrel without loss of water. The casing has a filling-hole, ordinarily closed by a screw-plug, near its rear end. A vent near the front end permits escape of steam whenever it is generated. In order that there may be no loss of water through the vent when firing at an angle of depression, a pipe is placed within and near the top of the casing, connected with this pipe, which extends the entire length of the casing, and at right angles to it there is another pipe leading to and closely fitting the vent. Openings are left at each end of the main pipe by which communication is made with the interior of the casing. Within this pipe there is a double-ended plunger. This, when the axis of the piece is other than horizontal, slides to the lower end of the pipe and closes the orifice. Steam but not water can then escape by the upper orifice.

A spiral spring surrounds that part of the barrel within the casing. It serves to hold the glands of the stuffing-boxes in position.

TO OPERATE THE GUN.

To operate the gun, the end of the cartridge-belt is passed from right to left through the feed-box slide. The lock is then withdrawn by means of the crank-handle and the cartridge-belt pulled through until the first cartridge comes into position above the axis of the bore. The lock is then returned to position, when the extractor rises and engages with the first cartridge in the belt. The lock is again withdrawn, and with it this cartridge. The belt is then pulled forward until the second cartridge comes into position over the axis of the barrel. The lock is again returned to position, by which movement the first cartridge is carried forward into the chamber and the second is seized by the extractor. The piece may then be fired by pressing on the trigger-lever. If the firing is to be continuous the lever is held down.

Should a cartridge miss fire it may be drawn from the chamber by means of the crank-handle, but the belt should be pulled forward by hand until the next cartridge comes into position, since, as there would be no recoil, there could be no movement of the feed-box slide and consequently no movement of belt and cartridges.

Should it be necessary to remove the lock it may be done in a few seconds, as the cocking-lever is connected by an interrupted screw-thread with the link attached to the eccentric crank.

TESTS OF THE GUN.

The gun not being adapted to the present service cartridge with 500-grain bullet, folded-head copper-case cartridges with 405-grain bullet were furnished the Board for the trial. On attempting to fire them it was found that they were not properly supported by the lock, and that they burst through the fold or swelled very badly at the head.

A few brass cartridges made in 1876 by the United States Cartridge Company, Lowell, Mass., being on hand, they were next tried. They appeared to vary in size, and in many instances entered the chamber with such difficulty as to stop the operation of the gun.

Solid-head copper-case cartridges with 405-grain bullet were then asked for by the Board. On trial it was found that they missed fire to the extent of about 8 per cent., due, it was thought, to the weakness of the main-spring, the service primer requiring a very heavy blow of the firing-pin to explode it.

In order that it might make a thorough test of the principle of the gun, the Board requested that a supply of the last-named cartridges, but primed with the Winchester primer, might be furnished. These cartridges having been received, the test was resumed, with the following results:

Number of cartridges in belt.	Number fired.	Time.	Target.	Remarks.
		Seconds.		
290	290	27.5	Fired to sea.	Gun mounted on carriage.
100	99	9.25		First cartridge missed fire. Struck by firing-pin near edge of primer.
50	50	4.75		Fired singly.
25	25	.....		
290	290	27.25		
100	100	9.25		
			Yards.	
	37	.....	1,000	Sighting shots. Telephone not working satisfactorily, firing at this range was suspended.
334	71	6.75	200	Lock caught and did not close breech. Cause not ascertained at time.
	97	9.25	200	Lock caught and did not close breach. Lock removed and mainspring pivot found loose and projecting beyond side face of lock to such an extent as to prevent lock sliding in its grooves in frame. Cause, breaking of small stay wire through outer end of pivot.
	20	.....	1,000	Sighting shots. Struck 20 yards short. Elevation used, 1,100 yards.
334	20	.....	1,000	Sighting shots. Struck 6 feet above and 20 feet to right of point aimed at. Elevation used, 1,200 yards.
	20	.....	1,000	Sighting shots. One miss-fire. Struck below point aimed at. Elevation used 1,175 yards. Sight jarred down to 1,150 yards.
	20	.....	1,000	Sighting shots.
246 } 334 }	580	.....	1,000	An attempt was made to fire 580 rounds, noting accuracy and time, two belts being used. Box containing second belt was placed on ground outside of wheel, in order that no time should be lost in changing boxes. After 150 rounds one miss-fire. Cartridge thrown out by operating crank by hand. In feeding second belt two hitches occurred, owing to inability of feeding apparatus to raise long column of cartridges from ground, an operation for which the gun was not designed. Accuracy, owing to stops, etc., not particularly good.
334	332	.....	200	All struck in rectangle 4 feet by 4 feet 3 inches. Two miss-fires. Last 242 rounds fired in 22 seconds.
334	332	.....	Fired to sea.	Operation of gun checked at fortieth round by cartridge entering feed-box obliquely and preventing barrel from returning to firing position. Two miss-fires while firing remainder of cartridges in belt.
334	334	.....		Gun worked perfectly.
334	334	.....		One miss-fire.

The guns having been sent for by the owners the tests were discontinued.

ADVANTAGES OF THIS GUN.

As this gun works automatically but one man is required to control its operation. The mounting is of such a character as to admit of the gun being elevated or depressed and at the same time traversed from right to left, or the reverse.

This is not a feature peculiar to the Maxim gun, but is found in many of the machine guns in the United States service. The dirigibility of the latter, however, is somewhat affected by the power applied at the crank-handle to fire them, which is not the case with the Maxim gun.

By means of two handles at the rear of the breech-casing the firer can readily change the direction of the gun without removing his thumbs from the trigger-lever; that is, without stopping the firing.

The gun is light, compact, and not complicated in construction, considering the many functions it has to perform.

The one tested by the Board was somewhat imperfect in construction. The lock did not run true in its grooves in the frame, and consequently the primers were struck at the side instead of centrally, thus causing, in connection with the weakness of the main-spring, frequent miss-fires. If "hang-fires" occur no mishap results, as there can be no recoil and no opening of the breech until the discharge takes place.

DISADVANTAGES.

The method of assembling the lock is objectionable. The pins with securing wires should be replaced by screws similar to that through the tumbler, except that the heads should be slotted clear across so as to avoid the use of a fork screw-driver. No means exist of showing whether the lock is cocked or not, and none are provided to throw it out of action. Unless the trigger be pulled after closing the breech the lock will remain cocked and the main-spring compressed.

If the gun be set aside in this condition for some time the spring may take a permanent set. This, it was thought, happened to the main-spring in one of the locks furnished with the gun.

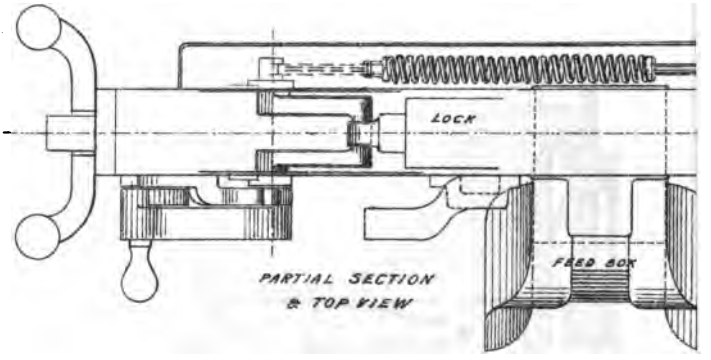
Without presenting it as a material objection, it may be well to state that the system necessitates the use of solid-head cartridges, as the interval of time, about one-eleventh of a second, between successive shots is so short that the breech system begins to recoil and the shell to be withdrawn before the bullet has left the bore. The shell there forms, as it were, a continuation of the chamber, and has by its inherent strength to sustain the then existing pressure of the gas.

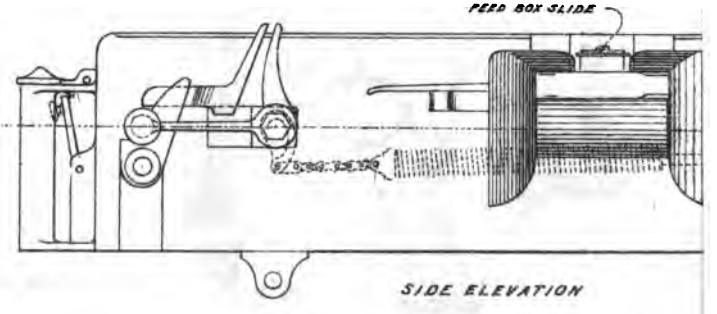
CONCLUSION.

In view of the fact that this gun is compact, portable, not complicated in construction, easily directed, requires but few men for its service, is extremely rapid, and, so far as the limited trials indicate, certain in its action, the Board would respectfully recommend that one gun, adapted to the standard service ammunition, be procured for a more extended trial of the system, as the withdrawal of the gun before the Board sooner than was expected prevented the thorough and exhaustive test contemplated.

A. MORDECAI,
Lieut. Colonel, Ordnance Dept., U. S. Army,
President of the Board.
J. P. FARLEY,
Major, Ordnance Dept., U. S. Army.
JOHN E. GREER,
Captain, Ordnance Dept., U. S. Army.

The CHIEF OF ORDNANCE, U. S. ARMY,
Washington, D. C.





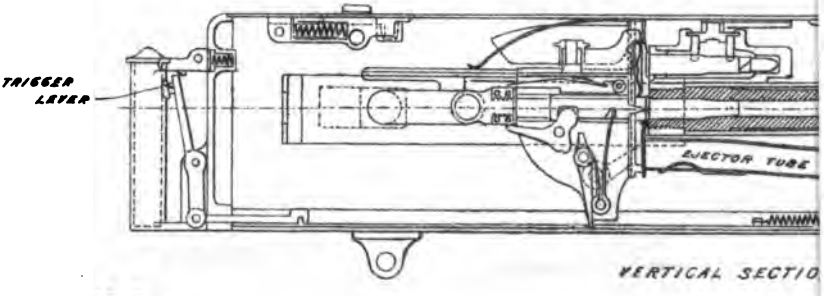


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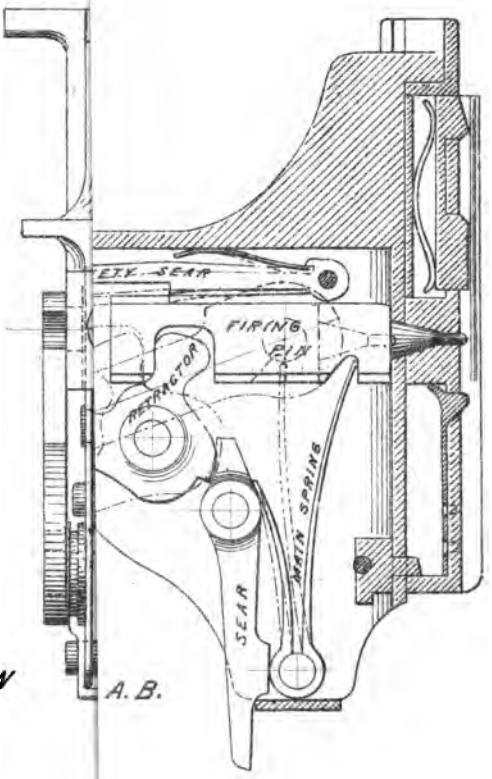
PLATE II



REAR VIEW A. B.

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APPENDIX 11.

DESCRIPTION OF AND INSTRUCTIONS FOR THE MANAGEMENT OF THE FIFTEEN-INCH SMOOTH-BORE GUN AND CARRIAGES, TABLE OF RANGES, DESCRIPTIVE PLATES, ETC.

By the ORDNANCE BOARD U. S. ARMY.

(2 plates.)

15-INCH SMOOTH-BORE MUZZLE-LOADING GUN.

The gun is fully described in the Ordnance Manual for 1861, page 18.

PRINCIPAL DIMENSIONS.

Caliber	inches..	15
Length of bore	do....	165
Distance from face of muzzle to axis of trunnions	do....	120.45
Total length of gun	do....	190
Weight of gun	pounds..	49,099

No preponderance.

The sights are two in number, one placed on the breech and one on the upper surface of the piece in front of the trunnions.

The breech sight consists of a brass limb, secured by screws to the upper surface of the gun in a vertical plane through the axis of the bore, and at 55.55 inches from the axis of the trunnions, measured on a line parallel to the axis of the bore. It is 16.625 inches in height, and has a longitudinal slit with three holes 0.2 inch in diameter, one at each end of the slit and one at the middle point, with intervals of 2.25 inches between the sight holes.

The front sight is a single piece of brass fastened to the gun by two screws, its upper extremity terminating in a blade.

The elevations are given by means of an arc and index, the former attached to the base of the breech and the latter to the elevating fulcrum on the carriage.

Projectiles.—The shell is 14.85 inches in diameter. It has two ears at the extremities of a diameter at right angles to the axis of the fuse hole. Thickness of the shell, 2.5 inches.

The solid or cored shot is also provided in like manner with ears for the shell hooks.

Weight of shell, 330 pounds; weight of shot, 450 pounds.

Charges are of sphero-hexagonal powder, having a granulation of 100 to the pound and specific gravity of 1.800; the pressure with no charge to exceed 28,000 pounds per square inch.

Weight of full charge, 130 pounds.

The paper time-fuses are used with the water-capped, metallic fuse plug, or with the wooden fuse plug.

The implements and equipments required are as follows:

IMPLEMENTS AND EQUIPMENTS.

For service of gun.

2 sponges.
2 rammers.
2 pass boxes.
2 carrying bars.
2 shell hooks.
1 gunner's pouch.
1 primer pouch.
2 lanyards.
2 thumbstalls.
2 priming wires.
1 water tub.
1 elevating bar.
1 tompion.
1 vent cover.
1 crane.

1 differential pulley (1,000 pounds).
1 ladle.
1 worm.
2 gunner's gimlets.
1 gunner's pincers.
1 gunner's quadrant, brass.
2 vent punches.
} To 6 pieces or less.

For service of carriage.

4 maneuvering bars.
1 pinch bar.
1 retraction rope, $\frac{5}{8}$-inch steel wire, 20 feet long.
1 set floor boards.

TOOLS.

For service of shells.

1 Fuse plug extractor.
1 Fuse mallet.
1 Fuse setter, brass.
1 Fuse cutter, knife.
1 Fuse wrench, for water cap.
1 Fuse reamer, for wooden plug.

For service of carriage.

1 screw wrench, large.
1 double wrench for $4\frac{1}{2}$ and $3\frac{1}{4}$ inch nuts.
1 double wrench for 2 and $1\frac{5}{8}$ inch United States standard nuts.
1 single wrench for $1\frac{1}{2}$-inch old style nuts.
1 hammer, claw.
} For 6 pieces or less.

ALTERED SEA-COAST CARRIAGES, MODEL 1883, WITH HYDRAULIC CYLINDERS, FOR 15-INCH GUN.

(2 plates.)

In order to strengthen the old 15-inch barbette carriage, that it may resist the strains caused by increasing the powder-charge of the gun to 130 pounds, and to adapt it to the 11-inch rifle, and also to facilitate its manipulation, the following alterations have been made:

TOP CARRIAGE.

Inner braces have been inserted between the cheek-plates, to give additional stiffness.

A buffer-plate has been added to the front transom, to receive the shock caused by running the carriage into battery.

The number and strength of the transoms have been increased; the front and rear ones having guide-hooks attached to restrict the motion of the carriage on the chassis.

A heavy cross-head has been added to the rear transom, connected with the front and middle transoms by two cross-head braces. This cross-head, extending as it does below the line of the upper surface of the chassis rails, is so slotted that it may receive and retain the piston-rod of the hydraulic cylinder.

The front and rear of the cheek-plates have been extended by means of bronze plates, which act as boxes for the steel truck-wheels, the front ones working in journals and the rear ones on an eccentric axle; the system being so arranged that the carriage shall always move with rolling friction, except for a distance of about 6 inches from the front buffers; the eccentric axle permits rolling friction for the whole distance when it is desired.

For the old cast-iron elevating fulcrum there has been substituted one of wrought iron, arranged with steps for the convenience of the gunner, and also with an eye for attaching the pulley for the "retraction rope."

The additional alterations required for the carriages used with the 11-inch rifle are the trunnion-bed plates, made to receive the eccentric trunnion-rings attached to the gun, to overcome the preponderance, and the replacing of the elevating fulcrum by bronze elevating arcs and gears.

CHASSIS.

Two kinds of chassis are altered. One with the narrow rail and the other with the deep rail. To make the chassis of equal height bracket bolsters are added to the narrow rails at the front, middle, and rear; the rear bracket bolster is deep enough to allow not only for the difference in depth of the two kinds of rails, but also to permit of the use of the old narrow-rail traverse wheels.

The other alterations of the chassis are common to the two carriages, and are the following:

The insertion of vertical braces between the plates of the rails to give additional stiffness.

The addition of an inclined rail on top of each rail of the chassis to cause an increasing resistance of the carriage when recoiling; and also to facilitate its running into battery.

The addition of an hydraulic cylinder, connected to the two rails by circular-bent straps, which also act as additional transoms.

This cylinder contains a piston-head perforated with four circular holes, three-quarters of an inch in diameter.

The piston-rod passes through a gland in the rear cylinder-head, and also through a slot in the cross-head, the end terminates in an eye, through which passes a steel pin, bearing two steel rollers to permit the easy adjustment of the piston-rod when the carriage ascends the inclined rails.

The addition of two buffer transoms, one attached to the front of the rails and the other to the rear, each being supplied with four rubber buffers to take up the shock when the carriage runs to the extreme limits of the rails.

To stiffen the rails of the chassis several transoms are added in rear of the hydraulic cylinder.

The addition of a wrought-iron prop and screw to the middle of each rail to permit of easy adjustment of the bearings due to a want of level of the platform.

Heavy wrought-iron bolsters are placed under the front of each rail. These bolsters are firmly bolted to the pintle transom and each rests on two conical rollers, which roll upon a plate on the platform, for ease and convenience of traversing.

The addition of a retraction apparatus placed at the rear end of the rails for the purpose of moving the carriage from battery. This con

sists of a drum revolved by means of gearing, to which the retraction rope is attached.

The addition of a retaining apparatus, consisting of a pawl and lever, the pawl engaging the teeth of the rack on the top carriage. This is so arranged with a steel spring that in its normal condition it will always retain the top carriage at the point where it may be left by the recoil. By pulling the lever and releasing the pawl the carriage will, owing to the inclined rails, readily run into battery. The lever may be held back by means of a pin, and it would be well that this should be done when maneuvering the carriage by hand.

The crane has been transferred from the top carriage to the chassis rail, it being arranged so that it will be in a position to load when the carriage has recoiled to any point beyond 4 feet and 6 inches from the front, and 7 inches from the rear buffers.

For the better convenience of the cannoneers, side and rear platforms of wire netting are added.

PRECAUTIONS TO BE OBSERVED.

The carriage is arranged to work almost automatically, but to do this it is necessary that care should be taken of its different parts.

The oil should always be poured in when the piston-rod is within the cylinder; not less than 25 gallons should be used when firing with full-powder charges.

The piston-rod should be kept free from rust in order that it may move freely.

There should be as little play as possible between the pintle transom and key-pin holding it in place, in order to avoid bending the transom.

The pintle rollers and all the wheel and axle journals should be kept well lubricated.

The carriage should be "in battery" when not in use, that the piston-rod may not be exposed to the weather.

The prop-screws should be given one-third of a turn before firing, just sufficient to clear them from the traverse circles.

As the loading crane operates best when the top carriage is 5 feet from the front buffers its position on the chassis should be observed.

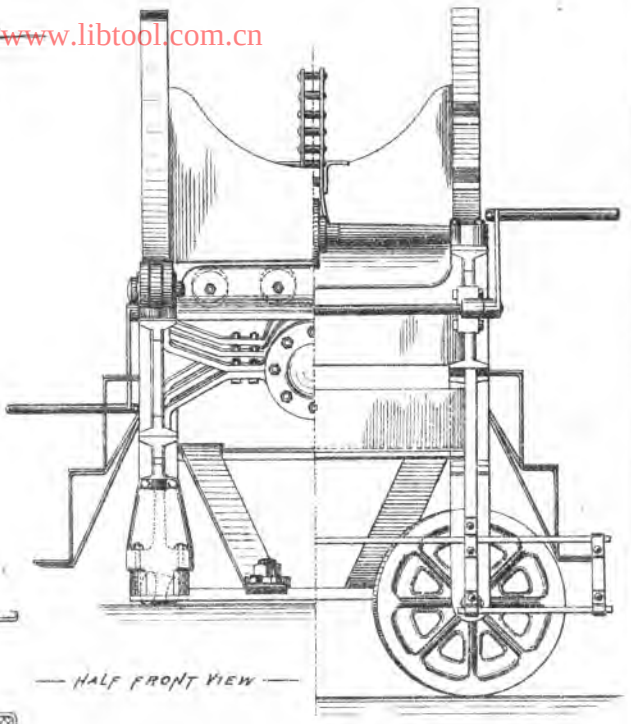
Range table.

[Weight of shot, 455 pounds. Initial velocity, 1,706 feet. Powder charge, 130 pounds.]

Distance of object.	Angle of—				Remaining velocity.	Energy.	Penetration (unbacked wrought-iron).
	Elevation.		Fall.				
Yards.	*Deg.*	*Min.*	*Deg.*	*Min.*	*Feet.*	*Foot-tons.*	*Inches.*
* 0	.....	.....	.....	.....	.....	.....	.....
100	.....	.....	.....	7	1,652	8,522	11.4
200	.....	3	.....	14	1,600	7,994	11.1
300	.....	10	.....	21	1,550	7,502	10.7
400	.....	17	.....	28	1,507	7,092	10.4
500	.....	24	.....	36	1,460	6,656	10.1
600	.....	31	.....	44	1,420	6,296	9.8
700	.....	40	.....	54	1,380	5,947	9.5
800	.....	49	1	5	1,340	5,607	9.2
900	.....	58	1	16	1,302	5,293	8.9
1,000	1	7	1	27	1,266	5,005	8.7
1,100	1	16	1	39	1,230	4,725	8.5
1,200	1	25	1	52	1,197	4,474	8.3
1,300	1	34	2	7	1,166	4,246	7.5
1,400	1	46	2	24	1,138	4,044	7.5
1,500	1	54	2	41	1,111	3,853	7.6
1,600	2	00	2	53	1,083	3,663	7.5
1,700	2	13	3	5	1,055	3,476	7.3
1,800	2	26	3	36	1,032	3,326	7.1
1,900	2	40	3	57	1,010	3,185	6.9
2,000	2	54	4	18	989	3,054	6.8
2,100	3	8	4	42	970	2,938	6.6
2,200	3	22	5	6	950	2,818	6.5
2,300	3	36	5	30	930	2,713	6.4
2,400	3	50	5	55	915	2,614	6.3
2,500	4	4	6	20	895	2,501	6.2
2,600	4	18	6	47	882	2,429	6.1
2,700	4	32	7	14	865	2,336	6.0
2,800	4	46	7	42	851	2,262	5.9
2,900	5	00	8	12	836	2,182	5.8
3,000	5	14	8	48	822	2,110	5.7
3,100	5	31	9	24	807	2,033	5.6
3,200	5	48	10	3	795	1,973	5.5
3,300	6	5	10	43	783	1,914	5.4
3,400	6	22	11	27	771	1,857	5.3
3,500	6	42	12	11	758	1,794	5.2
3,600	7	2	12	55	747	1,742	5.1
3,700	7	24	13	39	734	1,681	5.1
3,800	7	49	14	23	725	1,641	5.0
3,900	8	14	15	7	714	1,592	4.9
4,000	8	39	15	51	704	1,546	4.8
4,100	9	4	16	36	696	1,512	4.75
4,200	9	29	17	22	687	1,474	4.7
4,300	9	54	18	9	678	1,436	4.7
4,400	10	19	18	57	670	1,402	4.65
4,500	10	44	19	45	661	1,365	4.55
4,600	11	14	20	33	653	1,330	4.5
4,700	11	44	21	22	645	1,299	4.45
4,800	12	14	22	9	637	1,267	4.39
4,900	12	44	22	59	629	1,236	4.27
5,000	13	14	23	49	622	1,207	4.22
5,100	13	44	24	39	615	1,180	4.2
5,200	14	14	25	36	608	1,153	4.19
5,300	14	44	26	33	601	1,126	4.14
5,400	15	16	27	36	594	1,102	4.04
5,500	15	49	28	43	588	1,079	4.03
5,600	16	23	29	50	581	1,054	4.00
5,700	16	58	31	7	575	1,032	3.97
5,800	17	33	33	24	569	1,011	3.92
5,900	18	8	34	44	563	989	3.88
6,000	18	46	36	17	557	969	3.8

* Energy and penetration on basis of 450 pounds weight of projectiles.

PLATE I.



— HALF FRONT VIEW —

— HALF REAR VIEW —

10 5 0 10 20 30 40 50 60

— SCALE OF INCHES —

APPENDIX 12.

INSPECTING GLASS FOR SPRINGFIELD RIFLES AND CARBINES.

(1 plate.)

Fig. 1 is a perspective view from the front and above. Fig. 2, a longitudinal section through receiver and through the instrument when in a forward position, with a side view of breech-block. Fig. 3, a cross section through the receiver at the ejector-stud, with the instrument in rear position.

A brass frame, B, shaped to fit in the receiver A, holds a mirror, M, by which the bore can be viewed from the rear, or which illumines the bore for observation from the muzzle.

Portions of the brass frame at *t*, *t*, *t* are turned down to hold the mirror against the inclined face of a wooden block, W, concealed within the frame to stiffen it and prevent the crushing of the glass. The mirror does not extend quite to the top.

When the instrument is set well forward it is held between the breech-block, resting on the bar *b*, and the ejector-stud L, which supports the beveled face *l*.

A hole, H, in the bottom fits over the ejector-stud when the instrument is set well back, and the breech-block rests at *d* against the face *b*, holding the frame in place as before.

As at first designed, springs were to have been added to fit over the sides of the receiver and hold the frame in place, but this arrangement proved unnecessary. The springs are shown at S in Fig. 3.

This glass can also be used in inspecting the barrel of revolvers when the cylinder is removed.

A. H. RUSSELL,
Captain, Ord. Dept., U. S. A.

VANCOUVER BARRACKS ORDNANCE DEPOT,
March 30, 1886.

DIRECTIONS FOR USE.

This instrument is designed to facilitate the inspection of chambers and bores of Springfield rifles and carbines.

For this purpose, raise the breech-block, place the mirror in the receiver in such a position that the ejector-stud shall fit in the hole on the under side of the mirror-frame, or that the lower rear corner of the frame shall be immediately in front of the ejector-stud, as may be found most convenient.

To examine the chamber and rear portion of bore, cause the light to pass down the bore from the muzzle, and look at the mirror in a direction perpendicular to the axis of the piece.

To examine the front portion of the bore, cause the reflected light from the mirror to pass up the bore, and look down from the muzzle.

NATIONAL ARMORY.
Springfield, Mass., June 30, 1886.

INSPECTING GLASS
for SPRINGFIELD RIFLES and CARBINES

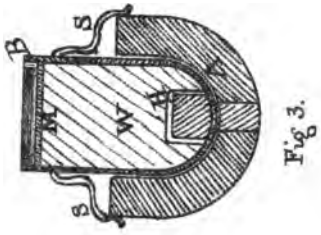


Fig. 3.

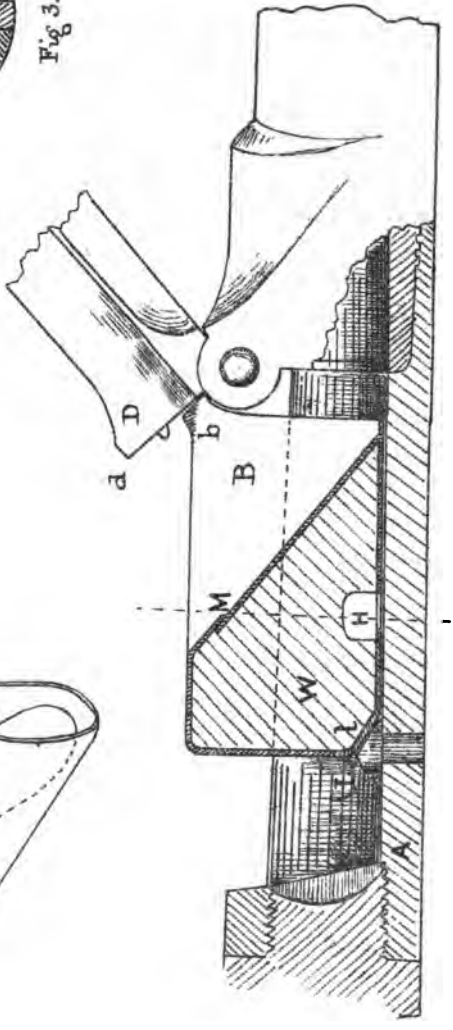


Fig. 2

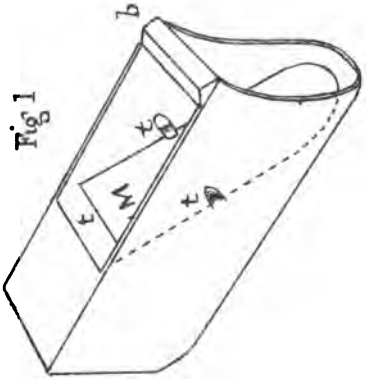


Fig. 1

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