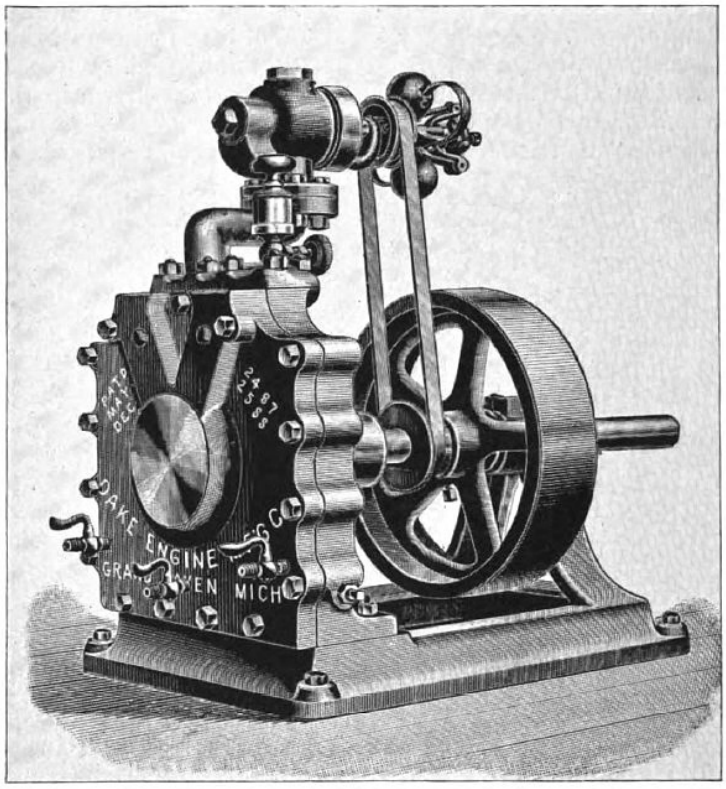
Moteur Dake



SQUARE PISTON ENGINE. BUILT BY THE DAKE ENGINE CO., GRAND HAVEN, MICH., U. S. A.

Le moteur Dake fait partie des rares moteurs à vapeur non conventionnels qui se sont fait une place assez durable. Aujourd'hui encore on trouve des moteurs hydrauliques haute pression fonctionnant selon le principe du moteur Dake.

Il s'agit d'un moteur à pistons carrés et bien qu'il donne l'apparence d'un moteur rotatif il s'agit bel et bien d'un moteur alternatif.

Il s'octroya un marché de niche, de manière durable, grâce à ses qualités propres :

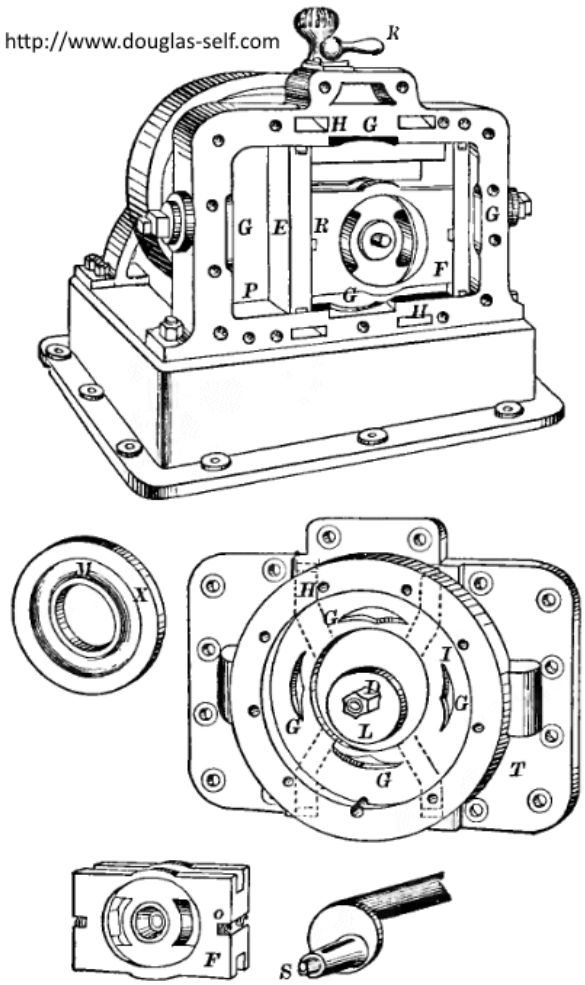
- « léger » et très compact
- très fiable car peu de pièces en mouvement
- totalement réversible avec un temps de latence faible ; il n'y a pas de point mort
- maintenance aisée
- fort couple moteur
- peu exigeant sur la qualité de vapeur.
- fonctionne aussi à l'air comprimé

Origine du moteur

Le moteur fut breveté en Décembre 1888 par William Dake.

Certains pensent que William Dake s'est inspiré du moteur à pistons carrés de John B. Root qui avait déposé un brevet en 1863.

Ci-dessous une vue d'un moteur Root.



Nota: le brevet original de Dake avec la description du fonctionnement est joint un peu plus loin

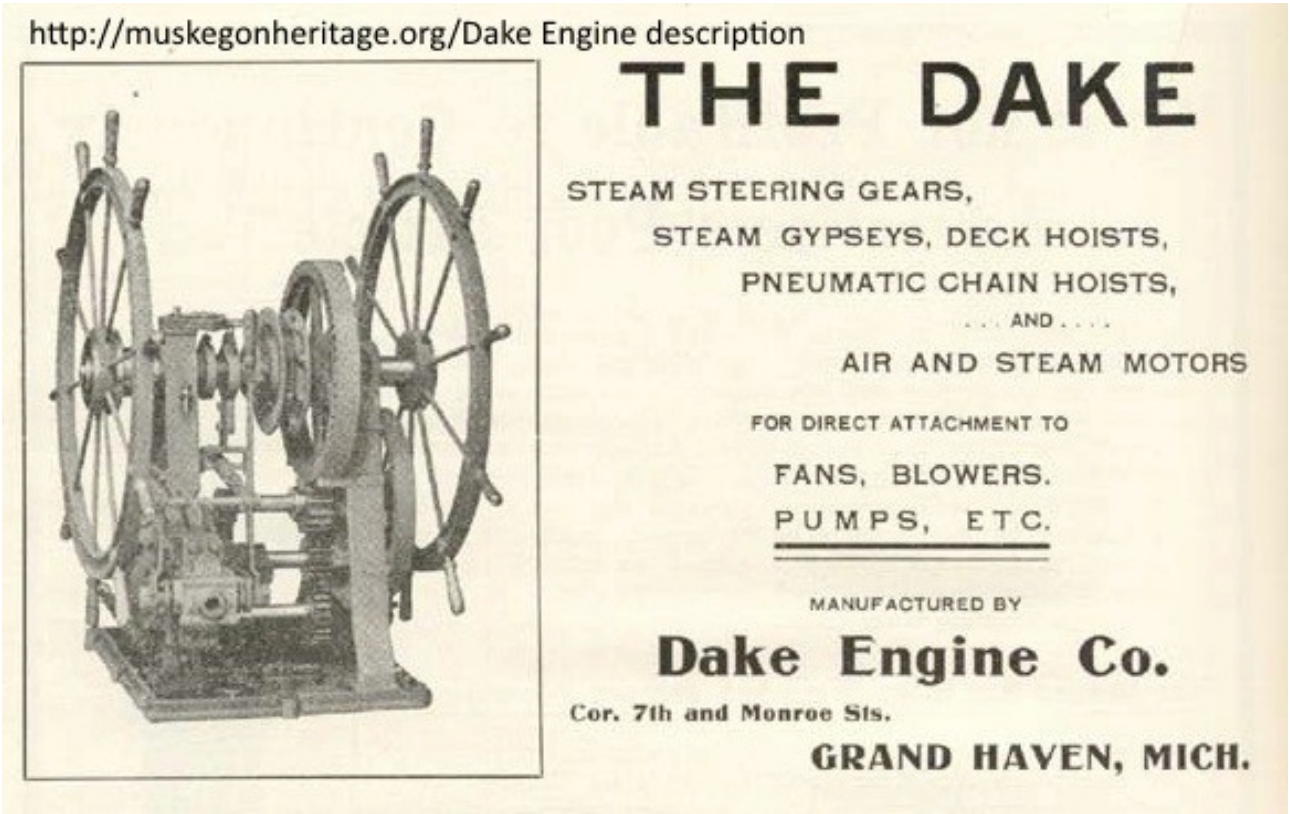
Le moteur Dake acquit assez rapidement une reconnaissance internationale. Il fut gratifié d'une médaille honorifique à l'exposition « Worlds Colombian Exposition » de Chicago en 1893 . Dans un premier temps on les utilisa en environnement sensible comme les mines de charbon, les réseaux ferrés souterrains, le creusement de tunnels.

Son utilisation a été surtout développée sur les appareils de levage mobile comme les palans à vapeur, en usage marin comme les cabestans, les guindeaux, en stationnaire sur les scies de

délignage, le pompage et paraît-il sur quelques chariots élévateurs à fourche, valeureux ancêtres des Fenwick.

http://muskegonheritage.org/Dake Engine description

http://muskegonheritage.org/Dake Engine description

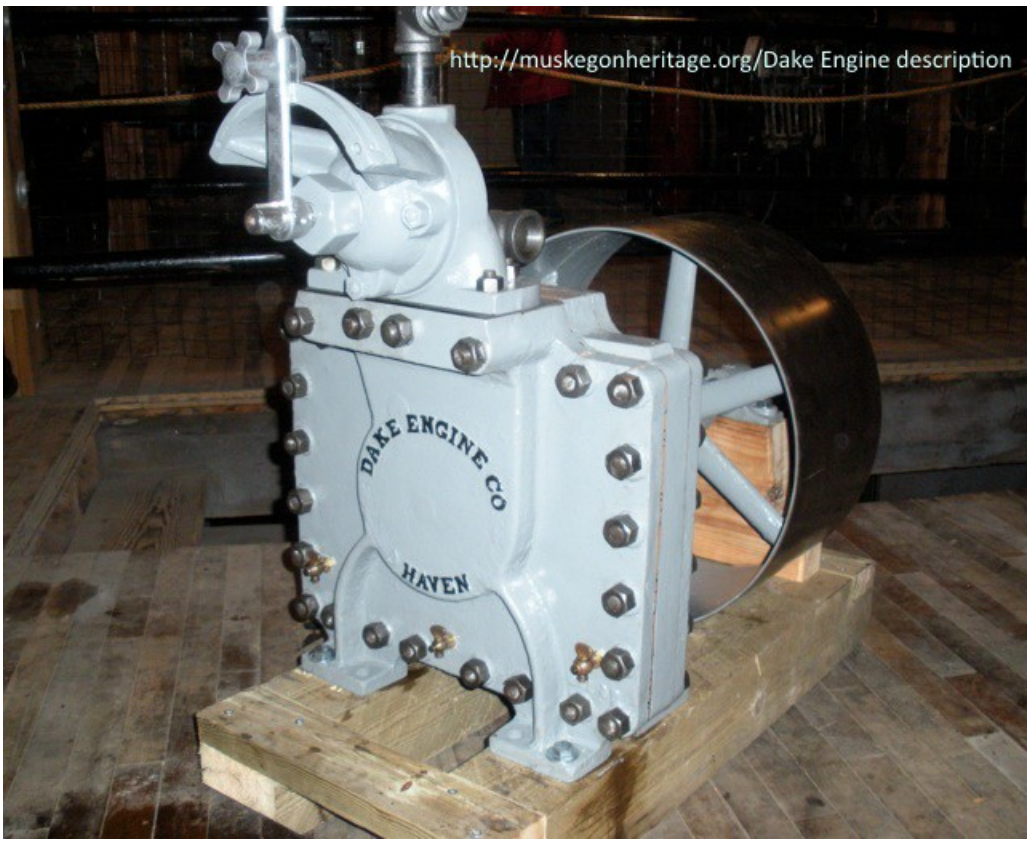


Leur grande compacité, l'absence de point mort, la réversibilité totale l'on fait assez vite adopter pour les machines de levage et de déchargement de cargos et l'usage marin se développa.

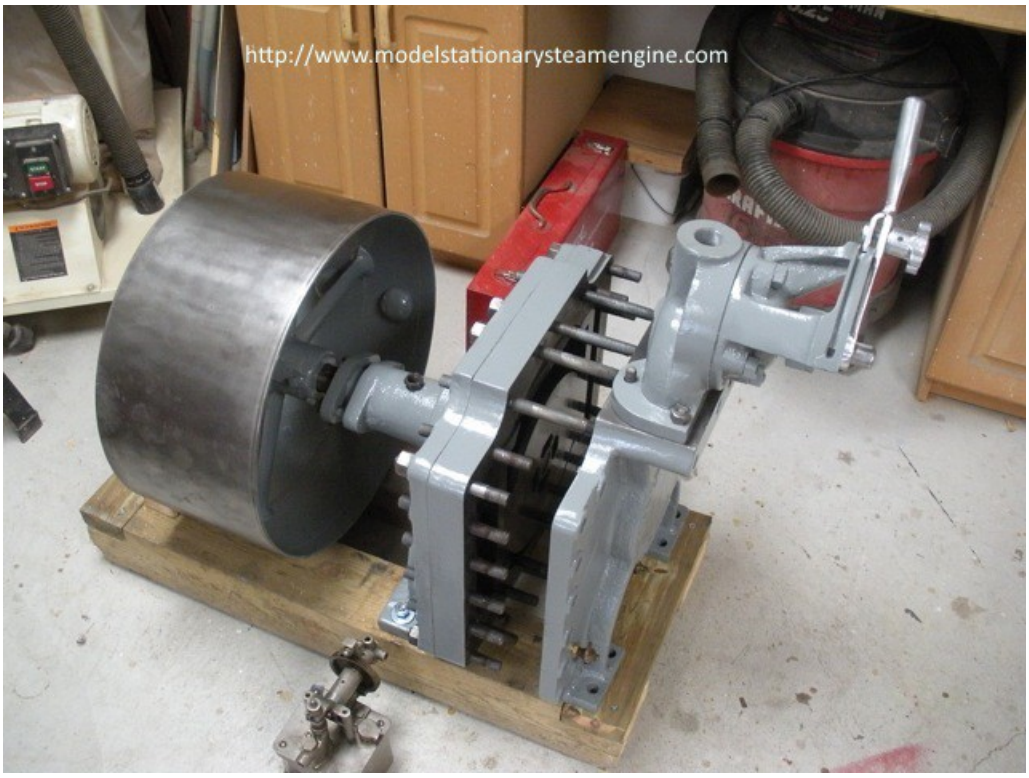
Par exemple il furent installés aux chutes du Niagara sur le « Maid of the mist » pour la commande de gouvernail où ils fonctionnèrent 40 ans d'affilée. L'usage marin se développa ainsi progressivement, et au cours de la seconde guerre mondiale ce sont quand même plus de 10 000 de ces moteurs qui furent installés sur la marine de guerre et commerciale.

Ils semblent n'avoir été produits que par la Dake corporation et en petite puissance (3,5 à 30 CV) et exclusivement en monocylindre.

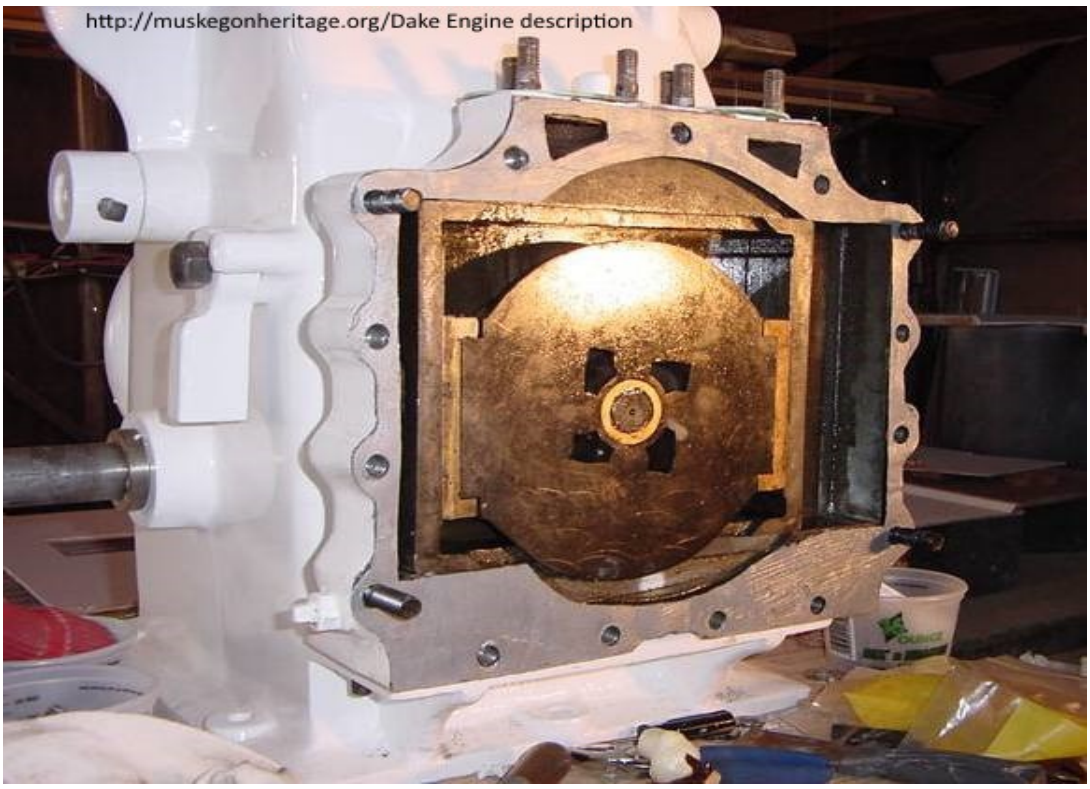
L'absence de muticylindres est un peu étonnante d'ailleurs car ces moteurs semblent, au premier abord, assez faciles à assembler, un peu à la manière des pompes centrifuges multiétagées.



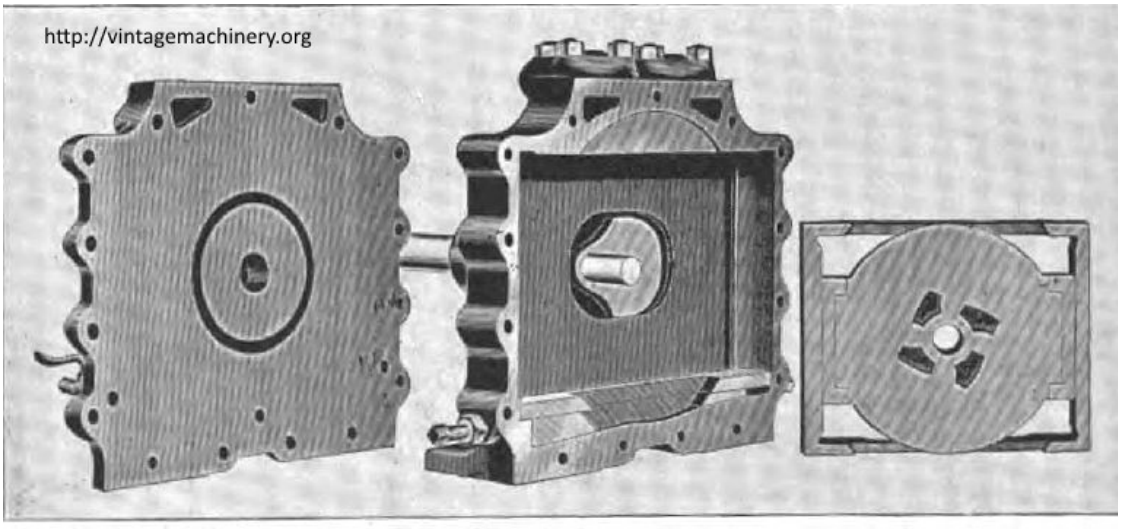
Ce moteur de 7CV a été construit en 1917 dans l'usine de Grand Haven (Michigan) et installé à la scierie de la Ford Motor Company à Pequaming (Michigan). Il y fonctionna jusqu'en 1934 environ.



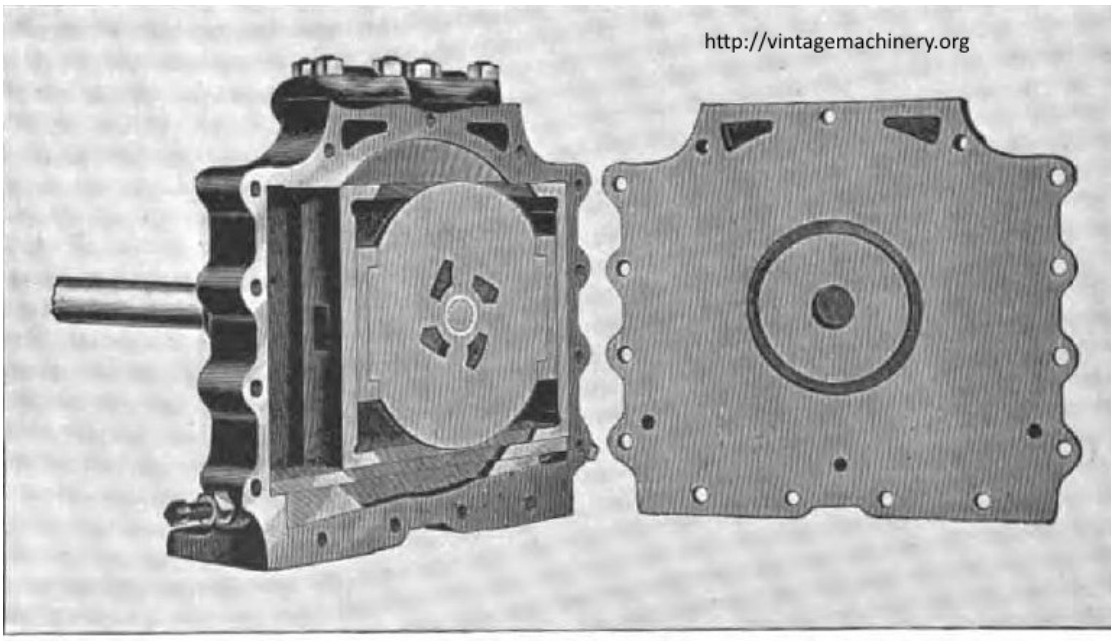
Moteur en cours de réassemblage. La remise en état fut simple et rapide et ce moteur se remit à fonctionner en 2009 sans problème.



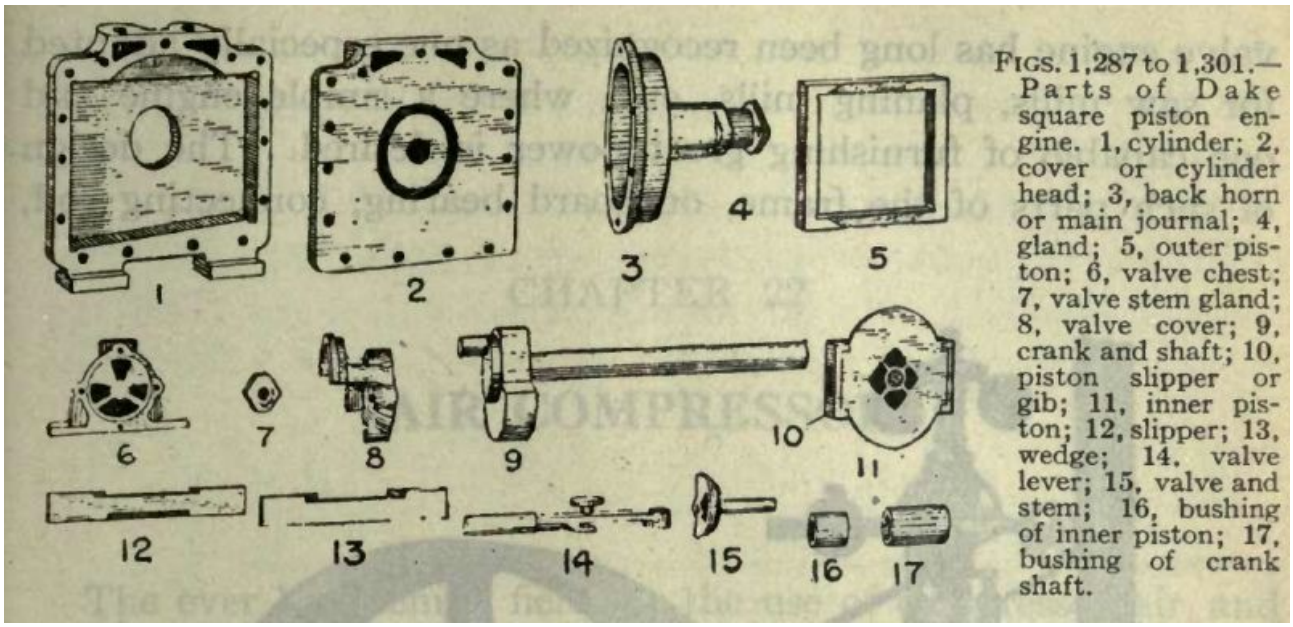
Vue du piston externe
On peut apprécier l'extrême simplicité de ce moteur



THE CYLINDER OF THE DAKE ENGINE, WITH PISTONS REMOVED.



THE PISTONS IN THEIR PROPER POSITION.



FIGS. 1,287 to 1,301.—Parts of Dake square piston engine. 1, cylinder; 2, cover or cylinder head; 3, back horn or main journal; 4, gland; 5, outer piston; 6, valve chest; 7, valve stem gland; 8, valve cover; 9, crank and shaft; 10, piston slipper or gib; 11, inner piston; 12, slipper; 13, wedge; 14, valve lever; 15, valve and stem; 16, bushing of inner piston; 17, bushing of crank shaft.

Le moteur Dake se compose de 17 pièces !

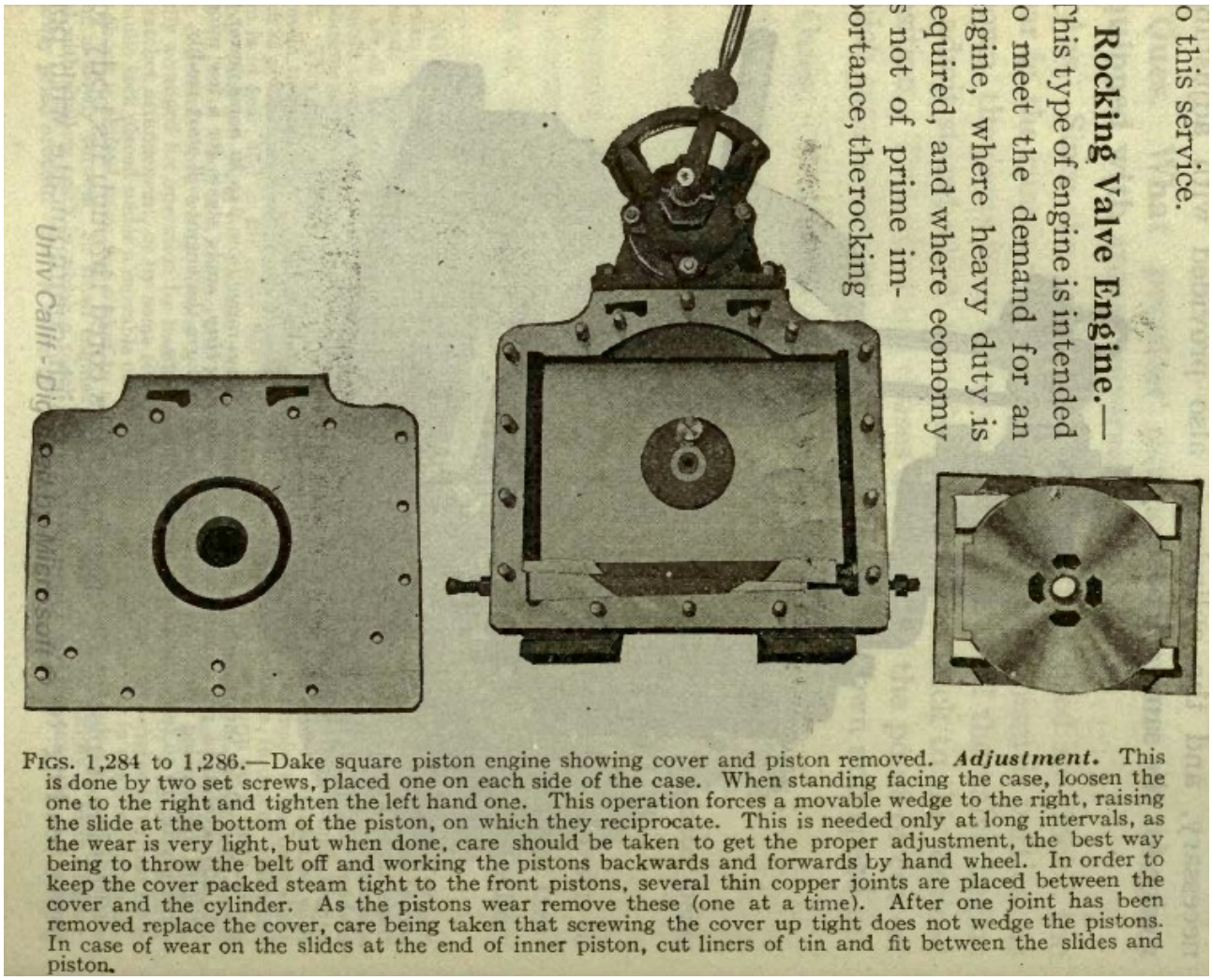
Fonctionnement du moteur

La machine est composée de deux pistons :

- le piston le plus à l'intérieur est connecté au maneton de bielle et se meut verticalement
- le piston le plus externe bouge horizontalement dans le bâti.

Un soin important doit être apporté aux jeux de fonctionnement et aux réglages des joints d'étanchéité des trois corps composant un moteur standard si l'on veut un fonctionnement efficace

sans fuites ni pertes par frottements mécaniques.



o this service.

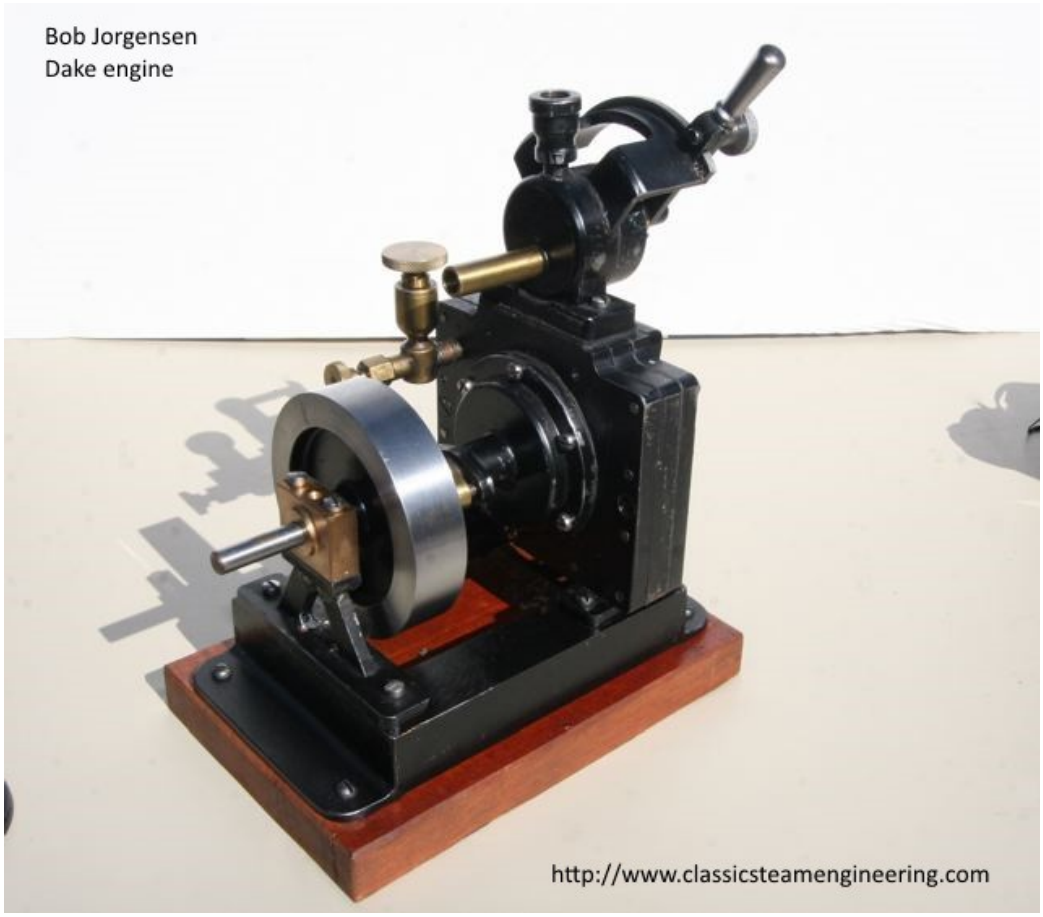
Rocking Valve Engine.—
his type of engine is intended
o meet the demand for an
ngine, where heavy duty is
equired, and where economy
s not of prime im-
portance, therocking

FIGS. 1,284 to 1,286.—Dake square piston engine showing cover and piston removed. ***Adjustment.*** This is done by two set screws, placed one on each side of the case. When standing facing the case, loosen the one to the right and tighten the left hand one. This operation forces a movable wedge to the right, raising the slide at the bottom of the piston, on which they reciprocate. This is needed only at long intervals, as the wear is very light, but when done, care should be taken to get the proper adjustment, the best way being to throw the belt off and working the pistons backwards and forwards by hand wheel. In order to keep the cover packed steam tight to the front pistons, several thin copper joints are placed between the cover and the cylinder. As the pistons wear remove these (one at a time). After one joint has been removed replace the cover, care being taken that screwing the cover up tight does not wedge the pistons. In case of wear on the slides at the end of inner piston, cut liners of tin and fit between the slides and piston.

Dake engine et modélisme

Les moteurs non conventionnels n'ont guère suscité beaucoup de réalisations. Il est vrai qu'il faut souvent faire des recherches car les plans sont rares et les fonderies inexistantes.

Réalisation de Bob Jorgensen à partir d'une gravure et d'un article.



Des plans d'un moteur Dake sont disponibles en téléchargement sur le site

http://www.classicsteamengineering.com/index.php?topic=946.0

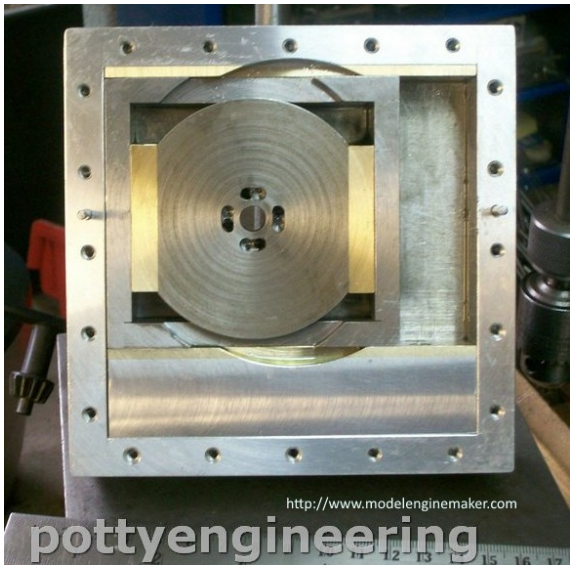
Réalisation à partir de plans personnels

Moteur Dake fonctionnant à l'air comprimé. Plans personnels du modéliste

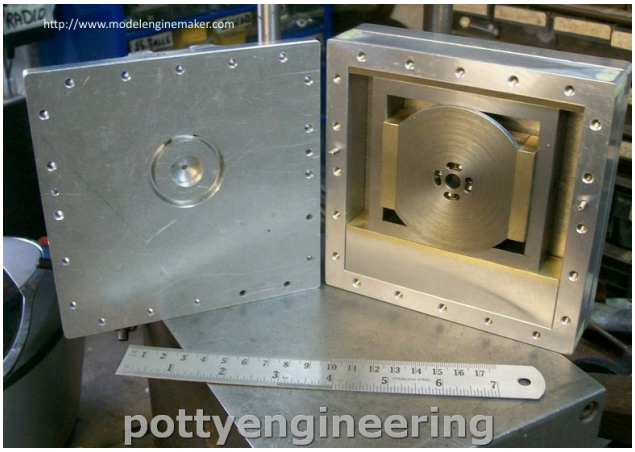
La réalisation est, au moment de la rédaction de ce document, détaillée à cette adresse. L'auteur tenait les plans à disposition des abonnés du forum.

http://www.modelenginemaker.com/index.php?topic=440.0

Piston interne usiné à partir d'un rond de 3''(76,2mm) en E1N14



Vue des 2 pistons dans leur logement



Vue du capot avec les rainures circulaires de distribution

Moteur terminé avec son inverseur

Site mekanizmalar

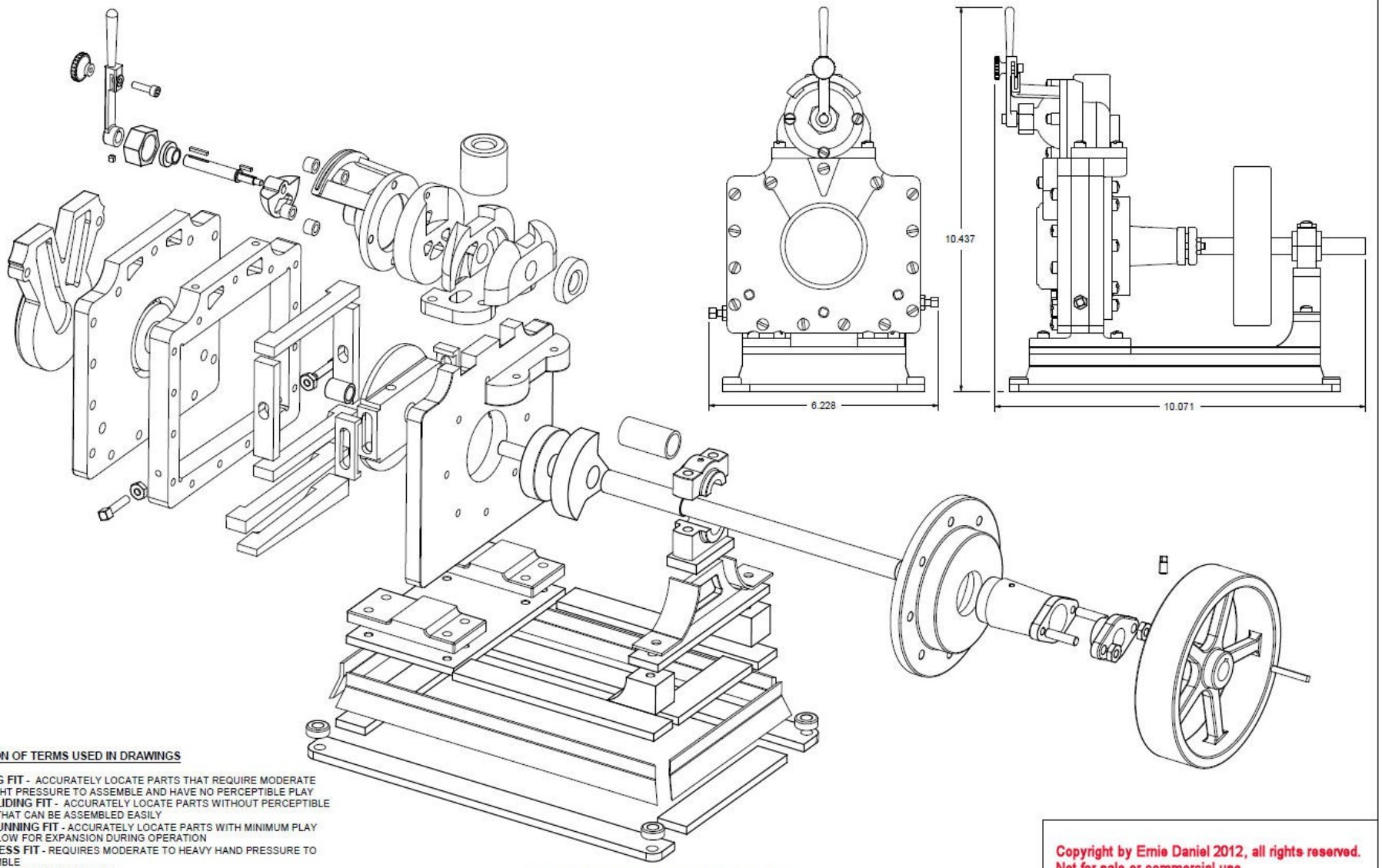
http://www.mekanizmalar.com/index.html

Enormément d'animations didactiques sur de nombreux sujets.

Des fichiers .STL sont fournis pour un modèle fonctionnant fabriqué par impression 3D amateur.

http://www.mekanizmalar.com/3d-printed-dake-steam-engine.html

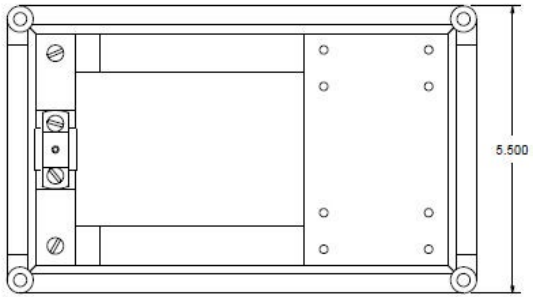
Plans parus sur le forum Home Model Engine Machinist
Suivis du brevet original de W. Dake

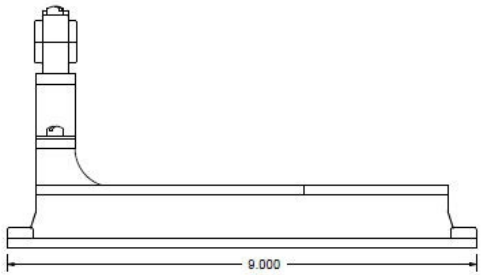


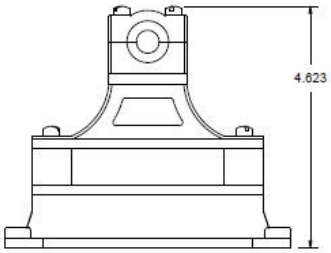
DEFINITION OF TERMS USED IN DRAWINGS

LOCATING FIT - ACCURATELY LOCATE PARTS THAT REQUIRE MODERATE TO LIGHT PRESSURE TO ASSEMBLE AND HAVE NO PERCEPTIBLE PLAY
CLOSE SLIDING FIT - ACCURATELY LOCATE PARTS WITHOUT PERCEPTIBLE PLAY THAT CAN BE ASSEMBLED EASILY
CLOSE RUNNING FIT - ACCURATELY LOCATE PARTS WITH MINIMUM PLAY TO ALLOW FOR EXPANSION DURING OPERATION
LIGHT PRESS FIT - REQUIRES MODERATE TO HEAVY HAND PRESSURE TO ASSEMBLE
PRESS FIT - INTERFERENCE FIT

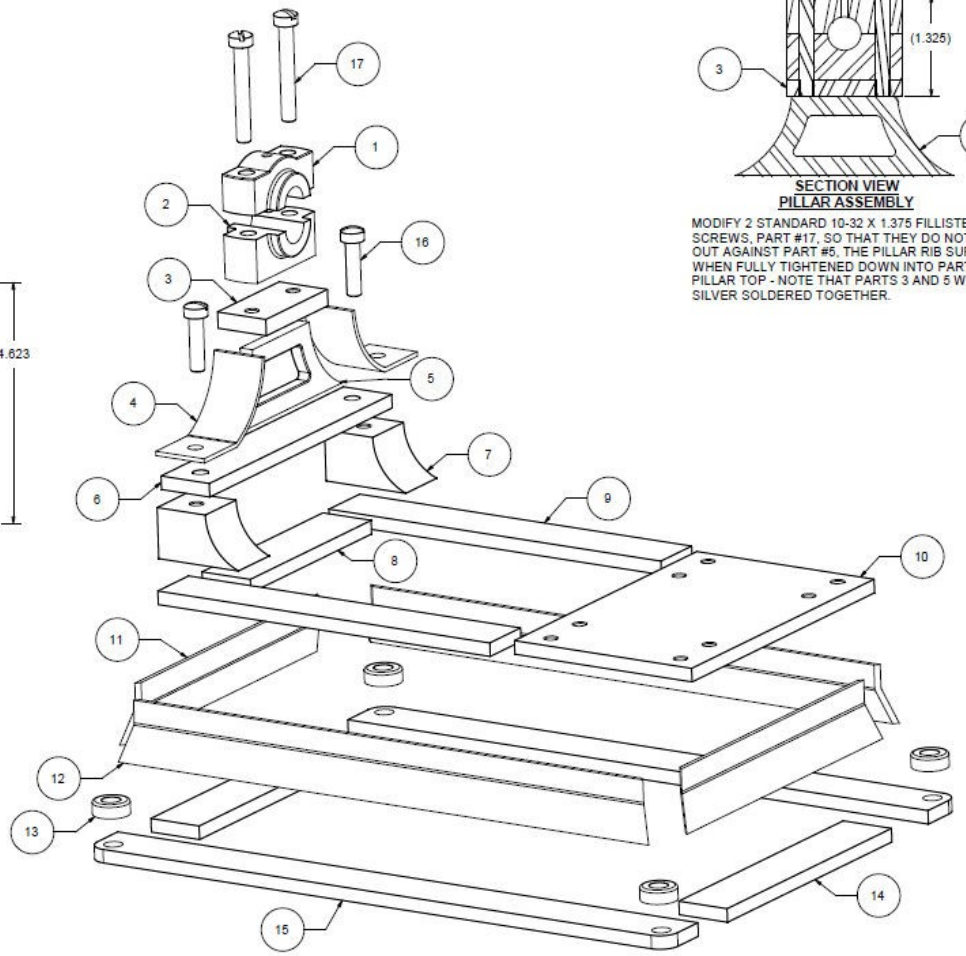
FILLISTER HEAD SCREWS NOT SHOWN FOR CLARITY







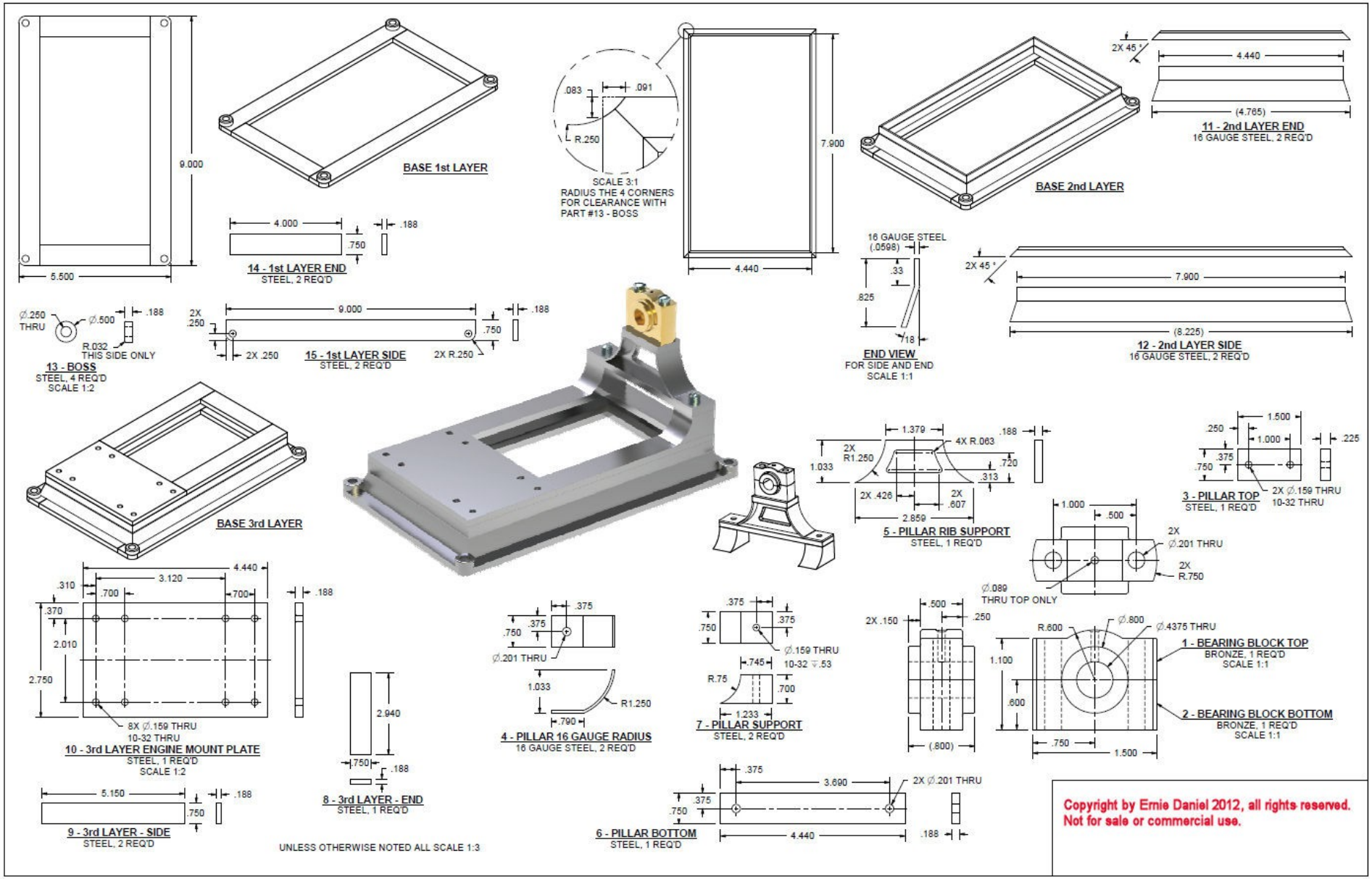
Item Number	Quantity	Part Name	Material	Minimum Stock Size
1	1	BEARING BLOCK - TOP	BRONZE/BRASS	.600 X .800 X 1.500
2	1	BEARING BLOCK - BOTTOM	BRONZE/BRASS	.600 X .800 X 1.500
3	1	PILLAR - TOP	STEEL	.225 X .750 X 1.500
4	2	PILLAR - 16 GAUGE RADIUS	16 GAUGE STEEL	.750 X 2.123
5	1	PILLAR RIB SUPPORT	STEEL	.188 X 1.033 X 2.859
6	1	PILLAR BOTTOM	STEEL	.188 X .750 X 4.440
7	2	PILLAR SUPPORT	STEEL	.700 X .750 X 1.235
8	1	3rd LAYER - END	STEEL	.188 X .750 X 2.940
9	2	3rd LAYER - SIDE	STEEL	.188 X .750 X 5.150
10	1	3rd LAYER - ENGINE MOUNT PLATE	STEEL	.188 X 2.750 X 4.440
11	2	2nd LAYER - END	16 GAUGE STEEL	.850 X 4.790
12	2	2nd LAYER - SIDE	16 GAUGE STEEL	.850 X 8.230
13	4	1st LAYER - BOSS	STEEL	.188 X .500 DIA.
14	2	1st LAYER - END	STEEL	.188 X .750 X 4.00
15	2	1st LAYER - SIDE	STEEL	.188 X .750 X 9.00
16	2	10-32 X .75 FILLISTER HEAD		
17	2	10-32 X 1.375-MODIFIED FILLISTER HEAD		



SECTION VIEW
PILLAR ASSEMBLY

MODIFY 2 STANDARD 10-32 X 1.375 FILLISTER HEAD SCREWS, PART #17, SO THAT THEY DO NOT BOTTOM OUT AGAINST PART #5, THE PILLAR RIB SUPPORT WHEN FULLY TIGHTENED DOWN INTO PART #3, THE PILLAR TOP - NOTE THAT PARTS 3 AND 5 WILL BE SILVER SOLDERED TOGETHER.

ALL PARTS OTHER THAN #1,2,16, AND17, ARE TO BE SILVER SOLDERED TOGETHER


BASE 1st LAYER
BASE 2nd LAYER
BASE 3rd LAYER
SCALE 3:1
RADIUS THE 4 CORNERS FOR CLEARANCE WITH PART #13 - BOSS
14 - 1st LAYER END
STEEL, 2 REQ'D
11 - 2nd LAYER END
16 GAUGE STEEL, 2 REQ'D
13 - BOSS
STEEL, 4 REQ'D
SCALE 1:2
15 - 1st LAYER SIDE
STEEL, 2 REQ'D
END VIEW
FOR SIDE AND END
SCALE 1:1
12 - 2nd LAYER SIDE
16 GAUGE STEEL, 2 REQ'D
5 - PILLAR RIB SUPPORT
STEEL, 1 REQ'D
3 - PILLAR TOP
STEEL, 1 REQ'D
10 - 3rd LAYER ENGINE MOUNT PLATE
STEEL, 1 REQ'D
SCALE 1:2
4 - PILLAR 16 GAUGE RADIUS
16 GAUGE STEEL, 2 REQ'D
7 - PILLAR SUPPORT
STEEL, 2 REQ'D
1 - BEARING BLOCK TOP
BRONZE, 1 REQ'D
SCALE 1:1
2 - BEARING BLOCK BOTTOM
BRONZE, 1 REQ'D
SCALE 1:1
8 - 3rd LAYER - END
STEEL, 1 REQ'D
9 - 3rd LAYER - SIDE
STEEL, 2 REQ'D
6 - PILLAR BOTTOM
STEEL, 1 REQ'D
UNLESS OTHERWISE NOTED ALL SCALE 1:3
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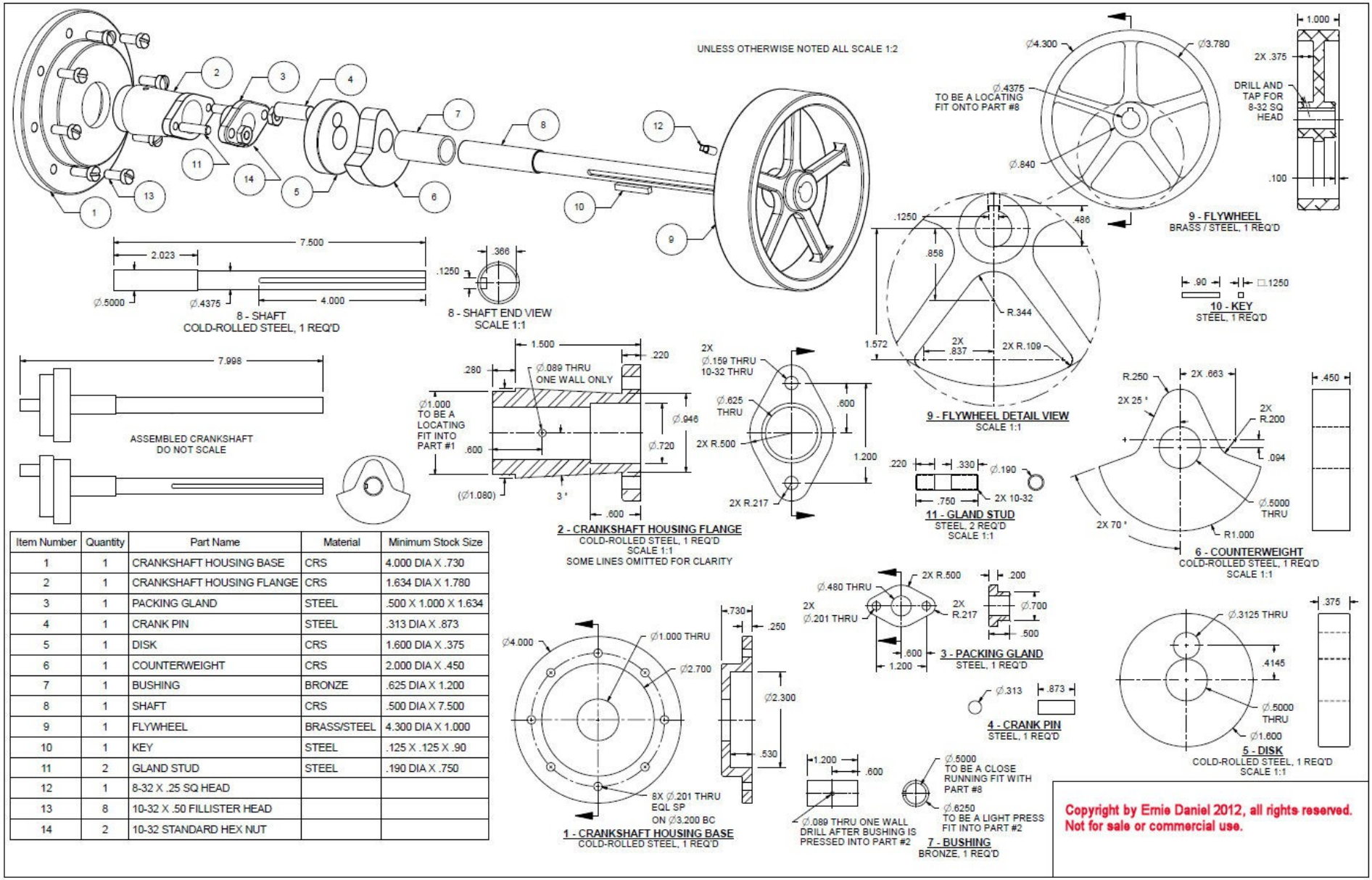
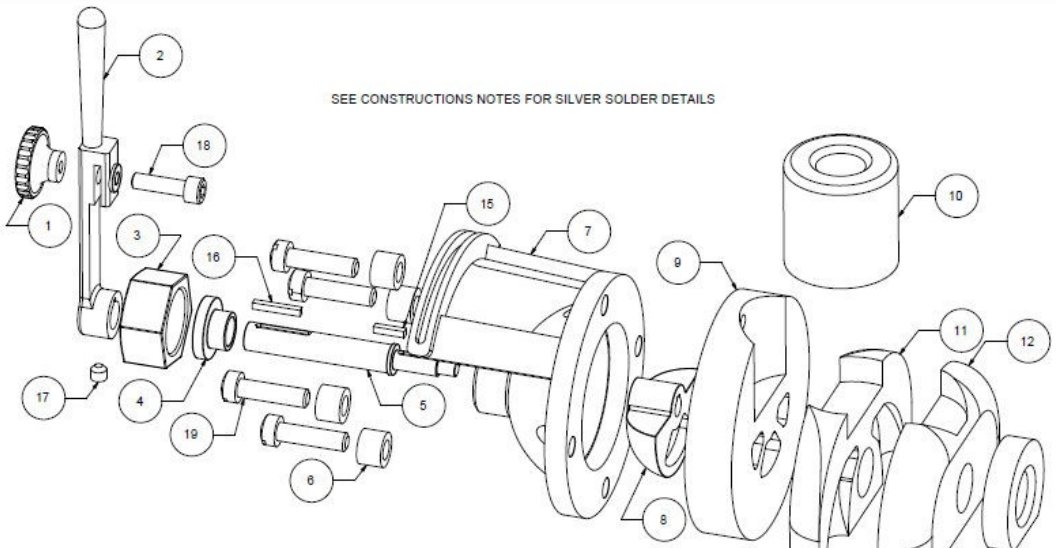
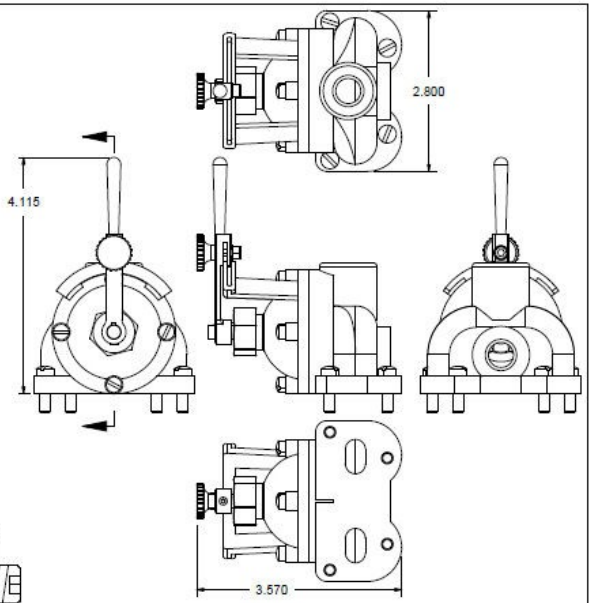
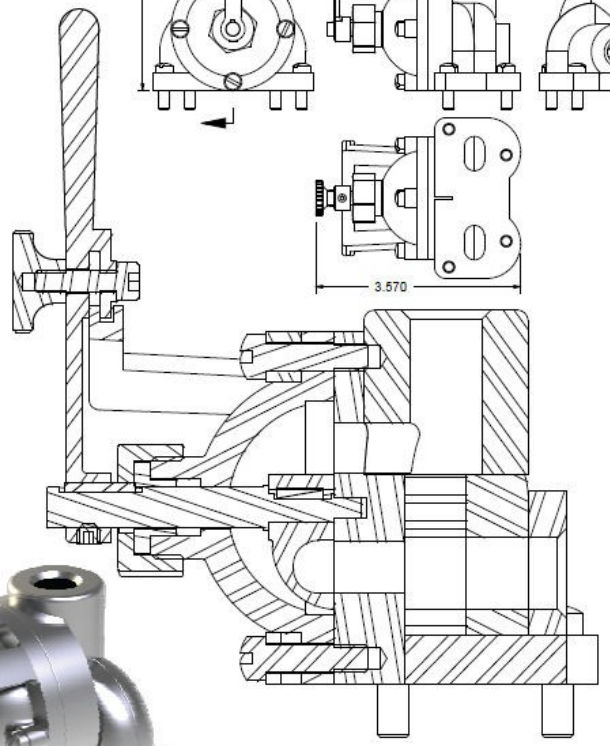


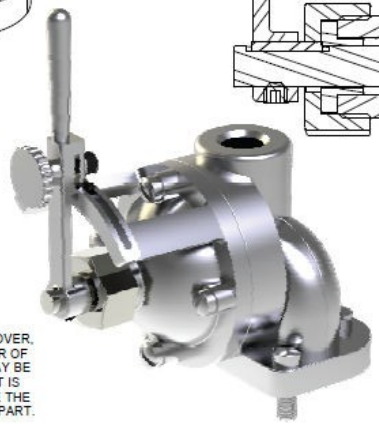
Item Number	Quantity	Part Name	Material	Minimum Stock Size
1	1	CRANKSHAFT HOUSING BASE	CRS	4.000 DIA X .730
2	1	CRANKSHAFT HOUSING FLANGE	CRS	1.634 DIA X 1.780
3	1	PACKING GLAND	STEEL	.500 X 1.000 X 1.634
4	1	CRANK PIN	STEEL	.313 DIA X .873
5	1	DISK	CRS	1.600 DIA X .375
6	1	COUNTERWEIGHT	CRS	2.000 DIA X .450
7	1	BUSHING	BRONZE	.625 DIA X 1.200
8	1	SHAFT	CRS	.500 DIA X 7.500
9	1	FLYWHEEL	BRASS/STEEL	4.300 DIA X 1.000
10	1	KEY	STEEL	.125 X .125 X .90
11	2	GLAND STUD	STEEL	.190 DIA X .750
12	1	8-32 X .25 SQ HEAD		
13	8	10-32 X .50 FILLISTER HEAD		
14	2	10-32 STANDARD HEX NUT		

SEE CONSTRUCTIONS NOTES FOR SILVER SOLDER DETAILS



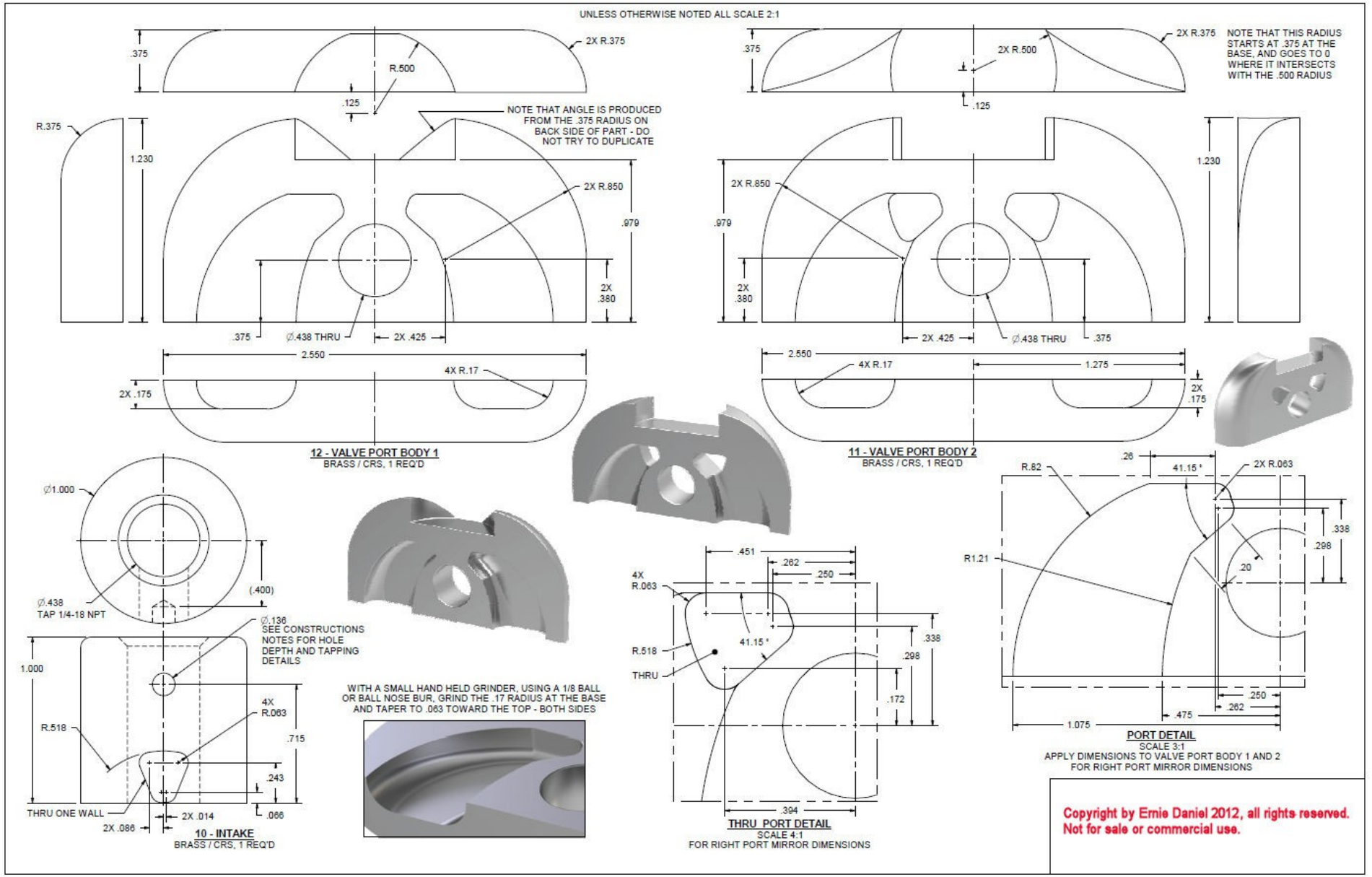


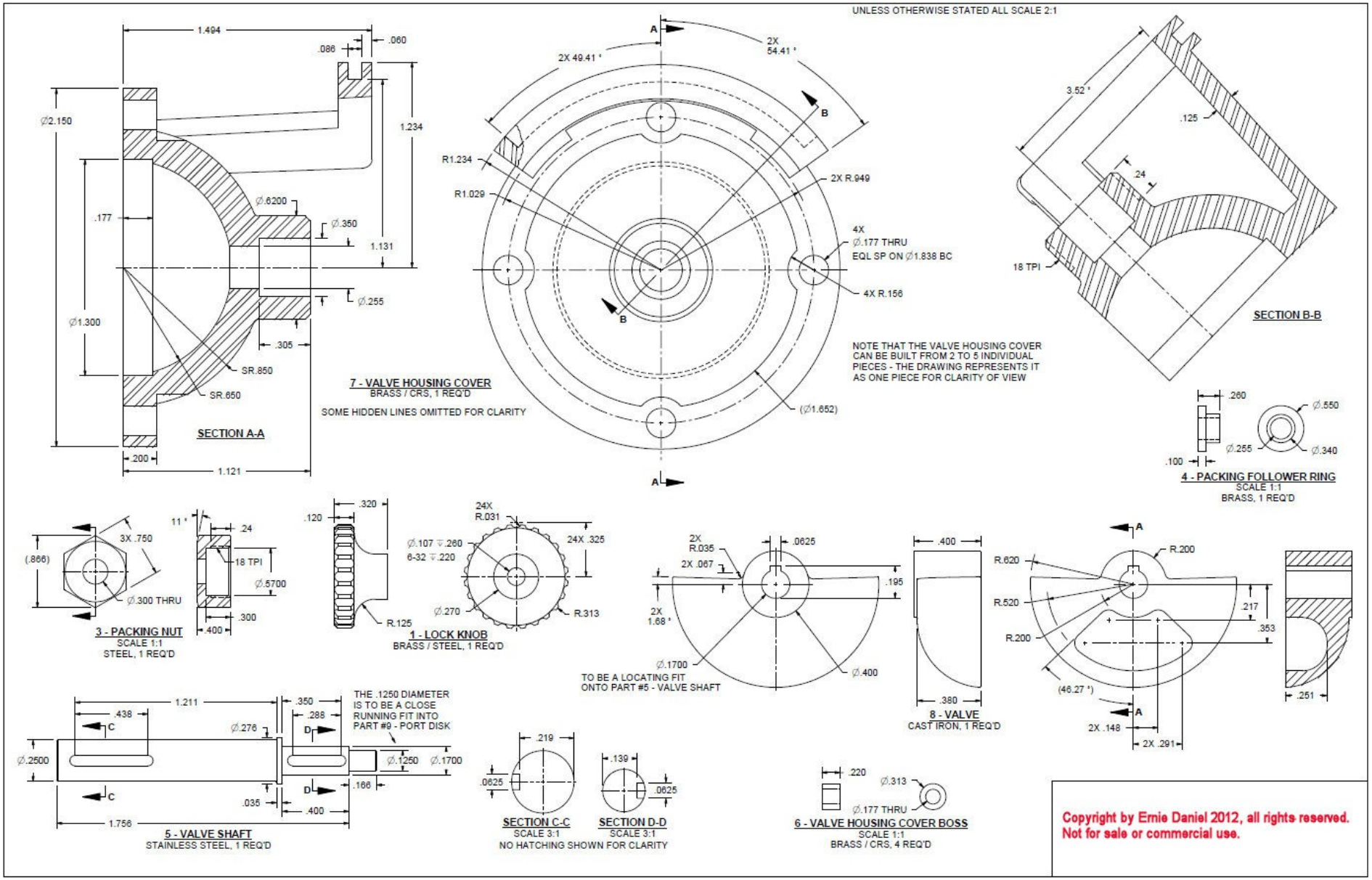




Item Number	Quantity	Part Name	Material	Minimum Stock Size
1	1	LOCK KNOB	BRASS / STEEL	.625 DIA X .320
2	1	HANDLE	BRASS / CRS	.280 X.310 X .3250
3	1	PACKING NUT	STEEL	.866 DIA X .400
4	1	PACKING FOLLOWER RING	BRASS	.550 DIA X .260
5	1	SHAFT	STAINLESS STEEL	.276 DIA X 1.922
6	4	VALVE HOUSING COVER BOSS	BRASS / CRS	.313 DIA X .220
7	1	VALVE HOUSING COVER	BRASS / CRS	*
8	1	VALVE	CAST IRON	1.240 DIA X .400
9	1	PORT DISK	BRASS / CRS	2.150 DIA X .430
10	1	INTAKE	BRASS / CRS	1.000 DIA X 1.000
11	1	VALVE PORT BODY-2	BRASS / CRS	.375 X 1.230 X 2.550
12	1	VALVE PORT BODY-1	BRASS / CRS	.375 X 1.230 X 2.550
13	1	EXHAUST RING	BRASS / CRS	1.000 DIA X .235
14	1	VALVE BASE	BRASS / CRS	.300 X 1.500 X 2.800
15	1	KEY	STEEL	.0625 X .0625 X .250
16	1	KEY	STEEL	.0625 X .0625 X .437
17	1	6-32 X .125 SS FOR VALVE HANDLE		
18	1	6-32 X .50 VALVE HANDLE SCREW		
19	4	8-32 X .625 FILLISTER HEAD		
20	4	10-32 X .625 FILLISTER HEAD		

*NOTE THAT THE VALVE HOUSING COVER, #7, CAN BE PRODUCED IN A NUMBER OF WAYS/PARTS. FOR EXAMPLE, IT MAY BE PRODUCED FROM 2 TO 5 PIECES - IT IS UP TO THE BUILDER TO DETERMINE THE BEST WAY FOR HIM TO BUILD THIS PART.




UNLESS OTHERWISE STATED ALL SCALE 2:1
1.494
.086
.060
Ø2.150
1.234
.177
Ø.6200
Ø.350
1.131
Ø.255
Ø1.300
.305
SR.850
SR.650
.200
1.121
SECTION A-A
7 - VALVE HOUSING COVER
BRASS / CRS, 1 REQ'D
SOME HIDDEN LINES OMITTED FOR CLARITY
2X 49.41 °
2X 54.41 °
R1.234
R1.029
2X R.949
4X Ø.177 THRU EQL SP ON Ø1.838 BC
4X R.156
(Ø1.652)
NOTE THAT THE VALVE HOUSING COVER CAN BE BUILT FROM 2 TO 5 INDIVIDUAL PIECES - THE DRAWING REPRESENTS IT AS ONE PIECE FOR CLARITY OF VIEW
3.52 °
.125
.24
18 TPI
SECTION B-B
.260
Ø.550
Ø.255
Ø.340
.100
4 - PACKING FOLLOWER RING
SCALE 1:1
BRASS, 1 REQ'D
(.866)
3X .750
Ø.300 THRU
11 °
.24
18 TPI
Ø.5700
.300
.400
3 - PACKING NUT
SCALE 1:1
STEEL, 1 REQ'D
.120
.320
R.125
Ø.107 ▽.260
6-32 ▽.220
24X R.031
24X .325
Ø.270
R.313
1 - LOCK KNOB
BRASS / STEEL, 1 REQ'D
2X R.035
2X .067
.0625
.195
2X 1.68 °
Ø.1700
Ø.400
TO BE A LOCATING FIT ONTO PART #5 - VALVE SHAFT
.400
.380
8 - VALVE
CAST IRON, 1 REQ'D
R.620
R.520
R.200
R.200
.217
.353
(46.27 °)
2X .148
2X .291
.251
1.211
.438
.350
.288
C
D
Ø.276
THE .1250 DIAMETER IS TO BE A CLOSE RUNNING FIT INTO PART #9 - PORT DISK
Ø.2500
Ø.1250
Ø.1700
.166
.035
.400
1.756
5 - VALVE SHAFT
STAINLESS STEEL, 1 REQ'D
.219
.0625
SECTION C-C
SCALE 3:1
.139
.0625
SECTION D-D
SCALE 3:1
NO HATCHING SHOWN FOR CLARITY
.220
Ø.313
Ø.177 THRU
6 - VALVE HOUSING COVER BOSS
SCALE 1:1
BRASS / CRS, 4 REQ'D
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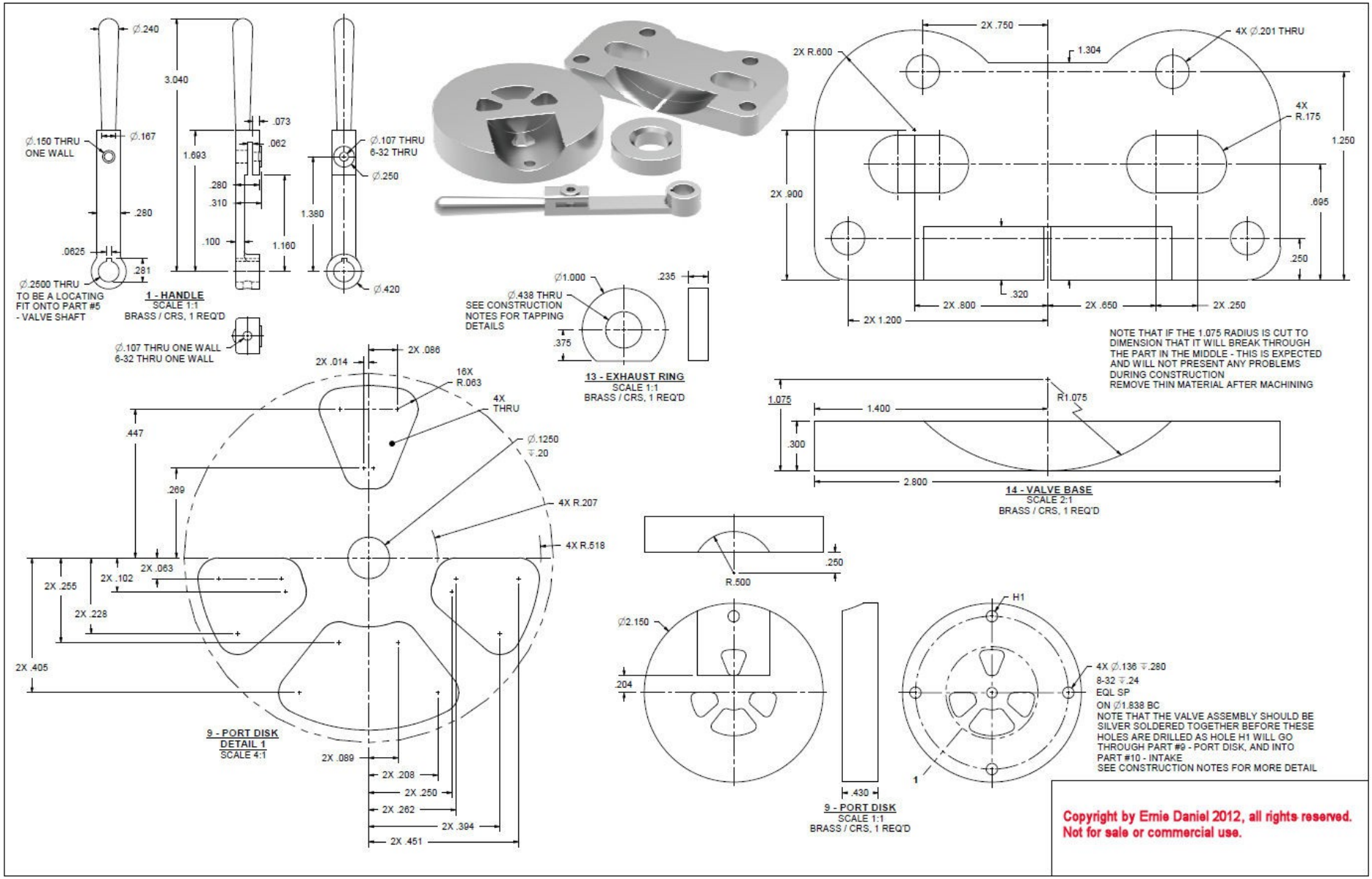
Ø.240
3.040
Ø.150 THRU
ONE WALL
Ø.167
.280
.0625
.281
Ø.2500 THRU
TO BE A LOCATING
FIT ONTO PART #5
- VALVE SHAFT
1.693
.073
.062
.280
.310
.100
1.160
Ø.107 THRU
6-32 THRU
Ø.250
1.380
Ø.420
1 - HANDLE
SCALE 1:1
BRASS / CRS, 1 REQ'D
Ø.107 THRU ONE WALL
6-32 THRU ONE WALL
2X .750
4X Ø.201 THRU
2X R.600
1.304
4X
R.175
1.250
2X .900
.695
.250
.320
2X .800
2X .650
2X .250
2X 1.200
Ø1.000
.235
Ø.438 THRU
SEE CONSTRUCTION
NOTES FOR TAPPING
DETAILS
.375
13 - EXHAUST RING
SCALE 1:1
BRASS / CRS, 1 REQ'D
NOTE THAT IF THE 1.075 RADIUS IS CUT TO
DIMENSION THAT IT WILL BREAK THROUGH
THE PART IN THE MIDDLE - THIS IS EXPECTED
AND WILL NOT PRESENT ANY PROBLEMS
DURING CONSTRUCTION
REMOVE THIN MATERIAL AFTER MACHINING
1.075
1.400
R1.075
.300
2.800
14 - VALVE BASE
SCALE 2:1
BRASS / CRS, 1 REQ'D
2X .014
2X .086
16X
R.063
4X
THRU
.447
Ø.1250
↧.20
.269
4X R.207
4X R.518
2X .063
2X .102
2X .255
2X .228
2X .405
9 - PORT DISK
DETAIL 1
SCALE 4:1
2X .089
2X .208
2X .250
2X .262
2X .394
2X .451
.250
R.500
Ø2.150
.204
H1
4X Ø.136 ↧.280
8-32 ↧.24
EQL SP
ON Ø1.838 BC
NOTE THAT THE VALVE ASSEMBLY SHOULD BE
SILVER SOLDERED TOGETHER BEFORE THESE
HOLES ARE DRILLED AS HOLE H1 WILL GO
THROUGH PART #9 - PORT DISK, AND INTO
PART #10 - INTAKE
SEE CONSTRUCTION NOTES FOR MORE DETAIL
.430
1
9 - PORT DISK
SCALE 1:1
BRASS / CRS, 1 REQ'D
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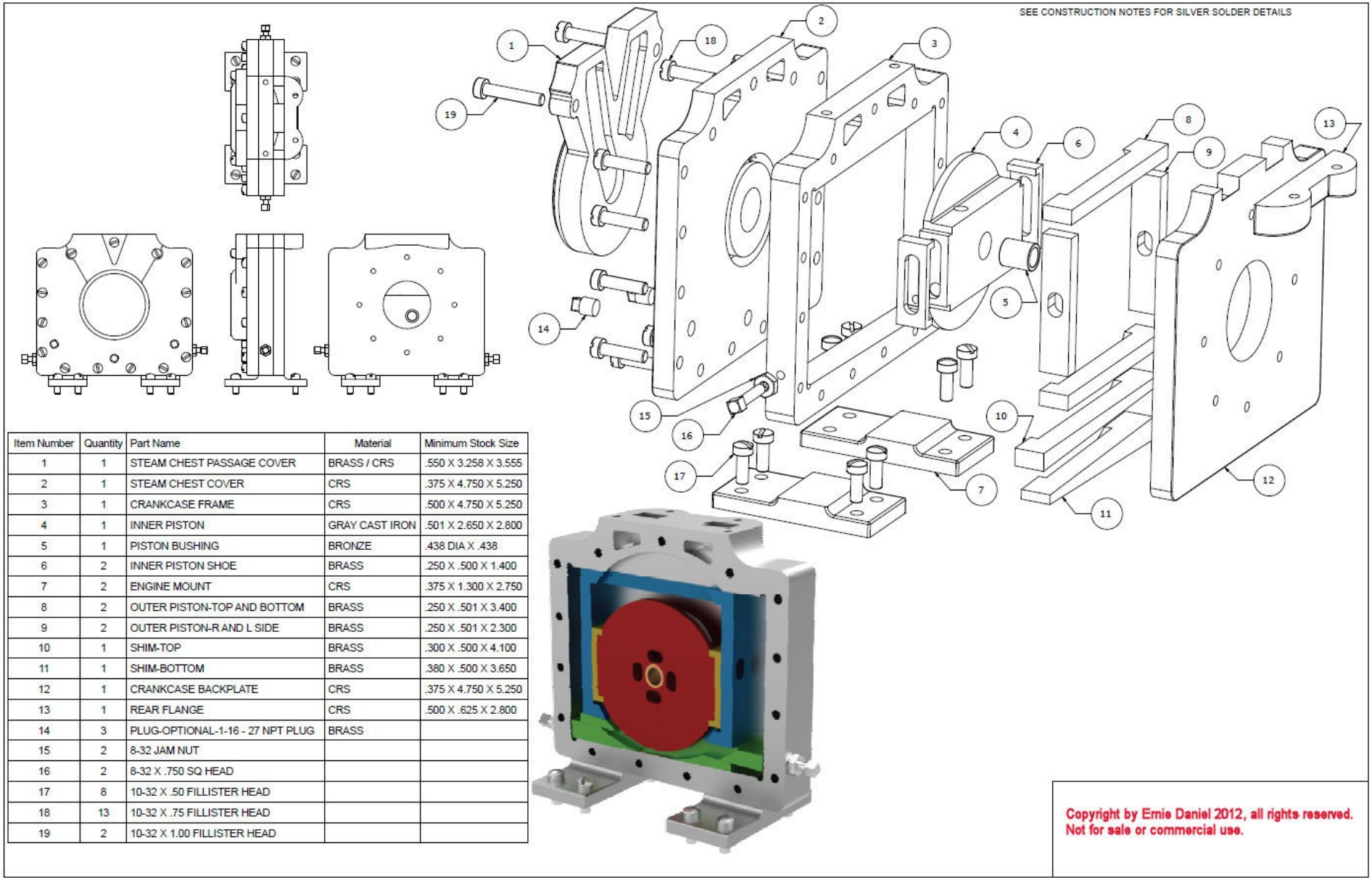
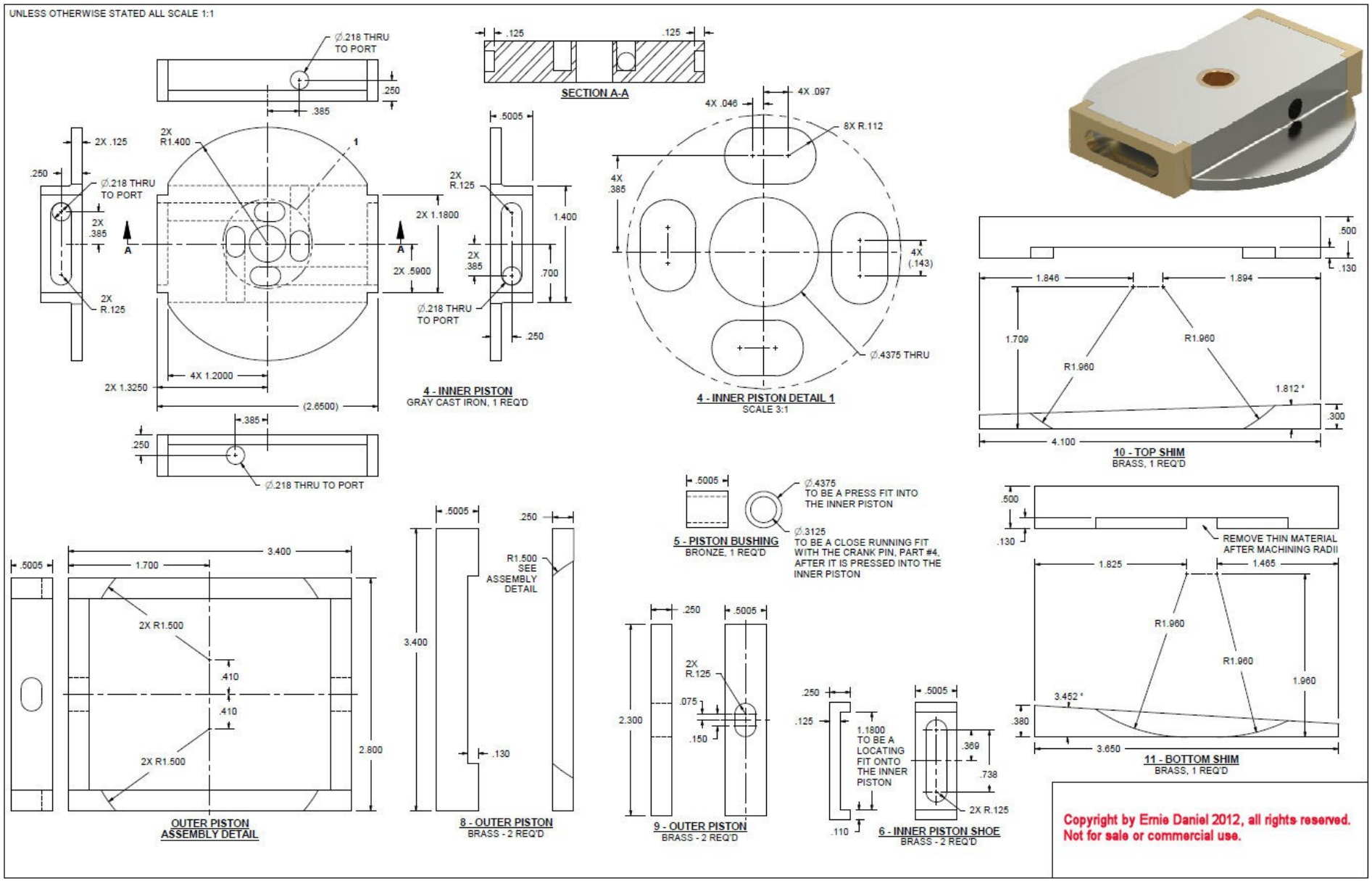


Item Number	Quantity	Part Name	Material	Minimum Stock Size
1	1	STEAM CHEST PASSAGE COVER	BRASS / CRS	.550 X 3.258 X 3.555
2	1	STEAM CHEST COVER	CRS	.375 X 4.750 X 5.250
3	1	CRANKCASE FRAME	CRS	.500 X 4.750 X 5.250
4	1	INNER PISTON	GRAY CAST IRON	.501 X 2.650 X 2.800
5	1	PISTON BUSHING	BRONZE	.438 DIA X .438
6	2	INNER PISTON SHOE	BRASS	.250 X .500 X 1.400
7	2	ENGINE MOUNT	CRS	.375 X 1.300 X 2.750
8	2	OUTER PISTON-TOP AND BOTTOM	BRASS	.250 X .501 X 3.400
9	2	OUTER PISTON-R AND L SIDE	BRASS	.250 X .501 X 2.300
10	1	SHIM-TOP	BRASS	.300 X .500 X 4.100
11	1	SHIM-BOTTOM	BRASS	.380 X .500 X 3.650
12	1	CRANKCASE BACKPLATE	CRS	.375 X 4.750 X 5.250
13	1	REAR FLANGE	CRS	.500 X .625 X 2.800
14	3	PLUG-OPTIONAL-1-16 - 27 NPT PLUG	BRASS	
15	2	8-32 JAM NUT		
16	2	8-32 X .750 SQ HEAD		
17	8	10-32 X .50 FILLISTER HEAD		
18	13	10-32 X .75 FILLISTER HEAD		
19	2	10-32 X 1.00 FILLISTER HEAD		


UNLESS OTHERWISE STATED ALL SCALE 1:1
Ø.218 THRU TO PORT
.250
.385
.125
.125
SECTION A-A
2X .125
2X R1.400
1
.250
Ø.218 THRU TO PORT
2X .385
A
2X R.125
2X 1.1800
2X .5900
.5005
2X R.125
2X .385
1.400
.700
Ø.218 THRU TO PORT
.250
4X 1.2000
2X 1.3250
(2.6500)
4 - INNER PISTON
GRAY CAST IRON, 1 REQ'D
.385
.250
Ø.218 THRU TO PORT
4X .046
4X .097
8X R.112
4X .385
4X (.143)
Ø.4375 THRU
4 - INNER PISTON DETAIL 1
SCALE 3:1
.500
.130
1.846
1.894
1.709
R1.960
R1.960
1.812 °
.300
4.100
10 - TOP SHIM
BRASS, 1 REQ'D
.5005
Ø.4375
TO BE A PRESS FIT INTO
THE INNER PISTON
Ø.3125
TO BE A CLOSE RUNNING FIT
WITH THE CRANK PIN, PART #4,
AFTER IT IS PRESSED INTO THE
INNER PISTON
5 - PISTON BUSHING
BRONZE, 1 REQ'D
.500
.130
REMOVE THIN MATERIAL
AFTER MACHINING RADII
1.825
1.465
R1.960
R1.960
1.960
3.452 °
.380
3.650
11 - BOTTOM SHIM
BRASS, 1 REQ'D
.5005
3.400
1.700
2X R1.500
.410
.410
2X R1.500
2.800
OUTER PISTON
ASSEMBLY DETAIL
.5005
.250
R1.500
SEE
ASSEMBLY
DETAIL
3.400
.130
8 - OUTER PISTON
BRASS - 2 REQ'D
.250
.5005
2X
R.125
.075
.150
2.300
9 - OUTER PISTON
BRASS - 2 REQ'D
.250
.125
1.1800
TO BE A
LOCATING
FIT ONTO
THE INNER
PISTON
.110
.5005
.369
.738
2X R.125
6 - INNER PISTON SHOE
BRASS - 2 REQ'D
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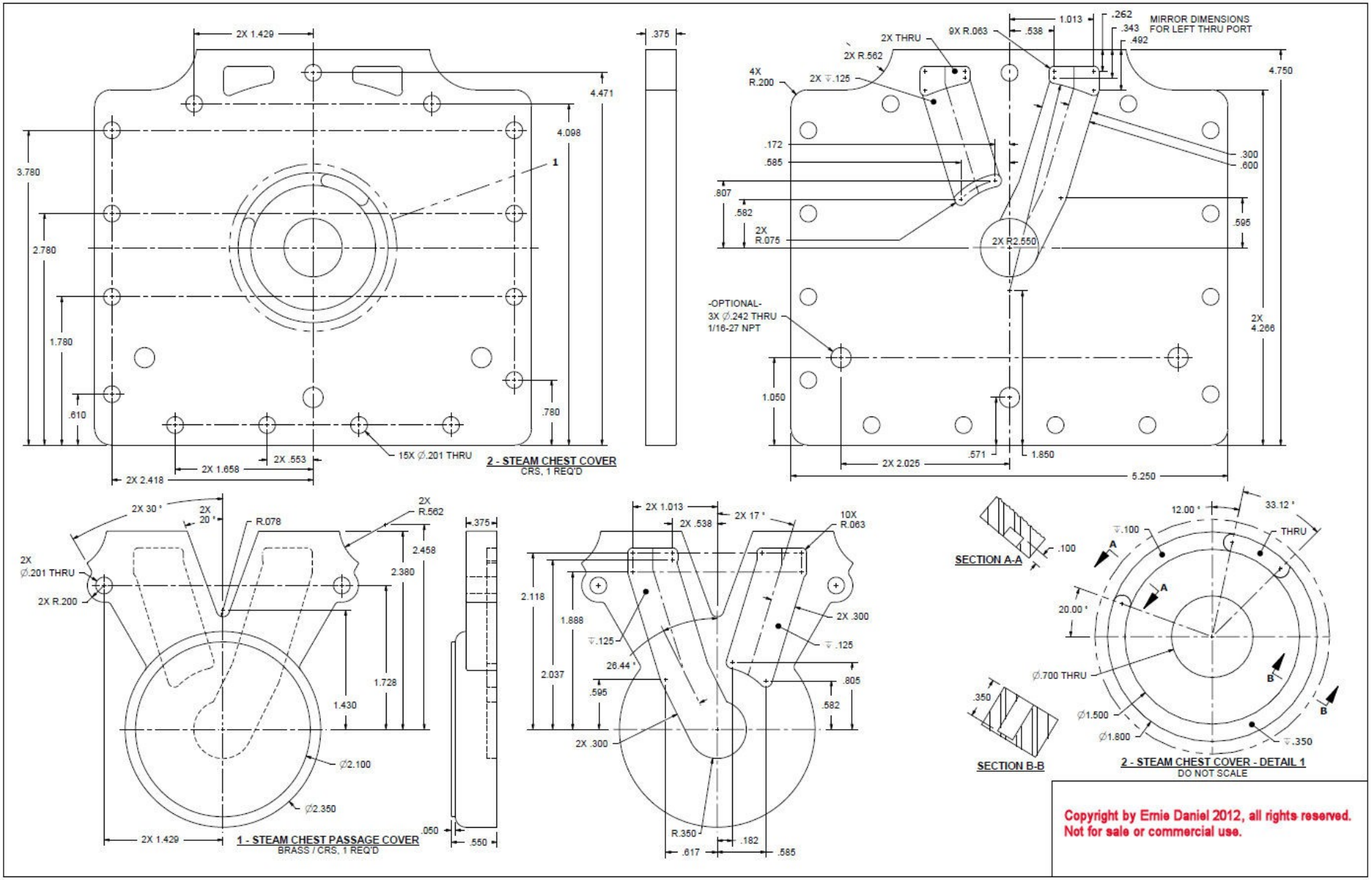

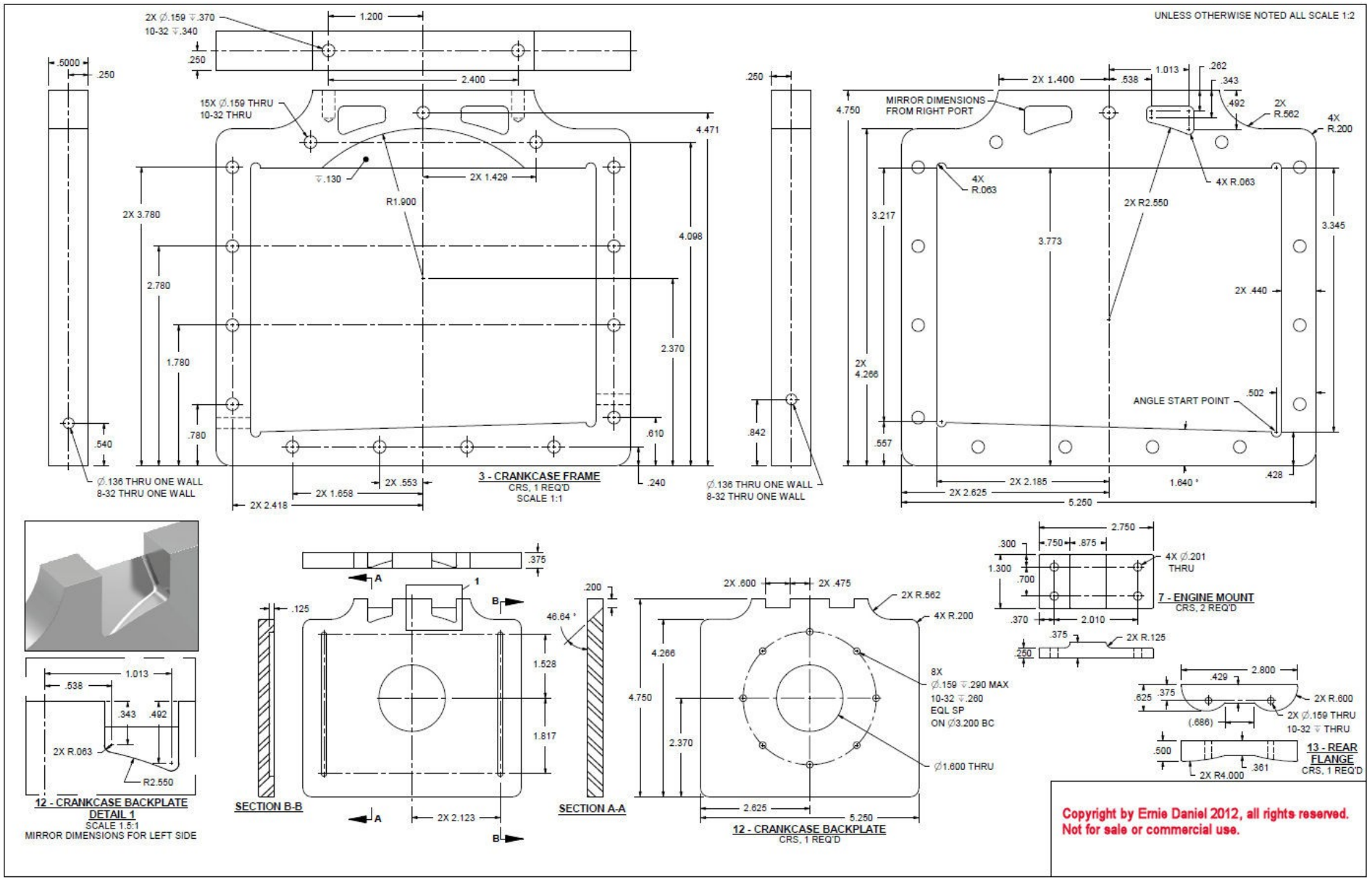

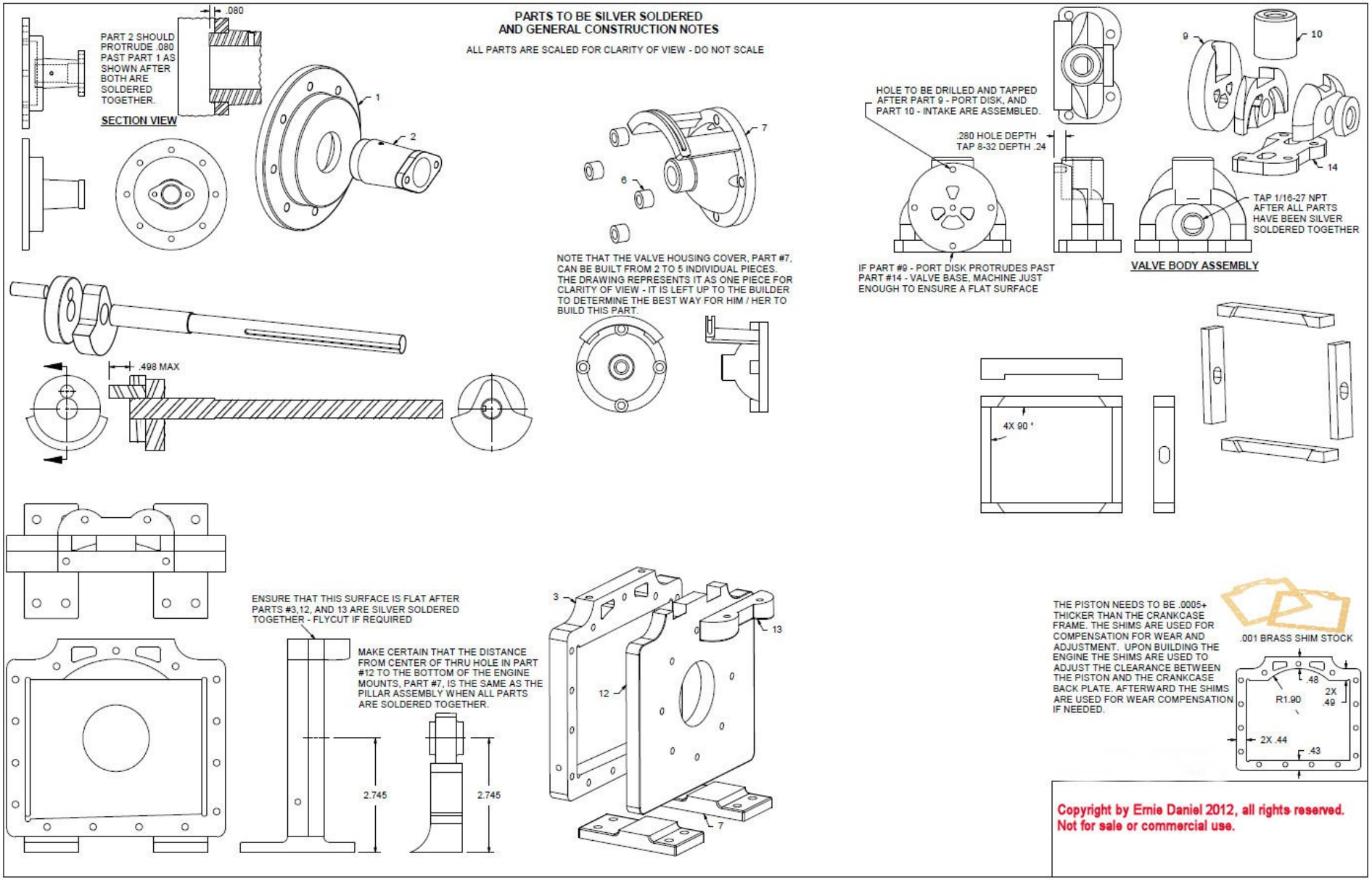
PARTS TO BE SILVER SOLDERED
AND GENERAL CONSTRUCTION NOTES
ALL PARTS ARE SCALED FOR CLARITY OF VIEW - DO NOT SCALE
.080
PART 2 SHOULD PROTRUDE .080 PAST PART 1 AS SHOWN AFTER BOTH ARE SOLDERED TOGETHER.
SECTION VIEW
1
2
7
6
NOTE THAT THE VALVE HOUSING COVER, PART #7, CAN BE BUILT FROM 2 TO 5 INDIVIDUAL PIECES. THE DRAWING REPRESENTS IT AS ONE PIECE FOR CLARITY OF VIEW - IT IS LEFT UP TO THE BUILDER TO DETERMINE THE BEST WAY FOR HIM / HER TO BUILD THIS PART.
HOLE TO BE DRILLED AND TAPPED AFTER PART 9 - PORT DISK, AND PART 10 - INTAKE ARE ASSEMBLED.
.280 HOLE DEPTH
TAP 8-32 DEPTH .24
IF PART #9 - PORT DISK PROTRUDES PAST PART #14 - VALVE BASE, MACHINE JUST ENOUGH TO ENSURE A FLAT SURFACE
9
10
14
TAP 1/16-27 NPT AFTER ALL PARTS HAVE BEEN SILVER SOLDERED TOGETHER
VALVE BODY ASSEMBLY
.498 MAX
4X 90 °
ENSURE THAT THIS SURFACE IS FLAT AFTER PARTS #3,12, AND 13 ARE SILVER SOLDERED TOGETHER - FLYCUT IF REQUIRED
MAKE CERTAIN THAT THE DISTANCE FROM CENTER OF THRU HOLE IN PART #12 TO THE BOTTOM OF THE ENGINE MOUNTS, PART #7, IS THE SAME AS THE PILLAR ASSEMBLY WHEN ALL PARTS ARE SOLDERED TOGETHER.
2.745
2.745
3
13
12
7
THE PISTON NEEDS TO BE .0005+ THICKER THAN THE CRANKCASE FRAME. THE SHIMS ARE USED FOR COMPENSATION FOR WEAR AND ADJUSTMENT. UPON BUILDING THE ENGINE THE SHIMS ARE USED TO ADJUST THE CLEARANCE BETWEEN THE PISTON AND THE CRANKCASE BACK PLATE. AFTERWARD THE SHIMS ARE USED FOR WEAR COMPENSATION IF NEEDED.
.001 BRASS SHIM STOCK
.48
2X .49
R1.90
2X .44
.43
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(No Model.) 2 Sheets—Sheet 1.

W. F. DAKE.

ENGINE.

No. 395,039. Patented Dec. 25, 1888.

Fig: 1.

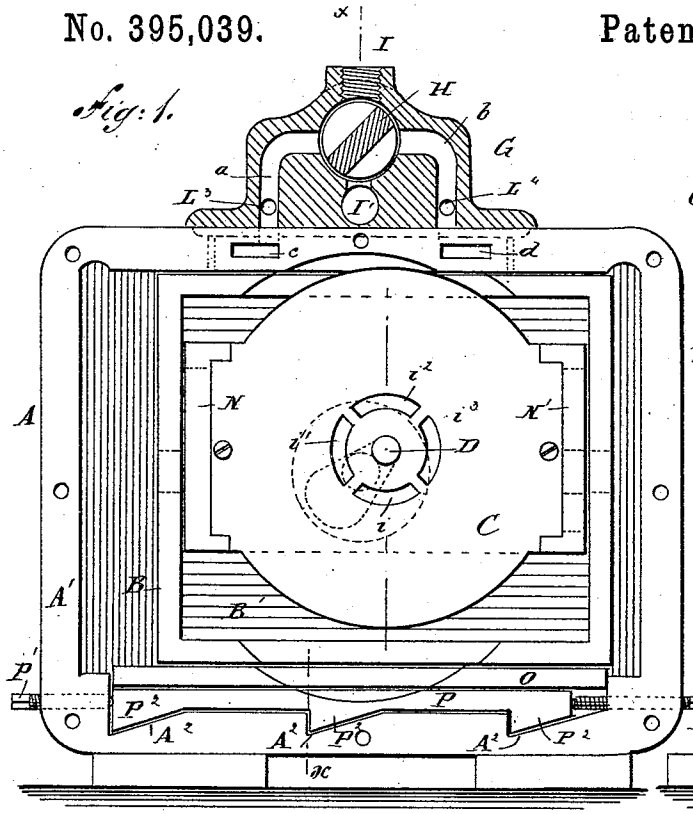


Fig: 2.

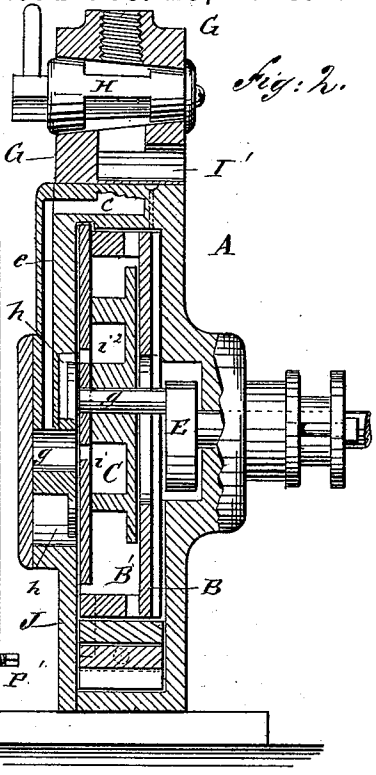


Fig: 3.

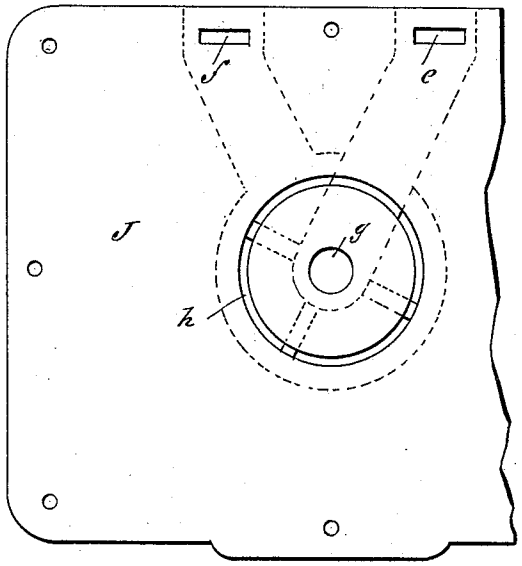
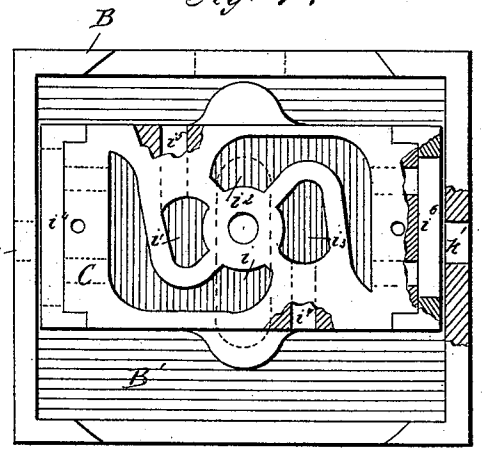


Fig: 4.



WITNESSES:

Chas. Nida.

C. Sedgwick.

INVENTOR:

W. F. Dake

BY Munn & Co

ATTORNEYS.

(No Model.) 2 Sheets—Sheet 2.

W. F. DAKE.

ENGINE.

No. 395,039. Patented Dec. 25, 1888.

Fig: 5.

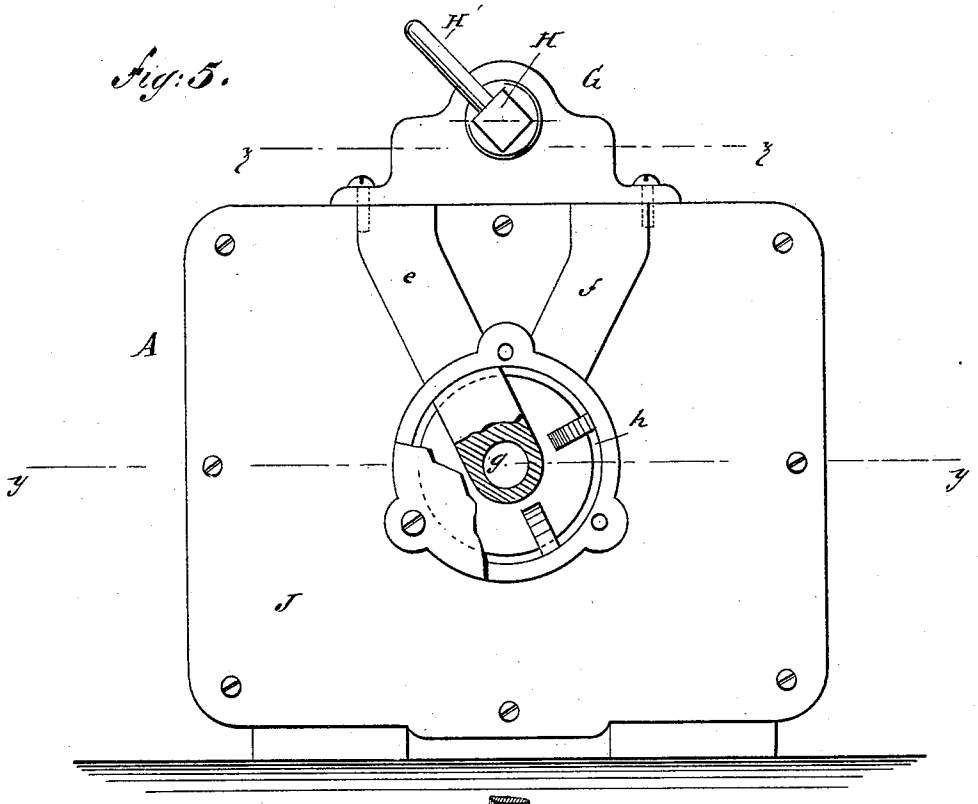


Fig: 6.

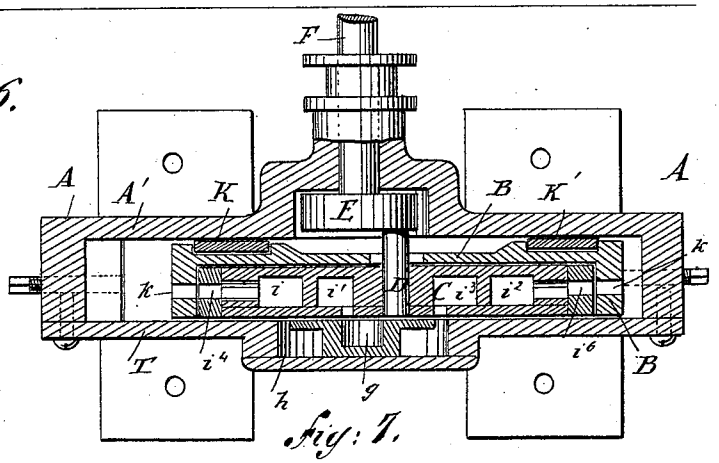


Fig: 7.

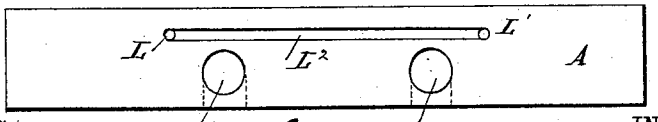
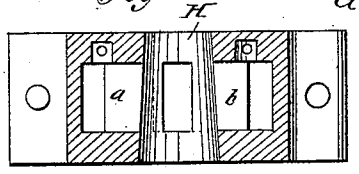


Fig: 8.



WITNESSES:

Chas. Nida.

C. Sedgwick.

INVENTOR:

W. F. Dake

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM F. DAKE, OF GRAND HAVEN, MICHIGAN, ASSIGNOR TO THE DAKE ENGINE MANUFACTURING COMPANY, OF SAME PLACE.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 395,039, dated December 25, 1888.

Application filed July 3, 1888. Serial No. 278,939. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. DAKE, of Grand Haven, in the county of Ottawa and State of Michigan, have invented a new and Improved Engine, of which the following is a full, clear and exact description.

The invention relates to the class of double reciprocating square piston-engines such as shown and described in Letters Patent No. 363,368, granted to me May 24, 1887.

The object of the present invention is to provide a new and improved engine which is simple and durable in construction and very effective in operation.

The invention consists of certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a front view of the improvement with the cover removed and the steam-chest in section. Fig. 2 is a sectional view of the same on the line *x x* of Fig. 1; Fig. 3 is an inner face view of part of the cover. Fig. 4 is a face view of the piston with the cover removed and parts in section. Fig. 5 is a face view of the improvement with parts broken out. Fig. 6 is a sectional plan view of the same on the line *y y* of Fig. 5. Fig. 7 is a plan view of the casing, the steam-chest being removed; and Fig. 8 is a sectional plan view of the steam-chest on the line *z z* of Fig. 5.

The improved engine is provided with a casing, A, of suitable shape and material and having a chamber, A′, in which is held to move backward and forward horizontally a rectangular piston, B, having a chamber, B′, in which is mounted to slide vertically the inner piston, C, mounted in its middle on a wrist-pin, D, projecting through a slot in the back plate of the piston B and secured to a crank-disk, E, fastened on the inner end of the main driving-shaft F. On top of the casing A is secured the steam-chest G, provided with a four-way valve, H, having a handle, H′, on its inner end for turning said valve H in any desired position. Other suitable means may be employed for turning the valve, if desired.

Into the valve H leads the steam-inlet pipe I, and the said valve also connects with the exhaust-pipe I′, leading from the valve-chest G. The valve H is adapted to connect the steam-inlet pipe I either with the port *a* or the port *b*, and also to connect the exhaust-pipe I′ with the said port *a* or *b*. The ports *a* and *b* are formed in the steam-chest G and lead to the ports *c* and *d*, formed in the casing A, and the ports *c* and *d* connect with the channels *e* and *f*, respectively, formed in the outside of the cover J of the casing A. The channel *e* leads to a central aperture, *g*, formed in the middle of the cover J and opening at the inside against the face of the inner piston, C. The channel *f* leads to an annular opening, *h*, also formed on the inside of the cover J and opening on the face of the inner piston, C.

The central opening, *g*, and the annular opening *h* are adapted to connect alternately with the ports *i*, *i′*, *i²*, and *i³*, formed in a circle in the inner piston, C, and of which the port *i* leads through a channel, *i⁴*, to an opening *k*, formed in the left side of the said piston B and leading to the chamber A′ of the casing A. The port *i′* leads to the channel *i⁵*, opening into the chamber B′ of the piston B at the top of the inner piston, C. The port *i²* is similar to the port *i* and leads to a channel, *i⁶*, which connects with an opening, *k′*, formed in the right end of the piston B and leading to the chamber A′ of the casing at the right of the piston B. The port *i³* is similar to the port *i′* and leads to the channel *i⁷*, opening into the chamber B′ of the piston B at the bottom of the inner piston, C.

In the back of the piston B are formed vertical recesses, into which fit the packing-plates K and K′, pressed against the rear wall of the casing A by live steam entering between the said plates K and K′ and the piston B through openings L and L′, connected with each other by a groove, L², in the top of the casing A, as is plainly shown in Fig. 7. The groove L² connects with the openings L³ and L⁴, formed in the steam-chest G and leading into the ports *a* and *b*, so as to admit

live steam into the groove L^2, from which the live steam passes through the openings L and and L′ between the packing-plates K and K′ and the piston B, so as to form a steam-tight packing.

The inner piston, C, is provided at its ends with the packing-plates N and N′, of any approved construction and pressed against the end walls of the piston B by any suitable means, so as to form a steam-tight packing between the said inner piston, C, and the piston B.

The wear of the latter is taken up by a plate, O, supporting the bottom of the said piston B and resting against the plate P, held to slide longitudinally by screws P′ in the casing A bearing against the ends of the said plate P. On the under side of the latter are formed the inclines P^2, sliding on corresponding inclines, A^2, formed in the bottom of the casing A. Thus, when the screws P′ are adjusted the plate P presses this plate O upward in firm contact with the bottom of the piston B.

The operation is as follows: When the engine is in the position shown in Fig. 1, steam passes from the inlet-pipe I through the valve H into the port *a*, and from the latter the steam passes through the port *c* into the channel *e* and into the central opening, *g*, formed in the cover J. The steam now passes from the central opening, *g*, into the port *i* of the inner piston, C, and through the channel i^4 and the opening *k* into the left end of the chamber *a*′, thus acting against the piston B from the left to the right, so that the said piston B is caused to slide from the left to the right. Rotary motion is thus imparted to the main shaft F by the inner piston, C, the crank-pin D, and the crank-disk E, secured to the said main shaft F. The inner piston, C, in moving causes the port *i* to register with the central opening, *g*, so that live steam now passes into the port *i*′ from the latter through the channel i^5 into the chamber B′ of the piston B on top of the piston C. The latter is thus pressed downward by the steam, whereby a new impulse is given to the main driving-shaft F by the action of the crank-pin D and the crank-disk E. On the further movement of the pistons B and C, as above described, the central opening, *g*, registers with the port i^2, so that the live steam passes through the channel i^6 and the opening *k*′ into the chamber A′ at the right end of the piston B, so that the latter is now forced to its return-stroke—that is, to the left of the casing A. The further movement of the pistons B and C now brings the central opening, *g*, to register with the port i^3, so that the live steam passes through the channel i^7 into the chamber B′ at the bottom of inner piston, C. The live steam thus presses the inner piston, C, upward, at the same time assisting the piston B in its movement to the left. The exhaust-steam from the left of the chamber A′ passes through the opening *k*, the channel i^1, and the port *i* into the annular opening *h*, formed in the cover J and leading to the channel *f*, connected by the port *d* with the port *b* in the steam-chest G. Steam then passes from the port *d* through the valve H into the exhaust-pipe I′ and to the outside. The exhaust at the upper end of the chamber B′ passes through the channel i^5 into the port *i*′, and from the latter to the annular opening *h*, through which it passes to the exhaust-pipe I′, as above described in reference to the port *i*. The exhaust in the right of the compartment A′ takes place through the opening *k*′, the channel i^6, and the port i^2 into the annular opening *h*, and the exhaust in the bottom of the chamber B′ takes place through the channel i^7 and the port i^3 into the annular opening *h*, from which the steam passes to the exhaust-pipe I′, as above described.

It is understood that the movement of the inner piston, C, brings the ports *i*, *i*′, i^2, and i^3 alternately to register with the central opening, *g*, and at the same time the exhaust-ports exhaust through the annular opening *h*.

When the valve H is turned, the live steam passes from the inlet-pipe I to the port *b*, and the port *a* is then connected with the exhaust-pipe *i*′. The above-described operation is repeated, except that it is in the reverse direction.

It will be observed that by the construction of this engine there are no valves whatever except on the face of the inner piston, C, against the cover-plate J, and no eccentric or other devices are needed to operate the valve, the action being directly upon the piston C and cover J to cut off and let in steam at the proper time to give continuous motion to the engine.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In an engine, the combination, with a casing and a piston reciprocating therein, of a second piston arranged within and having a reciprocating motion at right angles to the line of movement of the first-named piston, the outer face of the said second valve forming a valve for operating both pistons, substantially as described.

2. In an engine, the combination of a casing having a central opening in the inner surface of its front plate, a piston reciprocating therein, a second valve arranged within and having a reciprocating motion at right angles to line of movement of the first-named piston and provided with ports on its outer face, said ports being arranged in a circle and operating over the said central opening of the casing, substantially as herein shown and described.

3. In a steam-engine of the class described, the combination, with an inner piston having steam-ports arranged in a circle, of a cover having a central opening and an annular opening adapted to register with the said ports, substantially as shown and described.

4. In a steam-engine of the class described, the combination, with an inner piston provided with the ports i, i', i^2, and i^3, of an outer piston having the openings k and k', connecting with the said ports i and i^2, and a casing surrounding the said outer piston, substantially as shown and described.

5. In an engine of the class described, the combination, with a casing and a steam-chest held on the said casing, of a piston mounted to slide horizontally in the said casing, and packing-plates held at the back of the said piston and pressed against the back of the said casing by live steam passing from the said steam-chest through suitable openings in the casing between the said packing-plates and the said piston, substantially as shown and described.

WILLIAM F. DAKE.

Witnesses:
CHAS. T. PAGELSON,
J. P. ARMSTEAD.

Corrections in Letters Patent No. 395,039.

It is hereby certified that in Letters Patent No. 395,039, granted December 25, 1888, upon the application of William F. Dake, of Grand Haven, Michigan, for an improvement in "Engines," errors appear in the printed specification requiring correction as follows: In lines 116 and 122 page 2, the word "valve" should read *piston* and in line 124 same page the word *the* should be inserted before the word "line"; and that the said Letters Patent should be read with these corrections therein to conform to the papers pertaining to the case in the Patent Office.

Signed, countersigned, and sealed this 1st day of January, A. D. 1889.

[SEAL.]

D. L. HAWKINS,
Assistant Secretary of the Interior.

Countersigned:

BENTON J. HALL
Commissioner of Patents.