THESIS

A DESIGN OF A 500 LB. BOARD DROP HAMMER
FOR THE
M. A. C. SHOPS.

F. B. LOVE

R. J. CLYNE

JUNE 1917

A Design of a 500 lb. Board Drop Hammer
for the
M.A.C. Shops.

A Thesis Submitted to

The Faculty of

MICHIGAN AGRICULTURAL COLLEGE

By

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Candidates for the Degree of

Bachelor of Science

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THESIS

12-4-51
(9)

PREFACE.

The object of this thesis was to provide a design of a power hammer that could be made in the M.A.C. shops at some future time and be used for general forge work and the illustration of methods of doing drop forge work by the use of the drop or steam hammer.

The object of this choice of subject was to give the designers an insight into some of the methods of common practice in machine design and the making of complete detail drawings.

F.B.L.
R.J.C.

BIBLIOGRAPHY.

Encyclopedia Brittanica-Vol.XXVII Edition 11.

Machinery-Aug.1916. 8000 word article by Dixie, on the design of important details of drop hammers built by well known manufacturers.

Catalogs by the following manufacturers:

The Toledo Machine and Tool Co. Toledo Ohio.

Chambersburg Engineering Co. Chambersburg Pa.

The Billings and Spencer Co. Hartford Conn.

E.W.Bliss Co. Brooklyn N.Y.

HISTORY

The original drop hammers, which were believed to have originated with the locksmiths of England in the Birmingham district, consisted of a hammer head attached to a rope or a belt, the other end of which was thrown over a loose pulley suspended from the roof of the shop. The hammer was lifted by hand by pulling on the other end of the rope or belt. This form of hammer is still in use for light pressed work on sheet metal in the manufacture of steel ceilings and cornices. In some cases this hammer has been modified to the extent of having the pulley, over which the lifting belt runs, connected to a source of power. With this device, the men pulling the belt do not have to lift the hammer, but only tighten the belt so that the friction between the lifting wheel and the belt will lift the hammer to the required height. At the desired point of release the men let go of the belt. This form of hammer is still being manufactured and sold. Its main advantages are its simplicity, cheapness of construction, and ease of controll. Its greatest disadvantage is in the fact that the manual labor required to run it is very great for steady use. This objection led to the bringing out of the present type of hammer having the board and roll lifting mechanism. It is this type of power hammer that we have endeavored to design for the following reasons: For the M.A.C. forge shop the board hammer is to be preferred to the steam hammer because a dead end high pressure steam line would have to be installed in the forge shop and this would be a constant source of waste.

The M.A.C. forge shop is already equipped with a line shaft which is driven by a 7.5 H.P. motor. Sufficient power can be easily obtained to drive a board hammer. The board hammer is more simple to manufacture than the steam or the pneumatic hammer because there are no cylinders to be finished. All of the parts on the board type of hammer requiring accurate machine work are within the limits of the M.A.C. machine shop.

COMPUTATIONS FOR WEIGHT.

Base:-

Method: According to the principles of common practice as followed by the leading manufacturers of board hammers, the base block is designed to weigh from fifteen to twenty times the weight of the hammer. In this design the least of the two limits in weight was chosen. A preliminary layout was made and the spacing of the upright pieces set at 14". Other parts were proportioned liberally in size so as to give rigidity, strength, and weight. The thickness of the top of the base was set at 17½" and a taper to the sides of the base was provided.for. Knowing the width of the base, the mean depth, and the required weight, the height was computed. This was found to be 3'-3".

Computations:

Wt.of base = 15 x 500 = 7500# Add to this weight the weight of all metal not included in a regular geometrical solid. This will give an approximate weight of base which is near enough to the required weight for this use.

Amount of metal cut out to provide die space:

Width 5½" total; Length 14"; Height 5"; Wt. cast iron = .26# per cu.in. Total weight to add for clearance space = 5½ x 5 x 14 x .26 = 100# approx. 100# + 7500 = 7600#

Assigned length of base-35" Assigned mean depth-21"

$\frac{7600}{.26}$ = 29200 cu.in. cast iron required in base.

$\frac{29200}{35x21}$ = 39.7" height of base. The addition of bottom bosses for bolt holes, brings the height of the base to 39".

COMPUTATIONS FOR WEIGHT (Cont).

Hammer:-

Method: The size of hammer chosen for the design was to be 500# in weight. This size is convenient for general drop forge work on small parts, and for blacksmith work. The hammer is to be made of .35% carbon steel which has a weight of .282# per cu.in. The width of the hammer was chosen when the base was designed, and this was set at 14". The height of the hammer was set at 18". A slope to the sides was decided upon so as to give the hammer a regular geometrical shape to facilitate in the computation of weight. The weight of the metal that comprise the slant of the sides was computed, and after allowances were made for the metal taken out for the guides, the depth of the hammer at the top (or the narrowest point) was computed.

Allowances for irregularities of form:

Guides: Triangular section guides having a height of $1\frac{1}{2}$" and depth of 1.73" or 1-3/4" approximately.

Weight cut out: 1-1/2" x 1-3/4" x 18" x .282 = 12#

Hole for board: 6" x 5" x $1\frac{1}{4}$" x .282 = 10# approx.

Trip slide: 3/4" x 12" x $1\frac{1}{4}$" x .282" = 3.2#

Total weight to subtract = 25#.

Weight enclosed between the sides:- Slope of sides 2" to 18". 14" x 18" x 2" x .282 = 142#

500 − 25 − 142 = 333# weight of the inner rectangular section of the hammer.

COMPUTATIONS FOR WEIGHT (Cont).

$\frac{333}{.282} = 1180$ cu.in. $14'' \times 18'' \times X = 1180$ cu.in.

$X = 4.68''$ depth of the top of hammer.

After investigation on actual drop hammers we find that some manufacturers make a liberal allowance for an excess over the rated weight, and do not adhere absolutely to the rated weight of the hammer. Also for convenience in design of other parts and to provide for a more adequate die holding space, the hammer depth at the top was changed to 5½" Actual weight of the hammer as changed 570#.

Dies: Dies were not designed for this hammer because of the difference in dies for different classes of work.

SIZE OF ROLLER SHAFTS.

Test for bending:

Let P equal the pressure on the shaft.

" L " " length of the bearing between centers.

" M " " bending moment.

" s " " allowable bending stress.

" v " " distance from the neutral axis to the outer-most fiber.

" I " " moment of inertia.

Then $s = \frac{Mv}{I}$ or $M = \frac{sI}{v}$ Then since $M = \frac{PL}{4}$

$\frac{sI}{v} = \frac{PL}{4}$ For a round solid shaft $I = \frac{3.14\ d^4}{64}$

Simplifying, and substituting,

$d^4 = \frac{16\ P\ L\ v}{3.14\ s}$ s taken at 5000 #/sq.in.

$d^4 = \frac{16 \times 1920 \times 18 \times 1.5}{3.14 \times 5000} = 53$

1920 is the pressure in lbs. against the rolls.

$d \sqrt{53} = 2.7"$ diameter of shaft.

However on account of the sudden and repeated bending stresses that the shaft is subjected to, it was deemed advisable to use a shaft 3" in diameter.

ROLLER HEAD BEARING PRESSURES.

Diameter of the roller shaft = 3"

Length of one bearing = 6"

Area of one bearing surface = 6 x 3 = 18"

Number of bearings on each shaft 2.

Total bearing surface = 2 x 18 = 36 sq.in.

Allowable bearing pressures on cast iron bearings for intermittant use = 700 - 800 lbs. per sq.in.

Total pressure on bearings 1920 lbs.

Bearing pressure = $\frac{1920}{36}$ = 53.3#/sq.in.

This bearing is adequate for any stress it can be put to.

CHECK ON THE LIFTING CAPACITY OF THE ROLLER MECHANISM.

Weight of a steel rod $1\frac{1}{4}$" in dia. — 4.17# per ft.

" " " " " 2" " " — 10.68# " " .

Length of the roller releasing rod — 6 ft.

" " " lifting arm shaft including sleeves — 2.5 ft.

Weight of releasing rod — 6 x 4.17 = 25# .

" " lifting arm shaft including sleeves —

2.5 x 10.68 = 26.8#

Weight of tripping blocks — 5#.

" " " tee — 1.2#

Total weight = 60#.

Length of tripping arm — 12" (Long lever arm)

Eccentricity — 3/8" (short lever arm)

Mechanical advantage — $\frac{12}{3/8} = 32$.

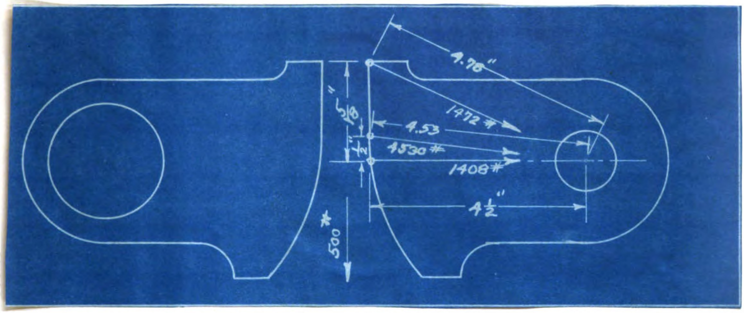
60 x 32 = 1920 # pressure exerted against the board by the rollers.

Coefficient of friction of steel against wood (maple) — .37

Lifting capacity 1920 x .37 = 710 #.

Hence if necessary this roller mechanism would be capable of lifting a hammer weighing 710 lbs.

CHECK FOR STRENGTH OF THE
GRIPPING MECHANISM SHAFTS.



Total pressure against shafts: From the above diagram-

500 : X :: 1.625 : 4.78 $\quad$ X = 1472 lbs.

Assume that the vertical distance is shortened to the extent of ½" which would occur if the grips were not adjusted properly. This would raise the bearing pressure to the following extent:

500 : X :: ½ : 4.53 $\quad$ X = 4530 lbs.

Total bearing surface 8"x 1½" = 12"

Resulting bearing pressure- $\frac{4530}{12}$ = 378 lbs per sq.in. area. This is found to be allowable for cast iron bearings when subjected to intermittant service.

The nature of the device is such that the dogs cannot slip when adjusted properly, so checking is unnecessary for this as was done for the roller head. Care must be taken to have the gripping dogs adjusted properly as experience has found that this must be set carefully or the result will

STRENGTH OF SHAFTS (Con).

be to let the board slip or that the board will be crushed at the point where the dogs grip the board.

Strength of the shafts: Suppose that the hammer should drop from its extreme height of 3'-2"and be gripped by the dogs at the bottom just before striking the die. From the table of forces of blows for different heights of fall it will be seen that the pressure of 4530# is increased to 15400# in the ratio of 500 to 1700.

Area of the shafts in shear (2-$1\frac{1}{2}$" shafts) 3.52 sq.in.

$\frac{15400}{3.52}$ 4375 #/sq.in. stress in shafts. This is allowable.

SPEED AND POWER.

Consider hammer shaft to run 180 R.P.M. 8"dia.roller.

Circumference of roller = $\frac{8 \times 3.14}{12}$ = 2.1ft.

2.1 ft. x 180 R.P.M. x 500 # = 189000 ft.lbs./min.

$\frac{189000}{33000}$ = 5.73 H.P. required to drive the hammer, when no allowance is made for the time of drop of the hammer

Since the forge shop is equipped with a 7.5 H.P.motor and a line shaft this hammer can be easily set up.

Size of pulleys on line shaft:

Line shaft 250 R.P.M. Hammer shafts 180 R.P.M.

24 : X :: 250 : 180 X = 17.25"

18" pulleys on the line shaft will do to drive the hammer.

FORCE OF BLOW FOR DIFFERENT HEIGHTS OF FALL.

V the velocity of fall in feet per second.

h the height from which the body falls.

w the weight of the body. (500#)

K.E. kinetic energy.

$$K.E. = \frac{1}{2}mv^2 = \frac{wv^2}{2g} = wh. \qquad (v^2 = 2gh)$$

For 1ft. fall-

K.E. = 500 x 1 = 500 ft.lbs.

For 1½ ft.fall-

K.E. = 500 x 1½ = 750 ft.lbs.

For 2 ft. fall-

K.E. = 500 x 2 = 1000 ft.lbs.

For 2½ ft.fall-

K.E. = 500 x 2½ = 1250 ft.lbs.

For 3 ft. fall-

K.E. = 500 x 3 = 1500 ft.lbs.

For 3.2 ft. fall-

K.E. = 500 x 3.2 = 1600 ft.lbs.

INDEX TO DRAWINGS.

Drawing	No.	1	Main Assembly
"	"	2	Unit Assembly of Roller Head
"	"	3	Unit Assembly of Gripping Head
"	"	4A	Upper Half Roller Frame
"	"	4B	Lower Half Roller Frame
"	"	5A	Lifting Arm
"	"	5B	Collar, Lifting Arm
"	"	5C	Bushing " "
"	"	5D	Shaft, " "
"	"	6A	Rollers
"	"	7A	Shaft, Roller
"	"	7B	Key, Roller Shaft
"	"	8A	Lower Tripping Block
"	"	9A	Bushing, Top Tripping Block
"	"	9B	Top Tripping Block
"	"	9C	Stud Bolt, Top Lifting Block
"	"	10A	Pedal, Arm
"	"	10B	Pedal
"	"	11A	Roller Releasing Rod
"	"	12A	Guide, Roller Releasing Rod
"	"	12B	Board Wedge
"	"	13A	Hammer
"	"	14A	Base, Tripping Mechanism
"	"	14B	Shaft, " "
"	"	14C	Plates, " "
"	"	15A	Sub-base Gib
"	"	15B	Sub-base
"	"	16A	Left Support
"	"	16B	Right Support
"	"	17A	Base
"	"	18A	Roll Adjusting Rod.
"	"	18B	Tripping Rod Ends(1&2)
"	"	18C	Adjusting Rod Cleat
"	"	18D	Tripping Rod
"	"	19A	Lock Washer, Upright Adjusting
"	"	19B	Plain Washer, " "
"	"	19C	Pedal Connection
"	"	19D	Upright Screw.
"	"	19E	Rod Cleats
"	"	20A	Rod Spring
"	"	20B	Spring Plunger
"	"	20C	Lifting Lever
"	"	21A	Rod Rest Block
"	"	21B	Rod Shoulder Base
"	"	22A	Tripping Arm
"	"	22B	Rear Gripping Dog
"	"	23A	Front Gripping Dog
"	"	23B	Key, Tripping Arm
"	"	23C	Eccentric Sleeve
"	"	24A	Tripping Tee
"	"	25A	Adjusting Plates
"	"	26A	Tripping Arm Sleeve
"	"	26B	Lever Support Block
"	"	27A	Head Bolts
"	"	27B	Bearing Block
"	"	28	Bill of Materials.

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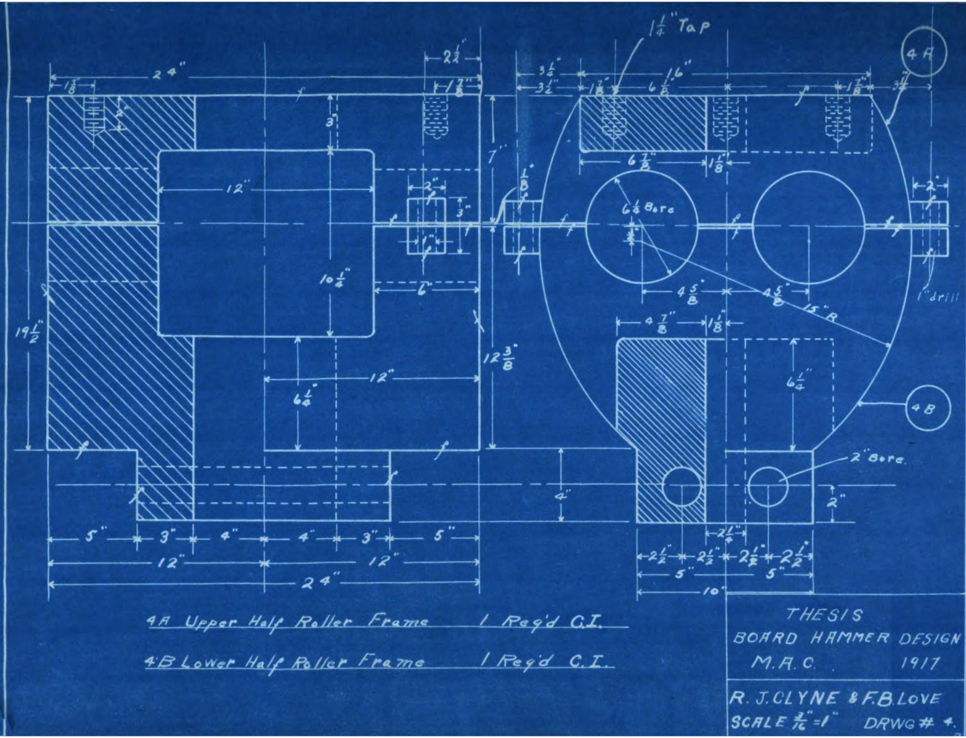
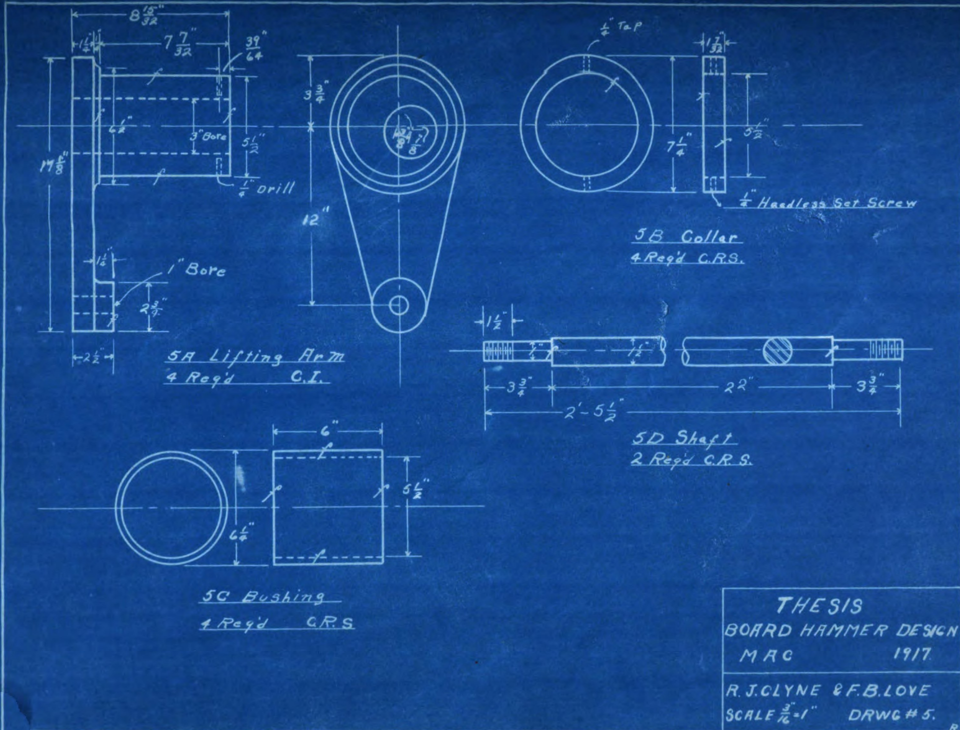
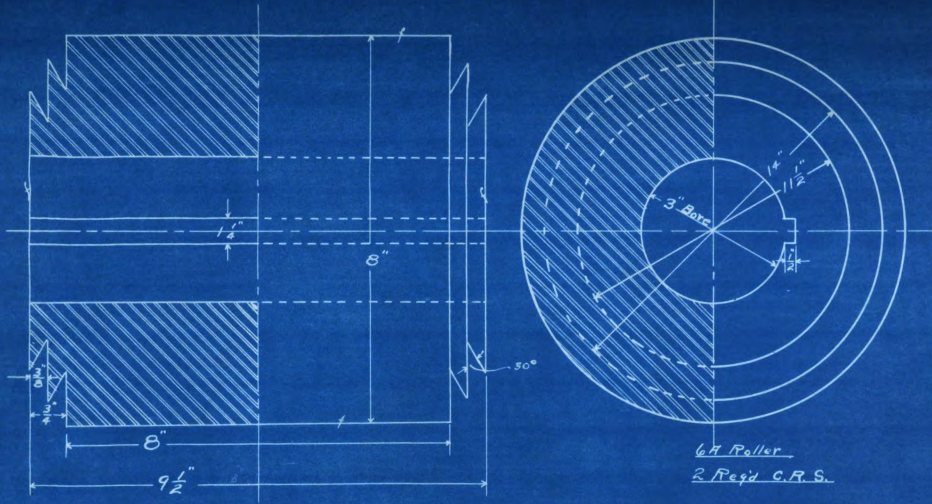
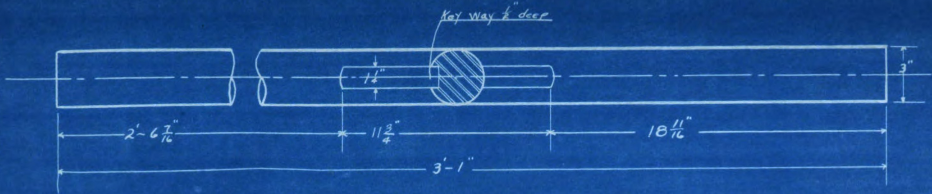

1¼" Tap
4A
4B
6¼ Bore
15" R
2" Bore
1" drill
4A Upper Half Roller Frame 1 Req'd C.I.
4B Lower Half Roller Frame 1 Req'd C.I.
THESIS
BOARD HAMMER DESIGN
M.A.C. 1917
R. J. CLYNE & F.B. LOVE
SCALE 3/16" = 1" DRWG # 4.


5A Lifting Arm
4 Req'd C.I.
5B Collar
4 Req'd C.R.S.
5C Bushing
4 Req'd C.R.S
5D Shaft
2 Req'd C.R.S.
1" Bore
3" Bore
1/4" Drill
1/4" Tap
1/4" Headless Set Screw
8 15/32"
7 7/32"
39/64"
1 1/4"
17 1/8"
6 1/2"
5 1/2"
2 3/4"
2 1/2"
3 3/4"
12"
7 1/4"
1 7/32"
1 1/2"
22"
2'-5 1/2"
6"
6 1/4"
THESIS
BOARD HAMMER DESIGN
MAC 1917
R. J. CLYNE & F. B. LOVE
SCALE 3/16" = 1" DRWG # 5.

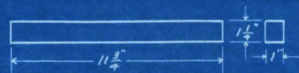


THESIS
BOARD HAMMER DESIGN
M.A.C. 1917.

R.J. CLYNE & F.B. LOVE
SCALE 3/16" = 1" DRWG # 6.



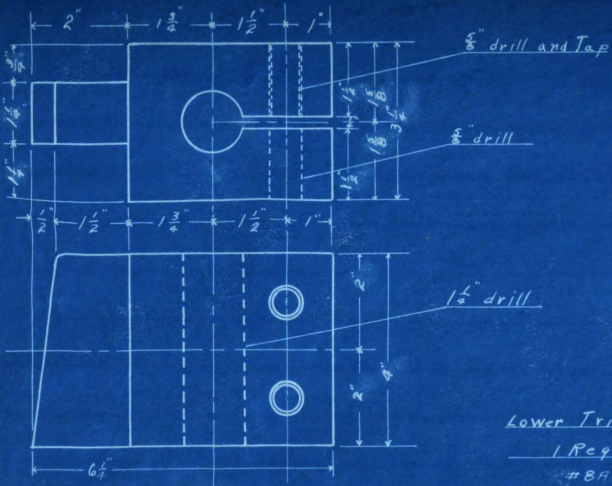
7A Shaft
2 Req'd C R S



7B Key
2 Req'd C.R.S.

THESIS
BOARD HAMMER DESIGN
M.A.C. 1917.

R. J CIYNE & F.B.LOVE
SCALE 3/16" = 1" DRWG # 7



Lower Tripping Block

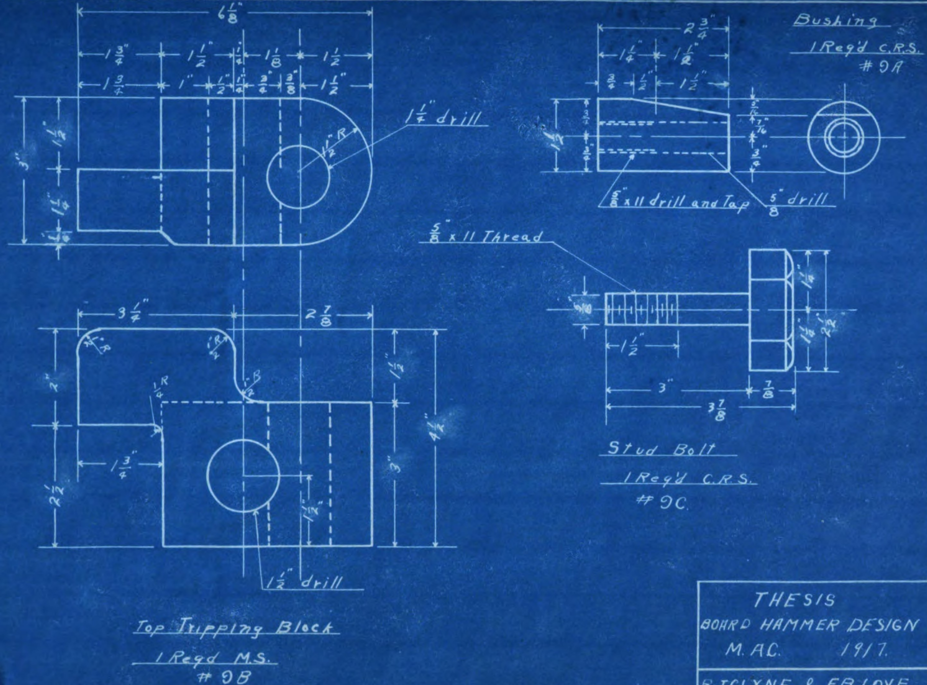
1 Req'd M.S.

#8A

THESIS
BOARD HAMMER DESIGN
M. A.C. 1917

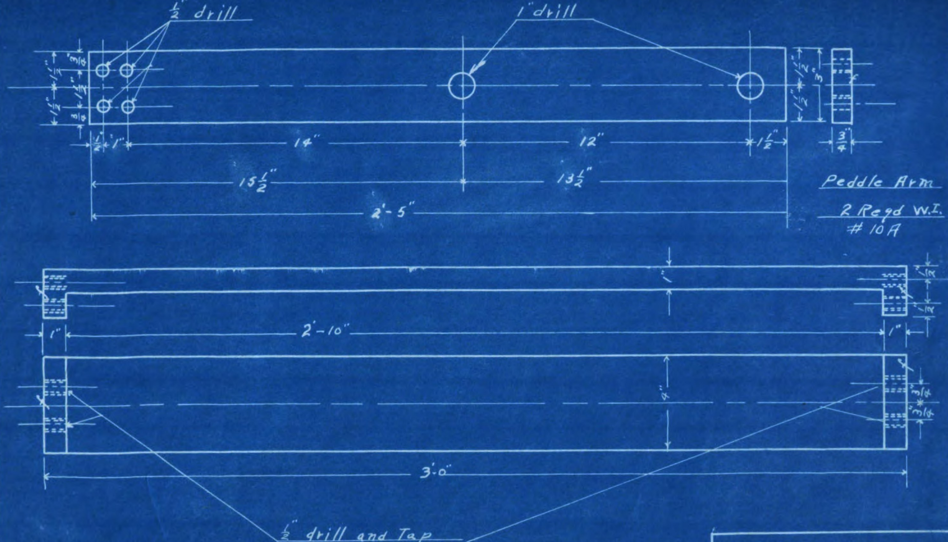
R. J. C. LYNE & F. B. LOVE

SCALE $\frac{1}{2}$" = 1" DRWG. # 8



THESIS
BOARD HAMMER DESIGN
M. A.C. 1917.

R J CLYNE & F.B. LOVE
SCALE 1/2" = 1" DRWG. # 9

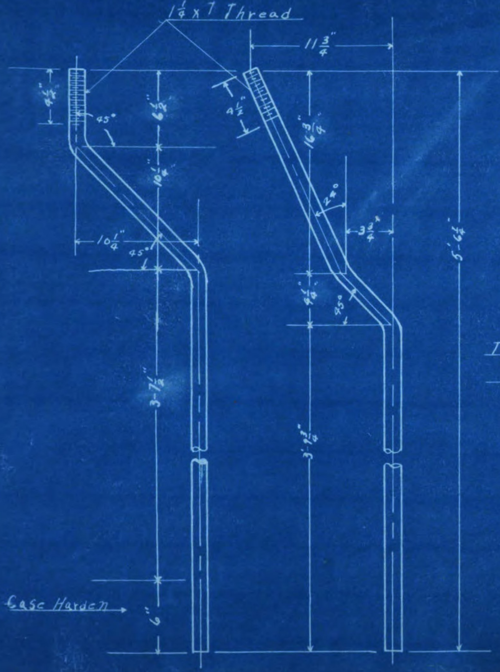


Peddle Arm
2 Reqd W.I.
10A

Peddle
1 Req'd W.I.
10B

THESIS
BOARD HAMMER DESIGN
M. A. C. 1917

R. J. CLYNE & F. B. LOVE
SCALE $\frac{1}{4}$" = 1" DRWG # 10.



Tripping Rod

1 Req'd C.R.S.

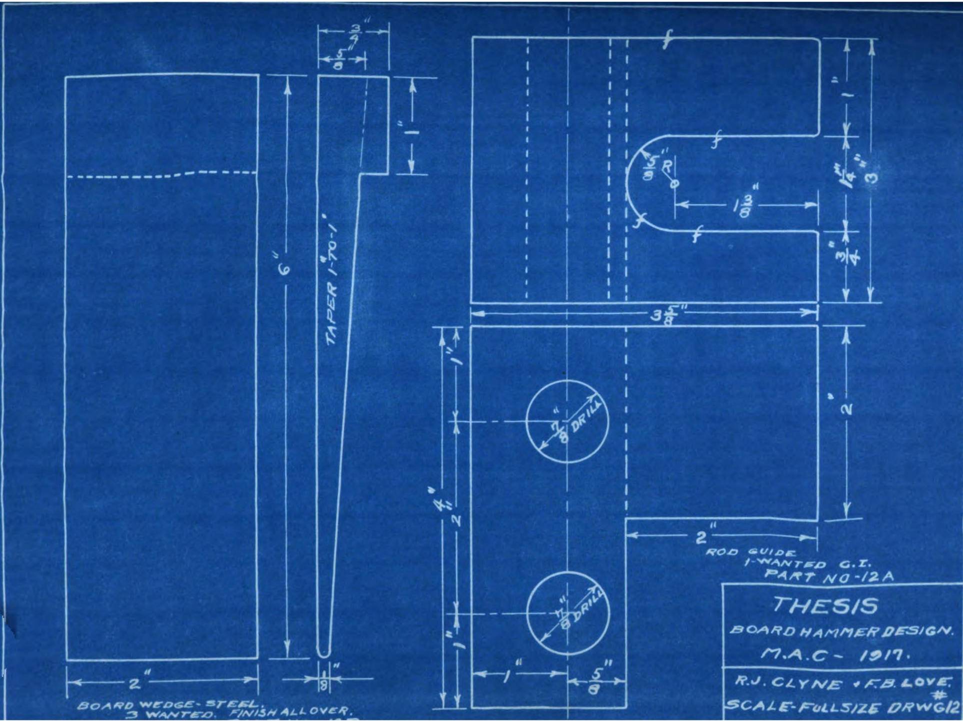
11A

THESIS

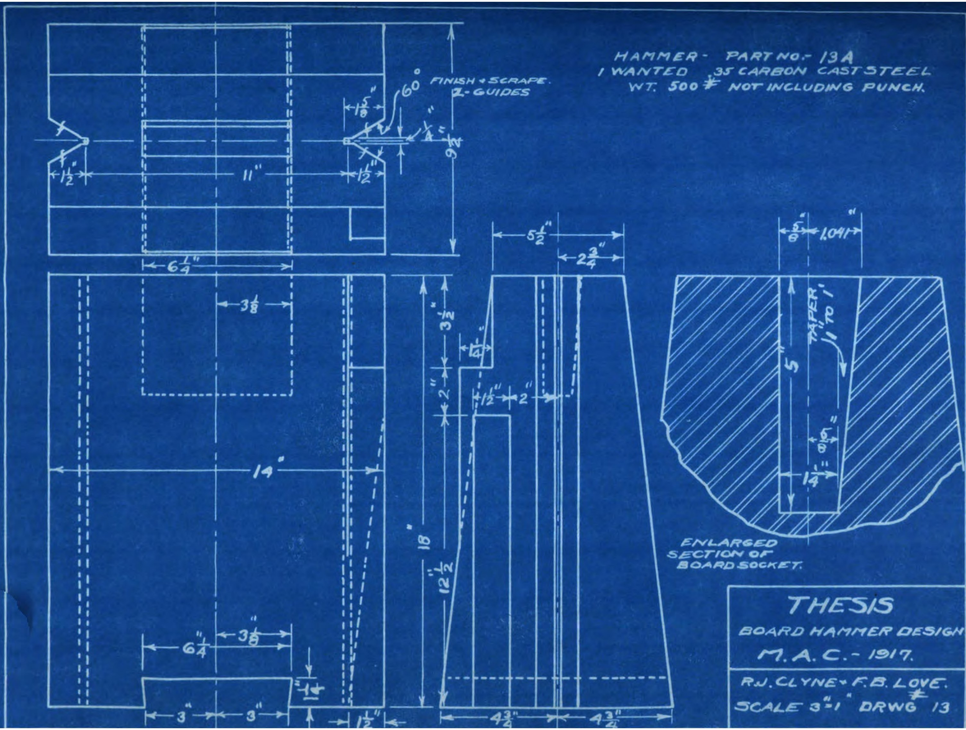
BOARD HAMMER DESIGN

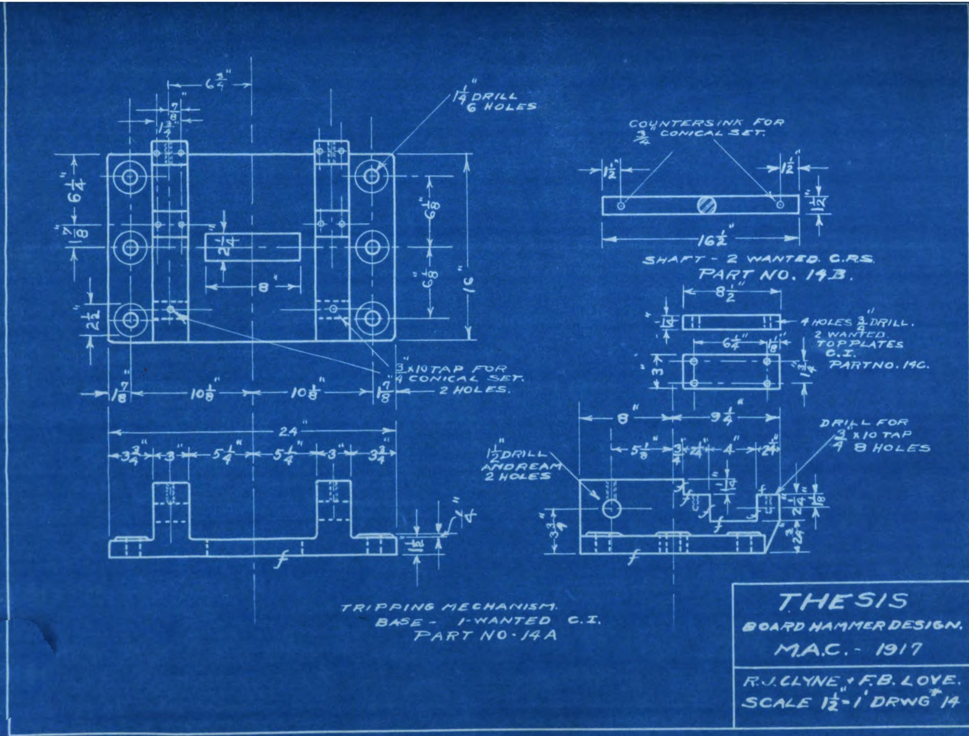
M.A.C. 1917

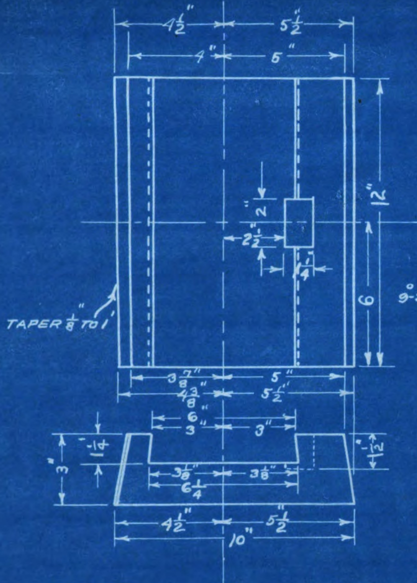
R.J. CLYNE & F.B. LOYE



3/4"
5/8"
1"
6"
TAPER 1"-TO-1'
1/8"
2"
BOARD WEDGE-STEEL.
3 WANTED. FINISH ALL OVER.
f
1"
5/8" R
1 3/8"
1 1/4"
3"
3/4"
3 5/8"
2"
7/8" DRILL
7/8" DRILL
4"
1"
2"
1"
1"
5/8"
2"
ROD GUIDE
1-WANTED C.I.
PART NO-12A
THESIS
BOARD HAMMER DESIGN.
M.A.C- 1917.
R.J. CLYNE + F.B. LOVE.
SCALE-FULLSIZE DRWG #12


HAMMER - PART NO:- 13A
1 WANTED .35 CARBON CAST STEEL
WT. 500 # NOT INCLUDING PUNCH.
FINISH & SCRAPE.
2-GUIDES
60°
ENLARGED
SECTION OF
BOARD SOCKET.
TAPER 1" TO 1'
THESIS
BOARD HAMMER DESIGN
M.A.C. - 1917.
R.J. CLYNE & F.B. LOVE.
SCALE 3"=1" DRWG # 13

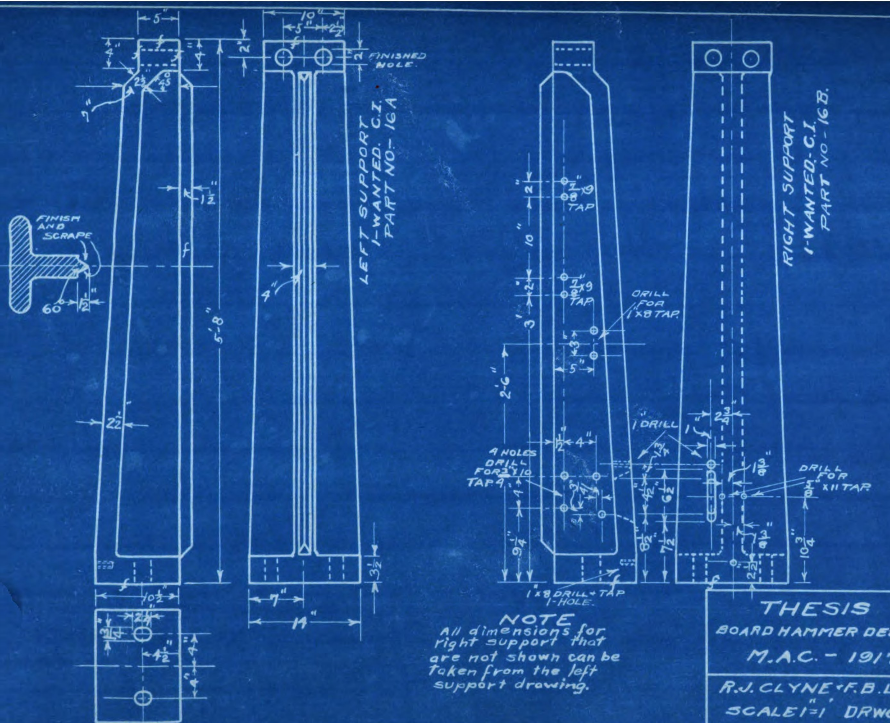

1¼" DRILL 6 HOLES
3/4" x 10 TAP FOR CONICAL SET. 2 HOLES.
TRIPPING MECHANISM.
BASE - 1-WANTED C.I.
PART NO-14A
COUNTERSINK FOR 3/4" CONICAL SET.
SHAFT - 2 WANTED. C.R.S.
PART NO. 14B.
4 HOLES 3/4" DRILL.
2 WANTED.
TOP PLATES
C.I.
PART NO. 14C.
1½" DRILL AND REAM 2 HOLES
DRILL FOR 3/4" x 10 TAP 8 HOLES
THESIS
BOARD HAMMER DESIGN.
M.A.C. - 1917
R.J. CLYNE & F.B. LOVE.
SCALE 1½"-1' DRWG # 14



SUB-BASE.
1-WANTED - STEEL.
PART NO-15B.

SUB BASE GIBB
1-WANTED - STEEL.
PART NO - 15A.

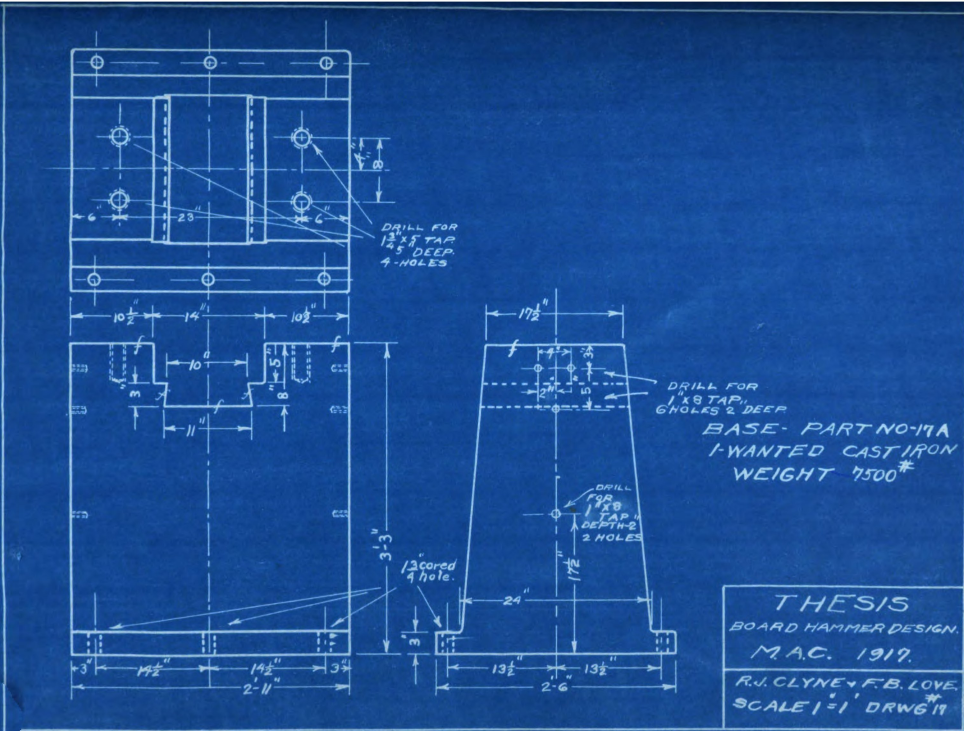
THESIS
BOARD HAMMER DESIGN.
M.A.C. - 1917
R.J. CLYNE + F.B. LOVE.
SCALE 3" = 1' DRWG # 15

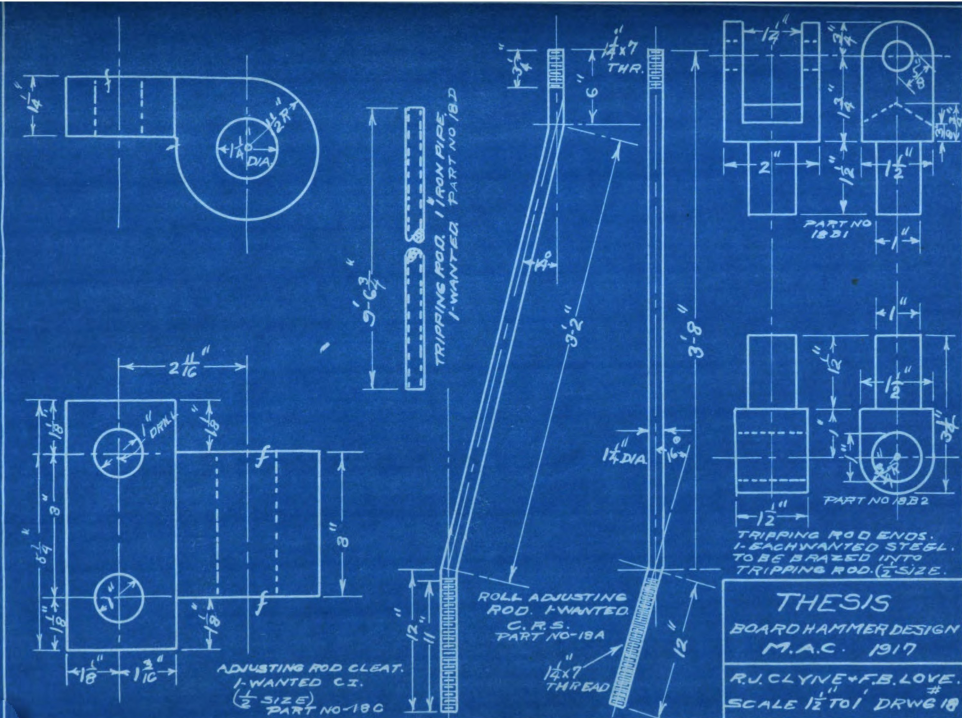


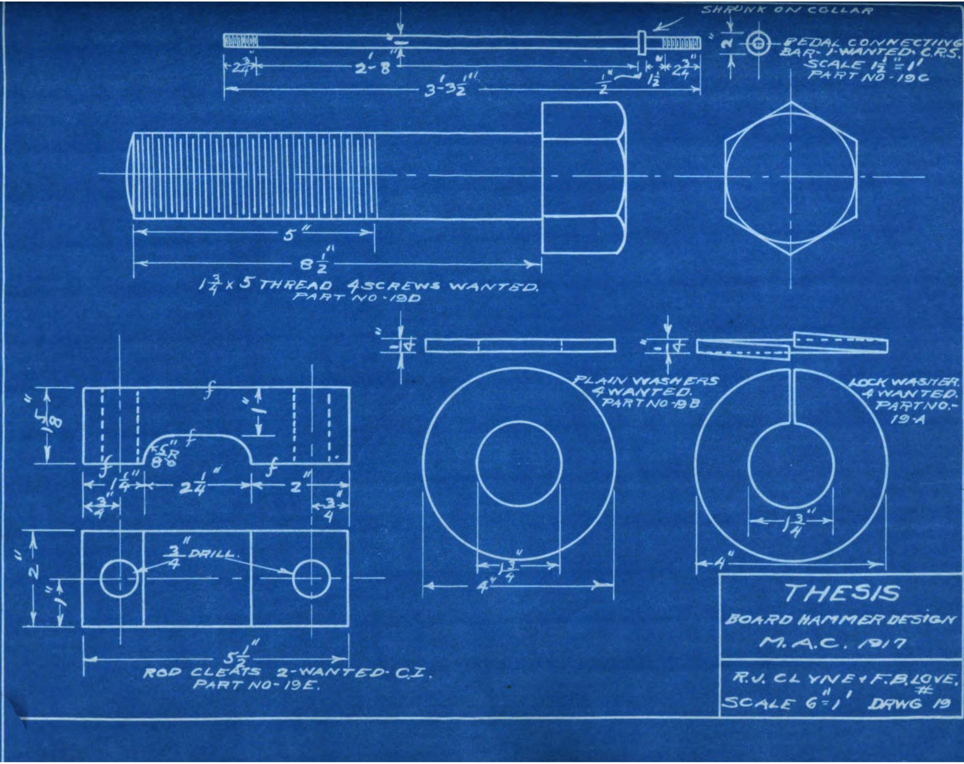
NOTE
All dimensions for right support that are not shown can be taken from the left support drawing.

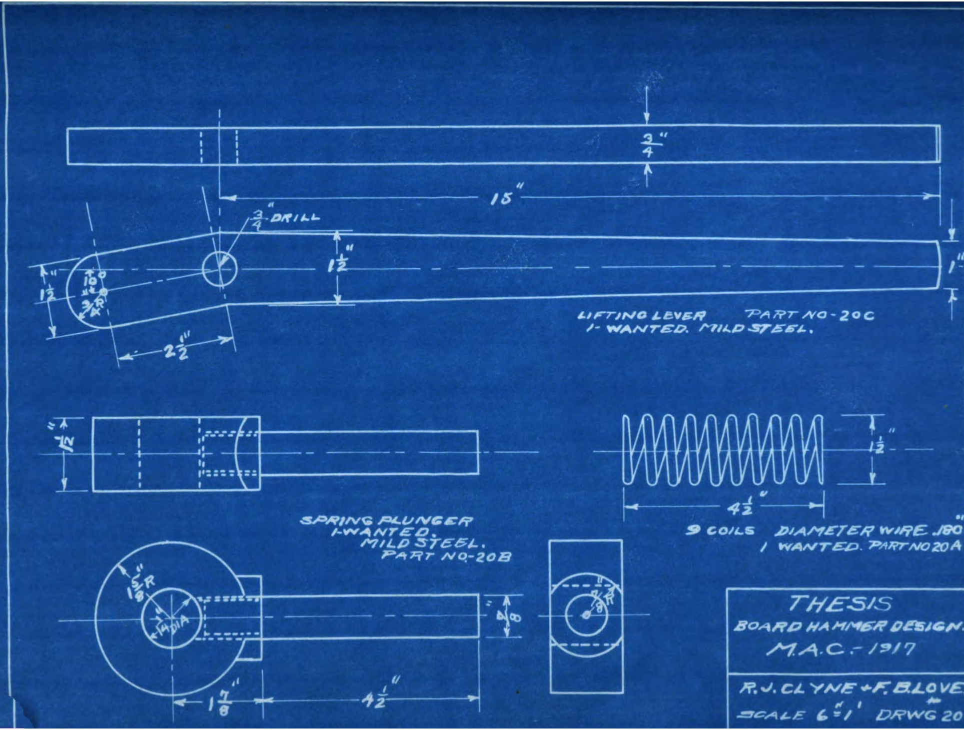
THESIS
BOARD HAMMER DESIGN
M.A.C. - 1917

R.J. CLYNE + F.B. LOVE.
SCALE 1"=1' DRWG # 16.

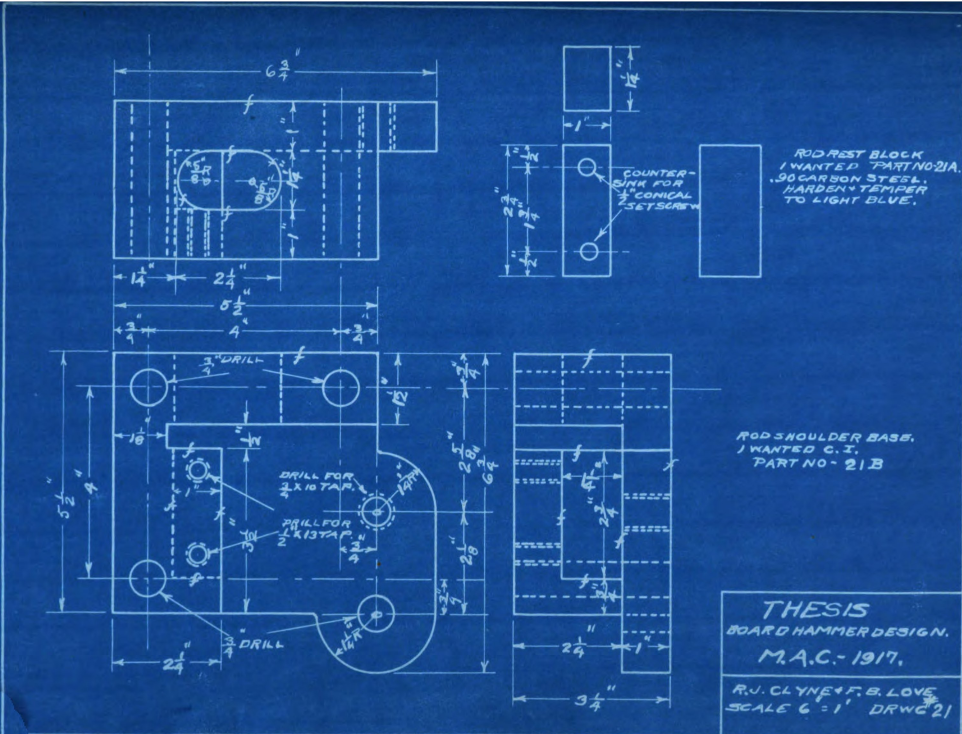

DRILL FOR 1 3/4" X 5 TAP. 5 DEEP. 4-HOLES
DRILL FOR 1" X 8 TAP" 6 HOLES 2 DEEP
BASE- PART NO-17A
1-WANTED CAST IRON
WEIGHT 7500#
DRILL FOR 1" X 8 TAP" DEPTH-2 2 HOLES
1 3/4" cored hole.
THESIS
BOARD HAMMER DESIGN.
M.A.C. 1917.
R.J. CLYNE + F.B. LOVE.
SCALE 1"=1' DRWG # 17

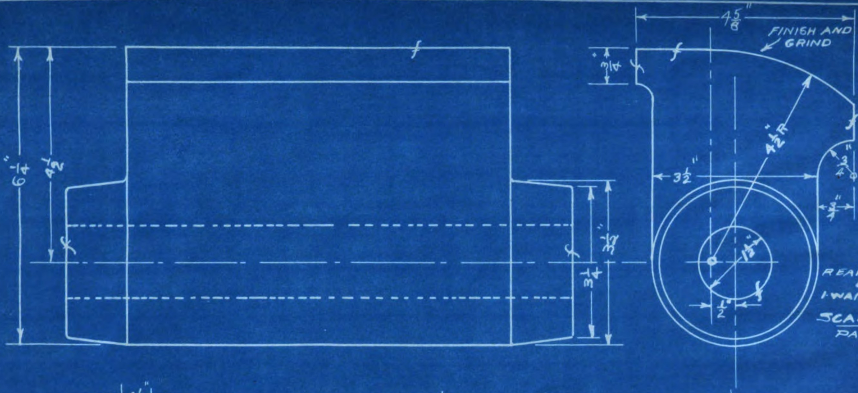

TRIPPING ROD. 1" IRON PIPE.
1-WANTED. PART NO 18D
ADJUSTING ROD CLEAT.
1-WANTED C.I.
(1/2 SIZE)
PART NO-18C
ROLL ADJUSTING
ROD. 1-WANTED.
C.R.S.
PART NO-18A
1 1/4 x 7
THREAD
1 1/4 x 7
THR.
1 1/4" DIA.
PART NO
18B1
PART NO 18B2
TRIPPING ROD ENDS.
1-EACH WANTED STEEL.
TO BE BRAZED INTO
TRIPPING ROD. (1/2 SIZE.
THESIS
BOARD HAMMER DESIGN
M.A.C. 1917
R.J. CLYNE + F.B. LOVE.
SCALE 1 1/2" TO 1' DRWG # 18


SHRUNK ON COLLAR
PEDAL CONNECTING BAR - 1 - WANTED - C.R.S.
SCALE 1½" = 1'
PART NO - 19C
1¾ x 5 THREAD 4 SCREWS WANTED.
PART NO - 19D
PLAIN WASHERS 4 WANTED.
PART NO - 19B
LOCK WASHER. 4 WANTED.
PART NO.- 19-A
¾" DRILL.
ROD CLEATS 2-WANTED - C.I.
PART NO - 19E.
THESIS
BOARD HAMMER DESIGN
M.A.C. 1917
R.J. CLYNE & F.B. LOVE.
SCALE 6" = 1'
DRWG # 19

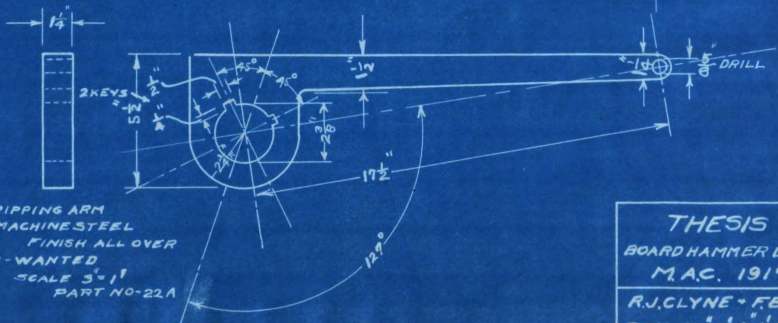


LIFTING LEVER PART NO-20C
1- WANTED. MILD STEEL.
3/4" DRILL
SPRING PLUNGER
1-WANTED.
MILD STEEL.
PART NO-20B
9 COILS DIAMETER WIRE .180"
1 WANTED. PART NO 20A
THESIS
BOARD HAMMER DESIGN.
M.A.C.-1917
R.J. CLYNE + F.B. LOVE.
SCALE 6"=1' DRWG 20


ROD REST BLOCK
1 WANTED PART NO-21A.
.90 CARBON STEEL.
HARDEN + TEMPER
TO LIGHT BLUE.
COUNTER-SINK FOR 1/2" CONICAL SETSCREW
ROD SHOULDER BASE.
1 WANTED C. I.
PART NO - 21 B
3/4" DRILL
DRILL FOR 3/4 X 10 TAP.
DRILL FOR 1/2 X 13 TAP.
THESIS
BOARD HAMMER DESIGN.
M.A.C. - 1917.
R.J. CLYNE + F. B. LOVE
SCALE 6 = 1' DRWG #21



REAR GRIPPING DOG
1-WANTED C.I.
SCALE 6" = 1'
PART NO-22B



TRIPPING ARM
MACHINE STEEL
FINISH ALL OVER
1-WANTED
SCALE 3" = 1'
PART NO-22A

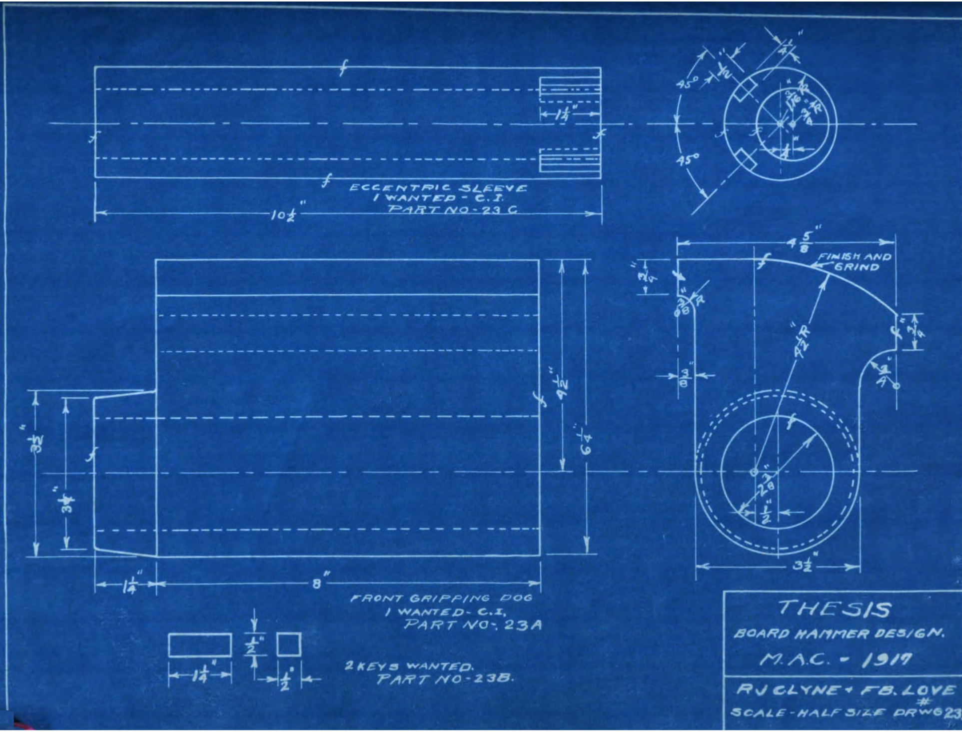
THESIS

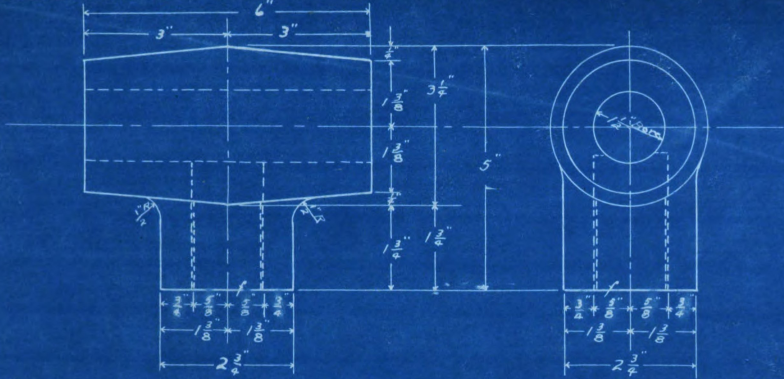
BOARD HAMMER DESIGN

M.A.C. 1917-

R.J. CLYNE + F.B. LOVE.

SCALE-3" = 1'-6" = 1' DRWG-#22


ECCENTRIC SLEEVE
1 WANTED - C.I.
PART NO - 23 C
FINISH AND GRIND
FRONT GRIPPING DOG
1 WANTED - C.I.
PART NO - 23A
2 KEYS WANTED.
PART NO - 23B.
THESIS
BOARD HAMMER DESIGN.
M.A.C. - 1917
R.J. CLYNE + F.B. LOVE
SCALE - HALF SIZE DRWG # 23



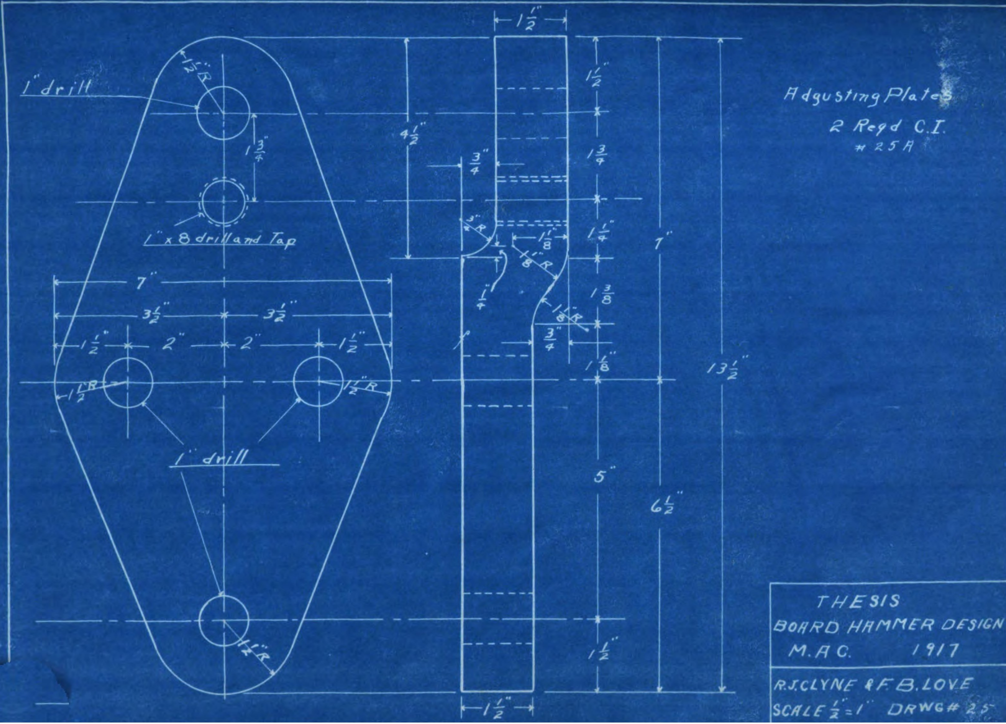
Tripping Tee

2 Req'd C.I.

#24A

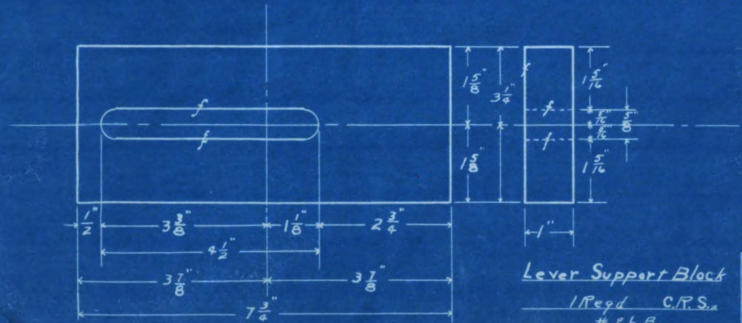
THESIS
BOARD HAMMER DESISN
M.A.C. 1917.

R.J.CLYNE & F.B.LOVE
SCALE 1/2" = 1" DRWG #24


Adgusting Plates
2 Reqd C.I.
25A
1" drill
1" x 8 drill and Tap
1" drill
THESIS
BOARD HAMMER DESIGN
M.A.C. 1917
R.J.CLYNE & F.B.LOVE
SCALE 1/2" = 1" DRWG # 25

Tripping Arm Sleeve

4 Req'd C.I.
#26A

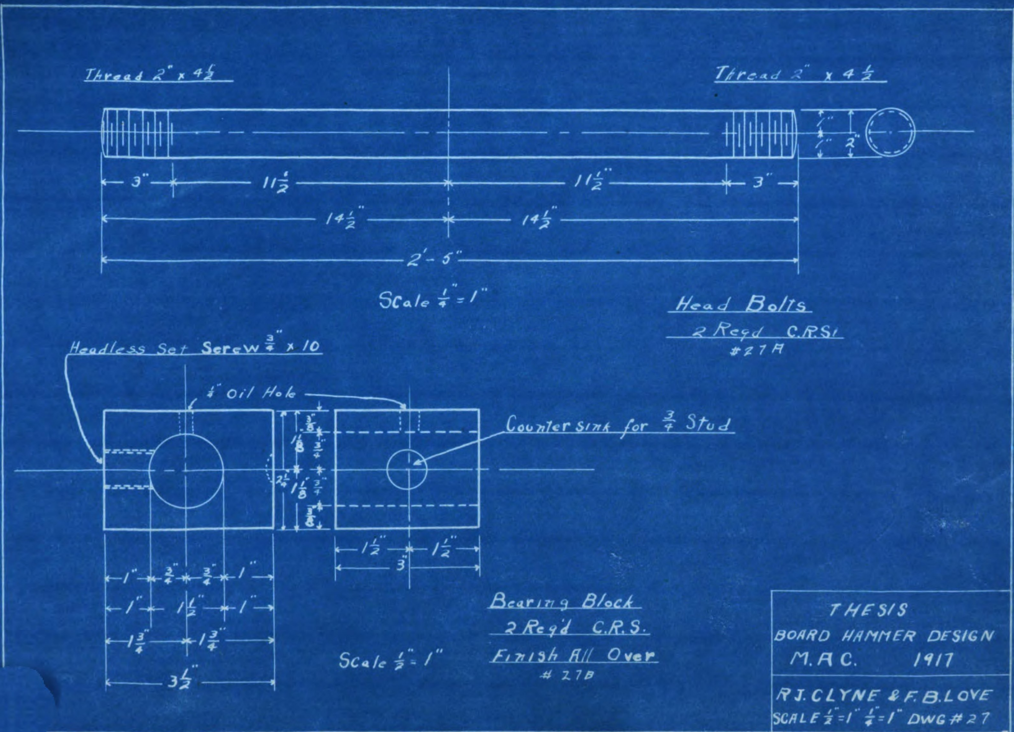


Lever Support Block

1 Reqd C.R.S.
#26 B

THESIS
BOARD HAMMER DESIGN
M.A.C. 1917

R. J. CLYNE & F.B. LOVE
SCALE $\frac{1}{2}''=1''$ DRWG. #26


Thread 2" x 4½
Thread 2" x 4½
3"
11½
11½"
3"
14½"
14½"
2'-5"
1"
1"
2"
Scale ¼" = 1"
Head Bolts
2 Reqd C.R.S.
#27A
Headless Set Screw ¾" x 10
¼" Oil Hole
Counter sink for ¾ Stud
Bearing Block
2 Req'd C.R.S.
Finish All Over
#27B
Scale ½" = 1"
THESIS
BOARD HAMMER DESIGN
M.A.C. 1917
R.J. CLYNE & F.B. LOVE
SCALE ½"=1" ¼"=1" DWG #27

BILL OF MATERIALS.

PART-	SIZE-	NUMBER.-
CAP SCREWS	3/4" x 2 1/4"	8
	3/4" x 2 1/2"	1
	3/4 x 4 1/2"	5
	3/4" x 1 3/4	1
	5/8" x 3 1/4"	2
	5/8" x 2 1/2"	2
	5/8" x 2 3/4"	1
	1/2" x 1 1/2"	8
	7/8" x 4"	2
	1" x 2"	2
	1" x 3"	8
	1 1/4 x 2 1/2	6
NUTS	5/8"	1
	3/4"	6
	1"	5
	1 1/4"	4
	2"	4
SET SCREWS	1" x 2"	2
	3/4" x 3 1/2"	2
Conical point.	3/4" x 3"	2
	3/4" x 2"	2
Headless	3/4" x 1"	2
Headless	1/4" x 5/8"	4
STUDS	1" x 5 1/2"	2
WASHERS	5/8"	2
PULLEYS (PRESSED STEEL)	24" DIA. 6" FACE 3" SHAFT	2
MAPLE BOARD (STRAIGHT GRAINED)	1 1/4" x 6" x 7' (PLANED)	1

NOTE - ABOVE SCREW SIZES U.S. STD. THREAD.