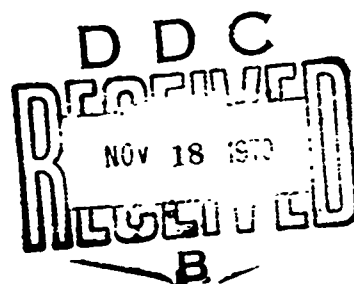


AD 714488

RDTR No. 172
1 September 1970

Conversion of
Hobart Model A-200 Electric Mixer
to Air Drive for Use in Mixing
Pyrotechnic Compositions



PREPARED BY
RESEARCH & DEVELOPMENT DEPARTMENT
Naval Ammunition Depot, Crane, Indiana

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NAVAL AMMUNITION DEPOT
Crane, Indiana 47522

RDTR No. 172
1 September 1970

CONVERSION OF HOBART MODEL A-200
ELECTRIC MIXER TO AIR DRIVE FOR
USE IN MIXING PYROTECHNIC COMPOSITIONS

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and

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CONVERSION OF HOBART MODEL A-200 ELECTRIC MIXER
TO AIR DRIVE FOR USE IN MIXING PYROTECHNIC COMPOSITIONS

I. Introduction. During development of a Catalyst Generator at Naval Ammunition Depot, Crane, Indiana, a special need arose for a somewhat universal mixer to thoroughly blend pyrotechnic mixes of various types under special conditions.

The search for a mixer which could be used to mix these pyrotechnic mixes of approximately 20 lbs. in size, on a reproducible as well as a productive basis, led to the Model A-200 (Planetary Action) Mixer manufactured by the Hobart Manufacturing Company, Troy, Ohio.

Preliminary testing of this mixer, with its planetary action, proved that it could meet the criteria already mentioned. One problem remained, however. The Model A-200 Mixer is equipped from the factory with the standard type electrical motor and related equipment which would not permit the Model A-200 to be used to mix pyrotechnic mixes because of safety requirements.

Since this mixer provided the proper mixing action, it was suggested that the electrical motor and related controls (switches) be replaced with an air motor to adapt this mixer to meet the safety requirements involved.

The following is a description of how the Model A-200 Mixer was converted from electrically to air driven power.

II. MATERIAL REQUIRED

1. Hobart Model A-200 Mixer
2. Gast Air Motor Model 6AM-NRV-11 (flange mounting)
3. Coupler (RDC-3-232)
4. Spacer (RDC-3-233)
5. Shaft (RDC-3-231)
6. Cap Screw 3/8-16 x 1 1/2 Allen Head (4 ea. required)
7. Mach. Screw #10-24 x 2" Fl. Head (4 ea. required)
8. Taper Pin #2 (2 ea. required)
9. 3/16 inch sq. key

III. REMOVAL OF ELECTRICAL MOTOR AND ELECTRICAL COMPONENTS

First of all, remove the two inspection covers from the back of the mixer housing. This provides access to the four #12-24 x 1" Fl. Head machine screws which holds the bearing bracket. It also provides access to the capacitor located under the right inspection cover. Remove the two wires from the capacitor and lift the capacitor out of its mounting bracket.

Before removing the bearing bracket, remove the switch plate (Illus. No. 27 of Fig. 2) on the right side of the mixer. The two wires on this manual switch must be removed along with the ground wire. This switch can then be removed from the plate and the plate replaced on the mixer.

The bearing bracket may now be removed. Part of the centrifugal switch and the capacitor bracket will remain intact with this bearing bracket. The input cord will also remain intact with this bracket and can be discarded with such.

The rotor assembly is now ready to be extracted from the mixer. This is done by simply pulling straight out on

the rotor shaft. This rotor assembly should contain the shaft rotor, fan, part of centrifugal switch, grease deflector, ball bearing, and worm gear.

The worm gear is locked onto the shaft end by means of a special nut and a retaining ring. The worm gear also includes the shock absorber spring, washer, and shock absorber spring washer. (Illus. No.'s 67, 66, and 68 of Fig. 3). Items which must be saved are the retaining ring, special nut, key, worm gear, washer, shock absorber spring, shock absorber spring washer, ball bearing, and grease deflector. See Figures 1 and 3 for parts illustration.

Next remove the starter assembly. The stator is secured by four #10-24 machine screws.

IV. MODIFICATION OF GAST AIR MOTOR MODEL 6AM-NRV-11

The only modification required for the Gast Air Motor is that a hole be bored in the shaft for a #2 taper pin and the outer flange be trimmed in four places to permit use of the old stator retainers to lock the assembly into the mixer. See RDC-3-234 for proper location of this hole in the shaft. This hole is drilled 90° from the keyway in the shaft. Trimming of the outer flange should be done as shown in Figure 4, with dimensions "X" and "Y" as required for clearance of the stator retainers.

V. REPLACEMENT OF ROTOR SHAFT

The rotor shaft removed from the mixer must be replaced by a new shaft (RDC-3-231) which can be adapted to the Gast Air Motor. Prior to connecting this shaft to the shaft of the air motor, the parts removed from the old rotor shaft must be assembled to this shaft in the same manner as removed. This is done by slipping the grease deflector then the ball bearing over the threaded end of the new shaft and pressing both into position as shown in drawing RDC-3-234. Next, on the same end of the shaft, place the shock absorber spring washer, the shock absorber spring, washer, key and worm gear, in respective order and lock with the special nut and retaining ring.

Now on the opposite end of the shaft, the coupler RDC-3-232 may be added by using a $\frac{3}{16}$ inch square key and locking with a #2 taper pin. (See RDC-3-234). The coupler can now be attached to the shaft of the air motor in the same manner.

VI. INSERTION OF THE AIR MOTOR INTO THE MIXER

Now before this air motor and mixer shaft assembly can be inserted into the mixer, the spacer ring (RDC-3-233) must be attached to the air motor. This is done by four $\frac{3}{8}$ -16 x 1 $\frac{1}{2}$ inch allen head cap screws as seen in RDC-3-234.

This air motor and spacer assembly is now ready to be

inserted into the mixer housing. This assembly is locked into position shown (RDC-3-234) by means of four #10-24 x 2 inch F11. Head machine screws.

VII. THE GAST AIR MOTOR

A. Operation

The Gast Air Motor can be used in any position providing adequate lubrication is administered through an air line oiler and end thrust is kept to absolute minimum. For best results, assemble the air motor so that the inlet and exhaust ports are on top since this is where the oilers are located for intermittent operation of the air motor. For continuous operation, the air line oiler must be used. Gast Manufacturing Company recommends use of their accessories for the Model 6AM Air Motor for longer life, proper operation, and dependability. These accessories include filter, regulator, lubricator, and lubricating oil part numbers 4F103, 4R001G, 4L002, and AD220, respectively.

For moderate speeds (under 2,000 r.p.m.) or intermittent operation, 1 squirt of oil in bearing oilers per day will suffice. If the duty is continuous or speed is high, use an automatic air line oiler set to feed 1-3 drops per minute. The bearings will receive oil from the rotor chamber during automatic oiling. Lubrication is necessary for the bearings, shaft seals, and rust prevention. Excessive moisture in the air line can cause rust formation

in motor and might also cause ice to form on muffler due to expansion of air through the motor. The moisture problem can be corrected by installing a moisture separator in the line and also by installing an aftercooler between the compressor and air receiver. If the motor is sluggish or inefficient, try flushing with kerosene in well ventilated area. Disconnect the air line and muffler and add several teaspoonsful of kerosene. Rotate the shaft by hand in both directions for a few minutes, again connect the air line and apply pressure slowly until there is no trace of kerosene in exhaust air. (Keep face away from exhaust air). Check the muffler felts for grease, dirt, etc. If dirty, wash them in solvent. Replace the felts and connect the muffler. Relubricate the motor with a squirt of oil in the chamber and bearing oilers.

B. Performance

The speed of the air motor can be easily adjusted to operate from 300 to 3000 rpm. The Gast Model 6AM delivers up to 3 horsepower as seen on the performance data sheet. This provides more than enough power to mix most pyrotechnic mixes since it replaces a 1/3 horsepower electrical motor previously in the mixer. Certain characteristics should be known about the air motor, however.

1. Horsepower of an air motor is relative to RPM and to air line pressure.
2. An air motor slows down when load increases

at the same time its torque increases to a point where it matches the load. It will continue to provide increased torque all the way to stall condition. It can maintain the stalled condition without any harm to the motor.

3. As the load is reduced, an air motor will increase speed and the torque will decrease to match the reduced load.

4. When the load on an air motor is either increased or decreased, speed can be controlled by increasing or decreasing air pressure.

5. Starting torque of an air motor is lower than running torque. While this provides smooth, no-shock starting, it is necessary to have additional air line pressure for starting under heavy loads.

6. Air consumption increases as speed and air pressure is increased.

7. It is simple to change horsepower and speed of an air motor by throttling the air inlet. Therefore, the best rule of thumb for selecting an air motor is to choose one that will provide the horsepower and torque required using only $\frac{2}{3}$ of the line pressure available. The full air line pressure will then be available for overloads and starting.

This explains why the Model 6AM Air Motor was chosen to replace the low horsepower electric motor. The next smaller model is the 4AM which develops less than $\frac{1}{4}$ horsepower at 300 RPM as can be seen from the air motor selection chart.

VIII. INSTRUCTIONS FOR OPERATION AND CARE OF THE A-200 HOBART MIXER WITH THE GAST AIR MOTOR

As before with the electrical motor, the air motor must be stopped to shift the mixer to a different gear speed to prevent damage to the gears in the mixer.

The transmission gearing is lubricated by a special

grease that will last for several years of normal use. Consult a Hobart service technician before adding grease. Lubricate the bowl slideways occasionally by applying a small amount of oil or grease with the tip of the finger. Only mineral oils are suitable for this type of lubrication. The polished drip cup is a safe-guard to prevent any lubricant that might work out of the planetary gearing from dropping into the mixing bowl. Remove the drip cup (by pulling straight down) once a month and wipe it clean.

Pull the lift handle forward to lower the bowl. It is necessary to lower the bowl to change agitators, this also makes the bowl more accessible for filling. When raising the bowl, move the lift handle a little beyond the vertical center until you feel it touch the stop.

The replaced electric motor was operated at a speed of 1725 RPM. This gave the mixer three positive speeds for the agitator. These speeds are as follows:

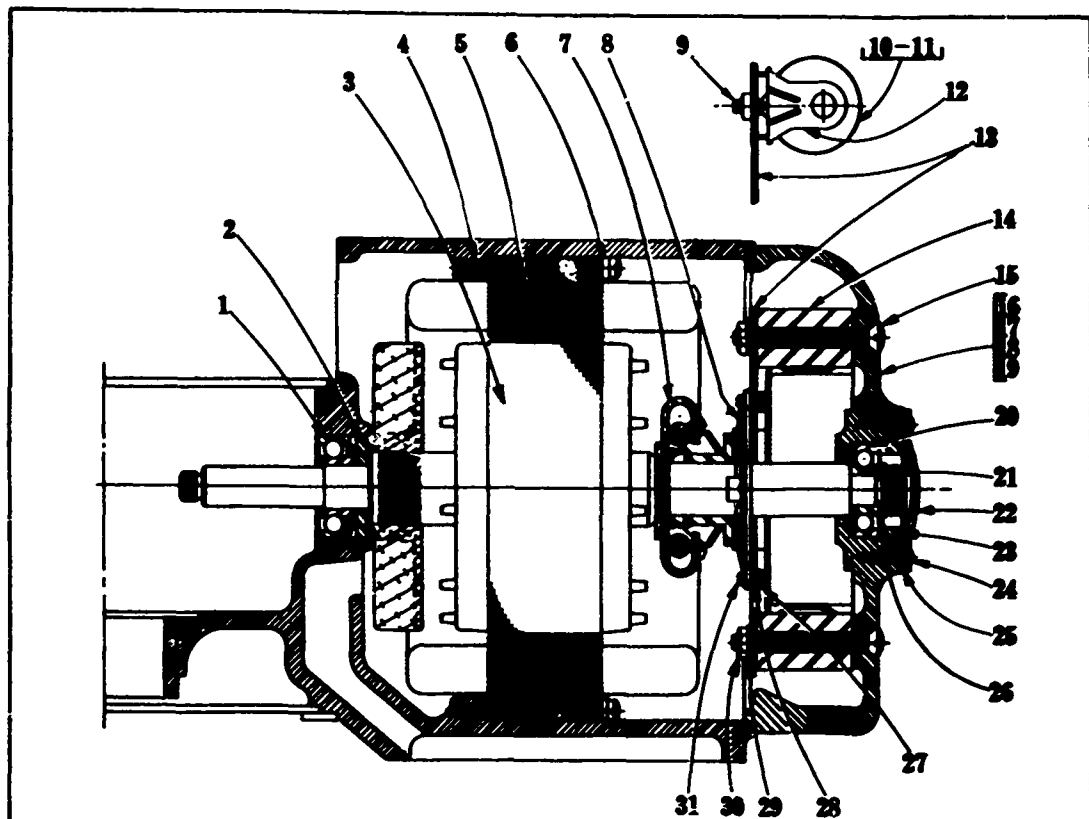
<u>Gear</u>	<u>Agitator Speed (RPM)</u>
Low	107
Intermediate	198
High	361

The mixer now has a wide range of speeds since the air motor speed can be varied. Care should be taken not to exceed the engineered design limits of gear speeds in the mixer. With this wide range of speeds for the agitator,

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there should be no reason to exceed the speed of the replaced electric motor, 1725 RPM. The graph of agitator speed vs. air motor speed shows this speed range. This speed does not include the planetary action of the agitator.

MOTOR **REPLACEMENT PARTS**



Type of Motor -KGA-A-200

Motor Spec. 8461

Motor type and Spec. number are stamped on motor (sometimes under Name Plate).

When ordering motor replacement parts, in addition to motor Type and Spec. No., give Serial No., Model, Spec., and all electrical data shown on machine name plate.

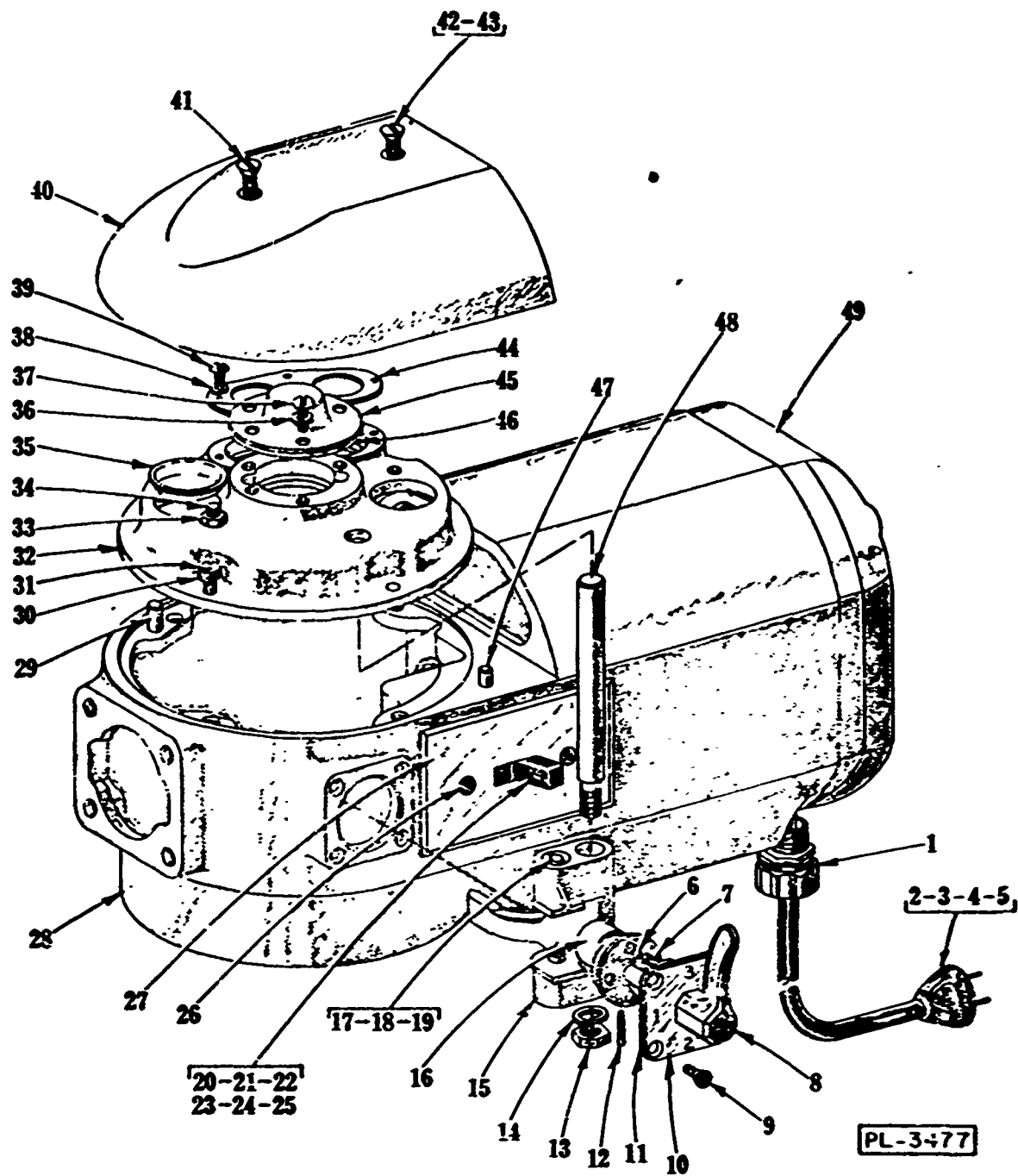
Illus. Part PL-4526 No.	Name of Part	Amt.	Illus. Part PL-4526 No.	Name of Part	Amt.
1	BB-11-8 Ball Bearing - Fairair #203 KL -----	1	17	P-23550-1 Cover - Inspection -----	2
2	M-13174-1 Deflector - Grease -----	1	18	SC-15-44 Mach. Screw - #10-24 x 1-1/4" Oval Hd. (For Item #17) -----	4
3	P-22275-41 Rotor Assy. (Incls. Item #7) -----	1	19	SC-11-04 Mach. Screw - #12-24 x 1" Flat Hd. (For Item #18) -----	4
4	SC-12-59 Mach. Screw - #10-24 x 2-1/4" Flat Hd. -----	4	20	BB-17-5 Ball Bearing - M.D. #7001 -----	1
5	P-65477-05 Stator Assy. (Give Elec. Spec.) (Rem #6 not included) -----	1	21	V-11430 Nut - Special -----	2
6	V-12671 Retainer - Stator -----	4	22	P-12062 Cap - Cover -----	1
7	P-21600 Switch - Starting (Rotating Part) -----	1	23	V-12669 Spacer - Bearing -----	1
8	P-66085 Switch - Starting (Stationary Part) -----	1	24	SC-15-22 Mach. Screw - #6-32 x 1/2" Oval Hd. -----	4
9	SC-14-57 Mach. Screw - #10-24 x 1/2" Flat Hd. -----	2	25	V-24464 Gasket - Cover Cap -----	1
10	P-70487-2 Capacitor -----	1	26	W8-7-9 Washer - Special -----	1
11	M-66622-1 End Cap - Capacitor -----	1	27	NS-9-7 Mach. Nut - #6-32 Hex -----	2
12	P-66621-1 Bracket - Capacitor -----	1	28	WL-3-9 Lock Washer - #6 x .047" x .031" -----	2
13	M-74738 Switch Plate & Weld Nut Sub-Assy. -----	1	29	WL-3-38 Lock Washer - 1/4" x .108" x .062" -----	2
14	M-72818-2 Post - Switch Retaining Plate -----	2	30	NS-13-2 Full Nut - 1/4"-20 Hex Fin. -----	2
15	SC-15-80 Mach. Screw - 1/4"-20 x 2-1/4" -----	2	31	SC-9-79 Mach. Screw - #6-32 x 5/16" Rd. Hd. -----	2
16	S-89067-1 Bracket - Bearing -----	1			

THE HOBART MFG. CO.

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TROY, OHIO
FIGURE 1
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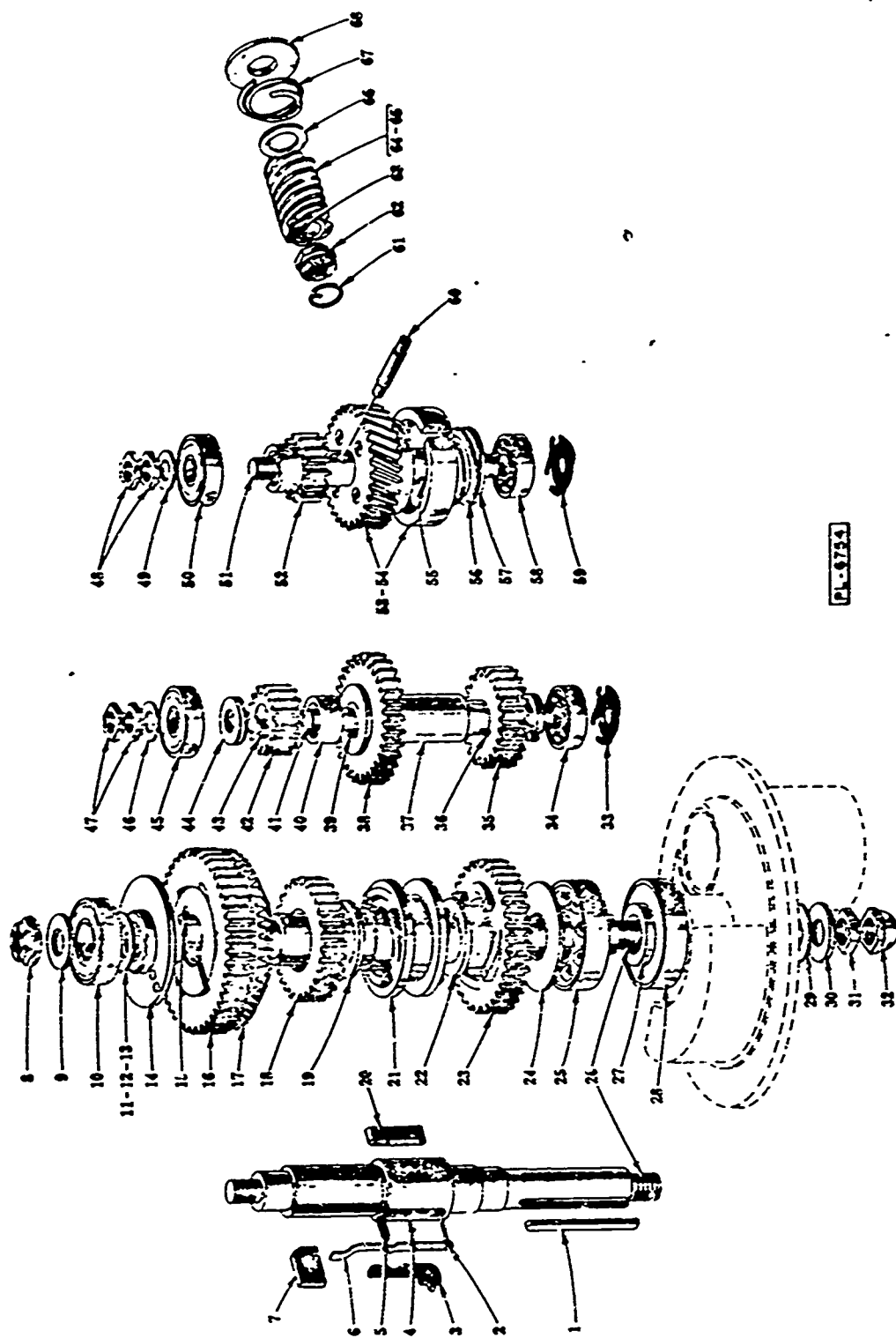
TRANSMISSION CASE AND FILTER UNIT

Figure 2

TRANSMISSION CASE AND SHIFTER UNIT

ILLUS. PL-3477	PART NO.	NAME OF PART	AMT
1	FE-6-31	Connector - Strain Relief	1
2	S-63335-9	Cord & Plug (2 Cond., Under 125 V.)	1
3	---	Open Number	1
4	S-63335-30	Cord & Plug (3 Cond., Under 150 V.)	1
5	S-63335-43	Cord & Plug (3 Cond., 250-250 V.)	1
6	BA-2-9	Ball - 1/4" Dia.	2
7	V-10755	Spring - Detent	2
8	P-12728	Handle - Shifter	1
9	SC-30-24	Mach. Screw - #10-24 x 1/2" Oval Hd.	4
10	P-12726	Plate - Shifter Index	1
11	M-23946	Gasket - Shifter Index Plate	1
12	PT-3-28	Taper Pin - #1 x 3/4" Lg.	1
13	NS-13-22	Full Nut - 3/8"-16 Hex Fin.	1
14	WL-4-2	Lock Washer - 3/8" x .136" x .070"	1
15	P-13160	Yoke - Shifter	1
16	M-12729	Cam - Gear Shifter	1
17	V-12733	Plunger - Shifter Yoke	2
18	V-12734	Spring - Shifter Yoke	2
19	V-12732	Retainer - Spring (Shifter Yoke)	2
20	P-87711-99-4	Switch (1 Ph.)	1
21	P-87711-99-2	Switch (2 & 3 Ph., Under 250 V.)	1
22	P-87711-57-1	Switch (2 & 3 Ph., Above 250 V.)	1
23	P-87810-19-1	Switch (D.C.)	1
24	P-16504	Insulator - Switch	2
25	M-74835	Screw - Switch Mounting	2
26	SC-30-6	Mach. Screw - #6-32 x 3/8" Oval Hd.	2
27	B-103118	Plate - Switch	1
28	T-12678	Case - Transmission	1
29	P-11800-116	Dowel	1
30	WL-3-28	Lock Washer - #12 x .062" x .047"	4
31	SC-8-31	Mach. Screw - #12-24 x 3/4" Rd. Hd.	4
32	P-67750	Transmission Shaft Support and Screw Assy. (Incls. Items #33 & 34)	1
33	NS-9-36	Mach. Nut - #12-24 Hex	1
34	SC-8-56	Mach. Screw - #12-24 x 1-1/2" Rd. Hd.	1
35	M-64871	Plug - Friction	2
36	WL-3-28	Lock Washer - #12 x .062" x .047"	3
37	SC-8-48	Mach. Screw - #12-24 x 1/2" Rd. Hd.	3
38	WL-3-22	Lock Washer - #10 x .055" x .040"	4
39	SC-7-74	Mach. Screw - #10-24 x 3/8" Rd. Hd.	4
40	S-18231-1	Cover - Transmission Case	1
41	SC-15-54	Mach. Screw - #12-24 x 1-1/4" Oval Hd.	1
42	SC-15-55	Mach. Screw - #12-24 x 1-1/2" Oval Hd.	1
43	NS-9-36	Mach. Nut - #12-24 Hex	2
44	M-12708	Retainer - Twin Bearing	1
45	M-20394-2	Cap - Bearing Retainer	1
46	M-20395	Retainer - Bearing	1
47	P-11800-61	Dowel	2
48	M-12735	Rod - Shifter Guide	1
49	---	Motor (see separate Motor Parts Sheet)	1
	R-77768-1	Case - Transmission (Timed Mach.)	1
	PL-3-14	Plug - 15/16" Dia. Expansion (Not Shown)	1
	PL-3-28	Plug - 1-5/16" Dia. Expansion (Not Shown)	1

Figure 2 (cont.)



TRANSMISSION GEAR UNIT

Figure 3

TRANSMISSION GEAR UNIT

ILLUS. PL-6/64	PART NO.	NAME OF PART	AMT.
1	R-12430-18	Key	1
2	V-15575-2	Rivet	1
3	M-13024	Block - Diving Key Control	1
4	V-16575-1	Rivet	1
5	V-12759	Spring	1
6	V-12749	Arm - Diving Key Control	1
7	M-15528	Key - Diving	1
8	NS-32-29	Stop Nut - 1/2"-20 "Flex'oc"	1
9	WS-6-13	Washer - Retaining	1
10	BB-20-18	Ball Bearing - N.D. #77503	1
11	WS-10-18	Shim - Brg. (.002" Thk.)	As Req'd
12	WS-10-19	Shim - Brg. (.003" Thk.)	As Req'd
13	WS-10-20	Shim - Brg. (.010" Thk.)	As Req'd
14	M-12701	Spacer - Upper	1
15	R-12430-59	Key	1
16	M-16225	Gear - Slow Speed (46T)	1
17	P-18500	Gear - Zerol Bevel (46T)	1
18	M-12694	Gear - Clutch (29T)	1
19	M-12695	Bearing - Clutch Gear	1
20	V-16577	Key - Special Feather	1
21	M-12703	Sleeve - Clutch	1
22	M-12695	Bearing - Clutch Gear	1
23	M-12696	Gear - Clutch (38T)	1
24	M-12723	Spacer - Lower	1
25	BB-20-6	Ball Bearing - N.D. #7504	1
26	R-12750	Shaft - Center	1
27	M-14674	Spacer - Bearing	1
28	M-23483	Seal - Oil	1
29	WS-7-26	Washer (Fiber)	1
30	WS-24-1	Washer - Retaining (STL)	1
31	V-10928-2	Nut - 1/2"-20 Special	1
32	M-24715-3	Acorn Nut - 1/2"-20	1
33	SL-2-6	Spring - Preloading	1
34	BB-5-1	Ball Bearing - N.D. #3200	1
35	V-12699	Gear (23T)	1
36	R-12430-2	Key	1
37	V-12697	Spacer - Lower	1
38	M-12700	Gear (32T)	1
39	R-12430-2	Key	1
40	V-12698	Spacer - Central	1
41	M-12717	Shaft - Transmission	1
42	M-103960	Gear (15T)	1
43	R-12430-2	Key	1
44	V-12744	Spacer - Upper	1
45	BB-5-2	Ball Bearing - N.D. #7500	1
46	WS-6-8	Washer - Retaining	1
47	V-12710	Nut - Retaining	2
48	V-12710	Nut - Retaining	2
49	WS-6-8	Washer - Retaining	1
50	BB-5-2	Ball Bearing - N.D. #7500	1
51	M-12725	Shaft - Worm Gear	1
52	V-12719	Gear (15T)	1
53	M-86525-1	Lower Release, Worm Wheel & Hub Sub-Assy. (29T.) (60 Cy.)	1
54	M-86525-2	Lower Release, Worm Wheel & Hub Sub-Assy. (24T.) (50 Cy.)	1
55	R-12430-1	Key	1
56	M-12724	Spring - Friction Drive	1
57	WS-9-28	Washer	1
58	BB-5-1	Ball Bearing - N.D. #3200	1
59	SL-2-8	Spring - Preloading	1
60	V-18431	Pin	1
61	V-12793	Retaining Ring	1
62	M-12792	Nut - Special	1
63	V-12747	Key	1
64	M-12743-1	Worm (5T) (60 Cy.)	1
65	M-12770	Worm (5T) (50 Cy.)	1
66	V-12754	Washer	1
67	V-12757	Spring - Shock Absorber	1
68	V-12711	Washer - Shock Absorber Spring	1
	P-24551	Center Shaft Assy. Unit (Incls. Items #2, 4, 5, 6, 20 & 26)	1
	M-24861-1	Worm Gear Shaft Sub-Assy. Unit (60 Cy.) (Incls. Items #51, 52, 53, 55, 56, 57 & 60)	1
	M-24861-2	Worm Gear Shaft Sub-Assy. Unit (50 Cy.) (Incls. Items #51, 52, 54, 55, 56, 57 & 60)	1

Figure 3 (cont.)

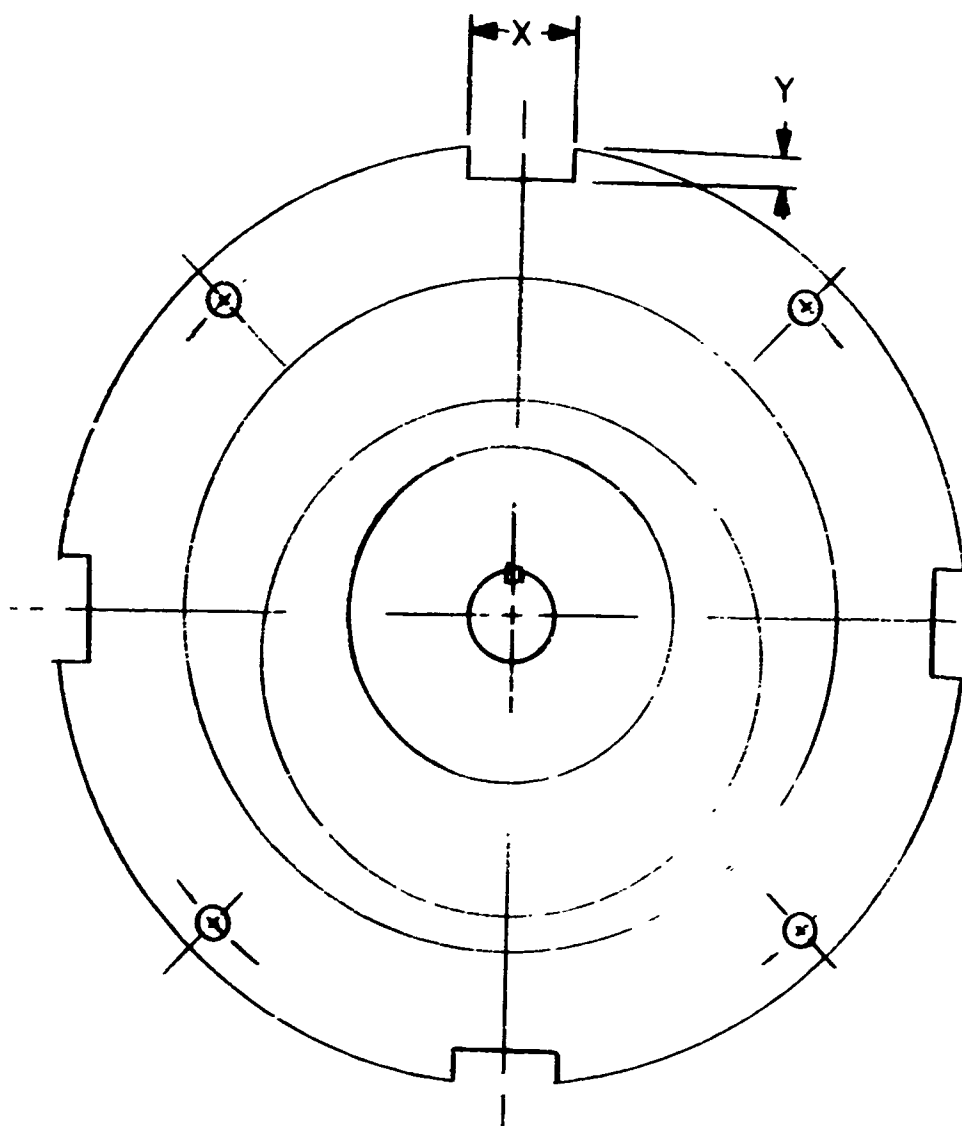


FIG. 4

AIR MOTOR SELECTION CHART

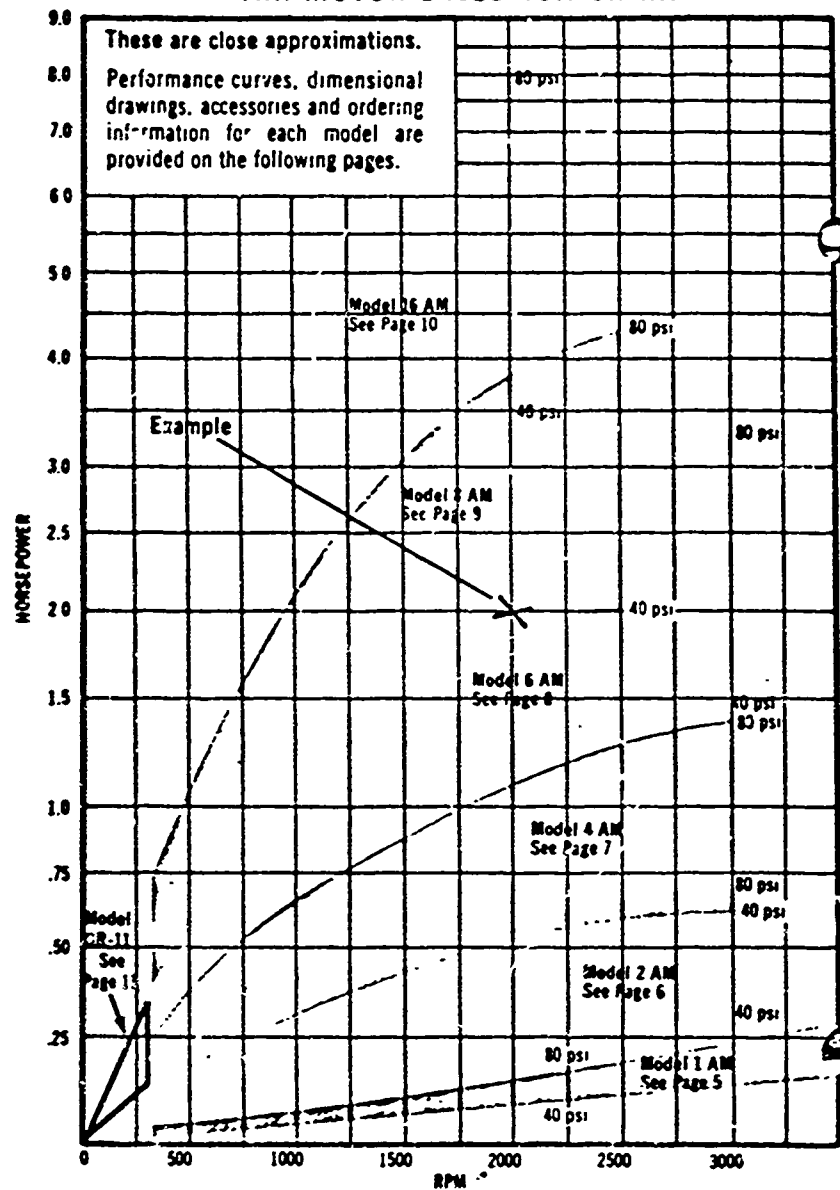


Figure 5

MODEL 6AM AIR MOTOR

Performance Data - Delivers up to 3 hp. Speed may be varied from 300 to 3000 rpm; hp is relative to rpm. Maximum recommended operating pressure—100 psi. Performance curves shown are for reversible models. Air consumption curves will be slightly lower for single rotation units.

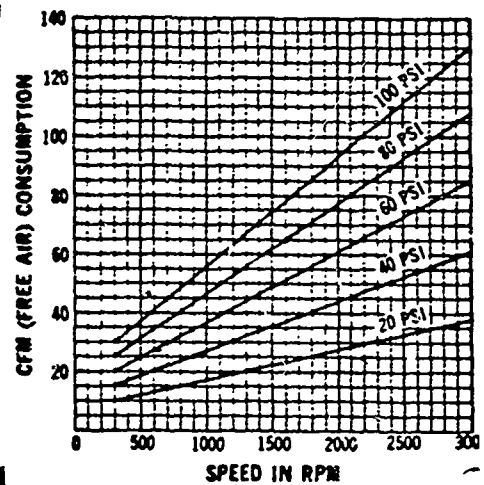
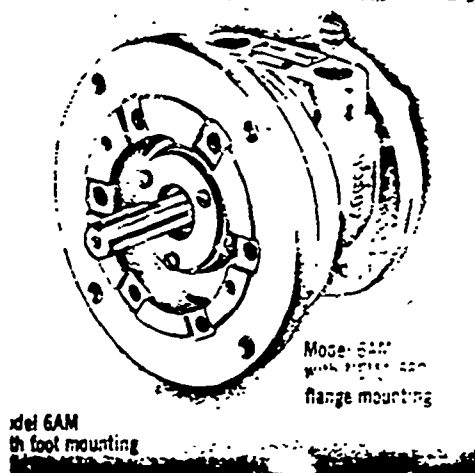
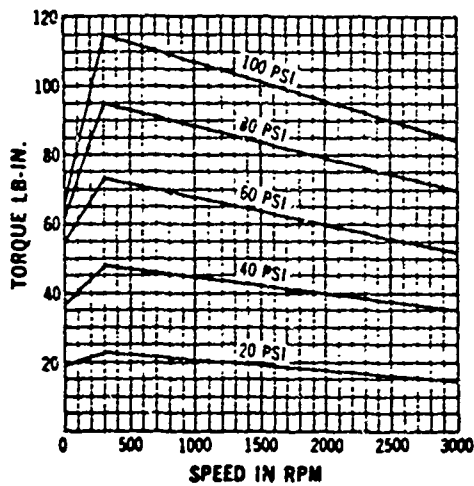
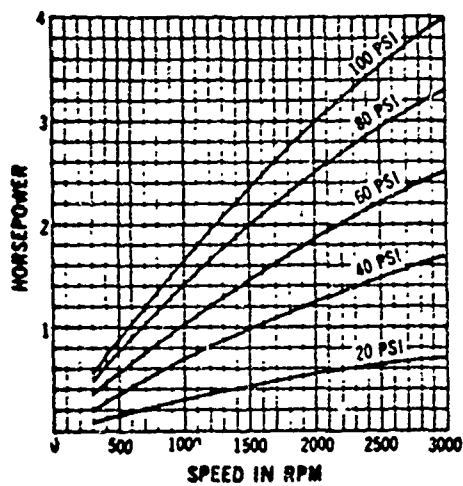
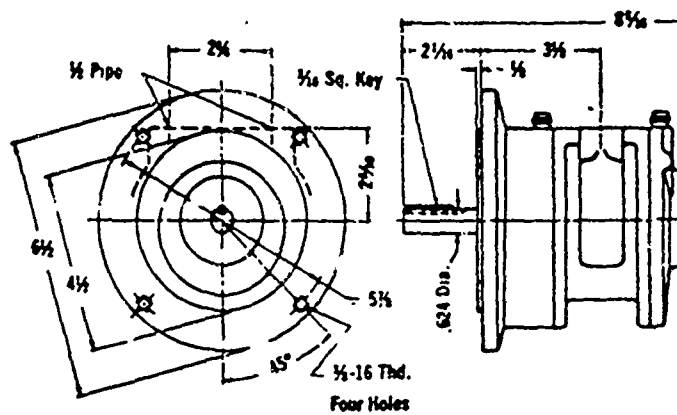


Figure 6

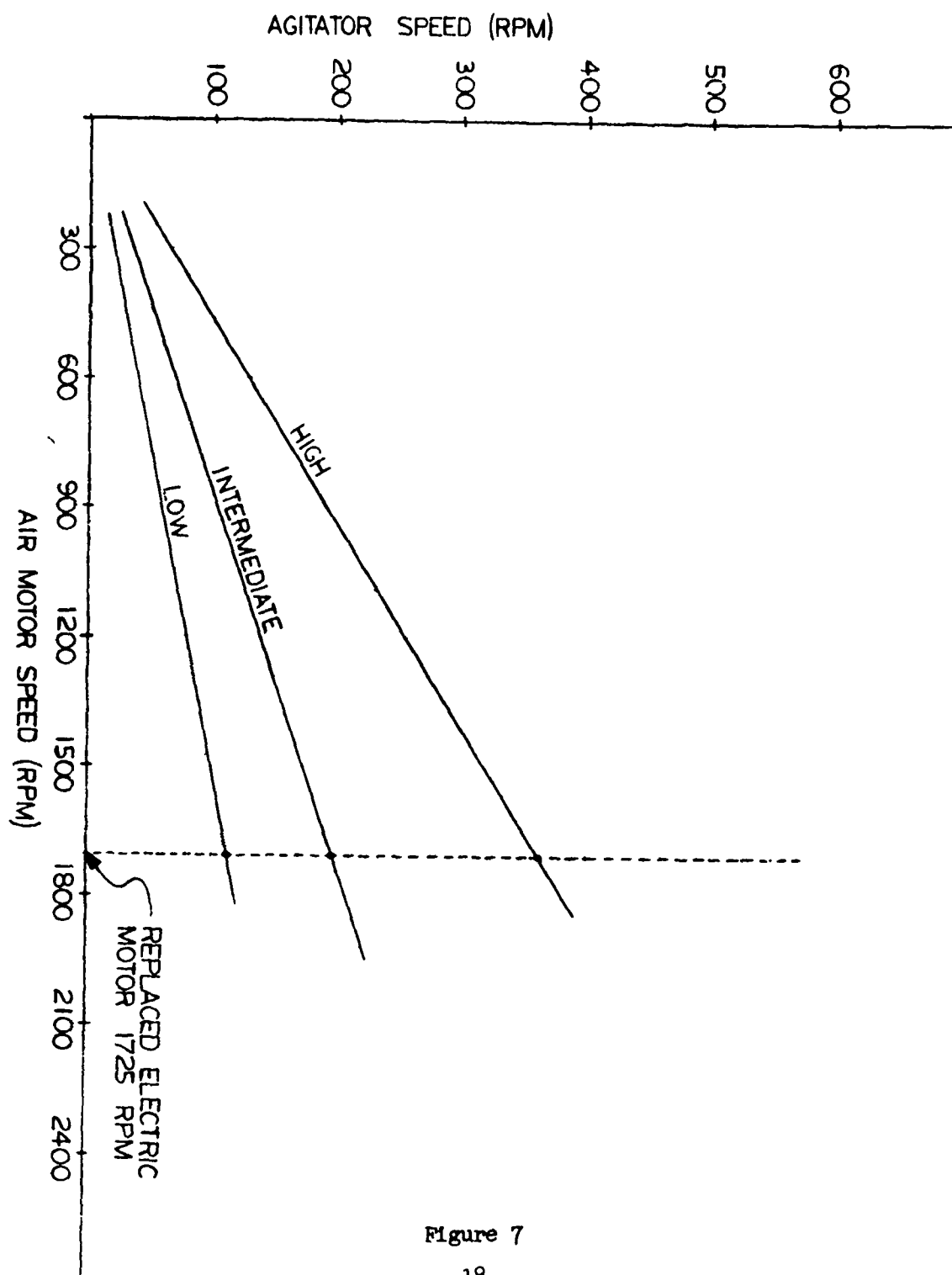
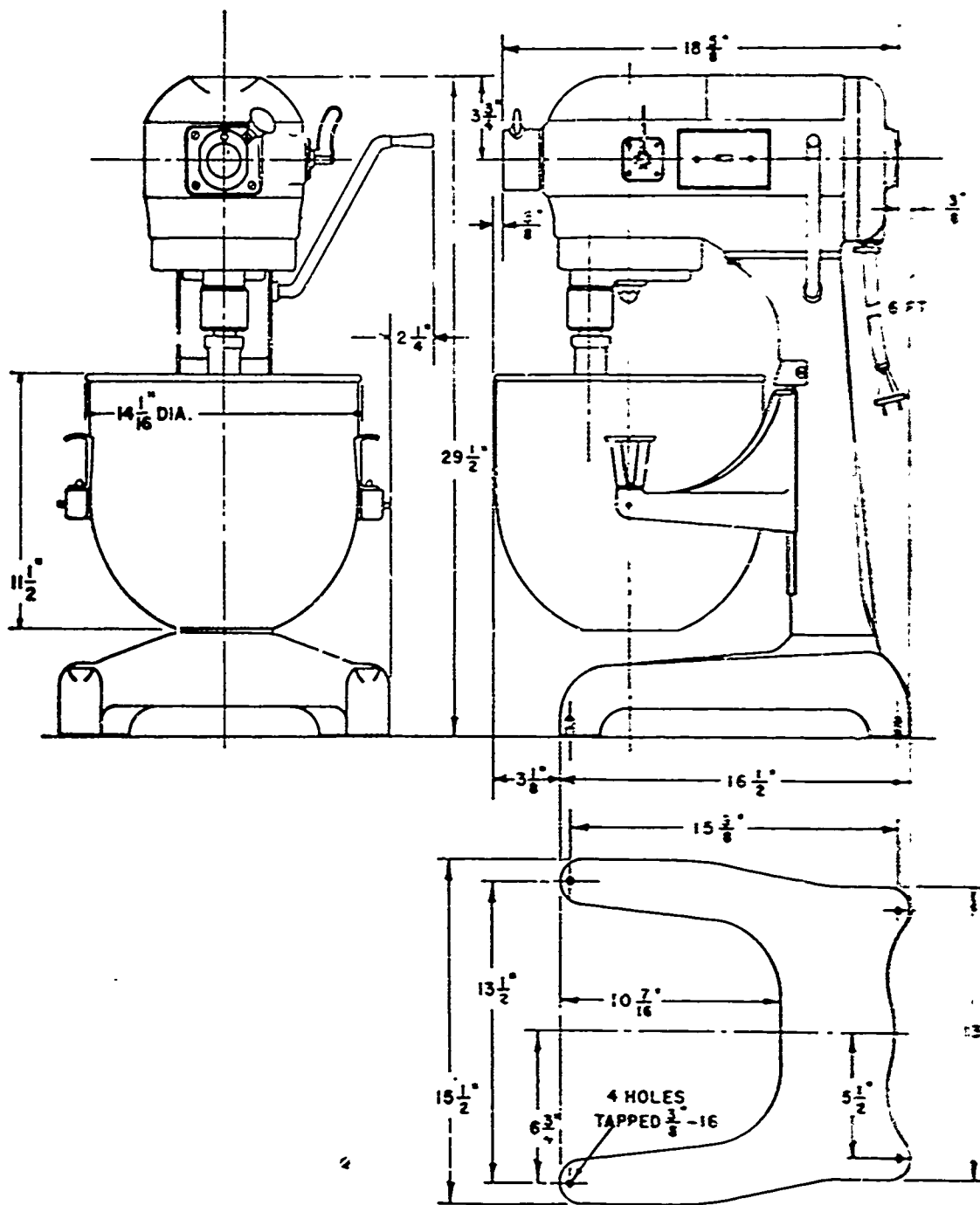


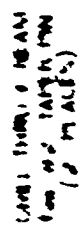
Figure 7



PL-5324

P-17446

INSTALLATION DIAGRAM
Figure 8



UNCLASSIFIED		NAD CRANE		DEPARTMENT OF THE NAVY	
UNCLASSIFIED		UNCLASSIFIED		NAVAL AIR SYSTEMS COMMAND	
UNCLASSIFIED		UNCLASSIFIED		WASHINGTON, D.C. 20360	
UNCLASSIFIED		UNCLASSIFIED		COUPLER, 20 T.	
UNCLASSIFIED		UNCLASSIFIED		HOBART MIXER	
UNCLASSIFIED		UNCLASSIFIED		SIZE	
UNCLASSIFIED		UNCLASSIFIED		CODE IDENT	
UNCLASSIFIED		UNCLASSIFIED		NAVAIR OWS NO	
UNCLASSIFIED		UNCLASSIFIED		B 30003	
UNCLASSIFIED		UNCLASSIFIED		RDC-3-232	
UNCLASSIFIED		UNCLASSIFIED		SCALE	
UNCLASSIFIED		UNCLASSIFIED		DINETS	
UNCLASSIFIED		UNCLASSIFIED		APPROVED FOR NARC	
UNCLASSIFIED		UNCLASSIFIED		MATERIAL	
UNCLASSIFIED		UNCLASSIFIED		4130 STEEL	
UNCLASSIFIED		UNCLASSIFIED		NEXT AGENCY	
UNCLASSIFIED		UNCLASSIFIED		USED ON	
UNCLASSIFIED		UNCLASSIFIED		APPLICATION	

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D		
Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified		
1. ORIGINATING ACTIVITY (Corporate author) Naval Ammunition Depot, Crane, Indiana 47522		2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP
3. REPORT TITLE Conversion of Hobart Model A-200 Electric Mixer to Air Drive for Use in Mixing Pyrotechnic Compositions		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)		
5. AUTHOR(S) (First name, middle initial, last name) Patrick L. Arvin and Sherman E. Dare		
6. REPORT DATE 1 September 1970	7a. TOTAL NO. OF PAGES 25	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. b. PROJECT NO c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) RD/R No. 172 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
10. DISTRIBUTION STATEMENT Distribution of this document is unlimited		
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY
13. ABSTRACT During development of a Catalyst Generator at NAD, Crane, Indiana, a special need arose for a somewhat universal mixer to thoroughly blend pyrotechnic mixes of various types under special conditions. The search for a mixer which could be used to mix these pyrotechnic mixes of approximately 20 lb. in size, on a reproducible as well as a productive basis led to the Model A-200 (Planetary Action) Mixer Manufactured by the Hobart Manufacturing Company, Troy, Ohio. Preliminary testing of this mixer, with its planetary action, proved that it would meet the criteria already mentioned. One problem remained, however. The Model A-200 Mixer is equipped from the factory with the standard type electrical motor and related equipment which would not permit the Model A-200 to be used to mix pyrotechnic mixes because of safety requirements. Since this mixer provided the proper mixing action, it was suggested that the electrical motor and related controls (switches) be replaced with an air motor to adapt this mixer to meet the safety requirements. The following is a description of how the Model A-200 Mixer was converted from electrically to air driven power.		

DD FORM 1473

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S/N 0101-807-6801

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