July 2014

Draftsmen's Sketch Book for Parts for the Ford Motor Company

M. M.

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TO BE USED BY THE DRAFTSMAN FOR ALL SKETCHES, NOTES, CALCULATIONS AND DATA RELATING TO THE ABOVE COMPANY ONLY, UNDER NO CIRCUMSTANCES ARE LOOSE SHEETS OR PRIVATE NOTE BOOKS TO BE USED.

NO UNUSUAL EFFORT SHOULD BE MADE AT NICETY, BUT EACH ENTRY SHOULD INVARIAABLY BE COMMENCED WITH THE SUBJECT AND DATE OF THE WORK, AND FULL NOTES MADE OF DATA ON WHICH CALCULATIONS ARE BASED AND THE RESULTS OBTAINED CLEARLY STATED.

BOOKS ARE TO BE ALWAYS QUICKLY AVAILABLE TO RECEIVE INSTRUCTIONS, SKETCHES AND DATA AS MAY BE GIVEN THE DRAFTSMAN AND HE WILL BE RESPONSIBLE FOR THEIR DELIVERY AT ANY TIME.

MORGAN CONSTRUCTION CO.            ENG. DEPT
WORCESTER MASS.
\[ c = \frac{D + W}{100} + 0.03 \]
\[ c = \frac{23 + 11}{100} + 0.03 \]
\[ c = \frac{35}{100} + 0.03 \]
\[ c = 0.08 \text{ in. for pulley A31682} \]

\[ \text{Aug No A31682} \]

\[ \text{Dia} = 1.06 \times 3 + 1 \]
\[ \text{Dia} = 4.98 + 1 \]
\[ \text{Dia} = 5.98 \text{ in. or 6 in. - dia of flue exchanger} \]

\[ \frac{324}{3564} \]
\[ \frac{55.24 \text{ in.}}{15.95} = 3.5 \text{ in} \]
\[ 10.00 \]
SUBJECT
COMPANY

PROPERTY OF MORGAN CONSTRUCTION
CO.

PROPERTY OF MORGAN CONSTRUCTION
CO.

12.75" to pad on bracket from bottom of tank.
Depth of base.

Bracket (girder)
68 1/8" from t of drive to t of I beam.
69.575
59.575
59.625

Bracket (Land)
59 1/4" from t of pad on s of I beam.
59.25
59.25
59.25

30 3/4" away from s of shelf
54.25
43 1/4
Shaft A
Old length from bearing 55" old C
New length from bearing 62"

\[
\begin{align*}
\text{C} & = 3 \frac{3}{4} \\
\text{D} & = 62 \\
\text{W} & = 70 \times 19.5 \text{ sq. in.}
\end{align*}
\]

\[
\text{Area of vanes added} = 15.3 \text{ sq. in.}
\]

\[
\text{Diam of vanes added} = 4.125 \text{ in.}
\]

Shaft B
New length 68" from bearing 62" old C

\[
\begin{align*}
\text{C} & = 5 \frac{1}{4} \\
\text{D} & = 70 \times 14.1 \\
\text{W} & = 10.7 \text{ sq. in.}
\end{align*}
\]

Shaft C
Larger diameter as

Bigger end of shaft A

Shaft D
Same as old shaft E

Crown for 40° incl. 15° face

\[
\begin{align*}
\text{C} & = 28 + 11 + 0.03 \\
& = \frac{39}{700} \\
\text{C} & = 3 \frac{9}{700} + 0.03 \\
& = \frac{0.078 + 0.03}{700} \\
& = \frac{0.082}{700}
\end{align*}
\]

Shackle Hub
4.875 X 1.66 + 1 = length + dia
7.75 + 1 = 8 1/4 = dia + length

Shackle B
4.875 X 1.66 + 1 = length + dia
8.1 + 1 = 9 1/2 = dia + length

Force Fit
4.875 X 16 = 48 tons
4.875 X 10 = 48 tons
**SUBJECT**

**COMPANY**

**DATE**

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**Worcester, Mass.**

**Co.**

**Property of Morgan Construction**

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**SUBJECT**

**COMPANY**

**DATE**

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16" belt will transmit 5.3 tons power at 1844 ft./min.

\[
53 = 1844 \times \frac{x}{3300} = 175\, \text{tons} \\
X = 950\, \text{lbs. belt pull for 10" belt}
\]

\[
P = \frac{7}{3}T \\
3P = 7T \\
T = 407\, \text{lbs. tension for 10" belt}
\]

\[
3P = 7T \\
4100 = 7T \\
T = 570\, \text{lbs. tension for 14" belt}
\]

Resultant belt pull on pulley A will = 570\times 2 + 1330 = 2,140\, \text{lbs. pressure}

Resultant belt pull on pulley B will = 407\times 2 + 950 = 1,764\, \text{lbs. total pressure}

Pressure on bearing C

\[
C \times 62 = (1764 \times 31 + 2470 \times 46) \frac{113700}{168400} \\
62C = 54,700 + 113700 \\
62C = 168,400 \\
C = 2,720\, \text{lbs. pressure at bearing C}
\]
SUBJECT
COMPANY

$D = \frac{(31 \times 1764) + (2470 \times 16)}{57400}

62D = 94,200

L = \frac{2720 \times 263}{20,000}

L = 715,000

L = 3.6

Bearing A 2,400 AA,

Adjusted area = 2,9375 \times 11 = 32.89 ft²

2 \cdot \frac{720}{32} = 58.5

58.5 lb/sq inch on bearing C

\frac{1520}{32} = 47.5 lb/sq inch on bearing D

Maximum belt pull is 176.4 lb.

\bar{x} = \frac{2.125}{3} \cdot \frac{8}{10} = \frac{16}{10}

x = 2.29

x = 2.5

1764

\bar{M} = 1764 \times 3.75 = 66200 

0.001 15.0 0.001
\[
\frac{(3.15)^3}{(x)^3} = \frac{12 \times 5 \times 53}{14 \times 10 \times 62}
\]

\[
5.820 = 5.080
\]

\[
x^3 = 0.979
\]

\[
x = 4.625 = 4.5\text{" dia. shaft}
\]

\[
\text{Call shaft }\frac{43}{4}\text{" dia}
\]

\[
\frac{(2.1875)^3}{x^3} = \frac{8}{10}
\]

\[
x^3 = 1.05
\]

\[
x = 2.350 = 2\frac{3}{4}\text{" call shaft 2\frac{7}{16}}
\]

\[
\text{Drill for C. Pulley}
\]

\[
\text{Dia shaft 2\frac{3}{8}}
\]

\[
1.66 \times 2.375 + 1 = 4.94 \text{" length of shaft}
\]

\[
3.94 + 1 = 4.94 = 5\text{" dia. 9" length}
\]

\[
P = 1.31 \times 9600
\]

\[
P = 12,600 \text{ lbs. amount of shear pin will resist (spring pin)}
\]
SUBJECT: Design Details

COMPANY: Morgan Construction

DATE:

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**Figure 1:**

- Location of holes for spool bracket

- Calculations:
  
  \[ (0.5)^2 - (0.25)^2 = \left(\frac{x}{2}\right)^2 \]
  
  \[ 0.25 - 0.0625 = x^2 \]
  
  \[ x^2 = 0.1875 \]
  
  \[ x = 0.433'' \]

**Bill of Material:**

- Spool bracket: 420 units

**Notes:**

- Text: "A32403"
- Handwritten calculations and diagrams related to the design details.
SUBJECT: Check on new spring data

COMPANY: [Redacted]

DATE: Jan 3

PO = 4016
PO = 2770 = 92.3 lb

FO = BR^2 N
FO = (71)(2.1)(42)
FO = 1479 = 4.91

2 4
1 D
2 7
P R

PO = 4016
PO = 2770 = 92.3 lb

N = 42 actual coil
35 4 N = 15

Open wound spring & dia wire

H4 coils 2 1/2 I.D. 3 1/2 OD 3 1/2 long

5' Compression at 930 lbs max resist
Ends ground & ginned

Need 1 1/2 threaded rod
Inland Belt Removal

Bill of Material for Aug A32403

<table>
<thead>
<tr>
<th>SUBJECT</th>
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<tbody>
<tr>
<td>A</td>
<td>C1</td>
</tr>
<tr>
<td>B</td>
<td>C1</td>
</tr>
<tr>
<td>C</td>
<td>Base, Spring bracket 5 3/4 x 6 7/8</td>
</tr>
<tr>
<td>D</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>E</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>F</td>
<td>&quot; &quot;</td>
</tr>
<tr>
<td>G</td>
<td>Bronze Bushing</td>
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<tr>
<td>H</td>
<td>Brass Pin</td>
</tr>
<tr>
<td>J</td>
<td>Bronze Nut</td>
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<tr>
<td>K</td>
<td>Bronze Nut</td>
</tr>
<tr>
<td>L</td>
<td>Spring Seat</td>
</tr>
<tr>
<td>M</td>
<td>&quot; &quot;</td>
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<td>N</td>
<td>&quot; &quot;</td>
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<td>Y</td>
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<tr>
<td>Z</td>
<td>&quot; &quot;</td>
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</table>
| B       | 3 1/2" 5/8"
| C       | 1/2" Nut |
| D       | 1/2" Nut |
| E       | 3/4" Dia x 1" Pin |
| F       | 1/2" Cotter 1/2 x 3/4 |
| G       | 1/2" Cotter 1/2 x 3/4 |
| H       | 1/2" Nut |
| I       | 1/2" Nut |
| J       | 1/2" Nut |
| K       | 1/2" Nut |
| L       | 1/2" Nut |
| M       | 1/2" Nut |
| N       | 1/2" Nut |
| O       | 1/2" Nut |
| P       | 1/2" Nut |
| Q       | 1/2" Nut |
| R       | 1/2" Nut |
| S       | 1/2" Nut |
| T       | 1/2" Nut |
| U       | 1/2" Nut |
| V       | 1/2" Nut |
| W       | 1/2" Nut |
| X       | 1/2" Nut |
| Y       | 1/2" Nut |
| Z       | 1/2" Nut |
| B       | 3 1/2" 5/8"
| C       | 1/2" Stone Nuts |
| D       | 3 1/2" Stone Nuts |
| E       | 3 1/2" Stone Nuts |
\[ d = \frac{5 - w}{384EI} \]

\[ d = \frac{5(16.7)(12,900,000)}{(384)(30,000,000)(1.9175)} \]

\[ d = \frac{108,000,000}{22,050,000,000} \]

\[ d = \frac{3.2}{5} \]

\[ d = \frac{5wE^2}{384EI} \]

\[ d = \frac{5(1002)(21,000)}{(384)(30,000,000)(1.9175)} \]

\[ d = \frac{1,082,000,000}{2,110,000,000} \]

\[ d = \frac{1,052,000,000}{2,110,000,000} \]
SUBJECT: April 14
COMPANY: 2.4375

\[ M_b = \frac{51}{9} = 5.71 \]
\[ Z = \frac{81}{6} \]
\[ M_b = \frac{5.71}{3} = \frac{18.6}{3} \]
\[ Z = \frac{2.16}{3} = \frac{6.48}{3} \]
\[ Z = \frac{3.2}{3} = \frac{9.6}{3} \]
\[ 4 \times 14 \times 6.5 = 8 \times \]
\[ 2 \times x = \frac{3280}{3} \]
\[ \frac{x}{3280} \text{ the tension of component.} \]
\[ 1250 = 1625 \text{ the tension on each bolt.} \]
\[ 3 \text{ bolts used (4.200 lbs)} \]
\[ 4 \times 10 = 40 \times 10 = 40 \times 10 \]
\[ 14.5 \times 14.5 = 210.25 \]
\[ 4 \times 10 = 40 \times 10 = 40 \times 10 \]
\[ 14.5 \times 14.5 = 210.25 \]
\[ 5.100 \times 2.850 \text{ the tension on each bolt.} \]
\[ 1.5 \text{ lbs used (2900 lbs)} \]

WORCESTER, MASS.

SUBJECT: April 14
COMPANY: 2.4375

\[ \text{2.4375} \text{ subjected} \]
\[ 14.625 \text{ in. long, subject.} \]
\[ 14.625 / 3 = 120 \times \text{ per sq in.} \]
\[ \text{79 bolt 5" Cuninut} \]
\[ \frac{79}{39.5} \text{ circle. est. 595 inches} \]
\[ \frac{39.5}{2} \text{ inches} \]
\[ \frac{3.1416}{39.5} \text{ (1000 lbs)} \]
\[ \frac{80}{490} \text{ lbs} \]
\[ \frac{62.8}{32} \text{ lbs} \]
\[ \frac{180}{80} \text{ lbs} \]
\[ \frac{1570}{80} \text{ lbs} \]
\[ 230000 \text{ lbs} \]
\[ 219912 \text{ lbs} \]
\[ 1088 \text{ lbs} \]
\[ 230000 \text{ lbs} \]
\[ 219912 \text{ lbs} \]
\[ 1088 \text{ lbs} \]

WORCESTER, MASS.

PROPERTY OF MORGAN CONSTRUCTION

PROPERTY OF MORGAN CONSTRUCTION

CIRCUIT OF MORGAN CONSTRUCTION
\[ \frac{72}{3.1416} \times 3.95 = \text{circum. of pitch circle} \]
\[ 25.731 \]

\[ 3.1416 \times 3.95 \div 10 = 12.573 \]

\[ \text{Pitch diam.} = 10' - 5.73'' \]
\[ 25 \times 5 = 125 \]
\[ 10 \div 2 = 5.25 \]

\[ \text{Addendum circle} = 10' - 8.23'' \]
\[ 5 \times 30 = 150 \times 2 = 0'' \]
\[ 10 - 5.73'' = \text{Addendum circle} \]
\[ \frac{4CP + \frac{1}{2}}{6} = 2' \frac{1}{2}'' \]

79 cut teeth, 20° involute
Cordal thickness of tooth = 1.591"
Subject: Project Evaluation

Company: [Redacted]

Date: April 24

79 lbf, 20° Involute

Cordal Width of Tooth = 2.427"

Eqn: Total Diameter = 2.5" cos pitch.

5" OD Pitch = 1.591" Dia Pitch

Adiabatic = .26 X C.P. = 1.25"

Refractive = .30 X C.P. = 1.50"

Pitch Dia = 125.731"

Outside Dia = 125.723"

Cord of Tread

\[ \frac{125.731 \times \sin 90°}{79} = 0.65 \]

\[ \frac{125.731 \times \sin 113.9°}{79} = 0.65 \]

\[ \frac{125.731 \times 0.197}{79} = 0.65 \]

Cord = 2.477 - 0.05

= 2.427

\[ \frac{2.477}{0.05} = 2.427 \]
SUBJECT ............................................................... .. ................... .. ...... .

COMPANY ............................................................... ....... ...

DATE ........................................................................

WORCESTER, MASS.

DISTANCES FROM 4" WALL TO 4" OF MAIN SHAFT
CHANGED FROM 21\(\frac{1}{2}\)" TO 20-9" and 74\(\frac{3}{4}\)" TO 79\(\frac{1}{2}\)".

DISTANCES BETWEEN 4" OF MAIN SHAFTS AND 4" OF SHAFTS CHANGED
FROM 25\(\frac{1}{4}\)" TO 25-3\(\frac{3}{4}\)" (1/42" MILL) and FROM 25\(\frac{1}{2}\)" TO 25-2\(\frac{3}{4}\)" (1/32" MILL).

These changes would mean adding 3" to the deal gear shafts in order
to move the gears for the deal gear
hood between 15" bearing and deal gear.

WORCESTER, MASS.

PROPERTY OF MORGAN CONSTRUCTION

Co.

20.25

\(\frac{1}{4}\)25

\(\frac{1}{4}\)25

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<td>21.4</td>
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<td>27-6</td>
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<td>15-3.25</td>
<td>30</td>
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<td>30</td>
<td>14-8.75</td>
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<tr>
<td>19-11.75</td>
<td>19-11.75</td>
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<tr>
<td>14-1.75</td>
<td>33 20 50</td>
</tr>
<tr>
<td>34</td>
<td></td>
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</table>
\[ F = \frac{1000 (100)^2}{5} \]
\[ F = \frac{(1000)(10,000)}{5} \]
\[ F = \frac{10,000,000}{5} \]
\[ F = 2,000,000 \]

\[ A^32193 \]
Special Base for Hat R.O.

\[ A^32197 \]
Special Stand for Hat Remont
16 V 3/4 X 3 3/4" Rivet
24 W 3/4 X 3 1/2" Bolt with 5/32" nut
16 X 3/4 X 3" Rivet
16 Y 1/2 X 2 7/8" Bolt with 3/16" nut
Z 3/4" STD. NUT
U 3/4" Flat washer

A 31694

8 V 3/4 X 2 1/2" Bolt with 8x
8 W 3/4 X 2 1/4" Bolt with 2x
16 X 3/4" NUT
5 Y 1 1/2 X 5" BOLT
5 Z 1 1/2" NUT

Special Stand for Nut Remout