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REPORT No. 710/29

5TH REPORT - COMPOSITE PLATE

C19 TO C26

CHANGE OF SPACES AND OF INNER MATERIAL

WATERTOWN ARSENAL, WATERTOWN 72, MASS.

O. W. MARTIN
1ST. LT., ORD. DEPT.

SEPTEMBER 15, 1934

WATERTOWN ARSENAL
WATERTOWN, MASS.

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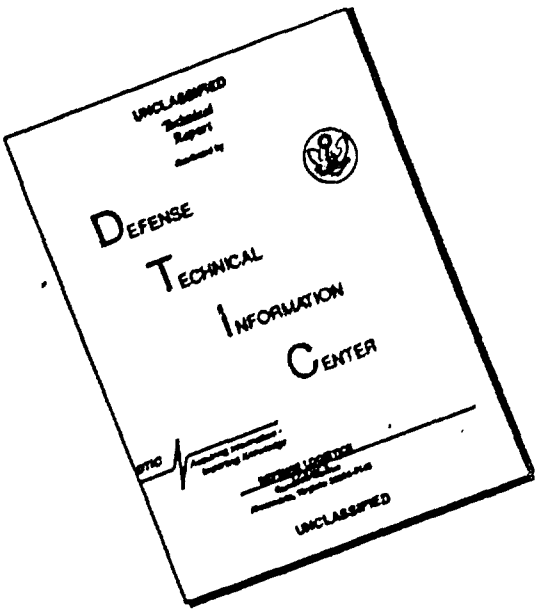

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Frankford Arsenal	-		1		1	-
Picatinny Arsenal	-		1		1	-
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1 - Cornell Aeronautical Laboratory

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REPORT NO. 710/29

5th REPORT - COMPOSITE PLATE

C 19 to C 26

CHANGE OF SPACES AND OF INNER MATERIALS

by

D. J. MARTIN
1st. Lt., Ord. Dept.

1934

Report No. 710/29 November 18, 1934
Watertown Arsenal

5th Report - Composite Plate
C 19 to C 26
Change of Spaces and of Inner Materials

This report covers tests on composite plates C 19 to C 26 in which variations were made in the space, weight, and order of the inner plates.

Plate C 19 was tested with a warped 1/8" plate on the rear. This plate was fastened securely to the other plates as shown in the sketch attached hereto. The space varied from nothing at the top and bottom to about 1/8" at the center. All of the shots fired were placed near the top where there was very little space. The results seemed to indicate that better resistance to penetration might be obtained without any space between plates.

As a result of the test on C 19 plates C 20 and C 21 were made up exactly alike except that C 20 had the 1/8" space, as shown, and C 21 had no space between the two back plates. The results indicate that C 21 - with no space - is better than C 20. It was found at an earlier date (see Rep.710/14) that 1/4" space gave poorer resistance than 1/8" of space. It now appears that no space at all is best. The amount of spring inherent in the materials is probably sufficient to permit the desired "working" in the low carbon and duralumin plates.

In plate C-22 the positions of the low carbon and duralumin plates were reversed. The results were not as satisfactory. It is, therefore, concluded that the duralumin plate should be close to the front plate, and followed by the low carbon steel plate.

In C-23 the thickness of the duralumin plate was cut from 3/16" to 1/8". The results obtained were excellent and it is apparent that this combination is as good as C-1 with slightly less weight.

C-24 was made up like C-23 except that 1/16" of low carbon steel was used, in place of 1/8". This combination seems to be as good as C-1, and weighs 3 pounds per sq. ft. less than C-1. The weight of this combination is equal to that of solid armor plate approximately 19/32" (0.594"). Its ballistic limit is greater than 2488 f.s.

Plate C-25, consisting of a 1/8" sheet of duralumin between two 1/4" plates, gave very good results. Apparently it is almost as good as plate C-1. Its weight was equivalent to that of solid armor plate approximately 17/32" (0.531") thick and its ballistic limit was greater than 2488 f.s. It is believed to have a decided advantage over 1/2" armor plate in that it would defeat the Gerlich-type bullet

in addition to the U. S. cal. .30 A.P. M 1922, for approximately the same weight.

Plate C-26, with 1/16" of low carbon steel between two 1/4" plates, was not satisfactory.

Respectfully submitted:

D. J. Martin
1st. Lt., Ord. Dept.

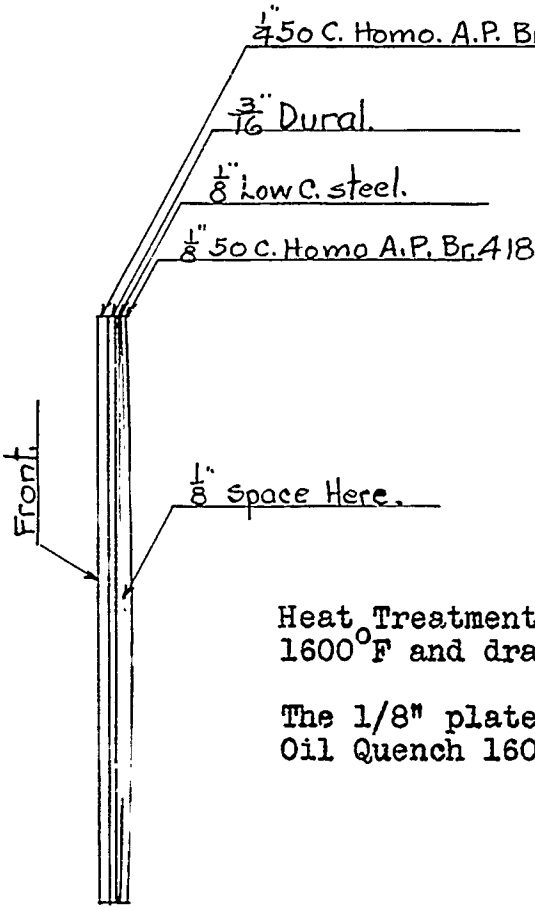


PLATE NO. C - 19

DATE Aug. 30, 1934

The armor plate was rolled from ingot at Henry Disston & Sons Co. and heat treated at the Watertown Arsenal.

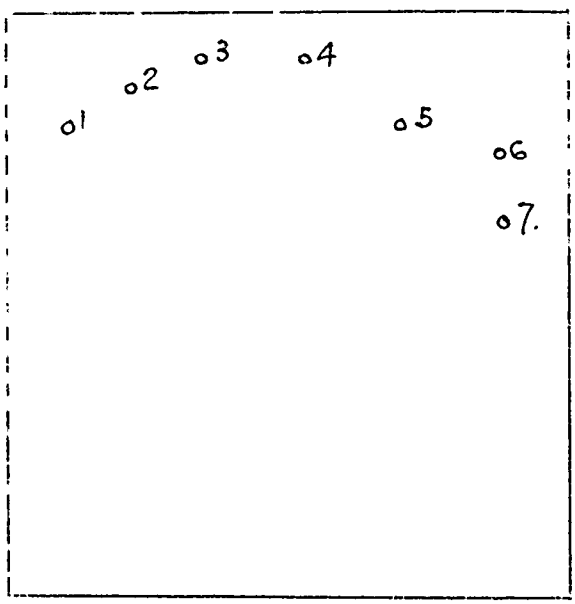
1/8" 50 C. Homo A.P. Br. 418 was curved as shown on sketch, by the Heat treatment. This plate was used as no others of this thickness were available, at the time of test.

Heat Treatment for 1/4" Plate. Oil Quenched at 1600°F and drawn at 525°F 2 hrs. Brinell 477.

The 1/8" plate was heat treated in the usual manner, Oil Quench 1600°F drawn at 1000°F 2 hrs. Brinell 418.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.30



ROUND NO.	STRIKING VELOCITY	REMARKS
	2488	All O.K. except No. 5. No. 5 just barely shows daylight.

Apparently better results where there is no space at all.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

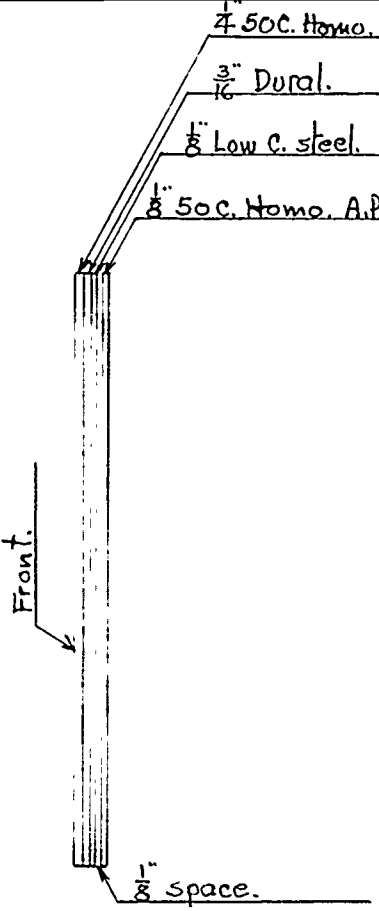


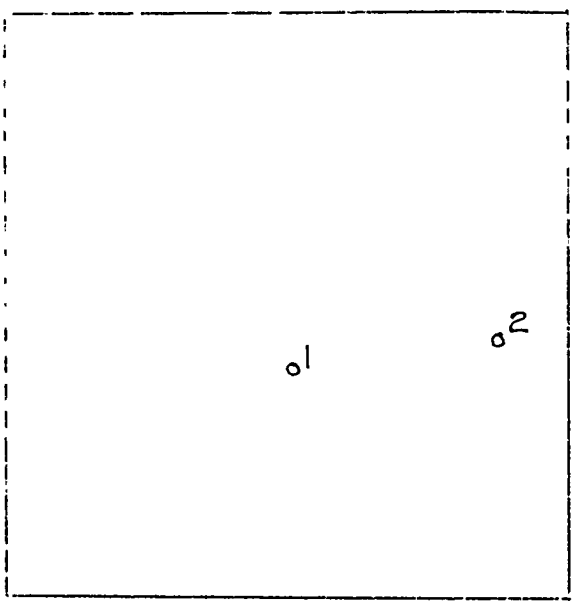
PLATE NO. C - 20

DATE Aug. 31, 1934

The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.30



ROUND NO.	STRIKING VELOCITY	REMARKS
	2488	1 - O.K.
		2 - Slight crack in back plate.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

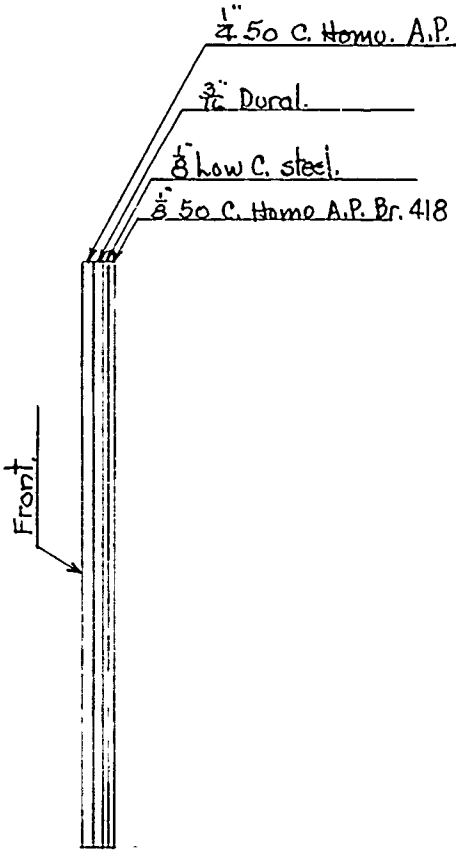


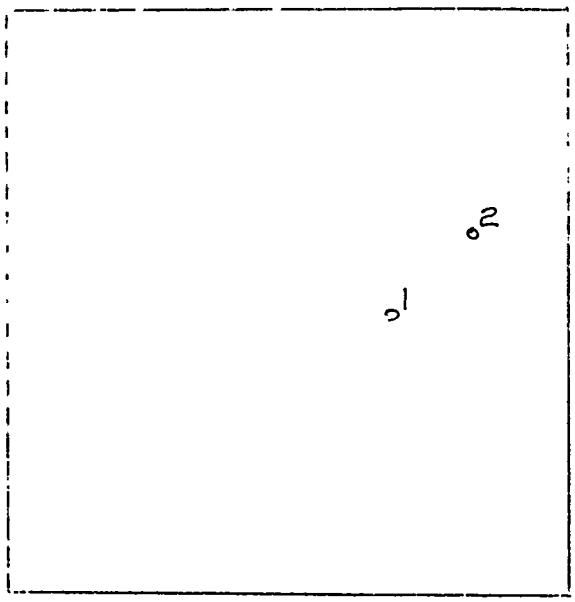
PLATE NO. C - 21

DATE Aug. 31, 1934

The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	..03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.[illegible]



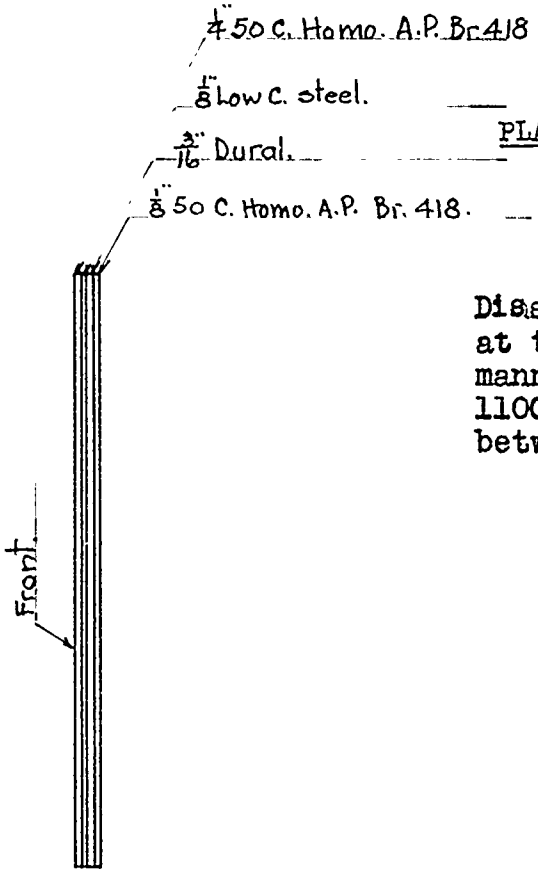
ROUND NO.	STRIKING VELOCITY		REMARKS
	2488	1	O.K.
		2	slight bulge on back

No space better than 1/8 space.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

PLATE NO. C - 22

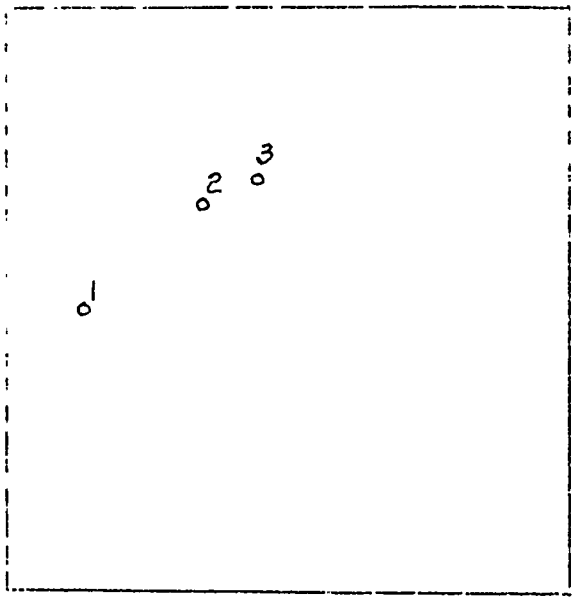
DATE Aug. 31, 1934



The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.30



ROUND NO.	STRIKING VELOCITY	REMARKS
	3488	All cracked daylight on back.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

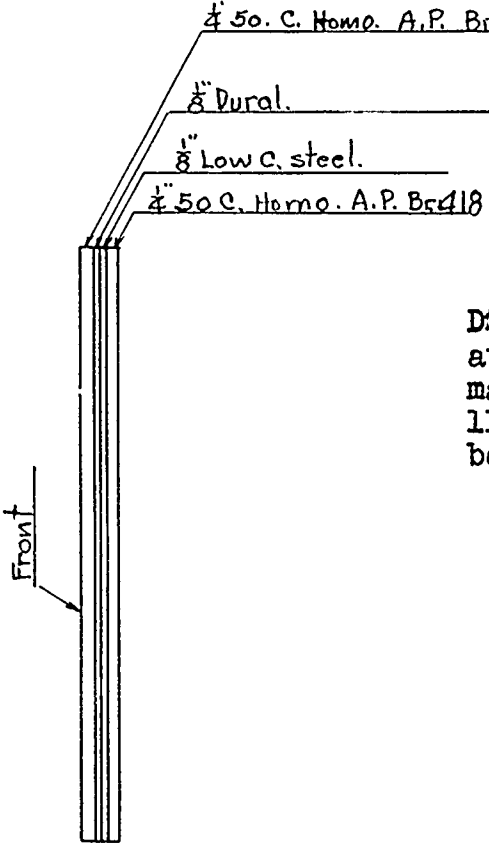


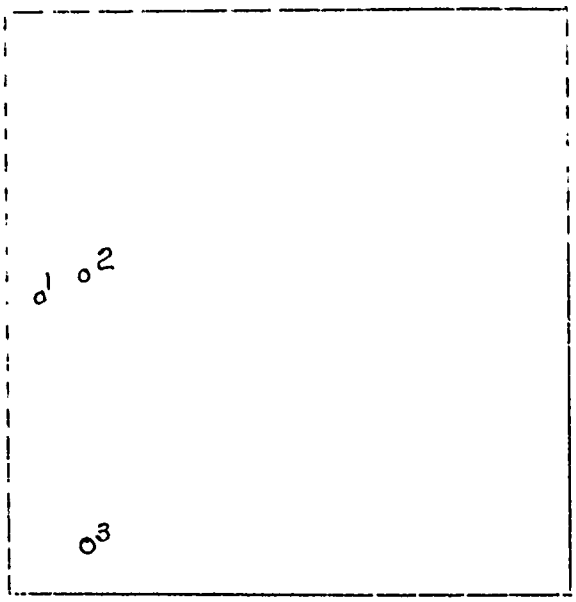
PLATE NO. C - 23

DATE Aug. 31, 1934

The plates were rolled by Henry Diaston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	..03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.



ROUND NO.	STRIKING VELOCITY	REMARKS
	2488	1 - Slight bulge
		2 - No bulge
		3 - Excellent

plates were drawn closer at corner and apparently effect is better - no bulge core only buried to ogive.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

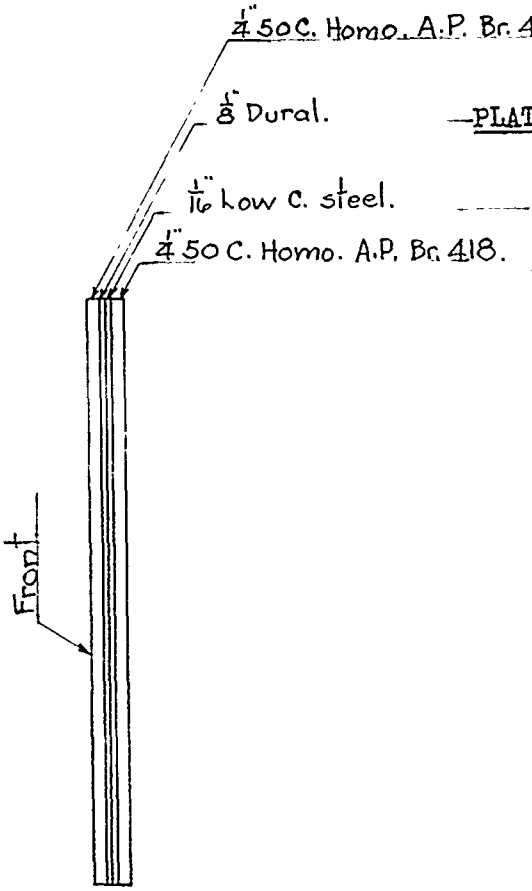


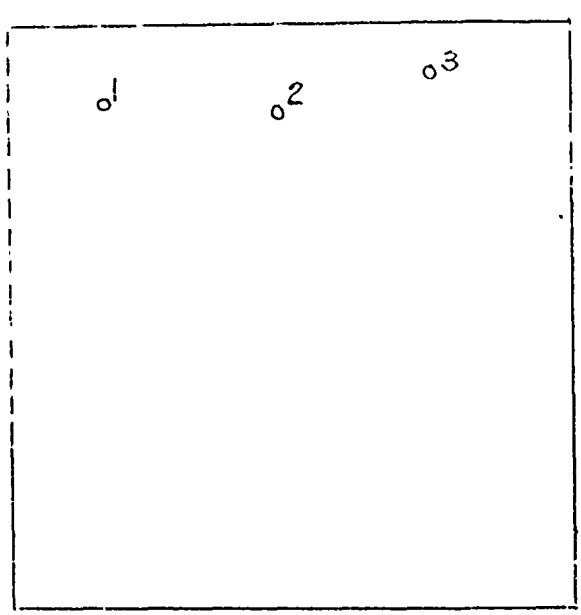
PLATE NO. C - 24

DATE Aug. 31, 1934

The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.30



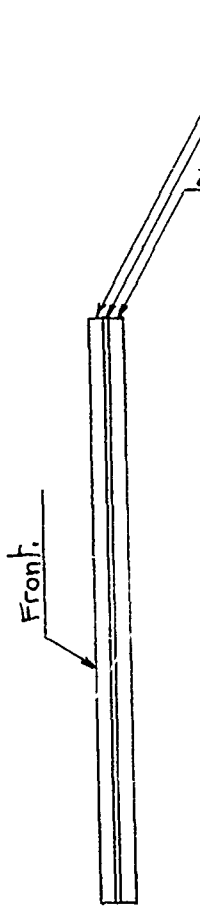
ROUND NO.	STRIKING VELOCITY	REMARKS
1	2488	Slight bulge
2	2488	No bulge
3	2488	Slight bulge

This looks as good as C 1 and weighs 1/8 L C + 1/8 Dural less than C 1.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

PLATE NO. C - 25

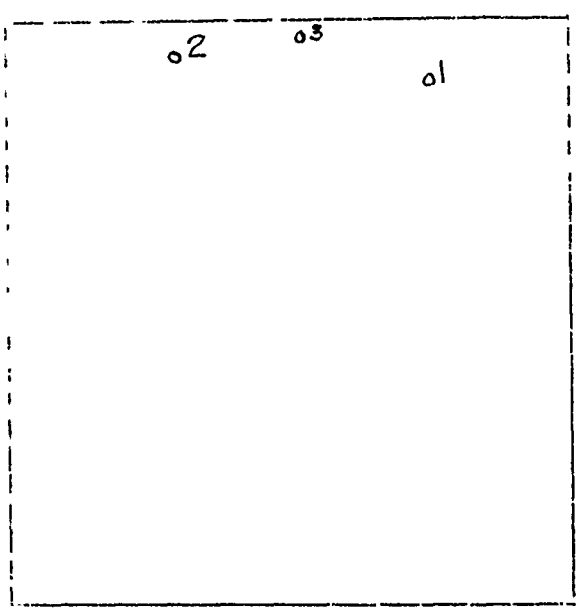
DATE Aug. 31, 1934



The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.3



ROUND NO.	STRIKING VELOCITY	REMARKS
1	2488	Slight bulge
2		bulge - no crack
3		bulge - no crack

About as good as 24, better than most of the others.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.

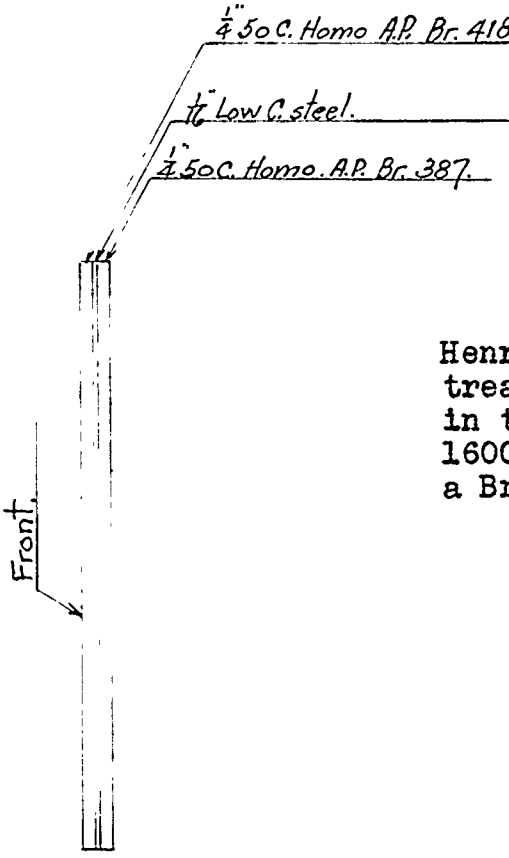


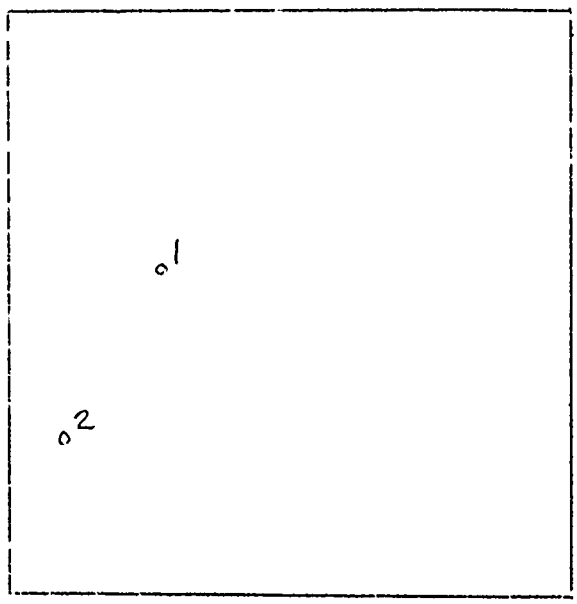
PLATE NO. C - 26

DATE Aug. 31, 1934

The plates were rolled by Henry Disston & Sons Co. and heat treated at the Watertown Arsenal in the usual manner, Oil Quench 1600°F drawn at 1100°F 2 hrs for a Brinell hardness between 418 to 430.

ARMOR PLATE COMPOSITION

C.	Mn.	P.	S.	Si.	Cr.	Mo.	Va.
.45/.55	.40/.60	<.03	<.03	.15/.25	1.10/1.30	.60/.80	.20/.30



ROUND NO.	STRIKING VELOCITY	REMARKS
1	2488	Bulge & crack
2	2488	Bulge & crack

Daylight thru not as good as 24 or 25.

PLATE NORMAL, 100 YD. RANGE, .30 CAL. M1922 A.P. BULLETS, MANN BARREL UNLESS NOTED OTHERWISE.