

FILE COPY

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R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 916.

Report on Comparison of Flat Wrenches.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
—
ORE DRESSING AND
METALLURGICAL LABORATORIES



CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Material and Object of Investigation:

The office of the D.C.I.A.(G), Department of National Defence, Ottawa, Ontario, requested a report on the properties of a group of wrenches submitted by them on October 10th, 1940. Seven brands of wrenches were examined.

Handle Design:

Four types of handle design were observed:

<u>Shape</u>	<u>Brand</u>
1. The "Dumbbell" type.	<u>AUTO-KIT</u>
2. The "Diamond Oval" type.	<u>BLUE POINT SUPREME</u>
3. The "Flat" type.	<u>GRAY</u>
4. The "Oval" type.	<u>WILLIAMS</u> <u>BLACKHAWK ARMSTRONG</u> <u>WILLIAMS SUPERRENCH</u> <u>HERBRAND</u>

Illustrations:

Figure 1.

1.
Dumbbell



2.
Diamond Oval



3.
Flat



4.
Oval

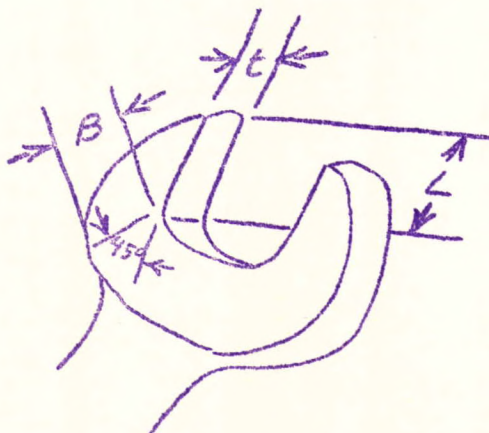


Jaw Design:

Some variations in design of jaws were observed.

Dimensions of jaw are shown in Figure 2.

Figure 2.



t = Thickness.
L = Length.
B = Base.

(Continued on next page)

(Jaw Design, cont'd) -

Dimensions:

<u>Area of base,</u> B x t, sq. in.	<u>Area of jaw,</u> t x L, sq. in.	<u>Brand of wrench,</u> 3/4 in. size
0.12	0.18	Blue point Supreme.
0.1875	0.225	Blackhawk Armstrong.
0.165	0.21	Herbrand.
0.155	0.217	Williams Superrench.
0.170	0.186	Gray.
0.1925	0.2275	Williams.
0.18	0.21	Auto-Kit.

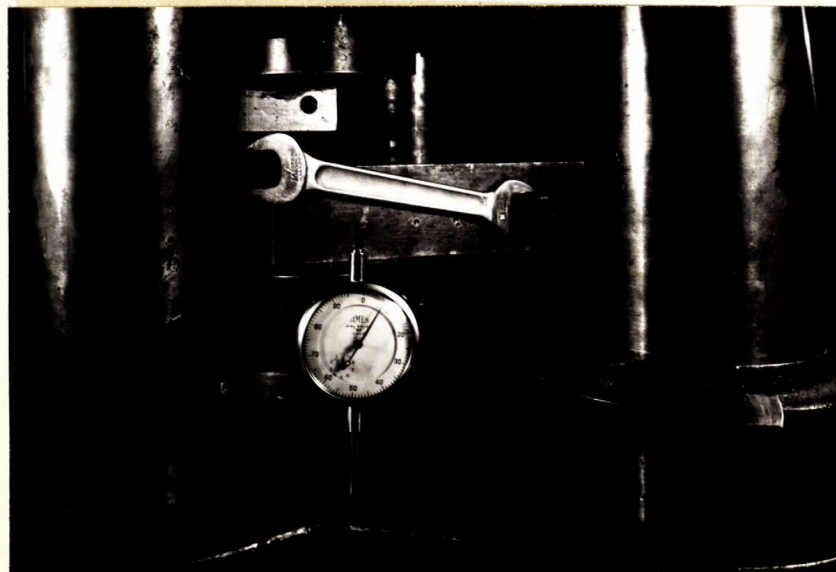
Hardness:

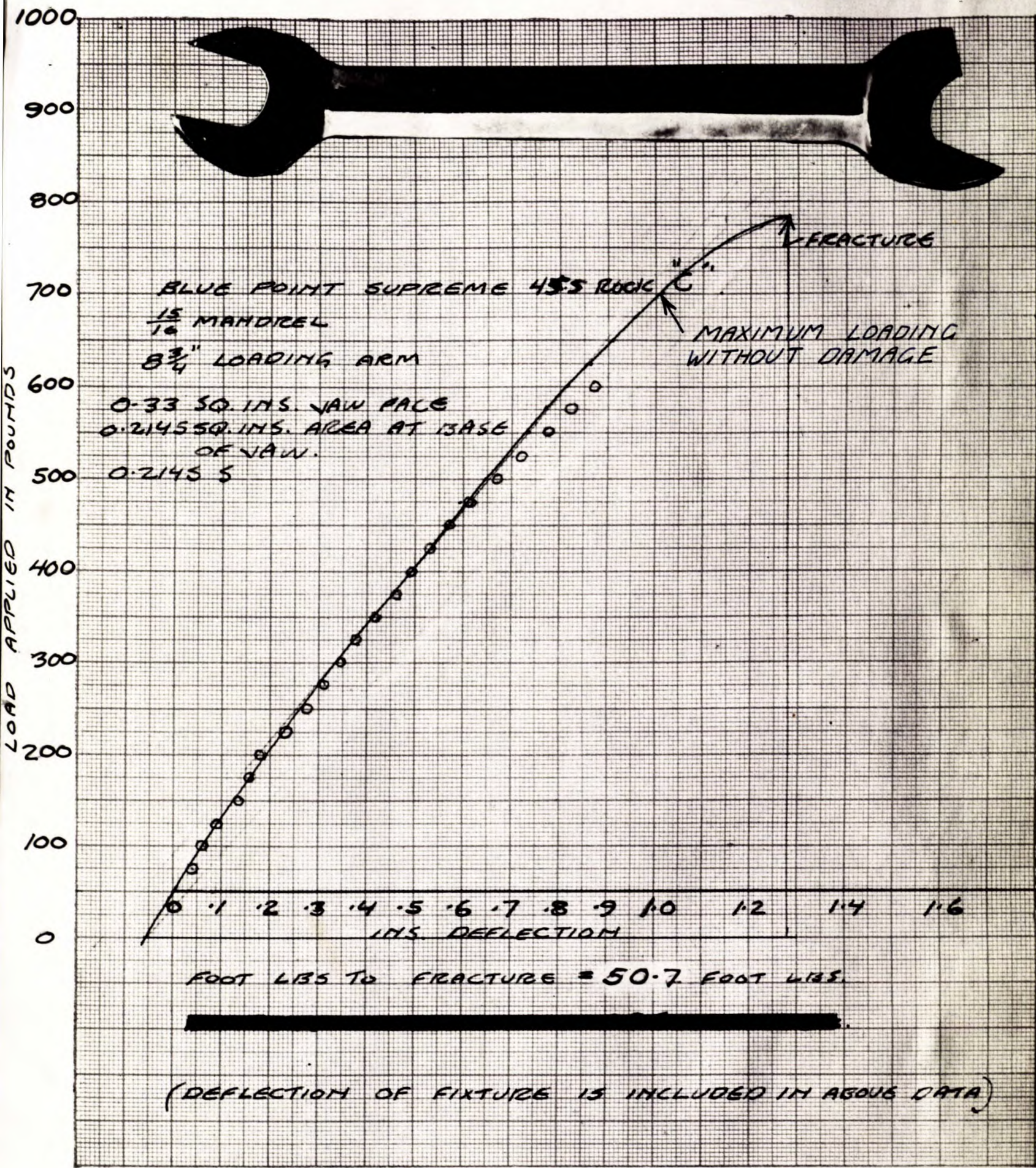
	<u>Rock. "C"</u>
Blue Point Supreme	- 49.5
Blackhawk Armstrong	- 42.0
Herbrand	- 41.0
Williams Superrench	- 44.0
Gray	- 41.0
Williams	- 37.0
Auto-Kit	- 47.0

Loading Tests:

The wrenches were loaded in a fixture as shown in Figure 3. Load and deformation were recorded and the information plotted on charts as shown on photostatic copies attached between Page 3 and Page 4 of this report.

Figure 3.







BLACK HAWK ARMSTRONG
DROP FORGED CHROME VANADIUM 42 ROCK C

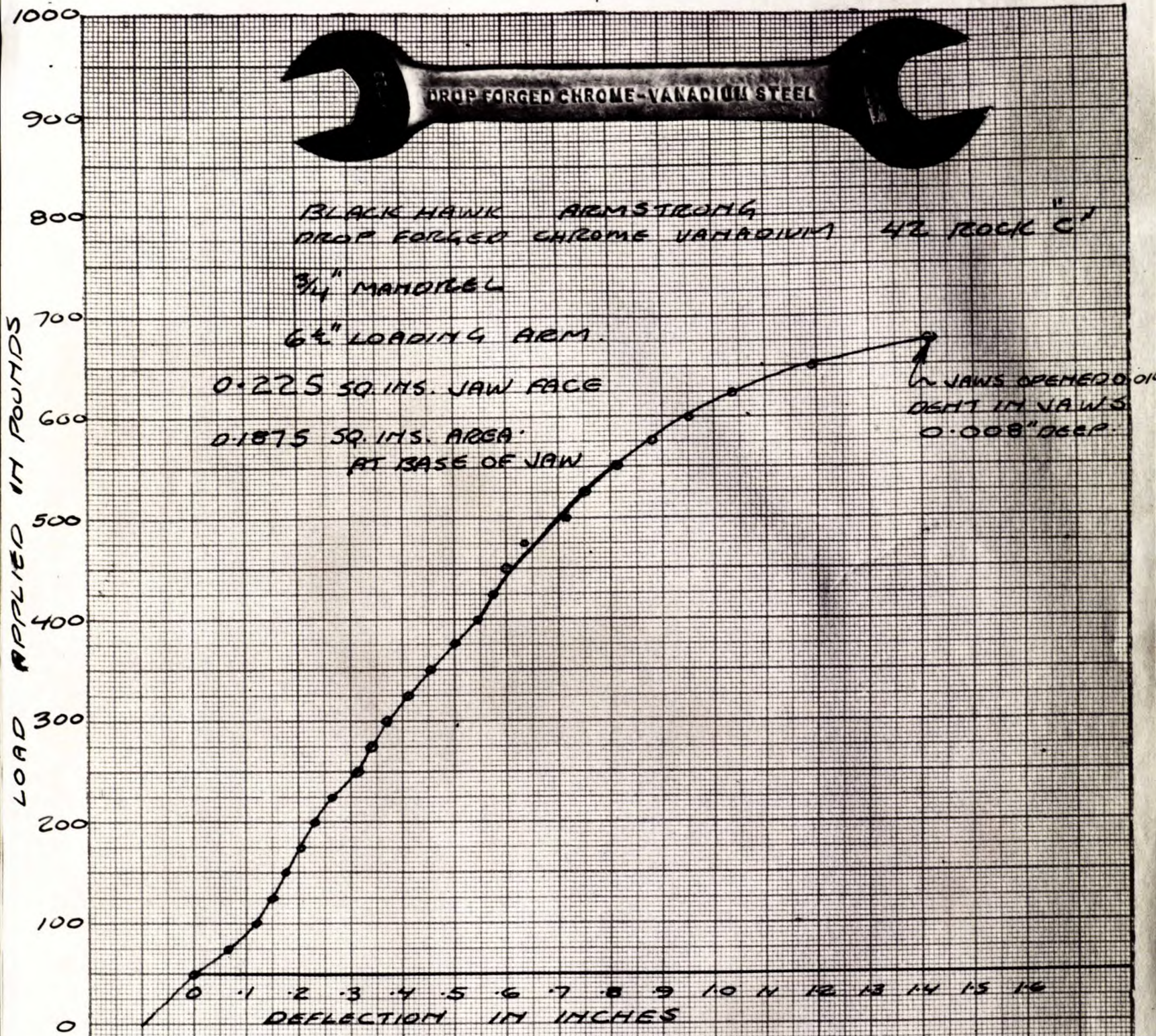
3/4" MANDREL

6 1/2" LOADING ARM.

0.225 SQ. IN. JAW FACE

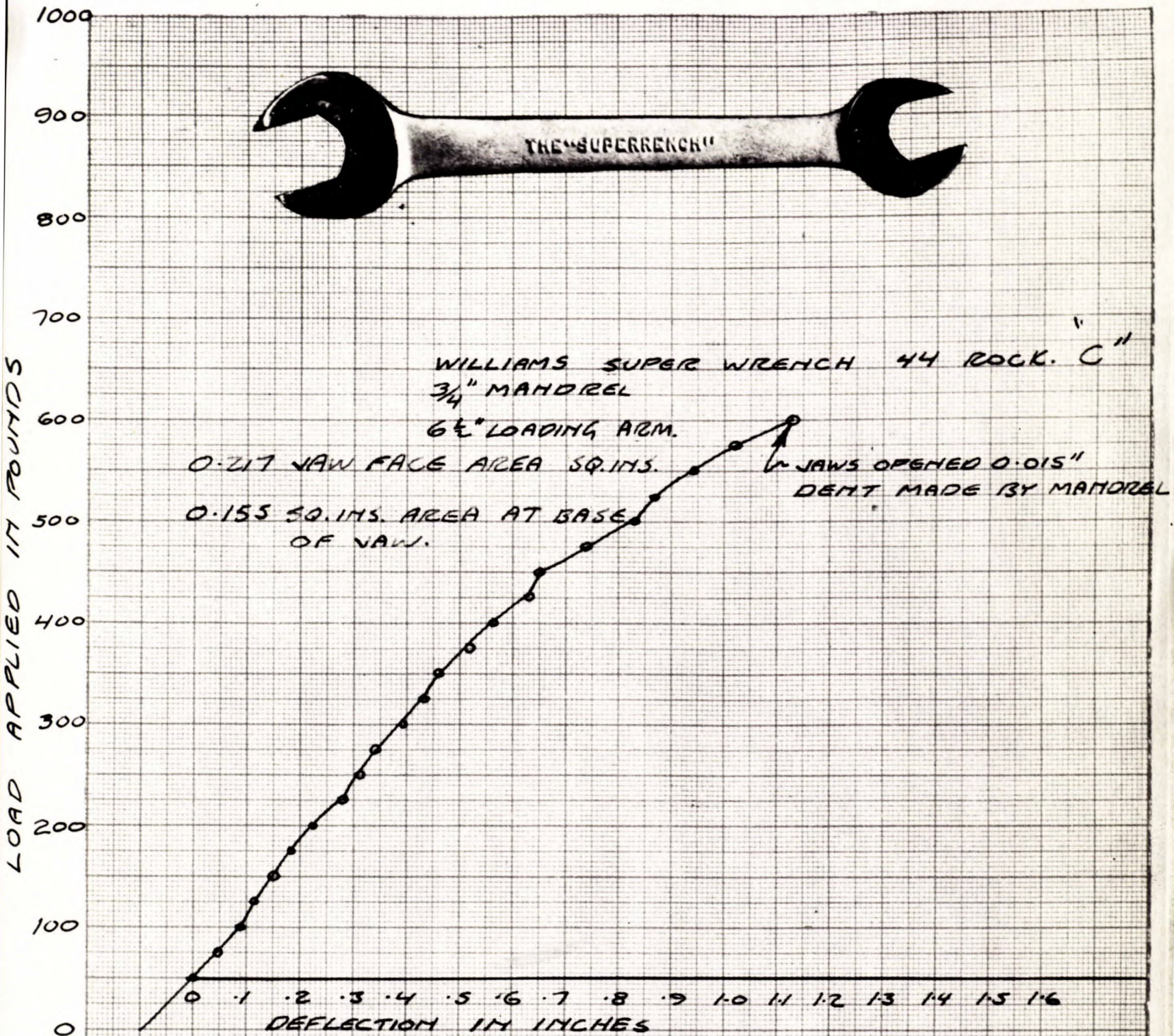
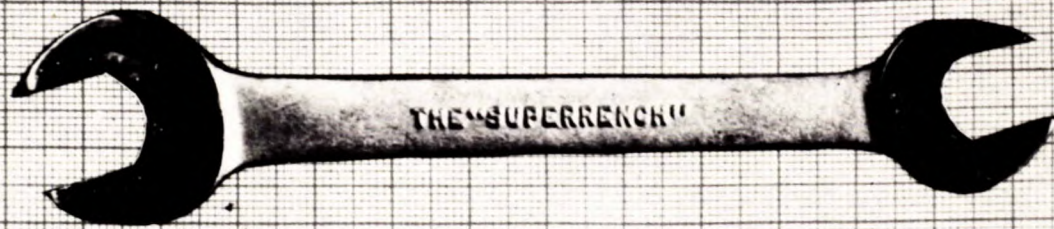
0.1875 SQ. IN. AREA
AT BASE OF JAW

JAWS OPENED ON
DENT IN JAWS
0.008" DEEP.



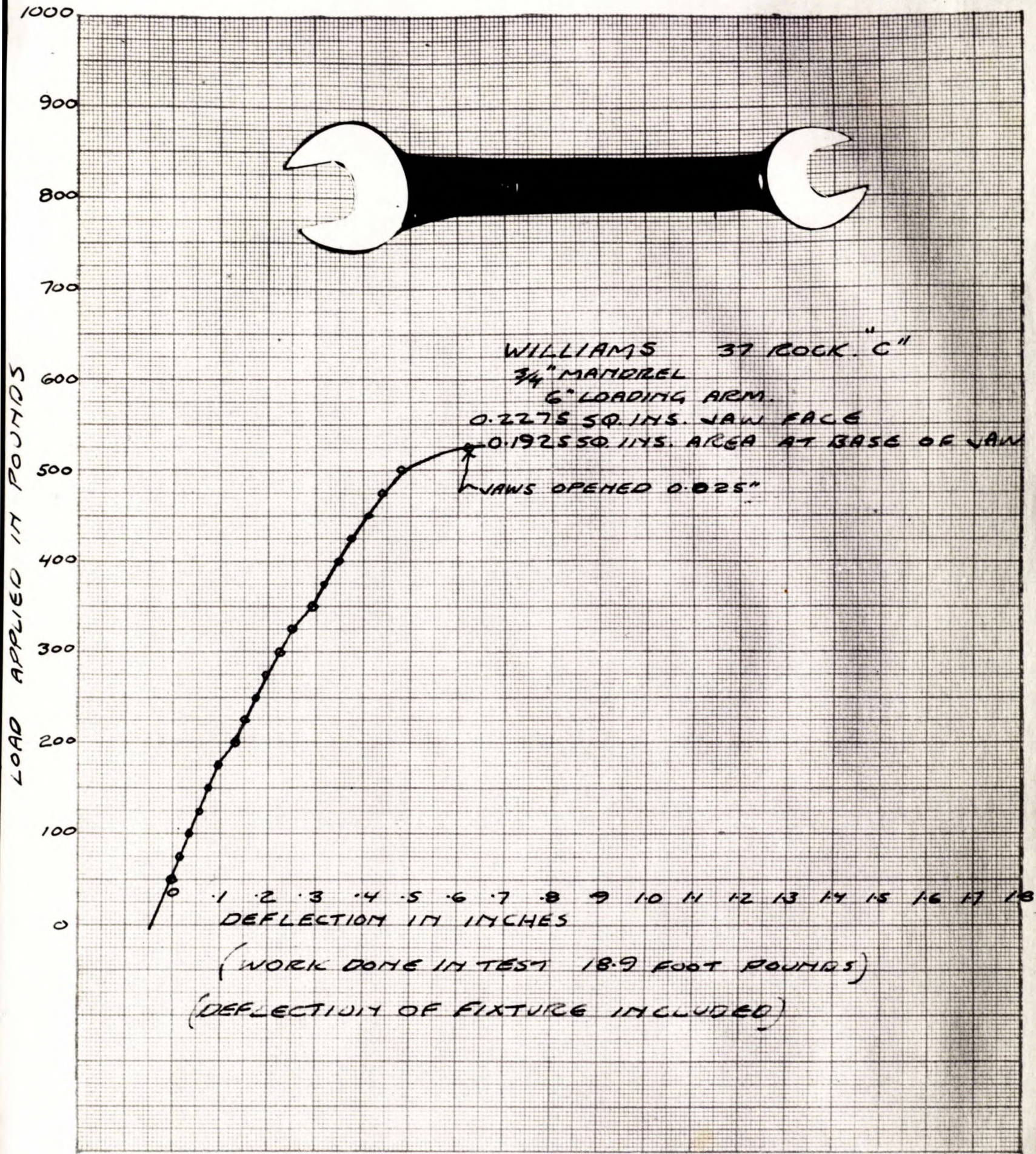
WORK DONE IN TESTING. 52 FOOT POUNDS

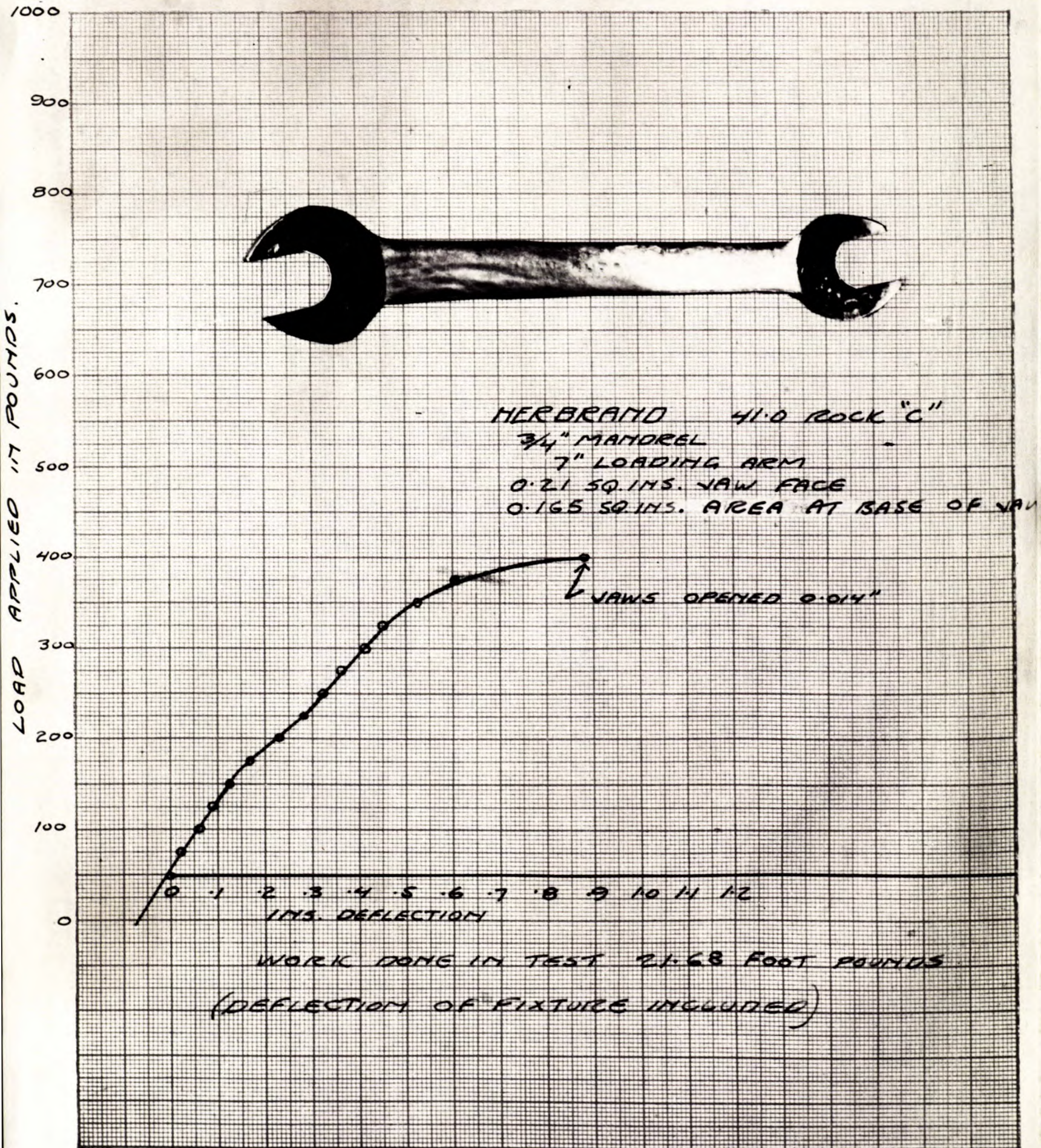
(DEFLECTION OF FIXTURE INCLUDED)

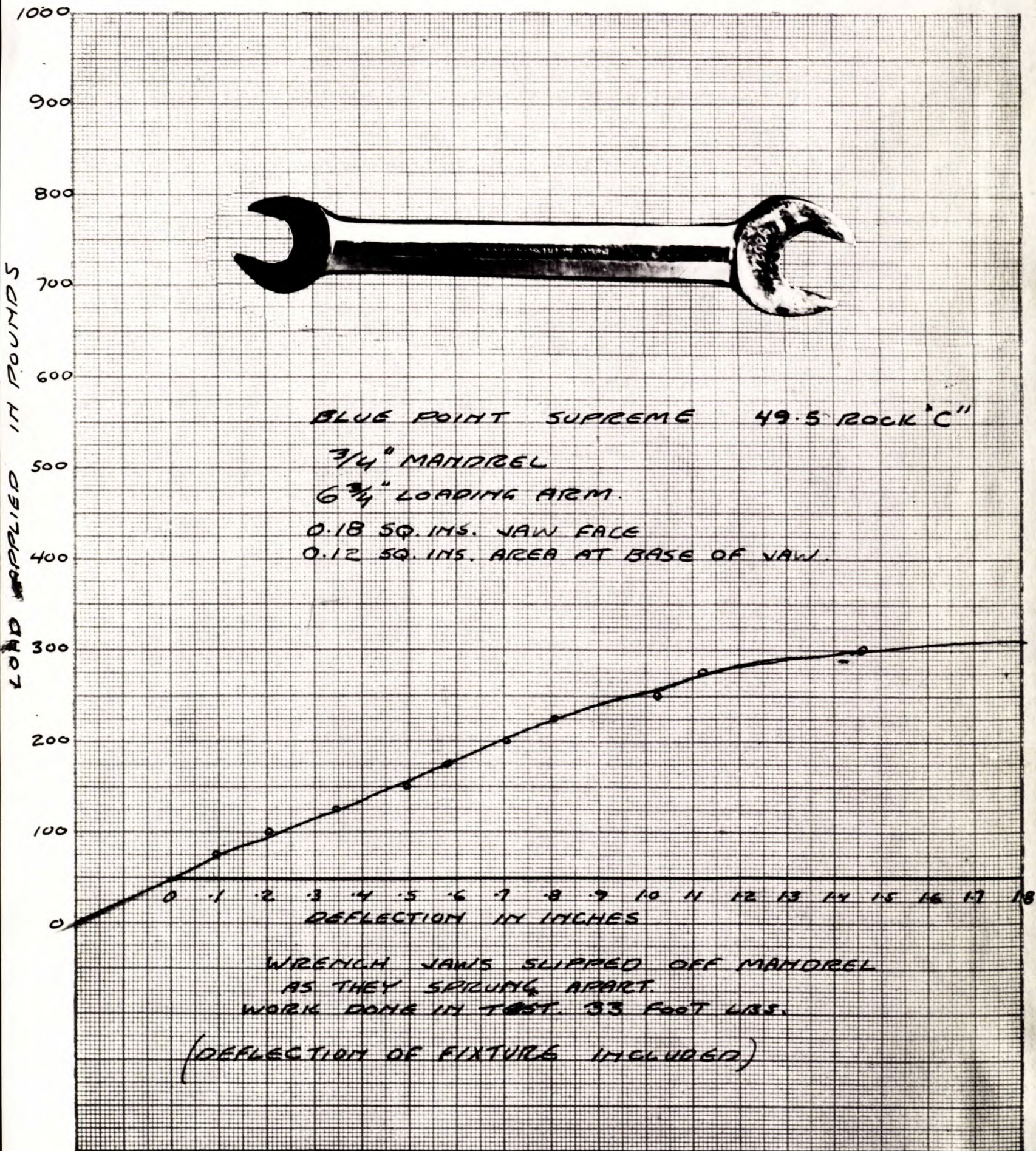


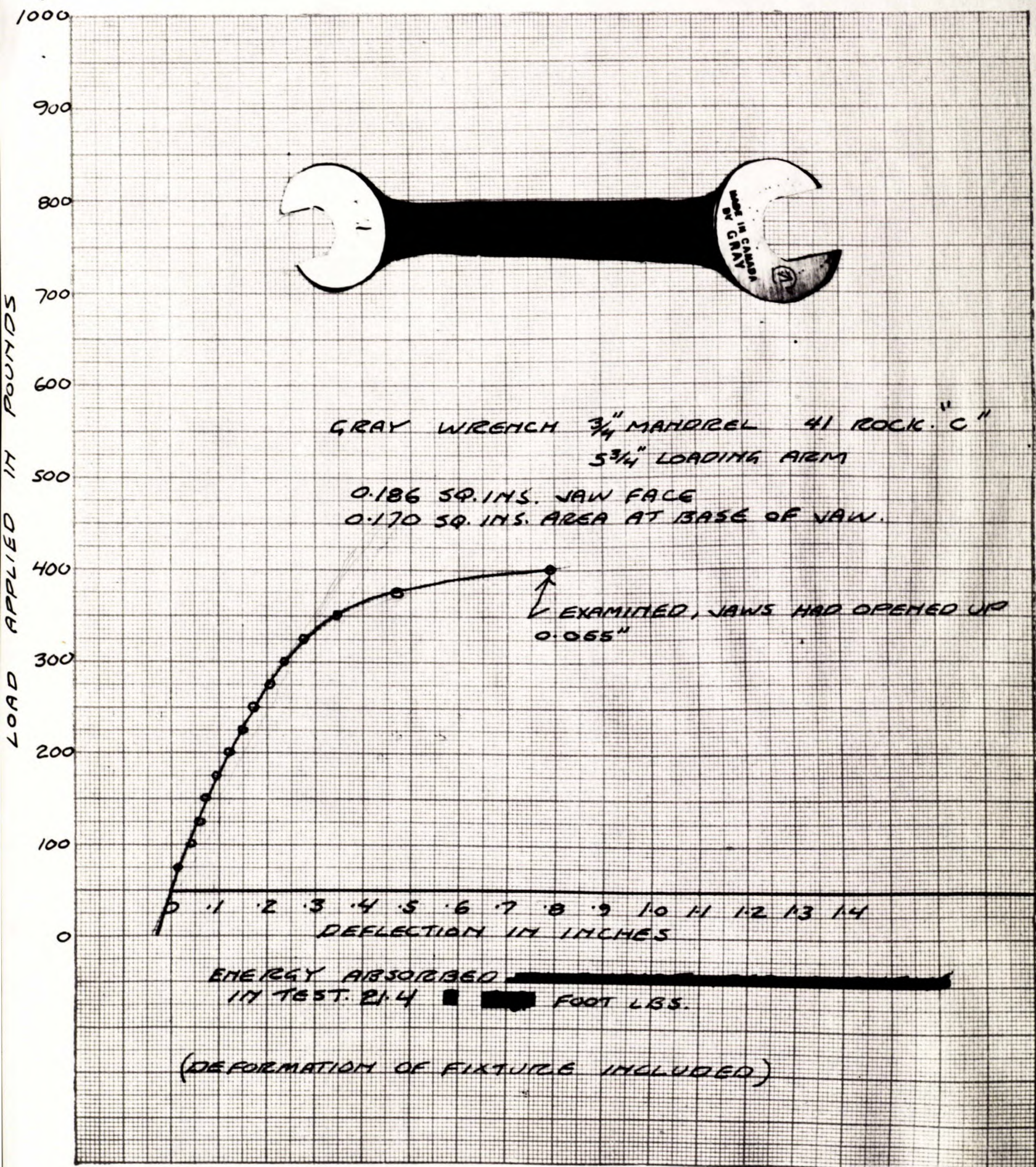
WORK DONE IN TEST 35.6 FOOT POUNDS.

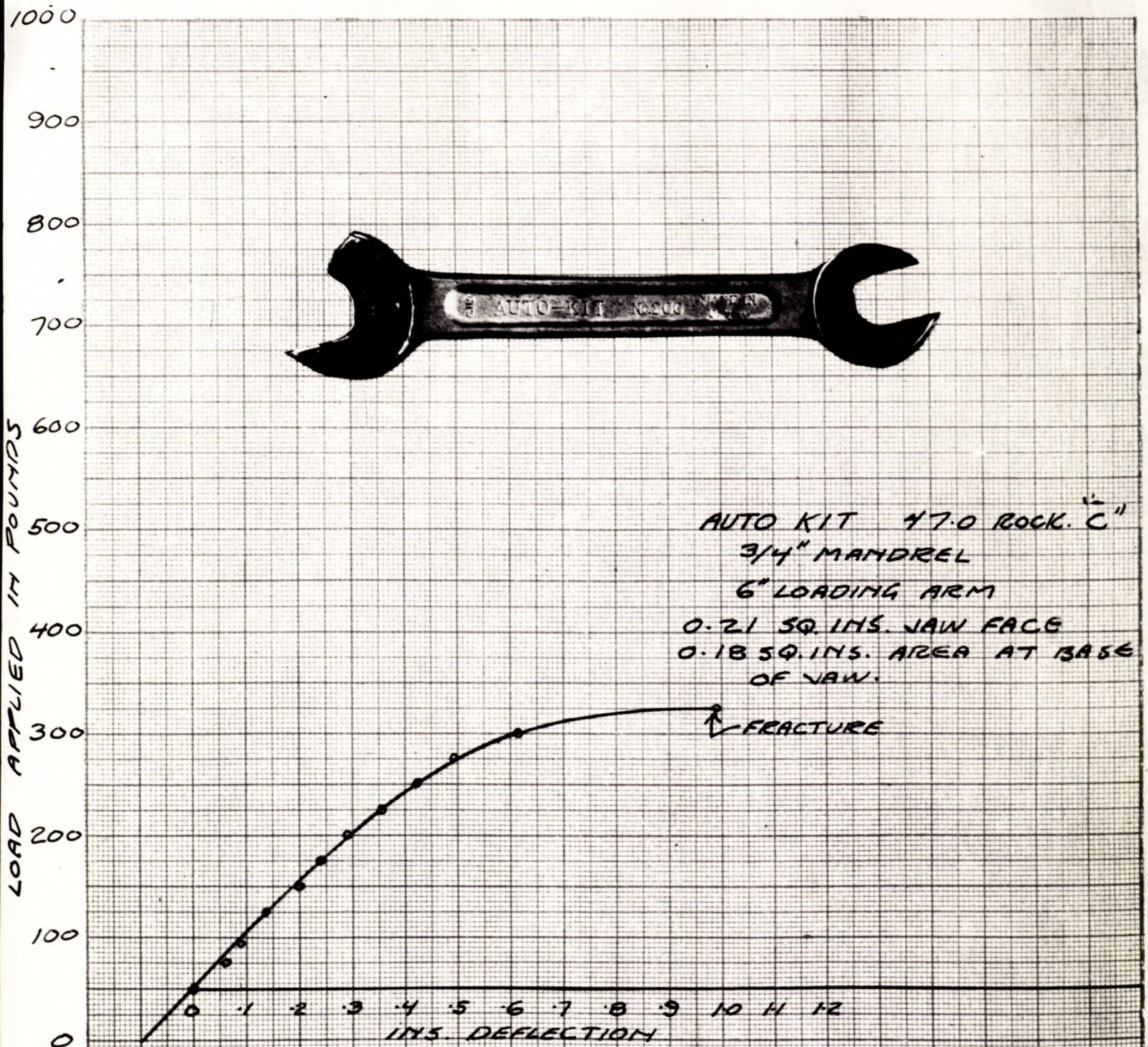
(DEFLECTION OF FIXTURE INCLUDED)





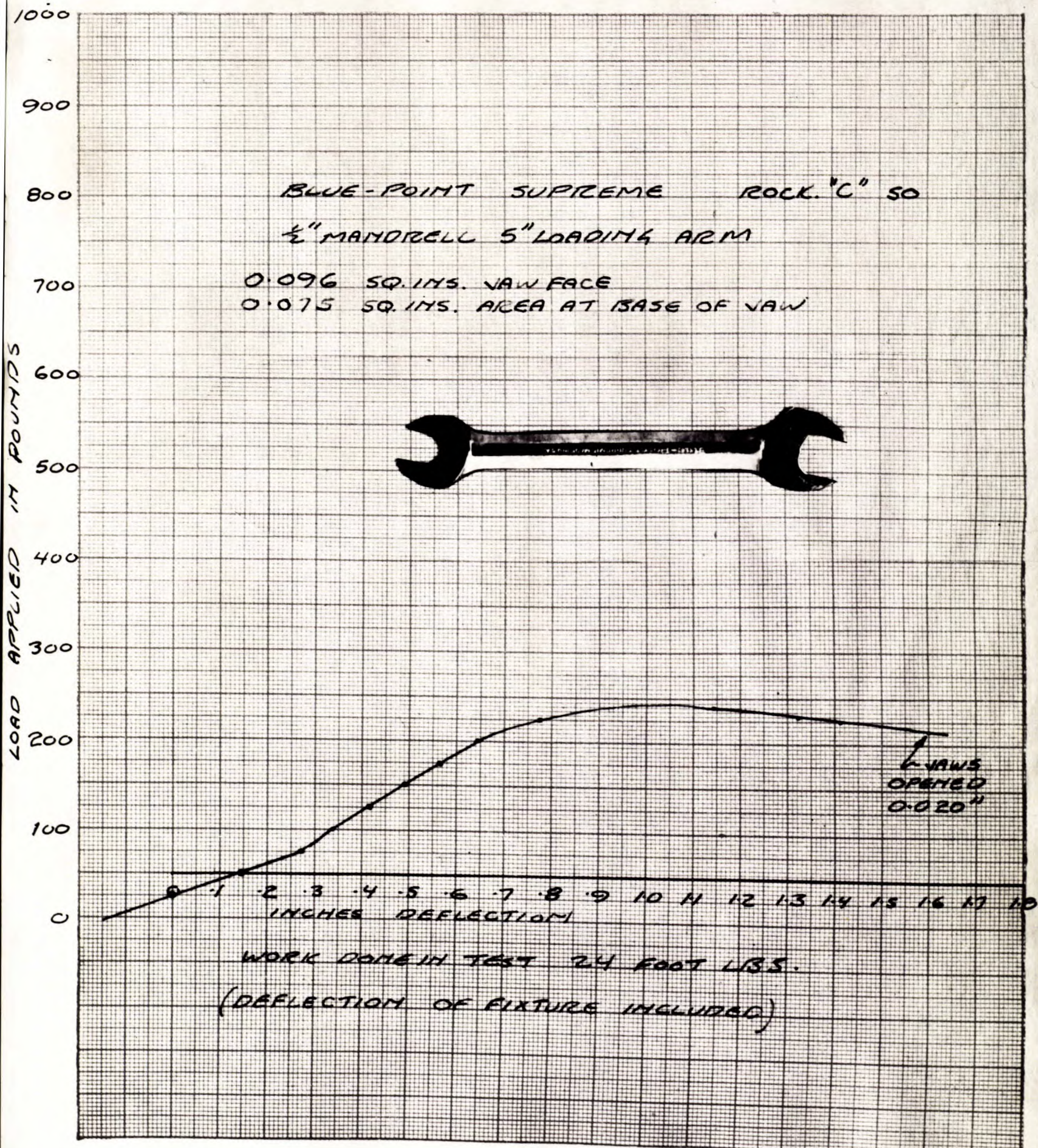




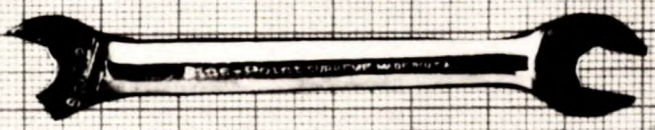
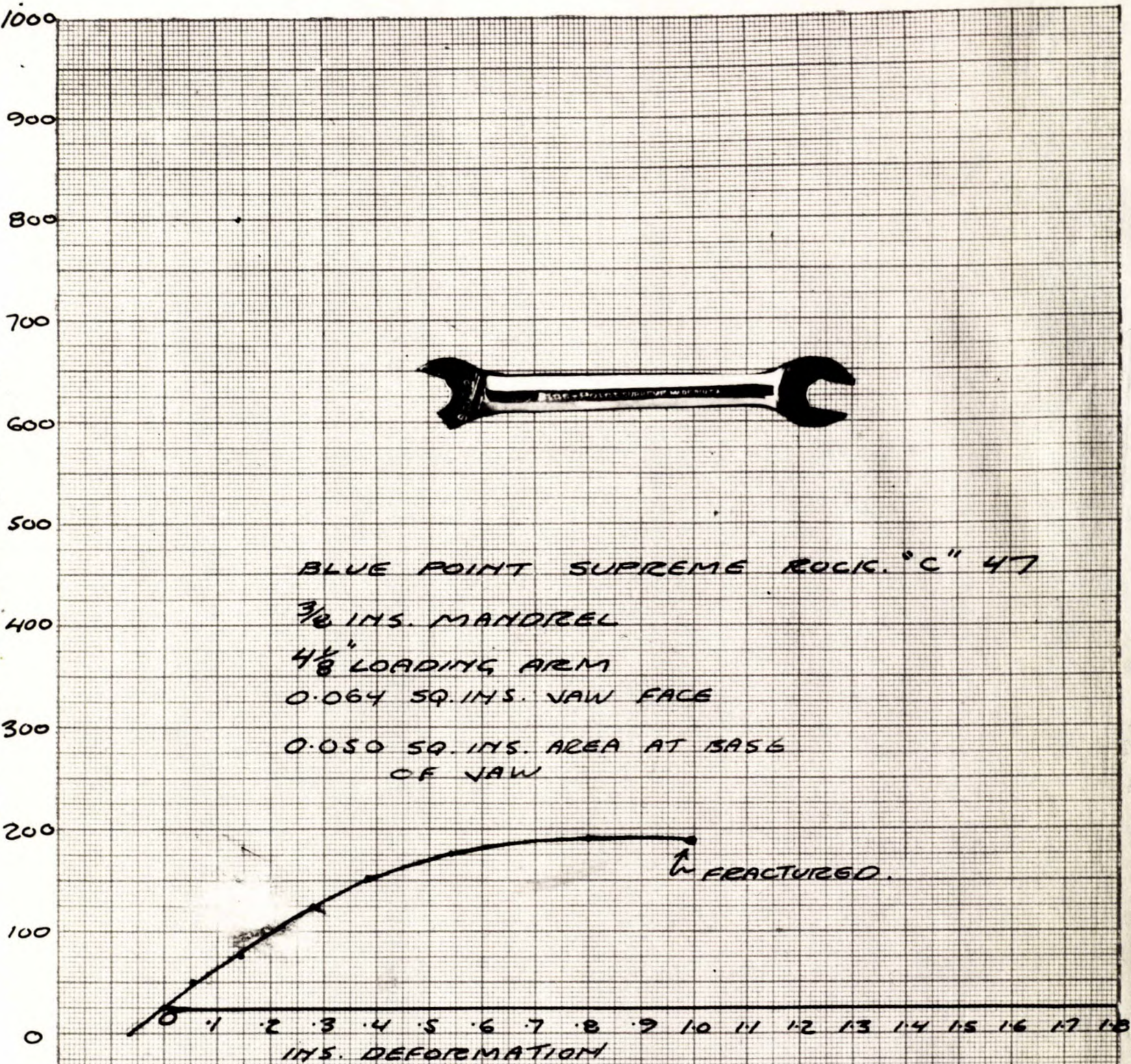


AUTO KIT 17.0 ROCK. C"
3/4" MANDREL
6" LOADING ARM
0.21 SQ. INS. JAW FACE
0.18 SQ. INS. AREA AT BASE
OF JAW.

WORK DONE TO FRACTURE = 20.45 FT. LBS.
(DEFORMATION OF FIXTURE INCLUDED)



LOAD APPLIED IN POUNDS



BLUE POINT SUPREME ROCK. "C" 47
 3/8 INS. MANDREL
 4 1/8" LOADING ARM
 0.064 SQ. INS. JAW FACE
 0.050 SQ. INS. AREA AT BASE
 OF JAW

WORK DONE IN TEST 12.37 FOOT POUNDS
 (DEFLECTION OF FIXTURE INCLUDED)

Summary of Physical Tests:

In summarizing the data in the following table the test results have been arranged in order of maximum allowable loading:

Name of wrench	Size, in.	Length, in.	Area of jaw, sq.in.	Area at base of jaw, sq.in.	Spring per 100 pounds, inches	Energy absorbed in test, ft.lb.	Maximum allowable loading, lb.	Hardness, Rock. "C"
Blue Point Supreme	15/16	10 1/2	0.33	0.2145	0.1575	50.7	700	45.5
Blue Point	7/8					42.3	700	
Blackhawk Armstrong	3/4	8	0.225	0.1875	0.143	52.0	625	42.0
Williams Superrench Williams Herbrand	5/8	7-7/8 7-5/16 8-3/16	0.217 0.227 0.21	0.155 0.192 0.165	0.195 0.105 0.175	35.6 18.9 21.7	575 500 350	44.0 37.0 41.0
Blue Point Supreme	3/4	7 3/4	0.18	0.12	0.460	33.0	300	49.5
Gray	3/4	7	0.186	0.17	0.085	21.4	300	41.0
Auto-Kit	3/4	7-3/16	0.21	0.18	0.200	20.45	275	47.0
Blue Point Supreme	1/2	5-7/8	0.096	0.075	0.310	24.0	200	50.0
Blue Point Supreme	3/8	4 1/4	0.06	0.05	0.320	12.37	150	47.0

Bf. ✓

Chemical Analysis:

Analysis of a Blue Point Supreme wrench gave results as follows:

	<u>Per cent</u>
Carbon	- 0.68
Manganese	- 0.50
Silicon	- 0.19
Sulphur	- 0.011
Phosphorus	- 0.007
Chromium	- 0.04
Nickel	- 0.10
Vanadium	- Nil.

Conclusions:

High quality flat wrenches (3/4 in. size) possess the following characteristics:

Hardness	--	42 to 46 Rock. "C".
Spring, per 100 lb.	--	0.1 - 0.2 in.
Oval cross-section handle.		
Area of jaw	--	0.22 sq. in.
Area of base of jaw	--	0.15 to 0.19 sq. in.
Energy absorbed without distortion	--	20 to 50 ft.lb.
Maximum loading	--	500 pounds.

A certain amount of spring in a wrench absorbs shock and prevents impact failure in the jaws. Under 0.1 in. per 100 pounds spring, the wrench is liable to be too brittle. With over 0.20 in. per 100 pounds spring the wrench is liable to slip off the nut and it is difficult to use the wrench effectively.

The area at the base of the jaw determines the

(Conclusions, cont'd) -

the space required for operation of the wrench.
Blue Point Supreme $\frac{5}{8}$ in. wrench has only 0.12 sq. in.
of stock at the base of the jaw. This wrench can be
used in places where other wrenches (Blackhawk Armstrong,
Williams, Gray, Auto-Kit) will not fit. However, the
thicker wrenches have a greater load-carrying capacity.

The type of wrench selected will depend upon
the service to which it is to be put.

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