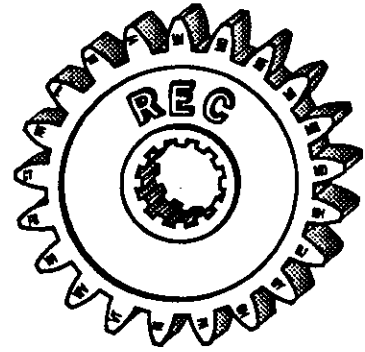


ROSCOMMON EQUIPMENT CENTER



Northeast Forest Fire Supervisors in cooperation with Michigan's Forest Fire Experiment Station

P.O. Box 68, Roscommon, MI 48653

July 1993

PROJECT 42 - Michigan 5-Ton 6x6 Retardant Engine¹ (On Demand System)

Information contained in this report has been developed for the guidance of employees of the member States, Provinces and Federal Agencies.

The use of trade, firm or corporation names is for the information and convenience of the user. Such use does not constitute an official evaluation, conclusion, recommendation, endorsement, or approval of any product or service to the exclusion of others which may be suitable.

¹ This project bulletin contains information that may change regularly. Its contents may include preliminary drawings or manufacturer's product data that may have changed. It is intended primarily for conceptual use. Additional or updated information may be available by contacting the address above.

The size of the mix chamber was 160 gallons. To mix a batch of 4:1, the operator checked the visual sight tube and positioned the indicator in line with the fluid level shown in the sight tube. A 4:1 mix ratio has 5 units: 1 unit of concentrate (32 gallons) and 4 units of water (128 gallons). A chart aided the operator in determining the amount of water and concentrate needed for various mix ratios. When the amount of concentrate required was determined, the operator lowered the indicator (for this example, the equivalent of 32 gallons), using the calibrated rod to determine the correct amount. Because the eductor intake opening was synchronized with the indicator, it was submerged in the concentrate 32 gallons deep. Water pressure was then directed through the eductor from the pump discharge. This water emptied into the mix chamber. As it passes through the eductor it picks up the 32 gallons of retardant concentrate. The two liquids mixed together and eventually filled the 160 gallon mixing chamber. An overflow tube indicated when the mixing chamber was full. The operator shut off the water pressure, completing the 160 gallon mix at 4:1 ratio - 32 gallons of retardant and 128 gallons of water. It took approximately three minutes to mix a 160 gallon batch of ready-to-use retardant. The time will depend on the size of the water pump and the capacity of the eductor.

The intake system of the pump was connected to the water chamber and to the ready-to-use mix chamber. A selector valve (20), allowed the operator to switch from one material to the other, as desired.

The ready-to-use retardant mix could be agitated by circulating it through the pumping system. It was necessary to agitate the mix before application if it had set for an extended period.

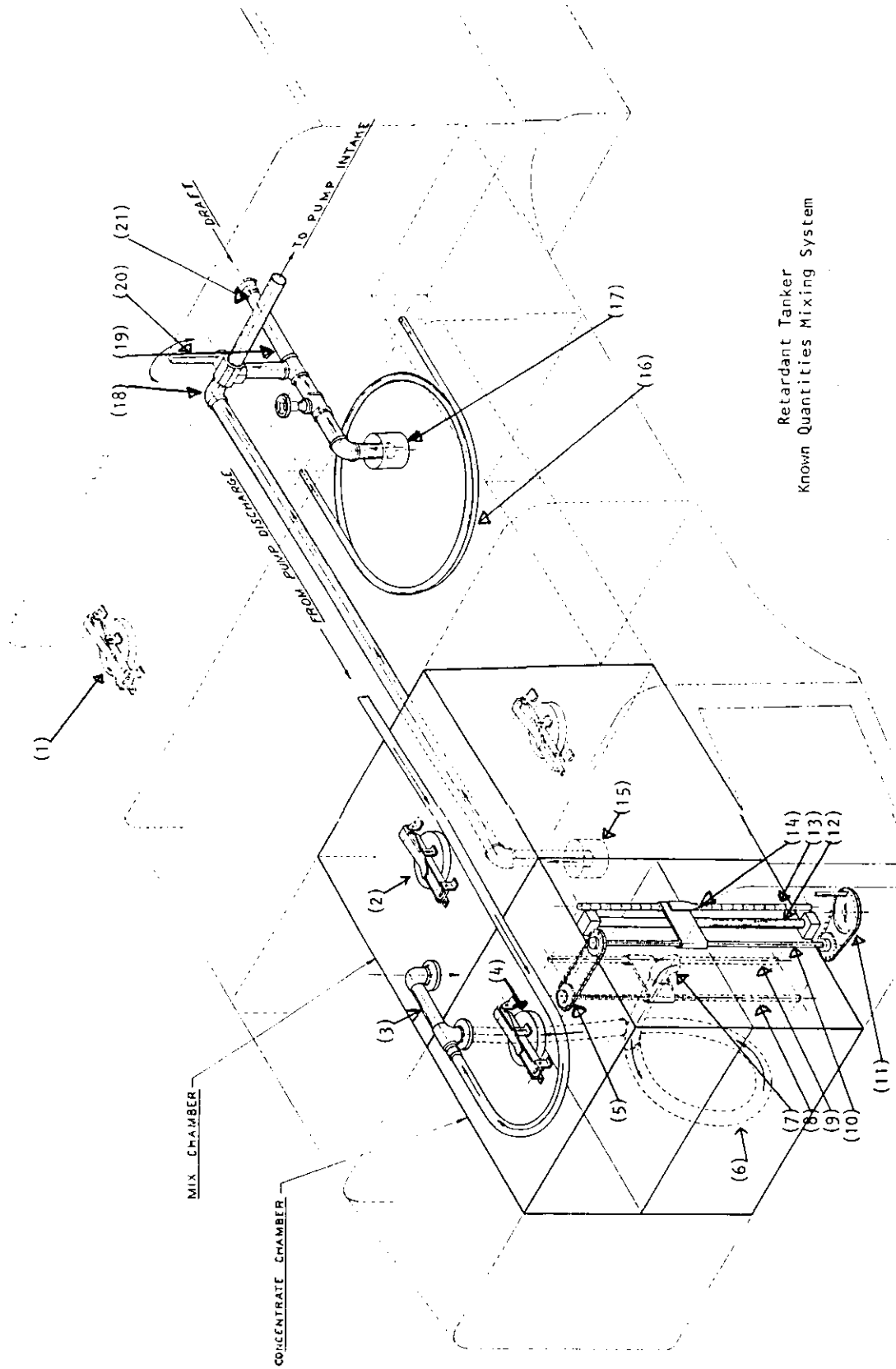
The mixing system described in the preceding paragraphs, and illustrated by Figure 1, proved to be workable and was used in REC Project 41A and 41B tests, as well as on prescribed burns³. A limited amount of satisfactory experience showed that this system has some merit as a practical concept. It was referred to as a "Known Quantity Batch Mixer". The term relates to mixing the materials in known quantities and in batches. The batch size is limited to the size of the mix chamber.

A batch system of this nature has some decided limitations: The user is limited to the volume of the mix chamber. When this amount of read-to-use retardant has been used, the operator must stop application and mix a new batch.

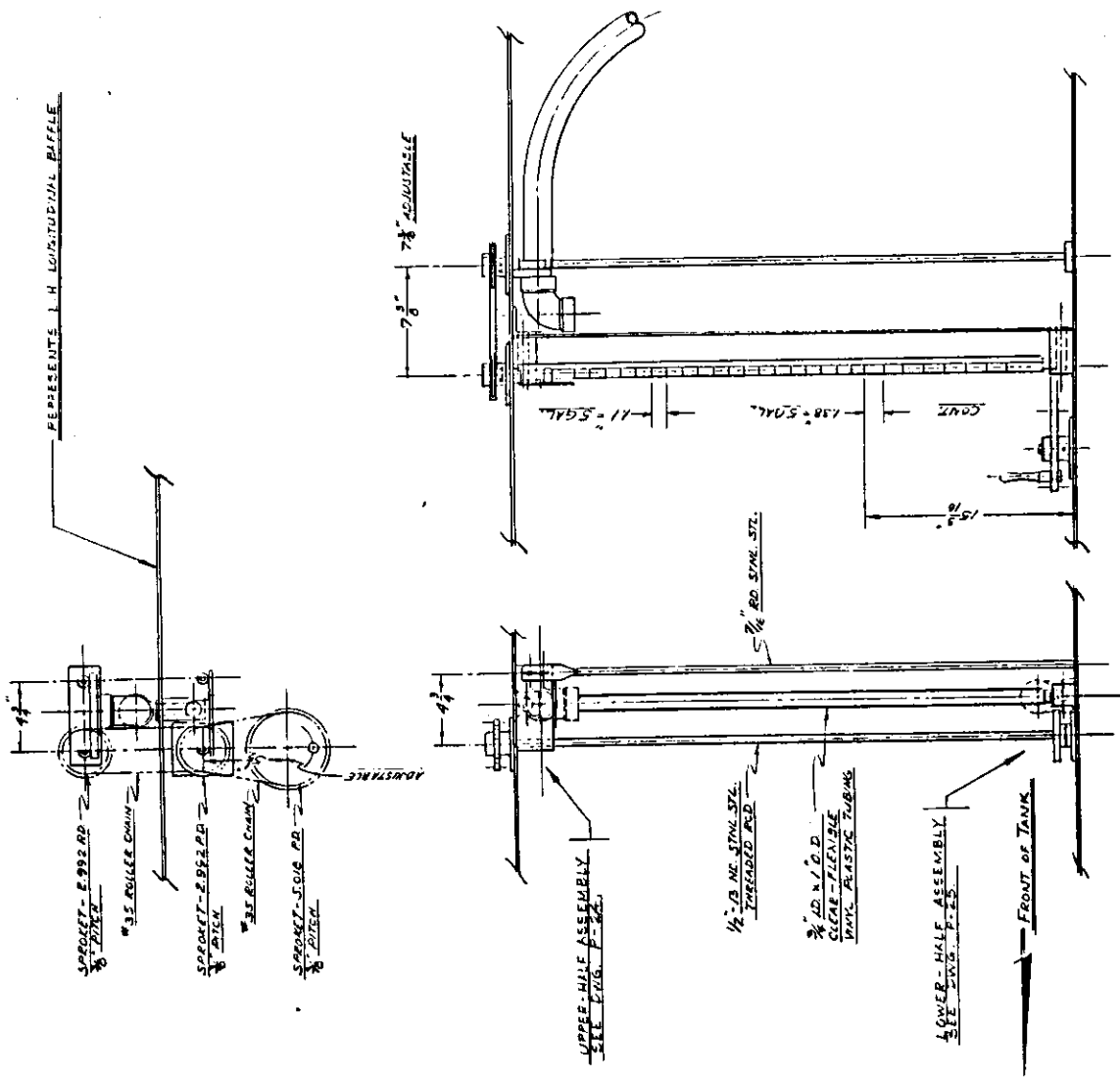
A portion of the water reservoir must be reserved for the mix chamber. The size of the chamber logically should be in proportion to the overall capacity of the tank. This may put an unrealistic demand on small units. This limitation can be largely offset by the fact that the mix chamber can be used to carry water and that it does not have to be used for retardant until it is desired to mix a batch. It is possible to use the entire water vessel as a mixing chamber. In this case, all elements and areas of the tank should be protected from


³ REC Project 41B *An Analysis of Foams, Long & Short Term Retardants*.

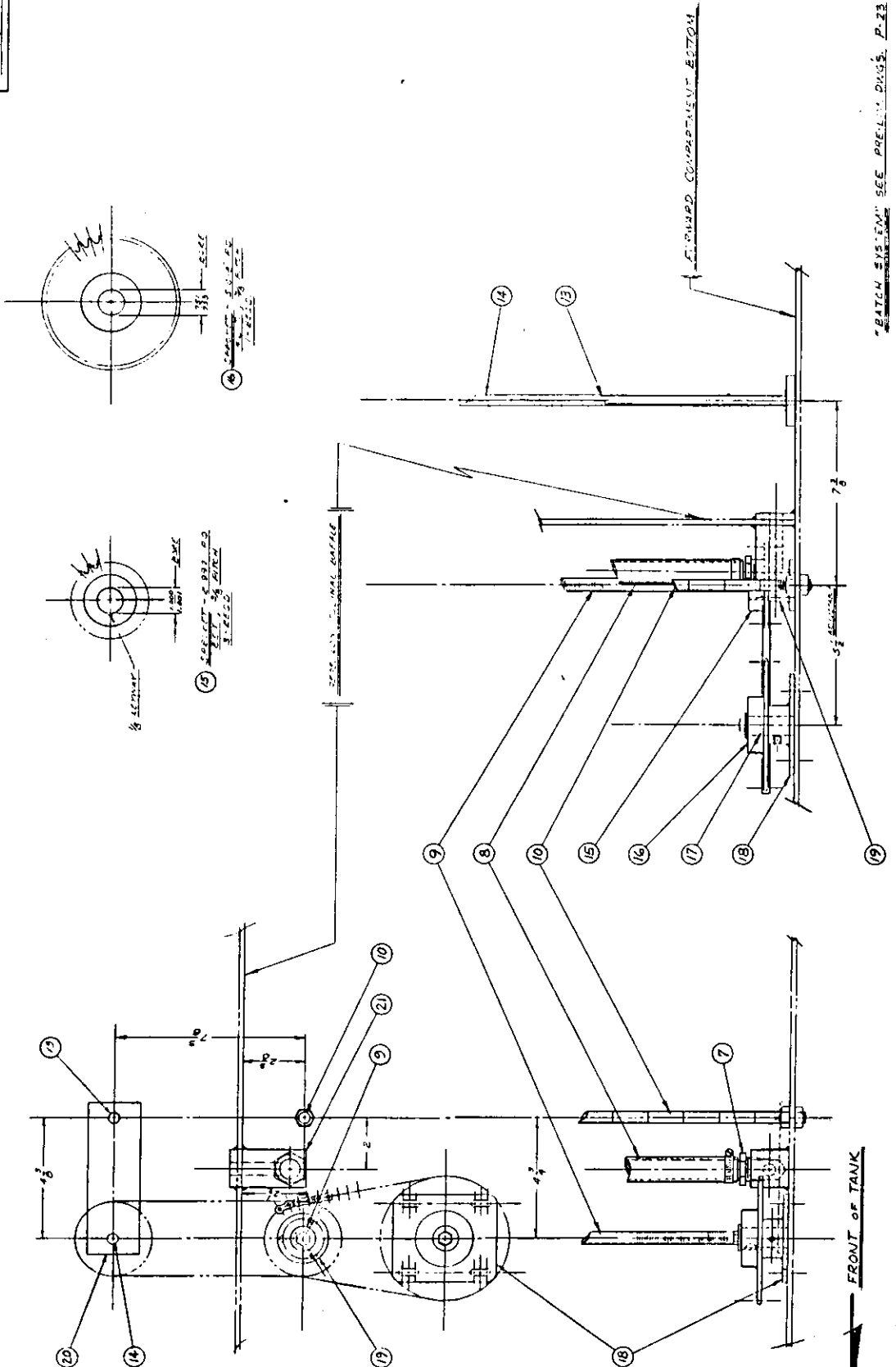
- (1) Filler port - water
- (2) Filler port - mix chamber
- (3) Eductor
- (4) Filler port - concentrate chamber
- (5) Synchronized chain drive
- (6) Flexible hose - eductor to intake
- (7) Concentrate intake opening
- (8) Threaded rod - inside of concentrate chamber
- (9) Guide rod
- (10) Threaded rod - outside of concentrate chamber
- (11) Chain drive - increaser
- (12) Visual sight tube
- (13) Guide rod
- (14) Indicator
- (15) Sump - mix chamber
- (16) Heat exchanger
- (17) Sump - water compartment
- (18) Intake pipe from mix chamber
- (19) Intake pipe from water compartment
- (20) Selector valve - water or retardant
- (21) Draft option




Retardant Tanker
Known Quantities Mixing System



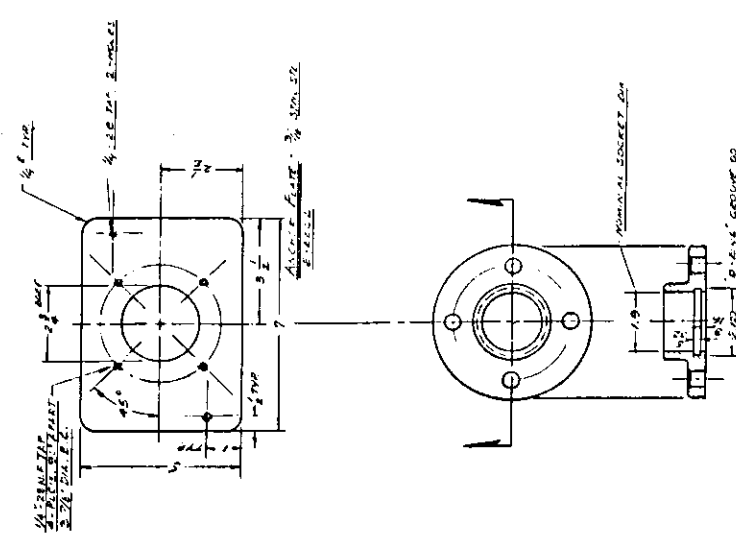
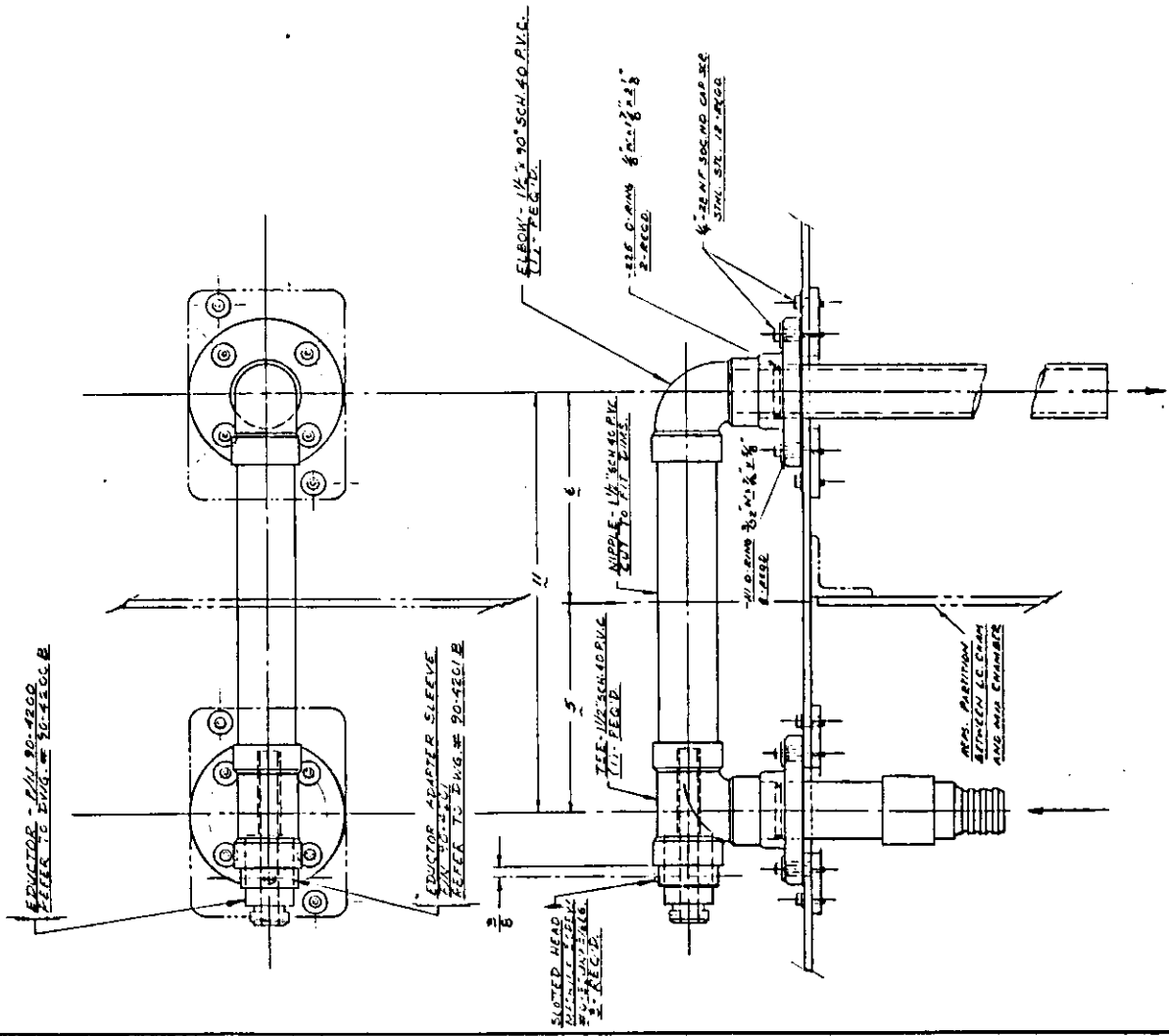
	
MICHIGAN FOREST FIRE EXPERIMENT STATION ROSSCOMMON EQUIPMENT CENTER PROJECT	
"BATCH SYSTEM" FALL ASSEMBLY - STONING ENGINE	
DESIGNED BY: <i>Max L. Gaudin</i> DRAWN BY: <i>Max L. Gaudin</i> CHECKED BY: <i>Max L. Gaudin</i> DATE: <i>10/18/58</i>	PROJECT NUMBER: <i>17-93</i>




*BATCH SYSTEM SEE PRELIM. DRGS. P-23 THRU P-28

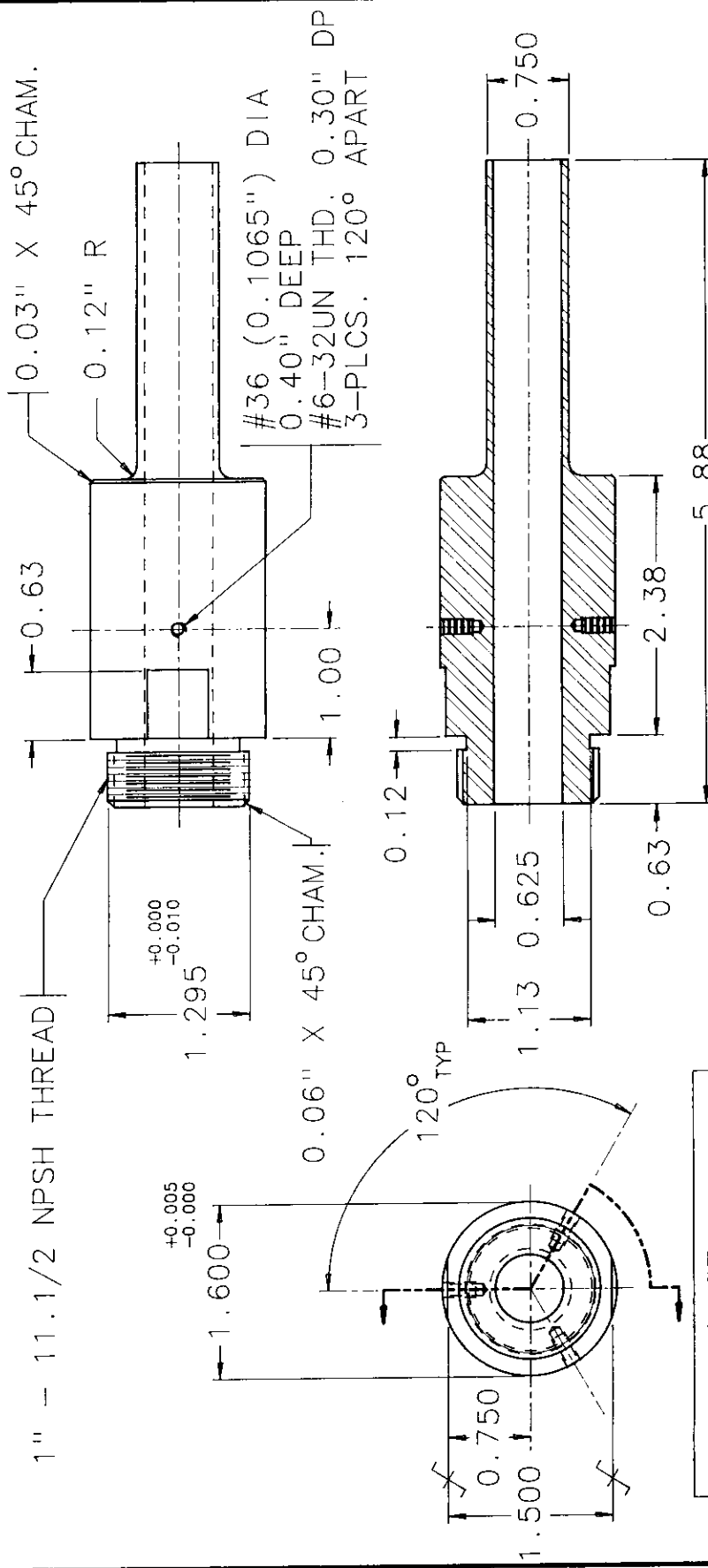
 MICHIGAN FOREST FIRE EXPERIMENT STATION FORESTRY EQUIPMENT CENTER PROJECT	
"BATCH SYSTEM" LOWER-HALF ASSEMBLY STOWING DEVICE	
DESIGNED BY W. W. MANNING	CHECKED BY J. J. O'NEILL
DRAWN BY W. W. MANNING	DATE 10/15/42

LOWER HALF ASSY SEE DRG. P-24 FOR UPPER HALF
 SEE DRG. P-23 FOR FULL ASSEMBLY



Std Socket Iron PVC Tee
 Minimum Outside Diameter
 2.0000

	
MICHIGAN FOREST FIRE EXPERIMENT STATION RESOURCES EQUIPMENT CENTER PROJECT	
EDUCTOR MFG. & PLUMBING "BATCH SYSTEM"	
SCALE: 1" = 1"	DATE: 7-98
DESIGNED BY: [Name]	CHECKED BY: [Name]
DRAWN BY: [Name]	APPROVED BY: [Name]
PROJECT NO. 42	REVISION NO. 12



NOTE
 FOR EDUCTOR MOUNTING, REFER TO
 PRELIMINARY DRAWING NO. 30.

PART NUMBER: 90-4200
 MAT'L.: BAR, ROUND 1.5/8" DIA. TYPE 303
 STAINLESS STEEL
 UNS S30300
 F.F.E.S. SPEC. NO.: AC-00162BM
 EST. WT.: 1.92 LBS.

STD. TOLERANCES	
FRACTIONAL:	
0 TO 8 IN. +-.0015	
8 IN. AND UP +-.002	
DECIMAL:	
1 PLACE +-.001	
2 PLACE +-.0005	
3 PLACE +-.0002	

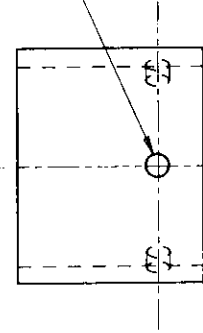
DRAWN:	R. GREENLAW
CHECKED:	B. HUTCHINS
APPROVED:	



FOREST FIRE EXPERIMENT STATION

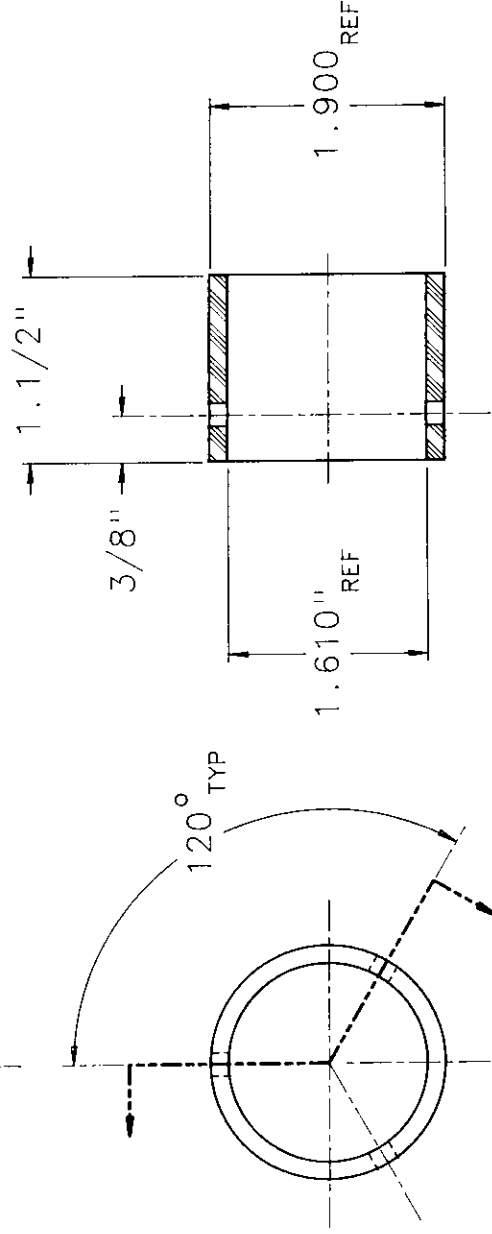
P.O. BOX 68 ROSCOMMON, MICHIGAN 48653

TITLE:	EDUCTOR: (RETARDANT LIFT)	SCALE:	FULL	DATE:	26 JUL 93
PROJECT NO.:	REC 42	DWG. NO.:	90-4200B		

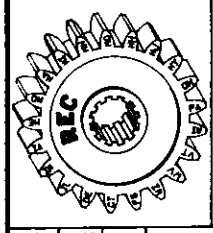


3/16" DIA.
(3) PLACES
120° APART

NOTE
EDUCTOR & ADAPTER SLEEVE
MOUNTING, REFER TO DWG.
PRELIMINARY # 30.



PART NUMBER: 90-4201
MAT'L.: PIPE: 1.1/2" SCH. 40 TYPE 1, PVC
ASTM D-1784-78
F.F.E.S. SPEC. NO.: P24-GAN12
EST. WT.: 0.06 LBS.



STD. TOLERANCES		DRAWN:	
FRACTIONAL:		R. GREENLAW	
0 IN AND UP	+ .015	CHECKED:	B. HUTCHINS
1 PLACE	+ - 0.1	APPROVED:	
2 PLACE	+ - 0.01	REVISION	
3 PLACE	+ - 0.000	NO.	BY
		DATE	

FOREST FIRE EXPERIMENT STATION

P.O. BOX 68 ROSCOMMON, MICHIGAN 48653

TITLE: **EDUCTOR ADAPTER SLEEVE** SCALE: FULL DATE: 26 JUL 93
PROJECT NO.: REC 42 DWG. NO. 90-4201B

PRELIMINARY No. 26

MACHINE END TO FINISHED
WITH AFTER VENTILATION
PROCESS AT RETRY

2 1/2" DIA. 3/16" WALL THICKNESS

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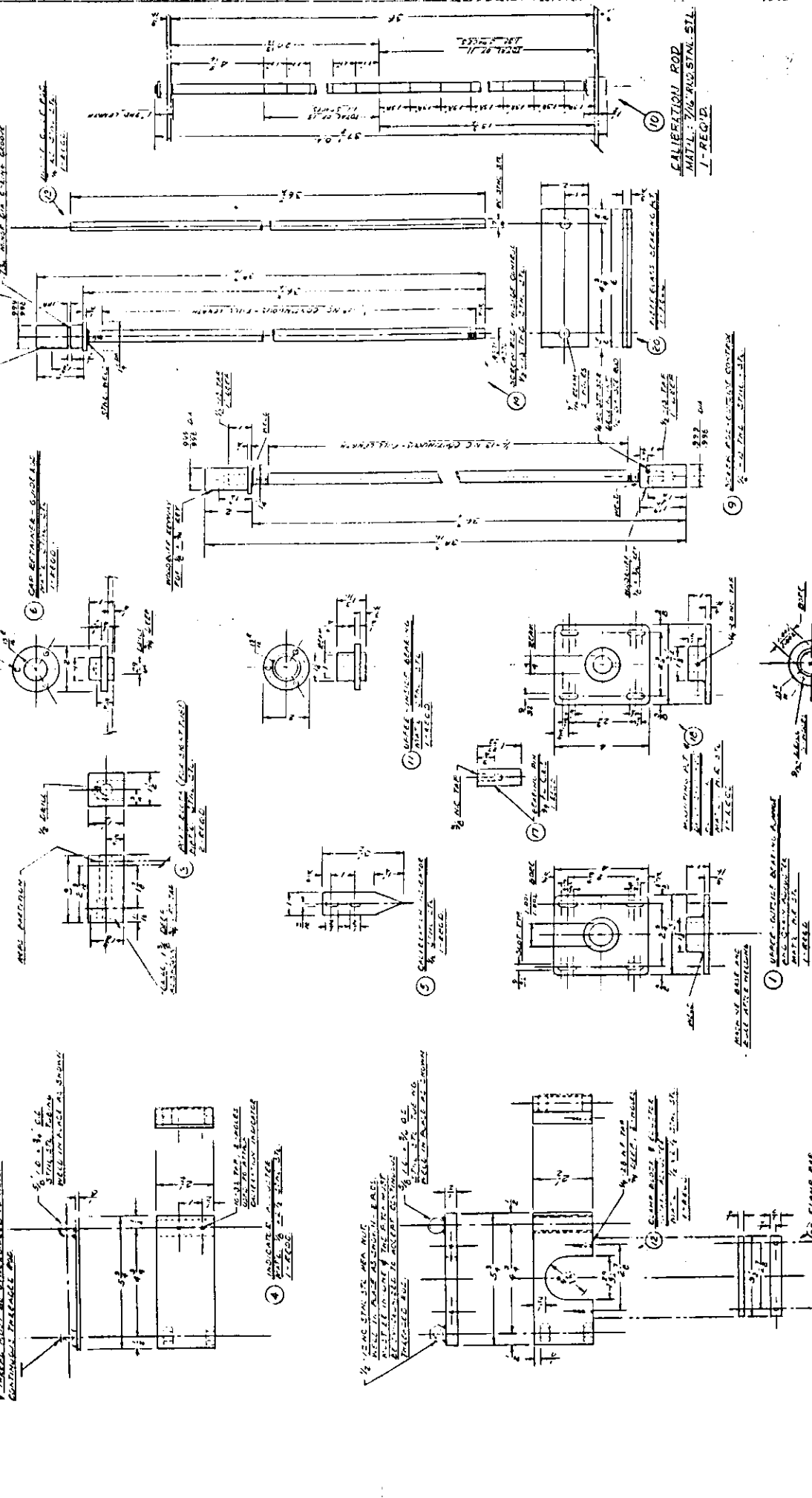
2 1/2" DIA. 3/16" WALL THICKNESS

2 1/2" DIA. 3/16" WALL THICKNESS

2 1/2" DIA. 3/16" WALL THICKNESS

2 1/2" DIA. 3/16" WALL THICKNESS

2 1/2" DIA. 3/16" WALL THICKNESS



COLLECTION ROD
MATERIAL: 7/8" DIA. STAIN. STL
1" RECD.

9) WATER PUMP - CENTRAL CONTROL
1/2" DIA. 3/16" WALL THICKNESS

1) WATER OUTLET BEARING ASSEMBLY
1/2" DIA. 3/16" WALL THICKNESS

4) LOWER - OUTLET BEARING ASSEMBLY
1/2" DIA. 3/16" WALL THICKNESS

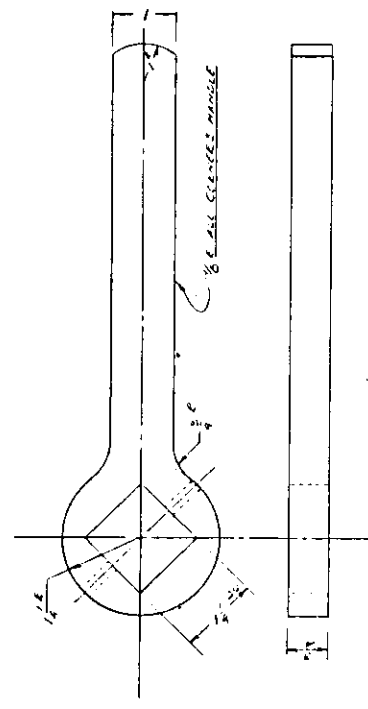
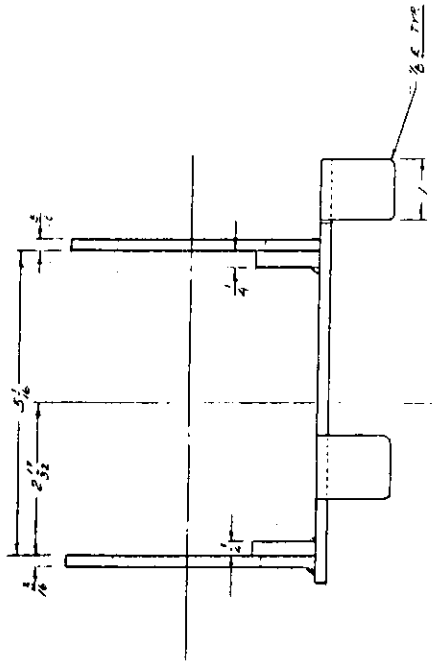
2) SIGNALS ROD
1/2" DIA. 3/16" WALL THICKNESS

MICHIGAN FOREST FIRE EXPERIMENT STATION
ROSCOMMON EQUIPMENT CENTER PROJECT

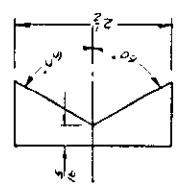
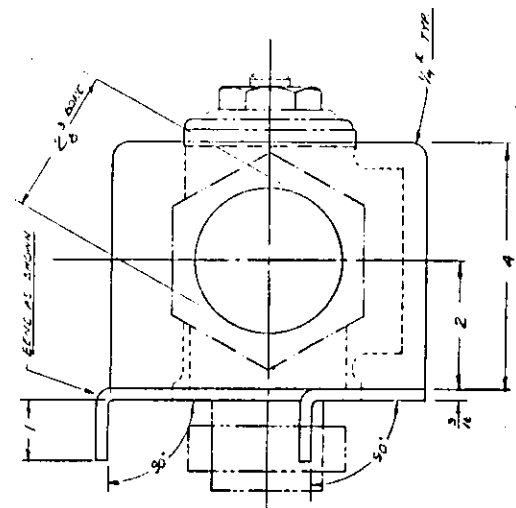
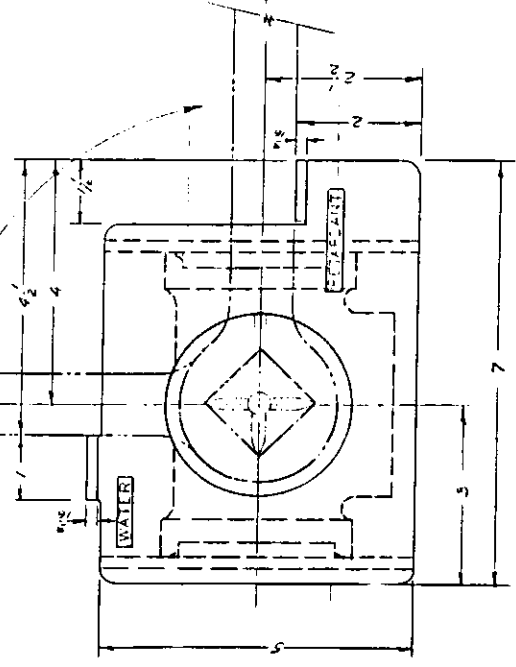
BATCH SYSTEM (PIPE RETARDANT MIXING) DETAILS

DATE: 11/11/58
DRAWN BY: M. J. MURPHY
CHECKED BY: G. L. HARRIS
SCALE: 1/2" = 1'-0"

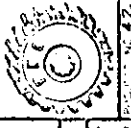




HANDLE MADE OF ALUMINUM



$\frac{1}{4}$ N.P.R. 2-1000
NOTE: THIS PART SHOULD BE MADE OF THE SAME MATERIAL AS THE VALVE BODY

	
AMERICAN FOREST FIRE EXPERIMENT STATION FORESTMAN EQUIPMENT CENTER PROJECT	
STOP CONTROL PLATE (2 IN FT 3 WAY PLUG VALVE)	
DATE: 10/15/54 DRAWN BY: J. W. BROWN CHECKED BY: J. W. BROWN	PROJECT NO. 17-92 SHEET NO. 31

FOR USE W/ RETARDANT MIXING "BATCH SYSTEM"
5-TON G.A.G. EQUIPMENT