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ABSTRACT

This guide is one in a series of four instructional aids designed to implement the first phase of the industriology concept. The teaching plan utilizes the instructional aids as prepared and listed for this phase of the program, and provides activity plans designed to aid the teacher in preparing for and conducting some of the activities of the teaching plan. This plan is intended to serve as a guide for those who feel the need for direction in planning and organizing the content of Phase I, but should be adapted for use by the individual instructor. Other documents in this series are available as VT 010 290, VT 010 314, and VT 010 315. (GR)

TEACHING PLAN

DEVELOPMENT AND STRUCTURE OF INDUSTRY

INDUSTRIOLOGY

WISCONSIN STATE UNIVERSITY- PLATTEVILLE

DEVELOPMENT AND STRUCTURE OF INDUSTRY

TEACHING PLAN AND ACTIVITY PLAN SHEETS

INDUSTRIOLOGY PROJECT

Subject To Further Research and Revision

COLLEGE OF INDUSTRY

WISCONSIN STATE UNIVERSITY-PLATTEVILLE

INTRODUCTION

The material in this booklet contains a specific plan for teaching the content as prepared for Development and Structure of Industry of the INDUSTRIOLOGY Concept. The booklet is organized into two parts. The first part is a step-by-step teaching plan of procedure for teaching the content, utilizing the instructional aids as prepared and listed for this phase of the program. The second part contains the necessary Teacher Activity Plans which have been developed as further suggestions designed to aid the teacher in preparing for and conducting some of the activities listed in the Teaching Plan.

To be effective, any teaching plan must be flexible. This plan is intended to serve as a guide for the individual who feels the need for direction in planning and organizing the content of Development and Structure of Industry. The teacher should not feel limited to using only those activities suggested in the plan. Most teachers may very well have other views and activities to incorporate into the content as they feel the need or as they adapt the plan to their particular situation.

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TEACHING PLAN
FOR
DEVELOPMENT AND STRUCTURE OF INDUSTRY

The following teaching plan is suggested as a step-by-step procedure for covering the content and activities contained in Phase I - Development and Structure of Industry. You should study this teaching plan very closely and note those steps which imply prior consideration needed before beginning a particular activity or study of specific content.

As you read through the teaching procedure step by-step, you may decide to leave a particular step out as you see how each step fits into your particular situation. If a film, booklet, kit, or other aid is listed for a teaching step to be completed in the near future, you will want to order them far enough in advance so that they will be on hand when needed.

1. Complete the first day general school and class room activities such as roll call, assignment of seats, lockers and benches.

2. Discuss safety as it applies to all school activities, both in and out of class. Stress the safe use of materials, tools, and equipment and personal pride in care of such. An in-depth study of safety will be completed later in this section.

3. Reproduce the contents of the Study Guide and hand out the section dealing with Introduction to Industry. At this time the Information and Job Sheets for this section should also be reproduced for future use.

4. Discuss the general content of the material in the section Introduction to Industry of the Study Guide and stimulate discussion centered around such questions as: What is industry? What does industry involve? What are some industries with which you are familiar?

5. Have students read the material covered on pages 1 through 4 of the Study Guide and assign reference readings for further study and discussion. Discuss the following questions: How many types of industries are there? What are they? Why are they classified as such?

6. Hand out Information Sheet IS 1-1 TERMS USED IN INDUSTRY and discuss the terms as they relate to the study of industry - INDUSTRIOLOGY.

7. Compare the concept of INDUSTRIOLOGY to that of the term Industrial Arts. Define these terms and have volunteers write these definitions on the chalk board.

8. Discuss the history of industry. Utilize Reference 1, page 3 of the Study Guide and A Study of Industry - Industriology.

9. Divide the class into groups and have them complete assignments #2 and #3, page 2 of the Study Guide, which calls for locating pictures of industry and classifying industries into the four types.

10. Discuss the four great textile inventions which aided the development of the factory system. Utilize Chart #3 Productivity Creates All Economic Growth, IM-33.

11. Show motion picture Film #66 Meaning of the Industrial Revolution, IM-10 and discuss.

12. Place in a conspicuous place Chart #1 This Is The Industrial Revolution, IM-33. Draw attention to this chart and ask for comments about it.

13. Distribute copies of Booklet #3 Evolution of Mass Production, IM-26 and have the students read and discuss this material.

14. Have students complete assignment 6, page 2 of the Study Guide by selecting an industry and describing it.

15. Hand out IS 1-2 JOB DESCRIPTIONS USED IN INDUSTRY. Discuss these terms.

16. Make announcement about mass producing a product in the class. Have on display a model which they may produce.

17. Set up a plan for production of the models. Teacher see Activity Plan AP 1-1, MASS PRODUCTION ASSEMBLY.

18. To illustrate the functioning of industry, begin a mass production assembly of model cars. Utilize Activity Plan AP 1-2, CORPORATION STRUCTURE AND DEVELOPMENT as a means of helping you organize a part of the mass production unit. This is a unit which will help students understand how industry and management work with capital. Portions of this Activity Plan AP 1-2 may be reproduced for the students to use. Discuss the content of this material with the class.

19. Pass out JS 1-1 MASS PRODUCTION ASSEMBLY OF AN AUTOMOBILE and discuss.

20. As you work with the mass production unit, utilize every other class period to present and discuss the content in the unit on Introduction to Industry. Tie in various parts of the assembly. Work with the teaching content shown in the succeeding steps in the teaching plan.

21. As the mass production and/or assembly gets under way, utilize a person from the community to come in and talk about the development of a local industry.

22. Show Chart #2 Tools That Created Civilization, IM-33 and discuss.

23. Have students bring an antique hand tool and have the class develop a display for a discussion to be held later concerning them. Compare these tools with tools found in your shop.

24. Discuss the evolution of tools through man's ingenious methods of manipulating materials and tools. Discuss with the class how the changes in tool structure have brought about the technological changes present today.

25. Show Film #15 The Common Denominator, IM-2 and discuss.

26. If possible, have the class take a trip to a local museum to explore the development of tools and industries in the local area.

27. Show Film #14 One Hoe for Kalabo, IM-2 and discuss.

28. Present a comparison of old and new methods (using old and new tools) of making products. This comparison will illustrate how industry has developed with the invention of new and better tools and machinery. Compare operation of one of the old tools brought in by students with its modern day counterpart (shop demonstration).

29. Center a discussion around the topic, "Automation". Show Film #4 Automation - What Is It?, IM-1 and discuss.

30. Have students make a comparison of industries of the local area with some of those in the U. S. Compare them in size and importance.

31. Show Film #6 The Large and Small of It, IM-1 and discuss.

32. Utilize any or all of the questions and assignments from pages 1 to 5 of the Study Guide for completion of a study of the Definition and Development of Industry.

33. Discuss social implications and the effect they have on different industrial areas of the country. Show and discuss Chart #3 Productivity - Creates All Economic Growth. Illustrates and describes the history, development, and factors involved in productivity and its relationship to economic growth.

34. Discuss what has been happening over the last fifty years as far as the labor force in the country is concerned. Booklet #2 1967 Business Trends and Progress, IM-26, can be utilized here.

35. Discuss political implications and the impact they have had on industry both large and small. Include a discussion of government and the control it may or may not have upon industry.

36. Have students complete the assignments on pages 5 and 6 of the Study Guide centered around a study of labor and occupations.

37. Have a class discussion on union control, strikes, and fueds. If possible, bring in a person belonging to a national or local union. Class discussion on labor leaders, past and present.

38. Discuss what controls a labor union may use to protect itself. Trace the formation of unions since their beginning and discuss in class.

39. Make assignment #4, page 5 of the Study Guide: What effect has competition had on industry and what effect will it have ten years from now?

40. Show Film #2 The Welcome Mat, IM-1. Illustrates what a community can do to encourage new industries to their area. Discuss.

41. Show Slide Series #2 Activities of Industry, IM-29. Depicts the basic activities found in typical industries. Script included.

42. Show Film #3 Getting Started, IM-1 and discuss. This film describes how firms, large and small, begin and develop into large successful businesses.

43. Have a class discussion in internal organization; utilize materials from the Study Guide and available sources.

44. Have students do assignment #2, page 9, in the Study Guide. Assignment: Look up words "Internal" and "Organization" and be prepared to report on your findings to the class.

45. Discuss the meaning of vertical, horizontal, and lateral expansion of industry.

46. Show and discuss flow charts. A flow chart may be used with the mass production project. Other flow charts of industry should also be used. These may be obtained from various manufacturing associations such as Portland Cement Association.

47. Have students do assignment #3, page 9, in the Study Guide. Assignment: Trace the internal organization of the school and compare it with that of industry. Also place on the board any good organization charts students may find.

48. Assign your students a number of occupational positions and have them make a line and staff personnel chart. This chart may be used as a test. See assignment #5, page 9 of Study Guide.

49. Have students complete assignment #7, page 9 of the Study Guide. Identify some industries in your town or city and classify them.

50. Discuss the purpose of industrial research and the reasons for industrial failures.

51. Show Film #8 Industrial Research, IM-1. Portrays the role of research in creating jobs and improving standards. Discuss.

52. Show Film #5 Surviving Crises, IM-1. Illustrates problems of industry and how they are solved. Discuss. (Optional).

53. Play Game #1 Stock Market Game, IM-48. This game will provide the students with insights into what stocks are and how the stock market operates.

54. Have speakers come in from industry to discuss just what goes on in industry as far as internal organization is concerned. This person may be someone who has retired from an industry. Parents of students should not be overlooked for this source.

55. Have each student prepare two paragraphs in class on "What Safety Means to Industry". Then discuss how safety is important to a school as well as industry.

56. Show Film #7 Good Place to Work, IM-1. Reviews improvements in factory working conditions and benefits. Examples for testing for better job placement, training, medical services, etc. Discuss. (Samples of pamphlets from unions could be used here also.)

57. Discuss simple safety procedures that industry uses such as guards on machines, marked aisles, safety glasses, etc. These facts should be related to the school and home shop.

58. Use a scale drawing of the shop and templates of machines and equipment for easy arrangement in working out an ideal shop set up. A safe and useful arrangement should be the prime objective. This will be done only on paper so that the students get some idea of the difficulty of getting a good shop arrangement.

59. Have each student in your industrial arts class study the present shop layout and make suggestions to improve it as a safer place to work.

60. Arrange a shop clean-up plan as it would be done in industry. Have a clean-up foreman and crew or have each person responsible for his area.

61. Show Film #34 The ABC's of Hand Tools, IM-4. Animated by Walt Disney; shows how hand tools should be used for best results. Discuss.

62. If not yet completed, complete the mass production assembly of automobiles started in this unit.

63. Have students evaluate and discuss the mass production assembly unit.

64. Give a test over the unit Introduction to Industry.

65. Reproduce the Raw Materials section of the Study Guide and pass it out to the students. Have this punched for looseleaf notebooks. The teacher will want to order Kits 2, 3, 4, 9, 35, 36, and 39 before beginning this unit on Raw Materials. Also reproduce the Information and Job Sheets for student use.

66. Have the students study the content of pages 11 through 15 of the Study Guide, complete the assignments dealing with defining raw materials and discuss the questions on page 12.

67. Hand out IS 2-1 CLASSIFICATION OF RAW MATERIALS and discuss the two major classifications of raw materials - non-mineral and mineral.

68. Have students name places in the school industrial arts laboratory or other areas of the school where they could find some of these raw materials. Place the list on the chalk board as it is being discussed. (A student who can write well may be asked to do this.)

69. Discuss forestry as a raw materials industry and introduce the Film #54 Journey of a Tree, IM-19. Discuss the film.

70. Hand out IS 2-2 THE MOISTURE IN LUMBER and have the students study and discuss the content. Explain to students that they will try an experiment in determining moisture content of wood.

71. Hand out JS 2-1 DETERMINING THE AMOUNT OF MOISTURE IN LUMBER. Group the students, if desired, to facilitate the use of tools, materials and equipment. The science department may be called upon to provide sophisticated measuring and weighing apparatus.

72. Have the students complete assignment #3, page 14 of the Study Guide which involves using a small, 10-power hand lens or other magnifying device.

73. Hand out JS 2-2 STRENGTH TESTING OF WOOD discuss and have students perform the jobs in groups.

74. Discuss the questions dealing with forestry products on pages 14 and 15 of the Study Guide.

75. Hand out JS 2-3 SPLITTING WOOD WITH NAILS, discuss and have the students perform the job in assigned groups.

76. Hand out IS 2-5 BY-PRODUCTS OF TREES. Have students study the content, and discuss the content.

77. Present an overview of the science and study of papermaking. Display Kit #4, Portfolio on Papermaking, IM-38 to the class.

    Referring to AP 2-1 MANUFACTURING PAPER, the instructor should prepare the equipment and materials he needs for wood pulp and papermaking and make paper pulp and paper before he has his students do it. Carefully follow the instructions given in the two job sheets, JS 2-4 MAKING WOOD PULP, and JS 2-5 MAKING PAPER FROM WOOD PULP. Pamphlet #54 How You Can Make Paper, IM-94, may also serve as a guide for the instructor in helping his students make paper.

78. Assign reference reading Booklet #44, The Story of Pulp and Paper, IM-101.

79. Show Filmstrip #7 The Story of Wisconsin Paper, IM-38 and discuss.

80. Hand out IS 2-6 THE PAPER INDUSTRY and have students study the material and discuss the questions.

81. Hand out JS 2-4 MAKING WOOD PULP.

82. Have students make wood pulp.

83. Hand out JS 2-5 MAKING PAPER FROM WOOD PULP.

84. Have students make paper from wood pulp to illustrate the method used before the invention of machines.

85. Assign as reference reading Booklet #56 Water, Water Everywhere . . ., IM-102. Discuss water as a natural raw material and our responsibility to future generations for good water.

86. Take a trip to a paper and pulp mill if there is one in your community, or to a local newspaper publishing house.

87. Assignment: Have students report to the class from one of the articles in the New York Times advertisement in Kit #9, IM-38.

88. Select and show appropriate film(s) from film list included in Kit #9 Portfolio on Paper, IM-38, if a field trip cannot be taken.

89. Give a test covering the history and processes of papermaking.

90. Have students discuss rubber and list products using this raw material.

91. Assign reading in Booklet #15 Rubber, IM-49 and discuss the content with the class. Alternate booklets which may be used are: Booklet #16 Rubber, IM-50; Booklet #17 Natural Rubber, IM-51 and Booklet #18 Wonder Book of Rubber, IM-52.

92. Show Film #46 Rubber from Malaya, IM-12 (order at least 3 months in advance). Discuss the film and have the students orally answer any questions on page 17 of the Study Guide which they found the answers to in the film.

93. Have students perform assignment 2, page 16 of the Study Guide. From your reading develop a list of words that are common to the rubber industry such as latex, masticator, vulcanization, pneumatic, coagulating, isoprene, styrene, etc.

94. Hand out IS 2-7 CHEMICAL COAGULATION and have students discuss the content and answer the questions.

95. Have the students perform the activities detailed in JS 2-6 CHEMICAL COAGULATING.

96. Have a class discussion centered about synthetic materials procured from raw materials such as petroleum gas, coal, coke, and other raw materials which are used in making synthetic rubber and other synthetic materials.

97. Show Film #57 A Stretch of the Imagination, IM-21 and discuss.

98. Give a test over the study of the rubber industry. Include content covered in the films, activities and discussion.

99. Discuss fishing as a raw materials extraction industry.

100. Have the students read the content of the Study Guide dealing with fishing. Assign reference reading to the class. Divide the class into groups and have the groups perform the assignments listed on page 18 of the Study Guide.

101. Show Film #26 Fish-Catching, Filleting and Packaging, IM-3 or Film #62 Salmon - Catch to Can, IM-25 and center a discussion around the content of the film after it has been shown.

102. Have a class discussion on the methods by which fish are caught. As the next activity will be the casting of fish sinkers, the instructor should pass out IS 2-8 CASTING METALS and discuss it with the students as it pertains to various methods and processes of casting metals. Refer to AP 2-2 PRODUCING LEAD FISH SINKERS for instructions on preparing for this activity.

103. Demonstrate to the class the pouring of lead into a fish sinker mold. If a mass production method of production is to be used, refer to Booklet #46 Manufacturing in the School Shop, IM-103 for additional ideas and suggestions for mass productions. Hand out JS 2-7 PRODUCTION OF LEAD FISH SINKERS and have students produce sinkers.

104. When the production of sinkers is completed, review the fishing industries with the students and have a short test over such.

105. Discuss agricultural industries in relation to providing raw materials.

106. Have students divide a map of the U.S. and have them note the various types of farming areas. Color code and label the areas as to types of farming done in these areas.

107. Procure the following kits and utilize the content which deals specifically with the production of agricultural products: Kit #16, Milk Industry Foundation, IM-63; Kit #17, Corn Industries, IM-67; Kit #18, Story of Processing and Utilization of Meats, IM-68; Kit #22, Rice Production; Kit #23, Wheat Flour, IM-72.

108. Much of the content of these kits can be used for bulletin board material. Assign a kit to a group of students and have each group utilize the materials for making group reports to the class on agricultural products.

109. Show Film #12 Cotton Holds Its Own, IM-1 and discuss the new methods of growing and cultivating cotton. Discuss new methods of growing and cultivating other crops.

110. If possible take a field trip to an implement dealer's place of business and have him explain the purposes of the various machines.

111. Show Film #31 How Scientists Study the Soil, IM-3 and discuss.

112. Discuss soil need for plant-food elements such as nitrogen, phosphorous, and potassium.

113. Students bring to class soil samples from home.

114. Hand out and discuss JS 2-8 OBTAINING AND TESTING SOILS. Use Kit #42 Soil Test Kit, IM-104. Make a complete set of directions for each student. (Directions come with kit.) Discuss these operations in class until each student understands them before having students test soil.

115. Make soil test. Test for nitrogen, phosphorous, potash, soil acidity.

116. Review all material covered on Agriculture. Give test and review test results.

117. Show some samples of ores and discuss. Utilize Kit #1 How Steel is Made, IM-34 which contains samples of ore.

118. Have the students study the content of the Study Guide, pages 23 to 29, which deal with a study of minerals, raw materials and extraction.

119. Have the students complete the first two assignments on page 23 of the Study Guide. Read references and bring in samples of rocks.

120. Hand out IS 2-9, MINING METHODS, and discuss.

121. Utilize a chart out of Kit #25, What It Takes To Manufacture an Automobile. Place this chart on a bulletin board and discuss.

122. Show Slide Series #3, Raw Materials - Metal Extraction, IM-29.

123. As an activity, take a field trip to a mine. If this cannot be done, show either of the following films: Film #32 Lead from Mine to Metal, IM-3 or Film #58 Zinc Mines and Mining, IM-21. Have a class discussion over the questions on page 27 of the Study Guide.

124. Refer to AP 2-3 EXTRACTING ORE for conducting the following activity. Explain ore extraction processes to the class. Have the students perform the suggested activities.

125. Show students a process of ore flotation. Utilize Activity Plan AP 2-4 ORE FLOTATION DEMONSTRATION.

126. Hand out IS 2-11 DESALINATION OF WATER and also utilize Booklet #45 Water, Water Everywhere, IM-102 and have students answer such questions as: What minerals are currently being extracted from the sea? What are some common methods used in the desalination process? What uses are made of water?

127. As a class activity, have the students perform the job described in JS 2-11 EXTRACTING SALT FROM WATER.

128. Discuss the minerals which men use for food and medicine such as iodine, salt, etc. Make a list of such and place it on the chalk board.

129. Show Film #23 White Wonder, IM-2 and discuss the uses of salt.

130. Assign reading references, page 28 in the Study Guide. Discuss the questions on page 29 of the Study Guide after students have read the assigned reference material.

131. Utilize the content from the following kits and booklets to center attention on the extraction of oil, petroleum and coal as raw materials: Kit #7 Gas Serves the Community, IM-11 and Kit #8 Petroleum, IM-37, Booklet #8 Facts About Oil Handbook, and Booklet #28 Class Report - Coal, IM-78.

132. Discuss with the students how rock is extracted from the earth. Hand out Booklet #24 The Story of Granite, IM-73 and have the students read the content and discuss it. Give a test over the minerals - raw materials area.

133. Distribute to the students the Manufacturing Industries portion of the Study Guide.

134. Assign reading covering the content of pages 30 to 36 in the Study Guide. Discuss the manufacturing industries.

135. Show Film #1, American Industry - Past and Present, IM-1 and discuss.

136. Hand out IS 3-1 HISTORY OF MANUFACTURING and discuss the history of manufacturing.

137. Using Kit #6, set of 8 filmstrips with script booklets, IM-36, show Filmstrip FS 8 The Cradle of American Industry and discuss it with the class.

138. Hand out IS 3-2 LOCATION OF MANUFACTURING and discuss manufacturing plant locations.

139. From the listed assignments found on pages 30, 31, 33, and 34 of the Study Guide, assign various groups in the class to complete and report on each.

140. Place Chart #4 How Steel Is Made, IM-34 in the room and discuss the flow chart and the purpose of it.

141. Explain and illustrate how steel is made by utilizing Kit #1 How Steel Is Made, IM-34.

142. Have a class discussion on the steel manufacturing industries - (where steel is used and how various other industries are affected by it).

143. Show and discuss Video Tape #1 Automated Transfer Line #100, IM-29

144. Hand out copies of Booklet #4 Copper - the Oldest and Newest Metal, IM-40. Have students read this and discuss it in class.

145. Show Film #50 A Product of the Imagination, IM-16 and discuss.

146. Study other non-ferrous metals and precious metals manufacturing by having the students report on these metals. Center discussion around where raw material metals are found and how they are utilized in the manufacturing process.

147. Through a group discussion, have students identify major non-ferrous metals and their uses in manufactured articles. Demonstrate to the class the various types of steel. Instructor use AP 3-1 SPARK TESTING METALS DEMONSTRATION to help the student understand what types of sparks are made by different types of steel and why. The student will not perform this activity.

148. Evaluate the students over the content covered in the metals manufacturing industries.

149. Hand out IS 3-4 THE TEXTILE INDUSTRY and have students read.

150. Show Film #10 Man Made Fibers, IM-1 and discuss the content with the class.

151. Center a discussion on textiles by utilizing the content found in Kit #5 Textiles, IM-32.

152. Show Filmstrip #3 Textiles for Everyone, IM-32 and have the students discuss the questions on page 37 and 38 of the Study Guide. Filmstrip #3 will provide many of the answers to these questions.

153. Have the students divide into groups and perform assignments 2, 3, and 4 on pages 36 and 37 of the Study Guide. The science and home economics departments may be called upon to furnish different fabrics and one or more microscopes for the completion of the assignments which deal with examining and working with textile fibers.

154 Refer to Activity Plan AP 3-2 for directions for conducting the rope making activity.

155. Using JS 3-1 MAKING A ROPE, have the students make a rope. This should help students to develop an understanding of one way in which fibers can be utilized.

156. Have a short evaluation covering the textile (fabrics) industry. Give a test over the material covered in this unit.

157. The following kits have excellent information concerning food processing and manufacturing activities. One or all may be procured by the instructor and utilized as a basis from which to stimulate discussion and research on the importance of the food processing industries. Included are: Kit #17 Milk Industry Foundation, IM-63; Kit #18 Corn Industries, IM-67; Kit #19 Manufacturing of Soft Drinks, IM-66; Kit #20 Consumer Knowledge of Canned Goods, IM-69; Kit # 23 Wheat Flour, IM-72; Kit #41 Baking Industry, IM-104.

158. Have students read the content of pages 39 to 41 in the Study Guide pertaining to food processing and related activities. Center a discussion around an attempt to answer the questions on pages 40 and 41.

159. Hand out IS 3-5 THE FOOD PROCESSING INDUSTRIES and discuss.

160. Provide an opportunity for the students to take a field trip to one or more of the following good processing plants if such are available in the community; milk processing and bottling or packaging, cheese and/or ice cream factory, soft drinks bottling company, meat packing and processing plant, flour mill, bakery, fruit or vegetable processing and canning factory, a brewery or distillery, tobacco manufacturing and processing plant, fish processing and canning plant.

161. Have the students divide into groups and report on the following topics concerning any field trip made: (1) What raw materials were utilized to manufacture or process the product? (2) What special health regulations and precautions were observed through the processing of the product and why? (3) What are some of the job titles given to the workers in these plants? (4) Would you want to work at any of the jobs in which you

observed people working in the plants visited? Why? (5) Was there little or much noise, how was the lighting and was a color scheme used to provide psychologically sound surroundings in which to work?

162. Have students study the chemicals section of the Study Guide, pages 42 to 44, and discuss.

163. Show Film #70 Plastics, Industrial Processes and Products, IM-80 or Film #69 The Shape of Plastics, IM-80. Discuss the film with the students. Center discussion around the fact that many chemicals are used to develop the many types of plastics in use today.

164. Hand out IS 3-6 THE CHEMICAL INDUSTRY and discuss the three major groups of chemicals.

165. Have students make a list of various chemicals with which they are familiar and identify some of their uses.

166. Have a chemistry or science teacher come to class and perform a simple chemical experiment before the students and explain the study and work of chemistry as an occupation.

167. Hand out IS 3-7 THE MANUFACTURE OF SYNTHETIC MATERIALS and discuss with students.

168. Hand out IS 3-8 THE STORY OF THE PLASTICS MANUFACTURING INDUSTRY. Have students read it and discuss. Explain to students that a short activity in the study of plastics will help them to become better acquainted with chemicals and how they are used. Teacher refer to AP 3-3 UNDERSTANDING SYNTHETICS-PLASTICS for suggestions of an activity for the study of chemicals and synthetics. This activity will involve work with sheet plastics as one means of an introduction and an understanding of a synthetic material. It will also involve the use of JS 3-2 SYNTHETIC MATERIALS - A PLASTIC PROJECT. Hand out JS 3-2 to students and begin the activity.

169. Discuss petroleum products and have students read pages 45-47 of the Study Guide pertaining to petroleum. Discuss the study questions.

170. Show Film #68 Refinery at Work, IM-106 and discuss.

171. Have students read IS 3-9 THE PETROLEUM MANUFACTURING INDUSTRY and discuss.

172. Divide the students into groups and perform assignments 2, 3, and 4 on pages 45 and 46 of the Study Guide which deal with a study of petroleum products.

173. Utilize Kit #7 Gas Serves Your Community, IM-11, and have a student set up the cut-out on the bulletin board.

174. Discuss the manufacturing of different gases and their uses.

175. Utilize Kit #8 Petroleum, IM-37, to illustrate several methods of manufacturing petroleum.

176. Assign reading pages 48 through 50 of the Study Guide concerning the printing and publishing industries and have students complete assignment 1.

177. If possible take a field trip through a local printing and/or publishing plant.

178. Show either of these two films which are excellent: Film #71 Making Books, IM-3 or Film # 72 Printing Through the Ages, IM-3, and discuss.

179. Hand out IS 3-10 THE PRINTING AND PUBLISHING INDUSTRY and have the students discuss.

180. As a result of the motion film seen and IS 3-10 handed out, have the students perform assignments 2, 4, 5, and 6 on pages 48 and 49 of the Study Guide dealing with the understanding of terms used in the printing industry.

181. As an activity, have the students complete a silk screen process as suggested in JS 3-3 BROWN PAPER METHOD OF SILK SCREEN PRINTING.

182. Give a quiz over the study of the printing and publishing industries.

183. Have students study the content in the Study Guide found on pages 51 through 53, complete assignment #1 and discuss the material studied.

184. Hand out IS 3-12 THE RUBBER MANUFACTURING INDUSTRY and discuss. Use Chart #9 Natural Rubber - A Product of Nature Plus Science.

185. Show Slide Series #4 Tire Manufacturing, IM-29 and have the students discuss question 6 on page 52 of the Study Guide.

186. Have the students perform assignment #4 on page 51 of the Study Guide which is developing a chart of the steps in manufacturing rubber.

187. Hand out IS 3-13 LEATHER MANUFACTURING and discuss. Place on display Kit #40 How Leather is Tanned, IM-41.

188. Utilizing Booklet #25 Leather in Our Lives, IM-41 and Booklet #19 Leather Facts, IM-53, have the students read the material and perform assignments 2 and 3 on page 51 of the Study Guide. These assignments ask for the student to determine what sources are used for leather.

189. Have the students discuss the questions concerning the leather industry found on page 52 of the Study Guide.

190. Utilizing a simple leather project kit procured from Tandy Leather Company, Forth Worth, Texas, have the students complete a project. Refer to JS 3-5 ASSEMBLING A LEATHER PRODUCT.

191. Have students study the content on pages 54 through 56 of the Study Guide concerning glass, brick, cement and ceramics.

192. Show Film #9 Looking at Glass, IM-1 and discuss.

193. Hand out IS 3-14 THE MANUFACTURING OF GLASS and discuss the content with the students.

194. Have students perform assignments 2 and 4 on page 55 of the Study Guide which deal with naming and describing processes of manufacturing glass.

195. Hand out JS 3-6 WORKING WITH GLASS and demonstrate the procedure of cutting and drilling glass. Have students perform activities in cutting and drilling glass.

196. Discuss questions which students may have concerning the glass manufacturing industry. Include questions 1 and 2 on page 55 of the Study Guide.

197. Hand out IS 3-15 BRICK MANUFACTURING and discuss how bricks are manufactured and how this industry is closely related to the ceramics industry.

198. Have the students discuss question 5 on page 56 of the Study Guide.

199. Have each student bring in a brick and compare the different types and sizes of bricks. These same bricks may be used later to construct a wall to illustrate how bricks are used in a brick laying construction activity. If the bricks are used for this purpose make the mortar mix out of lime and sand so that it will not set up, thus making it possible to reuse the bricks.

200. Have students divide into groups and report on various manufacturing processes used in the ceramics industry.

201. If the art department of the school has clay materials, have the art instructor illustrate the making of a ceramic piece and explain what goes into a ceramic piece.

202. Discuss questions 6 and 7, page 56 of the Study Guide.

203. Hand out IS 3-16 CEMENT MANUFACTURING and discuss.

204. Show Film #19 Portland Cement, IM-2 and discuss.

205. Utilize Kit #37 Portland Cement, IM-95 for materials to place on bulletin boards and for studying cement.

206. Explain that JS 3-9 MAKING A CONCRETE PLANTER will be used in conjunction with a study of lumber manufacturing and the construction industry. The forms for the construction of a concrete planter can be developed and made when studying the lumber industry. The concrete can be mixed and poured into the forms as an activity during the study of construction.

207. Begin a study of the lumber industry. Hand out IS 3-17 LUMBER MANUFACTURING and discuss how lumber is manufactured from raw material - trees.

208. Examine with the students hard and soft woods, plywoods, hardboard, and other types of manufactured wood products.

209. The students have previously studied the paper industry and have manufactured it if the teaching plan was followed in the Raw Materials and Extraction section of the Teaching Plan. Briefly review the paper industry and discuss it.

210. Have the students study pages 57 and 58 of the Study Guide which pertain to the lumber and paper manufacturing industry. Discuss the content and have the students perform assignments 1 through 5, page 57.

211. If possible, take a field trip to a local lumber yard or a sawmill. If no field trip can be arranged, utilize Slide Series #6 Saw Mill Operations, IM-29 and discuss.

212. Discuss the use of wood for building and construction. Show the students a form which you have made for a concrete mixture. See AP 3-4 FORM CONSTRUCTION FOR CONCRETE PLANTER. This may be a simple square or rectangular box or a flower planter identical to the one the students will use.

213. Discuss the many uses to which woods are put. Hand out JS 3-9 MAKING A CONCRETE PLANTER.

214. The instructor may desire to have students make the concrete forms if time permits. If this is done, organize students into small groups and have each group develop and build a flower planter similar to the one described in AP 3-4 FORM CONSTRUCTION FOR CONCRETE PLANTER. The class may be organized to develop and construct one type through a mass production method of manufacturing.

215. Have the students figure the amount of concrete required for each of the forms developed.

216. Check the estimates for the concrete materials needed and order them ready for mixture. Have the students mix concrete and pour the concrete in the planter forms. Use groups for this activity as was done for the forms manufacturing.

217. While curing is taking place, have students read the section of the Study Guide dealing with construction. Discuss the questions on pages 60 and 61.

218. Properly cure the planters and have students clean and smooth the surfaces for painting.

219. To illustrate one major type of construction activity, show Film #67 The Garrison Story, IM-7 which tells the story of the construction of a large dam in North Dakota.

220. Give a test over the manufacturing industries content and activities presented and covered.

221. Reproduce the section of the Study Guide dealing with the Distribution Industries and Information and Job Sheets for student use.

222. Show Film #74 Distributing American Goods, IM-3, or Film #75 Trade and Transportation, concerning in general, the distribution industries.

223. Hand out and explain the content of the portion of the Study Guide dealing with the distribution industries.

224. Divide the students into groups and have them perform assignments 1 through 6, pages 62 and 63 of the Study Guide. These assignments deal primarily with listing and classifying distributive systems.

225. Hand out and explain IS 4-1 INTRODUCTION TO THE DISTRIBUTION INDUSTRIES. Instructor read to class from book - Bibliography #47 Technological Trends in Major American Industries concerning "Advances in Transportation".

226. Show Film #83 Supermarket For Industry, IM-1 and discuss.

227. Teacher lecture from Booklet #8 Facts About Oil-Handbook, IM-44, pp. 10-13. The lecture will cover all types of transportation - follow with a discussion.

228. Utilizing Chart #7 Transportation Since 1775, IM-44, have a discussion centered upon the development of transportation systems in the United States.

229. Hand out JS 4-1 GRAPHICALLY REPRESENTING THE TRANSPORTATION INDUSTRIES. (Teacher distribute the assignments evenly by groups or other methods.)

230. Give a quiz over the general area of the distribution industries.

231. Hand out and discuss IS 4-2 LAND TRANSPORTATION-RAIL, HIGHWAY AND PIPELINE.

232. Discuss Chart #13 History of Land Transportation IM-109.

233. Give a short lecture over the material covered in Booklet #9 The Human Side of Railroading. Also select readings from book - Bibliography #47 Technological Trends in Major American Industries, pp. 196-202.

234. Show one of the following appropriate films concerning Land Transportation:

Film #22 Science Rides the High Iron, IM-2

Film #28 Trucking, IM-3

Film #29 Truck Driver, IM-3

Film #35 The Strongest Link, IM-4

235. Have students read Booklet #10 Railroads Deliver the Goods, IM-45.

236. Have students read the Booklet #11 Trucks and Things You Want to Know About Them, IM-46, pp. 3-14.

237. Lecture from Booklet #12 Wheel's For America's Progress, IM-46. Also select readings from the Bibliography Technological Trends in American Industries, pp. 204-208 concerning the motor freight industry.

238. Discuss Chart #5 America's Products and the Trucks that Carry Them, IM-43.

239. Show Film #45 Pipeline in the Rockies, IM-11 and discuss.

240. Discuss Chart #12 Natural Gas From the Well to Burner, IM-11. Note: The teacher may wish to refer back to page 10 of the Booklet #8 Facts About Oil-Handbook, IM-44, and in step 6 of this teaching plan.

241. Show Filmstrip #8 Natural Gas, IM-11 to supplement Chart #12 in teaching step 19 above.

242. Hand out and discuss IS 4-3 WATER TRANSPORTATION Also see pages 209-215 of Book - Bibliography # 47 Technological Trends in Major American Industries for discussion material.

243. Post Chart #6 The Inland Waterways of the U.S., IM-44. Discuss the contents of the chart with the class.

244. Show one of the following films on water transportation:

Film #76 Freighter at Sea, IM-3

Film #77 Great Lakes: Highway of Commerce, IM-3

Film #30 Story of the St. Lawrence Seaway, IM-3

Film #78 Oil, The Invisible Traveler, IM-3

245. Show and discuss the various types of ocean vessels using an opaque projector. Pictures may be obtained from Booklet #13 Pictures of Ocean Going Vessels, IM-47, or taken from any good encyclopedia.

246. Have students study content of Study Guide, pages 70 and 71.

247. Hand out and discuss IS 4-4 AIR TRANSPORTATION.

248. Hand out and have students read Booklet #48 The Air Express Story, IM-108.

249. Show Film #47 This Way Up and discuss how transportation of equipment by helicopter serves industries.

250. Show and discuss Chart #8 The Story of Flight and Air Transportation, IM-45.

251. Show Film #82 The 707 Astrojet, IM-115 and discuss how jet airpower has helped the transportation by air industry.

252. As a related activity have the students' perform one or more of the activities suggested in AP 4-1 RELATED ACTIVITIES FOR DISTRIBUTION.

253. Show Film #83 Man in Space, IM-114 and discuss man's future in space and the problems this will involve.

254. Lecture on internal combustion engines and their relationship to rocket thrust engines.

255. Utilize AP 4-2 A STUDY OF AEROSPACE TECHNOLOGY for an activity covering the study of aerospace.

256. Begin model rocket construction. To organize the class for this see AP 4-3 MASS PRODUCTION PROJECT (ROCKETRY).

257. Have students complete rockets and prepare for launching rockets.

258. Teacher use AP 4-4 CONSTRUCTING A MODEL ROCKET LAUNCH PAD and prepare a launch pad.

259. Hand out IS 4-6 PREPARATION FOR LAUNCHING A MODEL ROCKET and discuss.

260. Teacher check with local authorities on firing of rockets.

261. Teacher test the launching pad or pads constructed before the class demonstration. (Teacher - Read Rocket Safety for Students by James, George S., 1963. Cost $2.50. Rocket Research Institute) Discuss this thoroughly with students.

262. Lecture and discussion of types of model rocket recovery systems.

263. Hand out JS 4-4 LAUNCHING A MODEL ROCKET.

264. Lecture, discussion, and demonstration in model rocket launching.

265. Have students launch rockets and recover them.

266. Demonstrate the measuring of rocket engine thrust. Utilize AP 4-5 DEMONSTRATING MEASURING ROCKET ENGINE THRUST.

267. Conduct a project (rocket and launch pad systems) evaluation among the class members.

Rocket evaluation:
1. Design
2. Performance
3. Craftsmanship

268. Have a test over the distribution industries and aerospace technology.

269. Reproduce the Service Industries section of the Study Guide. Hand out and discuss the general content of the section of the Study Guide pertaining to the Services Industries. Also reproduce the information and job sheets for this section.

270. Have the student complete assignments 1 through 6 on page 74 and discuss the 12 questions found on page 75 and 76.

271. Discuss the professional laundering and cleaning service industries. Show Film #11 Fabric Care and Management, IM-1.

272. Hand out IS 5-1 LAUNDRY SERVICE and IS 5-2 DRY CLEANING SERVICE and discuss.

273. Invite a professional dry cleaning and/or launderer to speak to the class and answer any questions pertaining to this service industry.

274. Have students read the assigned references in Study Guide page 80 and discuss the appliance and motor repair services.

275. Assign the study questions made in the Study Guide page 81.

276. Discuss the various types of electrical appliances and the motors found in such.

277. Hand out IS 5-3 APPLIANCE AND ELECTRIC MOTOR REPAIR SERVICE and discuss the importance of this service industry.

278. Have as many students as possible bring in electric slot cars and illustrate and explain how the motors in these cars work - comparing this type of motor to other types of motors which you have on hand.

279. Divide the class into groups and have them bring in the following small electric motor operated appliances. These may or may not be in working condition. (Fan, clock, hand drill, mixer, hair dryer, shaver, model train engine.)

280. Have the students in groups carefully remove the outer covering and examine the parts of the various motors brought in by the students. Explain the various types of motors, their function, and the purpose of the various major parts of each different motor.

281. Explain to the students the role of the electric appliance serviceman to the consumer and the product.

282. Give a short test over this service industry.

283. Introduce the students to the radio and television service industries by discussing the content in the Study Guide pages 82 and 83.

284. Have students complete the assignments and discuss the questions listed on pages 82 and 83.

285. Have 5 students volunteer to bring in one portable radio each. These may be vacuum tube or solid state type. Using these five individuals as leaders of their particular groups, divide the class into groups and assign a boy with a radio to a group. Have the owner carefully remove the cover of the radio. Instructor move around to the various groups and point out the particular parts of the radio and the functions which they serve.

286. Hand out IS 5-4 RADIO AND TV REPAIR INDUSTRY and have students complete the assignments and discuss.

287. Have a class discussion on the importance of the radio and TV repair and servicing industries.

288. Have a student interview a television serviceman and give an oral report to the class on the interview.

289. Discuss the content of the Study Guide on pages 84 and 85 dealing with the services provided to products by tool and die makers.

290. Hand out and discuss IS 5-5 TOOL AND DIE REPAIR SERVICE. Explain the importance of this occupation to the manufacturing industries.

291. Show the students a simple jig or fixture which might be used to assist the person developing or manufacturing a product.

292. Discuss the occupational opportunities of this service industry and have a test over the material covered.

293. Discuss the content of the Study Guide, pages 90 and 91, pertaining to small engine repair servicing.

You may want to assign 2 or more students to an engine in this group activity if enough small engines are not available for each student to work one.

294. Have students bring in small engines (lawn mowers or other small engine power equipment.)

295. Hand out IS 5-6 SMALL ENGINE SERVICE and discuss. Instructor should already have on hand several copies of Booklet #50 Repair Instruction II, IM--31.

296. Show Film #79 Power In the Yard, IM-1 and discuss.

297. Show Film #36 The ABC of Internal Combustion and discuss.

298. Lecture on and discuss these terms: compression, carburetion and ignition.

299. Give a test on the theory of small engine operation.

300. Hand out IS 5-8 SAFETY REPAIR SERVICE INSTRUCTIONS FOR SMALL ENGINES and discuss the content with the class.

301. Hand out JS 5-2 EXTERNAL CLEANING OF A SMALL ENGINE and discuss.

302. Demonstrate to the class how to clean the external parts of a small engine.

303. Have students (working in small groups is desirable) clean the external parts of the small engines brought to class.

304. Show Slide Series #8 Check Up and discuss. IM-31.

305. Hand out JS 5-3 SERVICING AN AIR CLEANER OF A SMALL ENGINE and discuss.

306. Demonstrate how to service a small engine air cleaner. Have students clean the air cleaners on the small engines.

307. Hand out JS 5-4 CHANGING OIL IN A SMALL ENGINE and discuss.

308. Have students read the section pertaining to oil changing in Booklet #50 Repair Instruction II, IM-31.

309. Demonstrate the changing of oil in a small engine.

310. Have students change oil.

311. Hand out JS 5-5 CLEANING SPARK PLUGS OF A SMALL ENGINE, and discuss.

312. Have students read the section on spark plug cleaning in Booklet #50 Repair Instruction II, IM-31.

313. Demonstrate checking and cleaning spark plugs.

314. Have students check and clean spark plugs.

315. Hand out IS 5-9 SMALL ENGINE CARBURETORS and have students read and then discuss.

316. Have students read the section on carburetors in Booklet #50 Repair Instructions II, IM-31.

317. Hand out JS 5-6 ADJUSTING A SMALL ENGINE CARBURETOR and discuss.

318. Demonstrate how to adjust a carburetor.

319. Have students adjust a carburetor and run the engine to determine how well the carburetor is adjusted.

320. Have students read the section on removing carbon in Booklet #50 Repair Instructions II, IM-31.

321. Hand out JS 5-7 REMOVING CARBON DEPOSITS ON A SMALL ENGINE and discuss.

322. Demonstrate how to remove carbon deposits. Have students remove carbon deposits on a small engine.

323. Hand out IS 5-10 TROUBLESHOOTING SMALL ENGINES and have a discussion.

324. Hand out JS 5-9 TROUBLESHOOTING A SMALL ENGINE and discuss.

325. "Bug" each engine with a different problem and guide the students in discovering the problems.

326. Have students attempt to correct "bugs" in the engines.

327. Have students read section on engine storage in Booklet #50 Repair Instructions II and discuss.

328. Show Slide Series #9 Start, Stop and Store, IM-31 and discuss.

329. Hand out JS 5-8 SMALL ENGINE STORAGE and discuss.

330. Have students prepare engines for storage.

331. Close unit by having students adjust their engines to maximum performance and have a test over the material covered in studying small engine servicing.

332. Have students read material on pages 86 and 87 of the Study Guide. This content covers the automotive and farm equipment service industry.

333. The instructor may wish to order the Kit #43 Automotive Engine, IM-110 to assist him in helping the students to become familiar with the operation and function of the various parts of an automotive engine. If this kit is purchased, it requires from six to twelve hours on the part of the instructor to assemble before using as a teaching aid. It is not recommended that the instructor have students build this, as assembling the engine requires a great degree of precision and patient work.

334. Help the student to become acquainted with the automotive servicing industry by inviting an auto mechanic to speak to the class.

335. Pass out IS 5-11 AUTOMOTIVE AND FARM EQUIPMENT SERVICE and discuss.

336. Show Film #48 Say It With Service, IM-14 and discuss.

337. Explain to the class why it is not possible for an individual to do as much of his own automotive repair as was possible twenty and thirty years ago.

338. If Kit #43 was purchased and assembled, use it to explain how an automotive engine operates. If the kit is not used, point out the various

parts on an automobile at school which must be maintained and/or repaired by a qualified automotive serviceman.

339. Have the student complete the assignments on pages 86 of the Study Guide by discussing the questions covering the automotive service industry.

340. Introduce the students to the servicing of farm equipment by having a farmer friend or farm equipment dealer bring to the school a new model of a large tractor or other piece of farm equipment and have the person answer questions about the equipment and farming in general.

341. Have students read pages 88 and 89 of the Study Guide concerning the farm equipment service industry and discuss.

342. If possible, take a field trip to a farm implement dealer's shop to show students the various types of equipment which are necessary to provide us with farm produce.

343. Complete unit on service of farm equipment.

344. Have students study the rental service agencies as covered on pages 92 and 93 of the Study Guide.

345. Hand out IS 5-13 RENTAL SERVICE NEED AND STATUS and discuss.

346. Show Film #65 At Your Service, IM-28 and discuss.

347. Ask students what is meant by the term physical plant maintenance. Place answers on board and discuss.

348. Have students study the content on pages 94 and 95 of the Study Guide which pertains to the maintenance of physical plants.

349. Hand out IS 5-15 PHYSICAL PLANT MAINTENANCE AND SERVICE and discuss the content and answer the questions.

350. Show Film #80 Guided Maintenance With Madreck, IM-111 and discuss.

351. Organize a physical plant maintenance system for your school shop by utilizing AP 5-1 PHYSICAL PLANT MAINTENANCE FOR A SCHOOL INDUSTRIAL LABORATORY and discuss with the class.

352. Evaluate the maintenance system for the school Industrial Arts lab which has been organized with the class participating through discussion.

353. Introduce the students to the construction services industry by discussing what this industry involves. Have the students read from the Study Guide, pages 96 and 97.

354. Discuss with the students the different machines and tools which men use in the construction services. Make a list of these machines and have a student write them on the chalk board.

355. Hand out IS 5-16 CONSTRUCTION SERVICE INDUSTRIES and discuss.

356. Discuss the various occupations at which men work in the construction service industries such as carpentry, plumbing, electrician and heating and air conditioning.

357. Show Film #64 The Carpenter, IM-27 and discuss the role of the carpenter as a service occupation.

358. Have the students complete assignments 1 through 5 on pages 96 and 97 of the Study Guide, dealing with construction services.

359. Show Film #44 The Electrician, IM-10 and discuss.

360. Discuss with the students the sources of utility services and what these services provide.

361. If possible, have a telephone man come to class and illustrate a telephone and how the various parts of it function. This can be tied in with Film #86 Your Voice and the Telephone, IM-116.

362. Discuss the "products" which everyone receives in their homes from the utilities industry - gas, electricity, water and the telephone.

363. Have students discuss how each of these products, gas, electricity, water and telephone, is brought to the home.

364. If possible, obtain the rates for each product from each utility service in your area and have the students compute their bill for a five day period.

365. Complete the unit on the utility services and have the students evaluate the years' program in industriology.

ACTIVITY PLAN SHEETS

MASS PRODUCTION ASSEMBLY

The attached mass production assembly materials will furnish the instructor with some ideas of what can be developed for the student as an information and /or job sheet. The suggestions in this Activity Plan are made upon the basis of a production assembly organized and operated by graduate students in the Experienced Teacher Fellowship Program, Wisconsin State University-Platteville. In this mass assembly production a 1967 Ford Thunderbird Hardtop plastic model automobile was used. Any type of model could be used and would not have to be limited to automobiles but could include ships, planes and other commercial models available which might be adaptable to mass assembly for this activity.

In preparation for such a production unit, it will be necessary for the teacher to do the following:

1. Once the particular model has been selected an order should be placed for it at least one month prior to its use in the classroom.

2. Selection of the model to assemble can be done by the students by reviewing models catalogs of plastic models. Students should have the opportunity to select the model they will assemble.

3. After the material has been received it should be unpacked and an inventory taken of the parts. Responsible students can do this.

4. Parts may then be separated into groups by the students and prepared for each particular work station.

5. A model of the car should be assembled as a demonstrator and a copy or copies of the plans for assembly passed out to the students so that the work station positions and jobs can be determined and assigned to the students.

6. Determine the student assignments for the positions of management and responsibilities for the various work stations.

   It will be necessary for the instructor to approximate how many students will be involved in the various aspects of the production. The students may be involved in electing a plant manager. This cannot be a popularity contest, (unless the competent student selected happens to be most popular) as this individual will have a serious and responsible job for seeing that all students do their job and that students are assigned to take care of the following responsibilities:

   Management
   Production Control
   Materials Control
   Quality Control
   Assembling the product
   Taking orders for the customizing of the model and collecting the money for such
   Delivery of the product to the customer
   Packaging if necessary as a part of the production unit
   Painters to paint various parts as ordered for customizing by customers.

7. Have students develop a flow chart of the assemblying work stations and set up work stations for the assembly.

8. Have students place the parts at the various work stations in preparation for assembly.

9. Since the product has many parts, all necessary parts should be painted before assembly. The determination of how this is done prior to assembly shall be the decision of management. Aerosol can-spray painting is probably the most efficient method of painting the small parts.

10. Begin assembly.

A. The making of jigs for assembly will be the responsibility of the production control department and should be done well in advance of assembly.

B. It will be the responsibility of the staff functions plant manager, production control, materials control and quality control to assemble the prototype model in advance of the mass assembly. During this time all suggestions as to changes in assembly operations will be discussed and changes made based on approval of plant manager. Furthermore, it shall be the responsibility of this committee to develop a flow chart as to the assembly of the product.

C. Since there are considerable options to the equipment for the product, management will set up a work order for each product detailing what options are necessary, depending upon customer specifications. This responsibility may be delegated to staff by the plant manager.

D. If assembly workers have any problems about operations, they are to consult production control. If the problem concerns parts, they are to consult material control. These departments shall have decision making authority. However, if the problem cannot be answered by these departments, they are to consult the plant manager who will have the final authority.

E. During each assembly operation, as assembly Student 1 finishes his task, he will then act as lead man and supervising foreman.

Activity Plan
AP 1-2

CORPORATION STRUCTURE AND ORGANIZATION

Students should be familiar with corporation structure and organization. The following information may be utilized as lecture or discussion material for the instructor in organizing this activity.

A corporation is a form of organization which enables a group of individuals to set under a common name carrying on one or more related enterprises and distributing the profits of such enterprises among the associates. A corporation requires a charter issued by the government and the charter creates the corporation. The charter specifies what type of business it can engage in and how many shares of stock it can issue. A corporation is very similar to the "Constitution of the United States."

If a corporation piles up debts, the owners only stand to lose the money they invested. Property owned by the corporation can be attached and sold to satisfy the claims of the creditors.

Owners of a corporation cannot sell their shares to just anyone they want. The rest of the partners must agree to the sale. Those people who provide the capital are called stockholders. They are each given a stock certificate to prove that they own part of the corporation.

The stockholders elect a number of directors to represent their interests. The directors in turn elect officers who will do the actual managing of the business, subject to the approval of the directors. An officer need not own any of the stock.

Corporations are usually formed because a man or a group of men do not have the capital to finance a business by themselves. Also by forming a corporation, the taxes you must pay are decreased.

Sometimes the stocks become too high for the ordinary person to buy them so corporations do what is called, split the stocks. If a stock was originally priced at $500, two stocks would be issued at a value of $250 each.

Illustrate to the class the stock market quotations made in a newspaper and explain what the various columns mean on the stock market page.

Organizing the class into a corporation will involve the following steps:

1. Hold a class meeting and elect officers for the corporation.

2. Draw up a constitution, setting dates for corporate meetings and other important data. See example - Fig. 1.

3. Form a committee to design and print a stock certificate. See example of such - Fig. 2.

4. Print a news release and distribute. This should include such information as: what corporation has been organized and for what purpose, who the officers are, when meetings will take place, and where stock can be purchased and for how much.

5. Sell stock certificates to members of class and any others in school or in the local area.

6. Utilize money for purchasing the materials with which to produce a product. This production of an item may be done by mass production assemblying of model autos or it may be a mass produced item which is completely manufactured in the industrial arts shop.

7. Another news release could be released to inform the public of what the corporation has accomplished.

AP 1-2

"CONSTITUTION"

OF

THE SOPHOMORE IND. ARTS CORPORATION

Officers: President -

Vice President -

Secretary - Treasurer -

Chairman -

I. The name of this corporation shall be: The Sophomore Ind. Arts Corporation.

II. The president shall preside over the meetings and in his absence the vice-president shall be in charge.

III. The secretary shall take the minutes of each meeting and shall read them the following meeting.

IV. The day of Friday of each week has been designated for meetings.

V. Stockholders must be members of the _____hour Ind. Arts class.

VI. The cost of each share will be $2.00.

VII. The day of _____has been designated as the last day that the first share will be available.

VIII. The least number of shares a person may buy is one and the maximum is two.

IX. Capital _____.

Fig. 1

STOCK CERTIFICATE

INCORPORATED UNDER THE LAWS OF THE STATE OF WISCONSIN

NUMBER SHARES

(A club or school crest could be drawn here)

SOPHOMORE IND. ARTS CORP.

CAPITAL_____

FULLY PAID NON ASSESSABLE

THIS CERTIFIES THAT IS THE OWNER OF
SHARES IN THE CAPITAL STOCK OF
SOPHOMORE I. A. COMPANY,
TRANSFERABLE ONLY ON THE BOOKS OF THE CORPORATION BY THE HOLDER HEREOF IN PERSON OR BY ATTORNEY UPON SURRENDER OF THIS CERTIFICATE PROPERLY ENDORSED.

IN WITNESS THEREOF

THE SAID CORPORATION HAS CAUSED THIS CERTIFICATE TO BE SIGNED BY THE DULY AUTHORIZED OFFICERS AND BE SEALED WITH THE SEAL OF THE CORPORATION

THIS _____DAY OF _____ A.D., 19__

OFFICERS

1. 3.

2. 4.

Fig. 2

Activity Plan
AP 2-1

MANUFACTURING PAPER

This activity calls for paper pulp made from wood in the school shop. When nitric acid is used to break down the wood fibers this creates a nitro cellulose which is highly inflammable; therefore, care should be taken to prevent the mixture from coming into direct contact with any high degree of heat. Also nitric acid fumes are toxic to humans and may cause corrosion of metal on tools and equipment; therefore, mixing of the wood chips with nitric acid should be done only when using an exhaust fan or other exhaust system to withdraw the fumes. The nitric acid and wood chips solution should be left to react for at least 24 hours or overnight. Place caps on the glass jars of the nitric acid and wood chips mixture to prevent fumes from escaping when leaving the mixture overnight.

Sodium hydroxide, (caustic soda) used for neutralizing the mixture when it is ready, is also toxic and must be used with care.

After neutralizing the solution of nitric acid and wood chips the neutralized solution must be washed several times using clear water and a burlap bag or cloth to retain the fibers. These fibers are placed in fresh water again and washed and rinsed again. This must be done 5 to 6 times in order to remove any traces of acid solution.

After the pulp is made it can be stored for some time in plastic bags making sure that the bags are tightly closed or sealed.

If you wish to obtain pulp without the process of making the pulp from wood you can use facial tissue, (not wet-strength) or toilet tissue.

This tissue must be shredded and placed in a basin of water and beaten with an egg beater to make an approximate 1 per cent pulp to 99 per cent water ratio

solution. Also paper pulp in small quantities may be procurred from paper mills at a very nominal cost.

The only equipment which needs to be made for making the pulp into paper is a mold and a forming rack as described in JS 2-5. The mold, made from a sheet metal box, an old biscuit pan, or small cake pan supports the screen (known in the paper industry as a "wire") to catch the fibers which forms the paper. The bottom of the pan or box must be removed leaving 1/2" to 1" of ledge on all four sides of the bottom to support the frame for the "wire".

The forming rack for the paper fibers consists of a wood frame 1/2" to 5/8" thick and so constructed that it will clear all sides of the interior of the pan. Note: the size of the mold determines the size of the paper. If you want an 8" x 10" sheet of paper the frame and box (mold) will have to be large enough to accomodate an 8" x 10" opening in the "wire" frame. A fine meshed wire screen, silk screen or nylon hose can be used as the "wire" on the forming rack.

The paper pulp solution should be quite "watery" - approximately 1 part of pulp to 99 parts of water. Beat the pulp and water mixture with an egg beater keeping the solution stirred well as you dip into the solution to catch the fibers on the "wire" of the mold.

As the watery solution which is approximately 99 per cent water and 1 per cent fiber and sizing (starch) are briskly stirred and poured over the "wire" (screen) the fibers are caught upon the "wire" and held in place while the water passes through the screen.

Care must be exercised in drying the paper pulp on the wire by using blotter material or felt pads. By placing the wire on top of a blotter paper or felt a portion of the water can be removed through absorption. The other side of the screen may also be blotted by placing blotter paper or felt over the other side to remove as much moisture as possible.

When as much of the moisture has been pressed out of the paper pulp on the wire, carefully remove the sheet of paper which has formed on the wire. Laying the newly made sheet of paper over blotting paper and using an iron (a dry iron is best - one that is not too hot) press the sheet until all moisture has been removed. Be careful not to burn the paper with the iron.

An excellent source of information for teacher and student alike, is contained in a 4 page pamphlet entitled, How You Can Make Paper. It is made available to educators in quantity, upon request to the American Paper Institute - IM-97.

PRODUCING LEAD FISH SINKERS

Producing the lead sinkers by mass production can be a meaningful experience for your students. Not only should it make them aware of the fishing industry and sport, but it can also help them to understand how people working together can produce a product. This activity can also help them to gain a better understanding of the metals casting industry.

For this activity two types of sinkers could be made although JS 2-7 explains and illustrates only the manufacturing of the bass casting sinker. Commercial molds can be purchased for making either the pinch-on sinker or the bass casting sinker having the small wire eye. A mold similar to the one described in JS 2-7 may be purchased from McDonald Manufacturing, P.O. Box 70, Lee's Summit, Mo., or Point Sporting Goods, Stevens Point, Wisconsin.

The organizing which must be done by the teacher for mass producing a lead sinker will then depend upon what particular mold or molds will be used. You may want to utilize more than one mold at a time or several molds of both types at one time.

Organize a general production along the lines of the organizational chart shown in Fig. 1.

AP 2-2

Flow Chart for Fish Sinkers

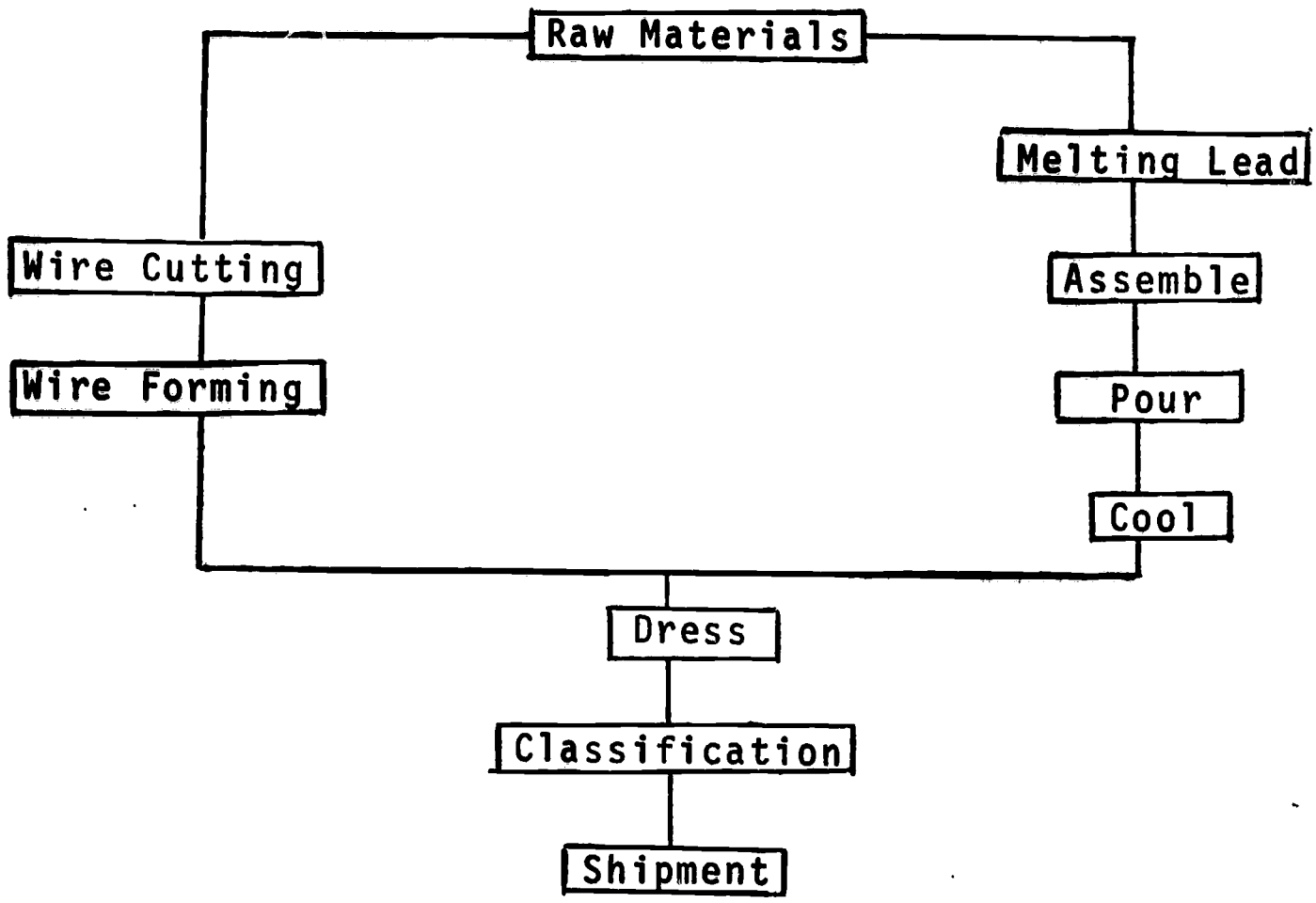


Fig. 1

EXTRACTING ORE

The listed activities will be assigned to students by instructor.

1. The extraction of ore may be accomplished by merely adding lead to gravel. Use the jigging method.

2. If ore is available, break it up into small parts and make separation.

3. Make drawings of different means of extracting ores such as shaft, open pit, strip and pillar.

4. Place pictures on bulletin board of step-by-step procedures in locating and extracting ore.

5. Use small firecrackers to demonstrate caving of wall sections in mining.

Activity Plan
AP 2-4

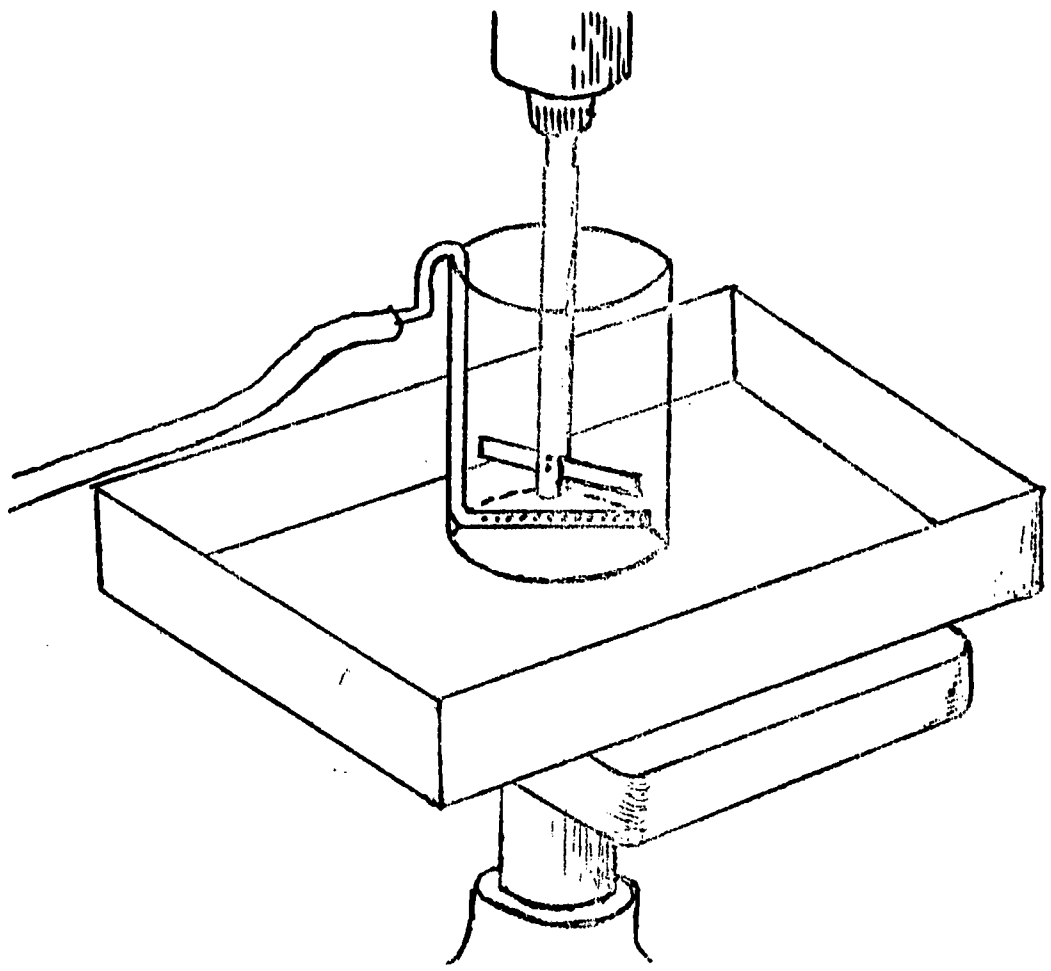
ORE FLOTATION DEMONSTRATION

The process of ore flotation can be demonstrated easily with the apparatus shown on the following page.

The flotation tank may be any high, narrow container such as a juice can. An L-shaped piece of 1/4 inch tubing, with small holes drilled in the bottom of the L, is soldered in the can. The tray into which the bubbles flow can be any large container with reasonably deep sides.

A means of agitation is necessary to insure that the material to be floated is kept in suspension. A paint mixer mounted in a drill press works well. An air supply with a pressure of several pounds is attached to the perforated tube to create bubbles.

Any of the metallic non-ferrous sulfides such as cupric sulfide and lead sulfide can be separated by flotation. These sulfides are mixed with water and a small amount of pine bath oil. When air is bubbled, the sulfide particles float to the surface and can be filtered off.



In this diagram the can is illustrated as glass so that the structure of the inside parts may be seen clearly.

Activity Plan
AP 3-1

SPARK TESTING METAL DEMONSTRATION

Although the spark testing of metal is no longer considered wholly reliable, it is a method used in common practice in many shops where metals are used when welding and fabricating metals. This demonstration will provide the student with a method of identifying some of the more common steel alloys.

To demonstrate the spark testing of certain metals, an electric grinder should be used which rotates at a minimum speed of 1750 RPM. By placing the metal against the grinding wheel various types of spark patterns may be observed in the stream of sparks. Because of the various elements and amounts of each found in steel, each steel alloy will cause different types of spark patterns to be emitted when ground. By observing the particular pattern of sparks given off by a metal a trained individual can often identify different types of steels.

Obtain as many different types of steel as possible to illustrate the different patterns given off when the metal is placed against a moving grinding wheel. The attached sketches illustrate four of the more common steel spark patterns.

A. Wrought iron -

B. Low carbon steel - .15%

C. Medium carbon steel - .45%

D. High carbon steel - .70%

1. Before giving the demonstration discuss some possible ways of determining types of steel without using spark testing. Explain how destructive and non-destructive testing of metals is done.

2. Explain why various elements are placed in steel and how this is accomplished.

3. Explain what such ratings as 1010, 1210, 1212 and 8620 steel mean, why, and how they are rated as such.

4. Discuss plain carbon steels and the spark given off. Explain how the amount of oxygen in steel affects it and how to detect it in a piece of steel by grinding.

5. Give demonstration on spark testing metals utilizing as many different alloys of steel as possible to illustrate the various patterns which may identify types of manufactured steel.

6. Discuss what qualities a person needs to become an effective spark tester.

The following materials will aid the instructor in becoming more familiar with the process of spark testing.

The Art of Determining Grade of Steel by Spark Observation, Automobile Industries, Vol. 48, Page 936.

Bishop, Edsel. The Art of Spark Testing. Wyckoff Steel Company, General Offices: Gateway Center, P. O. Box 1256, Pittsburg, Pennsylvania. Cost- $2.00.

Hildorf, W.G. and McCollam, C.H., The Spark Testing of Steel, Timken Roller Bearing Co., Canton, Ohio. Free.

The American Iron and Steel Institute. 150 East 42nd St., New York, N. Y. 10017. Has information concerning specific properties of stainless steel.

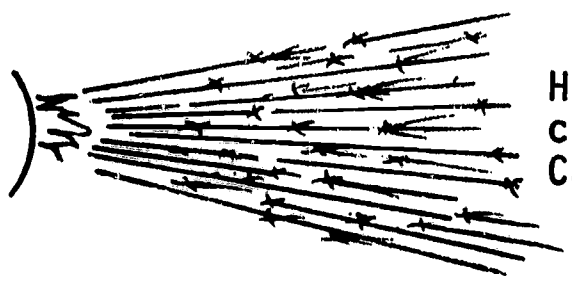
METAL SPARK STREAM PATTERNS

Wrought Iron

Long, dull red, with dark tips. Shoot off in straight streaks which widen in the middle and then disappear.

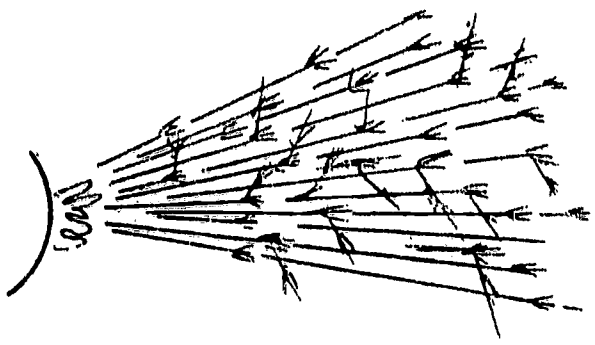
Low-carbon steel (also called Machine Steel or Mild Steel)

Bright with starlike explosions. More and brighter as carbon is increased. The more carbon in the steel the more the sparks look like stars.



High-carbon steel (also called Tool Steel or Carbon Tool Steel)

White and explode immediately into bright stars, then disappear. Many sparks follow around wheel. Thus high carbon steel burns easier and quicker than low-carbon steel; this must be remembered when heating high-carbon steel to keep from burning it.



Alloy Steel
High Speed Steel

Sparks of high speed steel are dark, broken lines which end in dull red, pear-shaped sparks a short distance from the wheel. Some sparks shoot or branch off at right angles to main stream of sparks. Many alloy steels give no sparks at all.

Activity Plan
AP 3-2

MAKING A ROPE

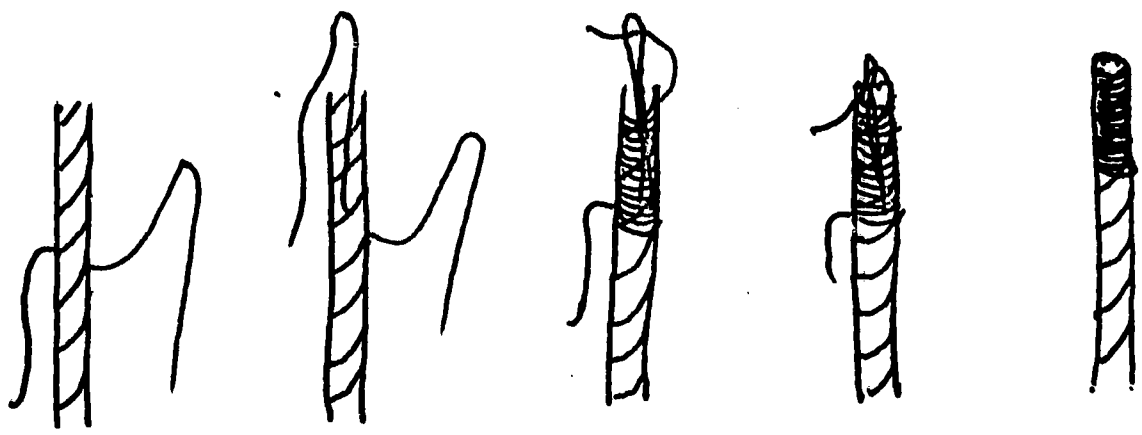
There are various ways in which one may design the rope twister and twine holder. The drawing attached is only suggestive of what could be used. The major point to keep in mind in designing and making a twister and holder are: The double strands on each hook must be kept from interferring with or winding around the double strands on the other hooks. If this happens turning of the rope twister cannot be done after a few turns. Also, the twine holder used at the other end of the rope must be designed so that the double strands are held far enough apart so as not to interfer with each other when the twisting is done with the rope twister.

The important or key point on which the success of this operation depends is the placing of the strands on the hooks of the twister and the holder. (See JS 3-1 for illustration of placing twine on twister and holder).

The double strands should be far enough apart (2 inches or more) so as to prevent them from twisting together as the twister is turned.

The end of the rope when taken off the rope twister will have three double twisted strands which all need to be twisted together at this time and either tied or whipped. Whipping the end of the rope is explained and illustrated below:

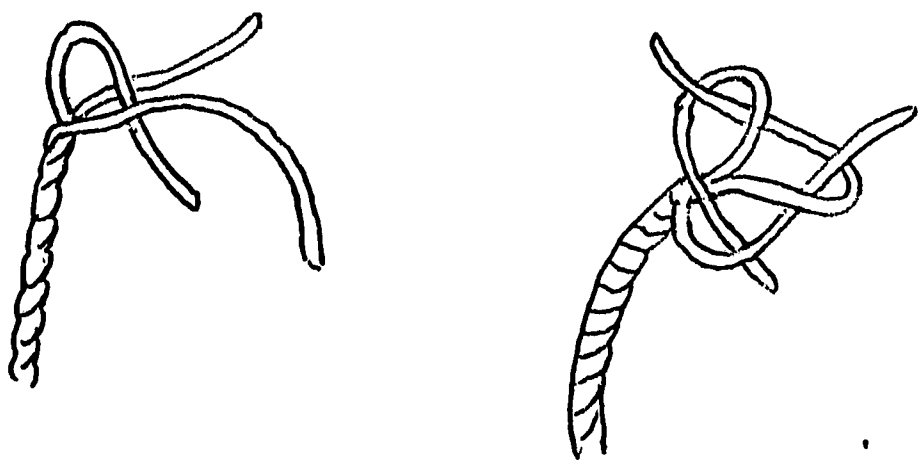
WHIPPING



1. Lift a strand about 1-1/2 inches from end of rope and pull a stout, hard string through it.
2. Hold rope in front of you, end up.
3. Make a loop of left end of string that reaches top of rope.
4. Circling the rope clockwise with other end, start winding string around rope.
5. Keep windings close and fairly tight.
6. Wind until about 1/4 inch from top of rope and insert string end through loop at top.
7. Pull loop string at bottom of windings.
8. Pull loop string through and under the windings.
9. Cut off the string ends.

If tying the end of the rope is desired instead of whipping, it may be accomplished following the directions and illustration given below:

TYING A CROWN KNOT



1. Unlay the end of the rope for two turns and hold it in the left hand so that the front strand under the thumb is the middle strand.

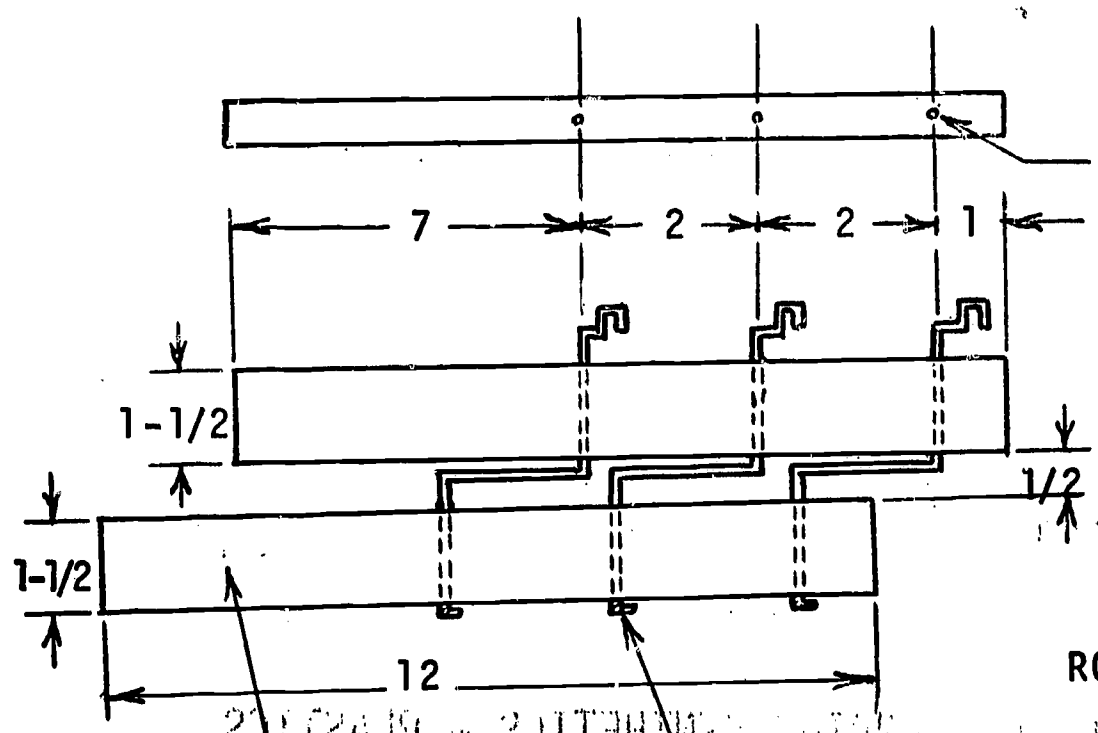
2. Bring the middle strand down forward tight over the first or left-hand strand. Hold it under the thumb and swing the end to the right under the end of the first strand. Pass the remaining strand around under the end of the middle or second strand used from the front, and then pass the end through the loop of the first strand from the rear.

3. Note that three loops have been made and the end of a strand passed through a loop.

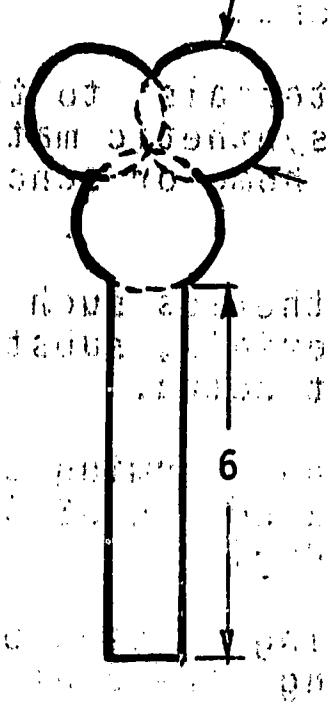
4. Pass each end through the loop just ahead of it.

5. Draw down tight and trim the ends.

After the rope has been completed it will have many "stray" fibers protruding from it. These may be quickly removed by using a source of flame to "singe" the rope somewhat like one would "singe" the hair off of a chicken when dressing it. Care should be taken not to hold the rope too long in one place.



ROPE TWISTER



TWINE HOLDER

Activity Plan
AP 3-3

UNDERSTANDING SYNTHETICS - PLASTICS

1. Define synthetic as the art or process of making or "building up" a compound by union of simpler compounds or of its elements.

2. Offer samples of synthetic materials to the students to see. A variety of synthetic materials may be procured around the home or school for this purpose.

3. Discuss the various types of synthetics such as drugs, toys, foods, building materials, substitutes for metals, textiles and et cetra.

4. Construct a jig for heating and forming the acrylic plastic tongs illustrated in JS 3-2 Synthetic Materials - A Plastic Project.

5. Assist the students in developing a step-by-step procedure for manufacturing the plastic tongs.

6. Organize a mass production plan for manufacturing the plastic tongs. Include a plan for the physical layout of the production.

7. Mass produce the tongs by involving as much as possible, every member of the class in some way or another. This should involve organizing the class into management and labor for production of the object and packing and distribution of the product.

8. After the product has been manufactured and distributed have the class evaluate the produc-

A bending jig must be designed and constructed to hold the part to shape while the plastic is cooling. You may design an alternate pattern or use the one illustrated with this plan. See Fig. 1.

It has also been found the easiest way to shape the notches on the ends of the tongs is to melt them into the plastic. This can be done by machining a metal block or you may buy an aluminum meat tenderizer which will serve the same purpose when heated.

Materials, Tools and/or Equipment Needed:

1 pc. 1-1/8" x 14" x 7" pine board for forms
1 pc. 3/16" x 1" x 18" acrylic plastic
1 ea. strap hinge with screws
1 set drawing board equipment
Power jig saw or band saw
Buffing equipment
Heat source
Sandpaper
File
Cotton gloves
Screwdriver
Grooved block

Procedure:

1. Lay out pattern for bending jig.
2. Cut wood pattern for bending jig.
3. Fasten two halves of outside pattern with hinge.
4. Sand pattern smooth.
5. Fit inside of wood pattern to fit hinged mold (Be sure you have allowed for the thickness of the plastic all around the pattern.
6. Lay out and cut wood clamping device.

Pattern for Tongs

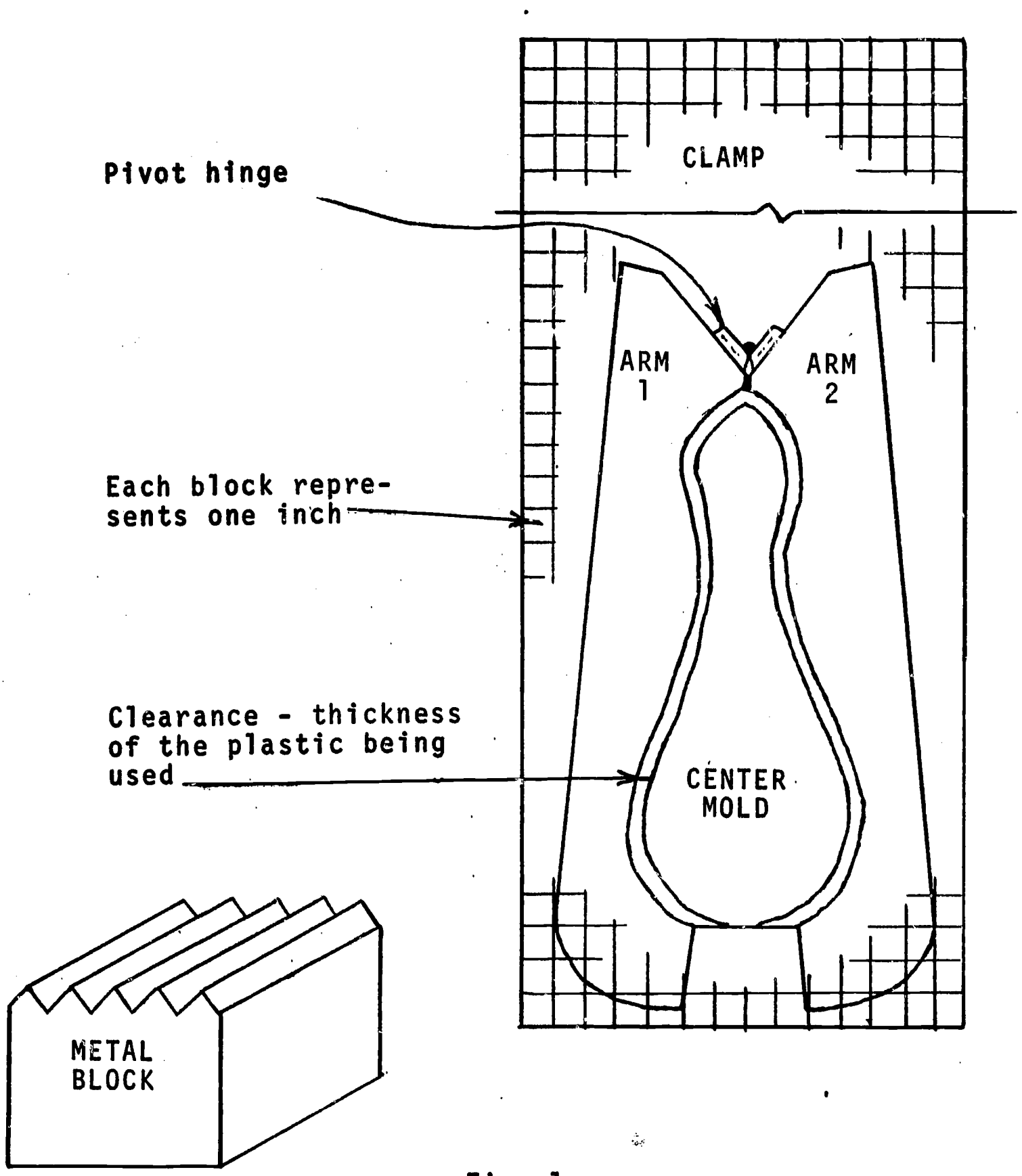


Fig. 1.

FORM CONSTRUCTION FOR CONCRETE PLANTER

In constructing a concrete flower planter, you need an inside and outside form. Any width or length may be chosen to fit your plans. The illustration shows one method of forming molds for a concrete flower planter. See Fig. 1.

Be sure to sand the inside face of the forms and coat them with shellac or clear plastic spray to give a smooth concrete finish.

Elaborate patterns may be placed on the form side if desired.

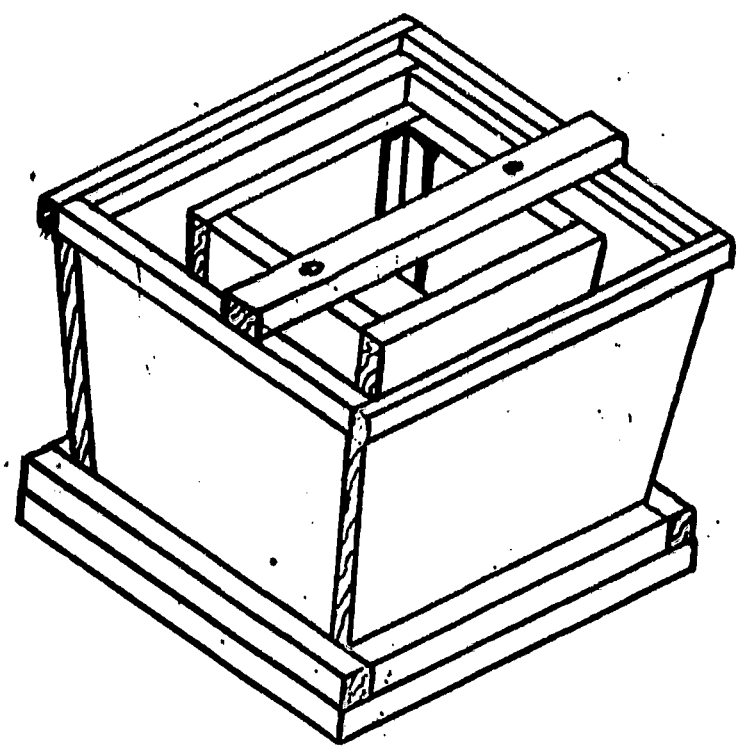
Use 3/4" exterior plywood, if available, for the forms.

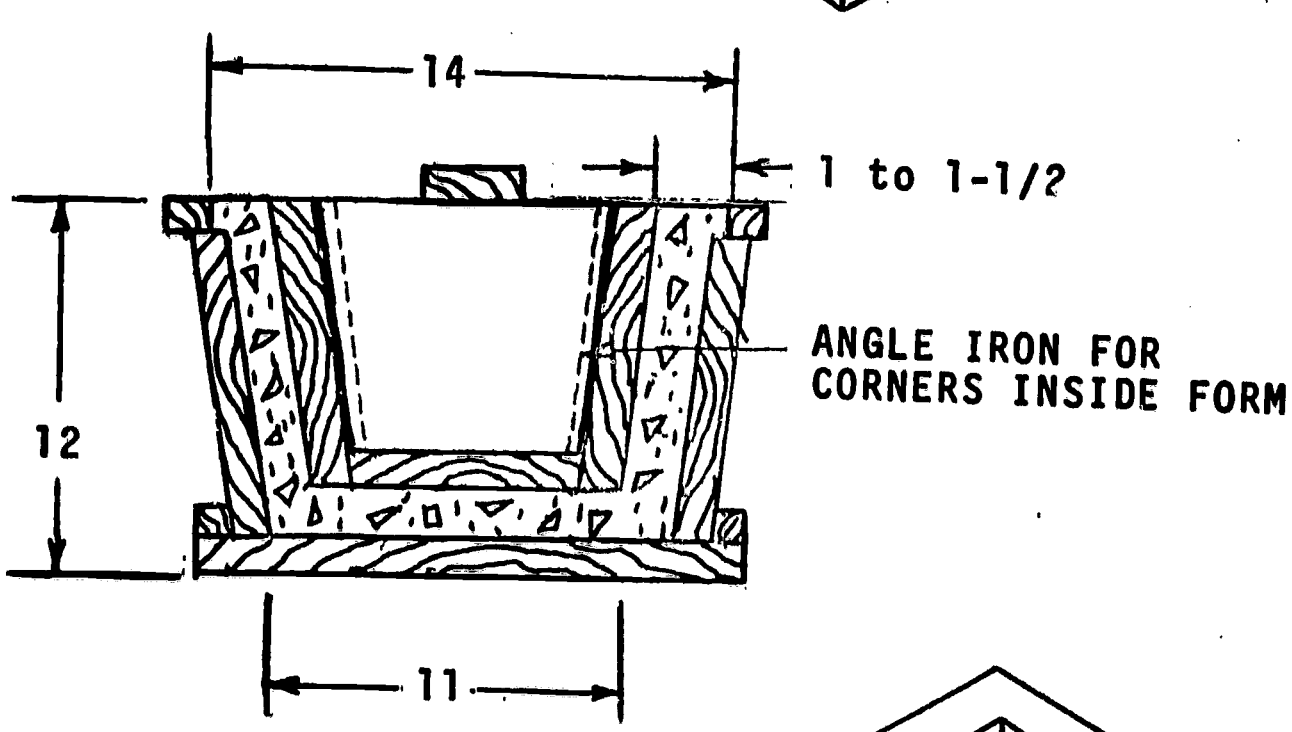
Use 1" or 1-1/2" angle iron to hold the corners of the inside form. Place this angle iron on the inside corners of the inside form. (See Diagram)

Generally speaking, the size of the form may vary depending on your individual desires. The wall of the completed planter should be a minimum of 1" thick at its thinnest points.

Reinforcement of the concrete can be accomplished by carefully inserting welding rods or straightened coat hanger wires into the center of the walls of the planter.

Use grease or heavy lube oil to coat the walls of the forms which come in contact with the cement.





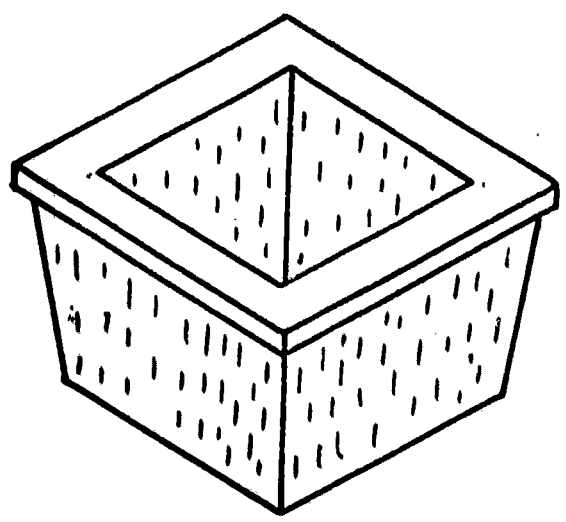


Fig. 1.

RELATED ACTIVITIES FOR DISTRIBUTION

Identified below is an outline of the major modes of distribution of products. It is conceivable that a teacher could group students in two's and three's and each group develop various models of the different modes of transportation such as Conestoga wagon, sailing vessel, steamship, rocket, etc.

Land Transportation

Rail system, terminals, train track, steam, electric, mono-rail

Pipeline system, refinery

Electrical power transmission, generator plant, major transmission lines in U. S. etc.

Highway System
- Conestoga wagon
- Dog sled
- Trucks
- Semi-trailer & tractor
- Buses
- Train
- Auto, antique, latest design, etc.

Conveyors
- Belt
- Elevators

Water Transportation

Waterways of the U. S.
- Ships docking terminal, dry docks

Water vessels
- Sailing
- Steam
- Submarine
- Raft
- Riverboat
- Barge
- Canoe

Air

Air terminal

Air routes in U. S.
Mail, commercial

Space terminal

Vehicles
Balloon
Dirigible
Bi-plane
Commercial '30's plane
Jet airliner
Spacecraft

Other Related Activities:

1. Find out why semi-trailers have different numbers of wheels and why.

2. Find out what the cost of a highway is per foot or yard or mile. Break down into labor, materials, amount of time needed, etc.

3. Make a map of the U. S. plotting major airlines in black ink, railroads in red and waterways in blue ink, etc.

4. Build a small balloon basket, attach to balloon filled with helium or hot air and ascend it.

5. Mass production unit on a rocket or automobile would work well here.

6. Build a model of an electrical power distribution system from generator plant to an industry and homes.

7. Build a model pipeline of clear plastic tubing using colored water to show mixture of materials at a petroleum plant.

A STUDY OF AEROSPACE TECHNOLOGY

Below are listed several research topics of which you may assign students. On a sheet of paper have them list their choices in order of preference. In other words, the one which they would most like to report on first and the one they would least like for an assignment last. After the topics have been assigned, have them prepare a 500 word report which will be handed in for evaluation and returned to them for inclusion in their notebook.

Assignment:

Research Topics:

- Ram Jet Engines
- Pulse Jet Engines
- Turbo Jet Engines
- Turbo Prop Engines
- Turbo Fan Engines
- Lift and forces in flight
- Airplane controls
- Commercial Aviation
- Liquid Rocket Engines
- Offensive and defensive applications of aerospace
- Space development and research
- The light plane industry

References:

Power Primer - IM-4

Technological Trends in Major American Industries
U. S. Dept. of Labor, Bulletin No. 1474

Aircraft, Missiles and Spacecraft, NASA Publications

Activity Plan
AP 4-3

MASS PRODUCTION PROJECT (ROCKETRY)

The following mass production project is designed to fit into the unit on Distribution dealing with Aerospace technology. This unit consists of an attached flow chart, using industrial symbols, and a station by station job description, for the mass assembly of experimental sounding rockets. The following standard process chart symbols serve as a special sort of shorthand to aid in listing quickly the steps or activities in a process.

Operation. An operation occurs when an object is intentionally changed in one or more of its characteristics. An operation represents a major step in the process and usually occurs at a machine or work station.

Transportation. A transportation occurs when an object is moved from one place to another, except when the movement is an integral part of an operation or an inspection.

Inspection. An inspection occurs when an object is examined for identification or is compared with a standard as to quantity or quality.

Delay. A delay occurs when the immediate performance of the next planned action does not take place.

Storage. A storage occurs when an object is kept under control such that its withdrawal requires authorization.

The JAVELIN sounding rocket, purchased from Centuri Engineering Company, Phoenix, Arizona, for $1.50, is the vehicle for this unit.

Introduction

The JAVELIN sounding rocket is a terrific all 'round model for beginning rocketeers, for general sport flying, or for demonstrations. Its "clean" high performance design permits it to reach altitudes approaching 2,000 feet when powered by the B.8-6 engine.

"Sounding" as applied to rockets, means to investigate or examine. A "sounding rocket" is a meteorological rocket used to gather upper atmosphere data such as temperature, pressure, radiation, and wind velocity. Sinsitive instruments within the nose cone and payload compartment are exposed to the upper atmosphere for purposes of measuring these objects of study. This information is sometimes recorded within the rocket itself, but is most often telemetered back to Earth by means of radio transmitters within the rockets payload compartment.

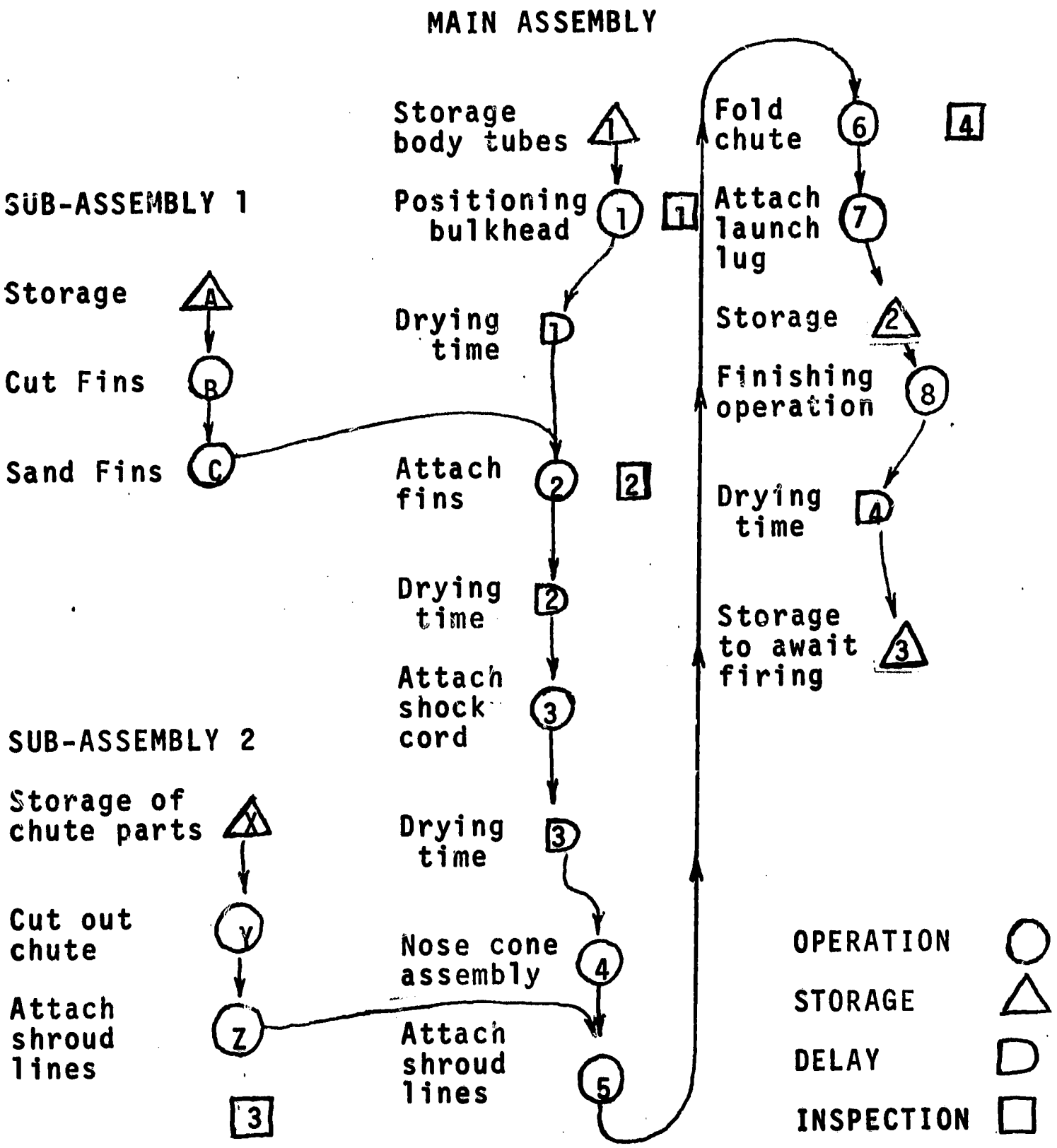
The JAVELIN model rocket, of course cannot carry meteorological instruments; however, its basic design is patterned after the large sounding rockets such as those launched from Wallops Island, Virginia.

When properly assembled, the JAVELIN will soar straight as an arrow to maximum altitude (apogee), eject its parachute, and float gently back to earth to be flown again.

Materials:

Javelin rocket kit
Modeling knife or single edge razor blade
Paint for finishing - preferrably spray paint
Glue
Sandpaper

SAMPLE OF FLOW CHART for JAVELIN SOUNDING ROCKET



Instructions Main Assembly
Javelin sounding rocket

use assembly drawing furnished with rocket kit at each station

△ 1. Assemble parts from each kit into proper areas, checking to see that each kit contains complete parts. Body tubes into storage area 1.

(1.) Apply a heavy bead of glue around the top rim of the thrust ring and insert into the body tube. With the engine spacing tube, quickly push the thrust ring forward until 1/8" of the spacing tube extends beyond the end of the body tube.

Withdraw the spacing tube immediately and roll body tube around slowly so that glue will flow into ring-tube joint, bonding the thrust ring in place.

[1.] Inspect.

[1.] Set body tube on end and allow to dry.

Sub-assembly one feeds into main line here. See sheet for sub-assembly one.

(2.) Insert spacing tube into the body to keep the tube round while gluing on fins. Cut out the fin positioning guide as indicated, wrap around the base of the body tube. Tape loose end with scotch tape or masking tape, and mark the fin locations with pen or pencil.

Remove guide, and glue each fin, one at a time, to the body tube over the pencil marks. Be sure the root chord of each fin is lined up parallel with the long axis of the body tube.

[2.] Check to make sure that opposite fins are in line and that adjacent fins are at right angles to each other.

(2.) Stand rocket assembly on its top and allow to dry.

(3.) Attach one end of the rubber shock cord to the body tube as shown in the assembly drawing. Cut two slits about 3/8" long and 1/4" apart, in the body tube one inch down from the top end, and depress the tube paper between the slits.

Bring the cord cut through the first slit, and back into the body tube through the second slit. Apply glue to the body tube to obtain a good bond.

[3.] Set aside to dry.

(4.) Thread the screw eye into the nose cone base, and unscrew the eye from the cone. Squirt glue into the resulting hole, slip the nose weights over the screw eye, and rethread the eye into the cone.

Sub-assembly two feeds into the main assembly line here. See sheet for sub-assembly two.

(Z-5) Attach shroud lines to nose cone screw eye as shown in figure three of parachute assembly directions.

[3.] Inspect.

(6.) Fold the chute temporarily, insert into the top of the body tube, and place nose cone in place. See instructions for folding on the parachute assembly instructions.

[4.] Inspect.

(7.) Glue launch lug to the body tube in the position shown on the assembly drawing.

△2.△ Store to await finishing.

(8.) Finishing the Javelin: For maximum altitude flights and ideal appearance take pains in finishing the rocket. See assembly drawings for maximum finishing instructions.

[5.] Inspect.

[4.] Allow to dry.

△3. Storage to await launch.

Instructions Sub-Assembly 1. Javelin sounding rocket

Use assembly drawing furnished with rocket kit at each station

△A. Storage of tail fin parts prior to assembly.

(B.) Cut out the four fins from the printed balsa sheet.

(C.) With fine sandpaper, round the leading and tip edges, and taper the trailing edge. DO NOT SAND ROOT EDGE.

Sub-Assembly one fits into the main-assembly line at this point.

Instructions Sub-Assembly 2. Javelin sounding rocket

Use assembly drawing CP-12 parachute assembly sheet

△X. Storage of chute parts prior to assembly.

(Y.) As shown in assembly drawing CP-12 attach shroud lines.

(Z or 5) Attach shroud lines to nose cone screw eye as shown in figure three of parachute assembly directions.

Sub-Assembly two fits into main-assembly line at this point.

NOTES:

While everyones' class size will vary it is possible to use one or more people at many of the work stations.

If some protype models are ordered extra students can be used in the research and development department building these on a job type basis.

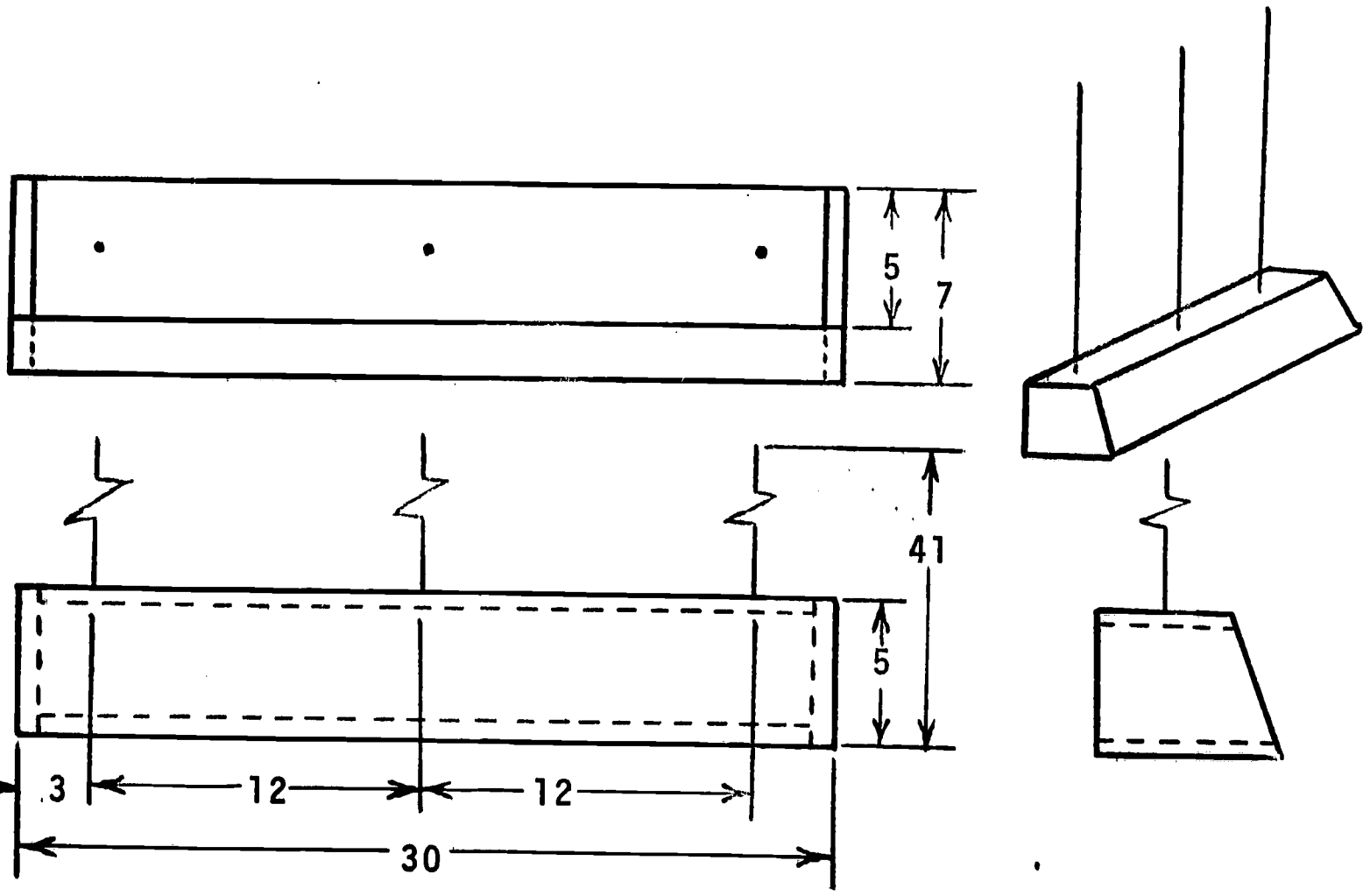
Some students may be utilized in the launching systems also.

CONSTRUCTING A MODEL ROCKET LAUNCH PAD

This launch pad is suggested for launching three model rockets independently of each other. Other launch pads may be designed to meet the needs of the individual.

Materials, Tools and/or Equipment Needed:

3 1/8" bronze welding rods
1 top, 1/2" x 5" x 29", plywood
2 sides, 1/2" x 5" x 7", plywood
1 bottom, 1/2" x 7" x 29", plywood
1 front, 20 ga. sheet metal 7" x 30"
1" brads



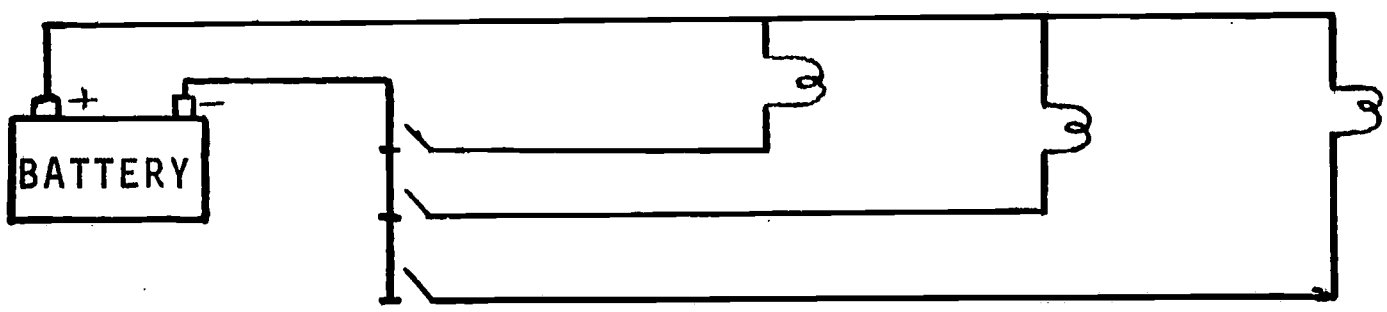
Procedure:

1. Cut and assemble top, bottom, and sides.
2. Form sheet metal front.
3. Attach front to launch pad.
4. Attach bronze welding rods to top.
5. **Note**: See the following on wiring the model rocket launch pad in order to prepare for the firing of the model rockets.

WIRING THE MODEL ROCKET PAD

Materials, Tools and/or Equipment Needed:

12 volt automobile battery
3 switches (push button type)
One 30 foot length of number 18 insulated wire
Four 15 foot lengths of number 18 insulated wire
3 pieces of nichrome wire (This is the heat source which fires the model rocket. It comes with the model rocket kits.)



Wiring Diagram

Procedure:

1. Using the alligator clips, connect the 30 foot length of insulated wire from the positive battery terminal to each of the three launch pads.

2. Using the alligator clips, connect one of the 15 foot lengths of insulated wire from the negative battery terminal to one terminal on each of the three push buttons.

3. Using the alligator clips, connect one 15 foot length of insulated wire to one terminal of each push button and one terminal of each launch pad.

4. Note: When the wiring has been completed, connect a 12 volt light bulb to each launch pad and test the system to insure that it is working properly. This must be done before attempting to fire any rockets.

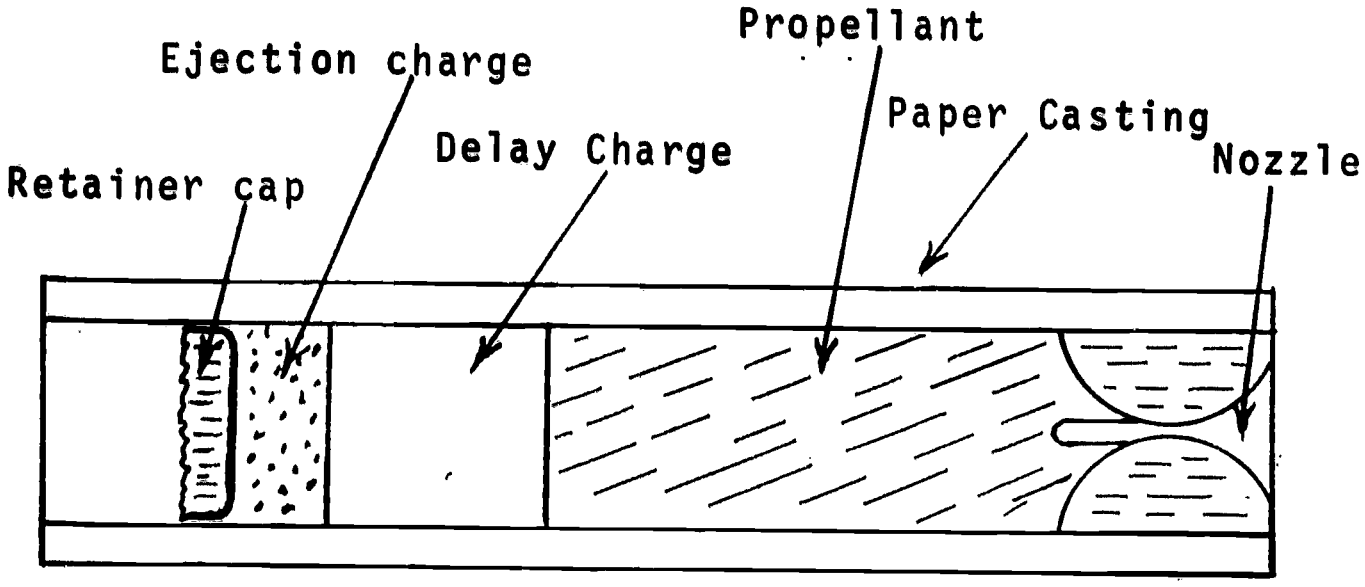
Summary:

The suggested launch pad will work very well for the firing of the model rockets. If time does not permit the construction of such a pad, a welding rod pushed into the ground will serve the same purpose.

Activity Plan
AP 4-5

DEMONSTRATING MEASURING ROCKET ENGINE THRUST

The small model rocket engines used for this project have a modified end burning, solid propellant grain. These engines, upon ignition, produce a short duration, high level thrust which imparts sufficient stabilizing velocity to your model rocket. Following this high initial thrust is a lower level sustaining thrust which is maintained until burnout. These engines also contain a slow burning delay charge which is ignited at the instant of propellant burnout. This smoke producing charge provides no thrust but allows the rocket to coast upward to its maximum altitude before the ejection charge is ignited. The ejection charge provides a sudden release of gases which activates the recovery system.



Materials, Tools and/or Equipment Needed:

Wood Frame (similar to Figure 2), scale, 2 pcs. 1/8" welding rod, 6 1/8" eye screws, 1-1/2" eye screw, 1 metal shield, two stop watches, power source, 30' wiring (lamp cord)

Procedure:

1. Assemble test equipment
2. Install rocket motor (tape for snug fit)

3. Wire motor to power source
4. Ignite engine
5. Start stop watch
6. Observe reading on spring scale - Fig. 1.
7. Stop stop watch at burnout and record time (thrust duration)
8. Start second stop watch at burnout (delay period)
9. Stop second stop watch at ejection charge
10. Record time periods and plot thrust curve (Fig. 2.)

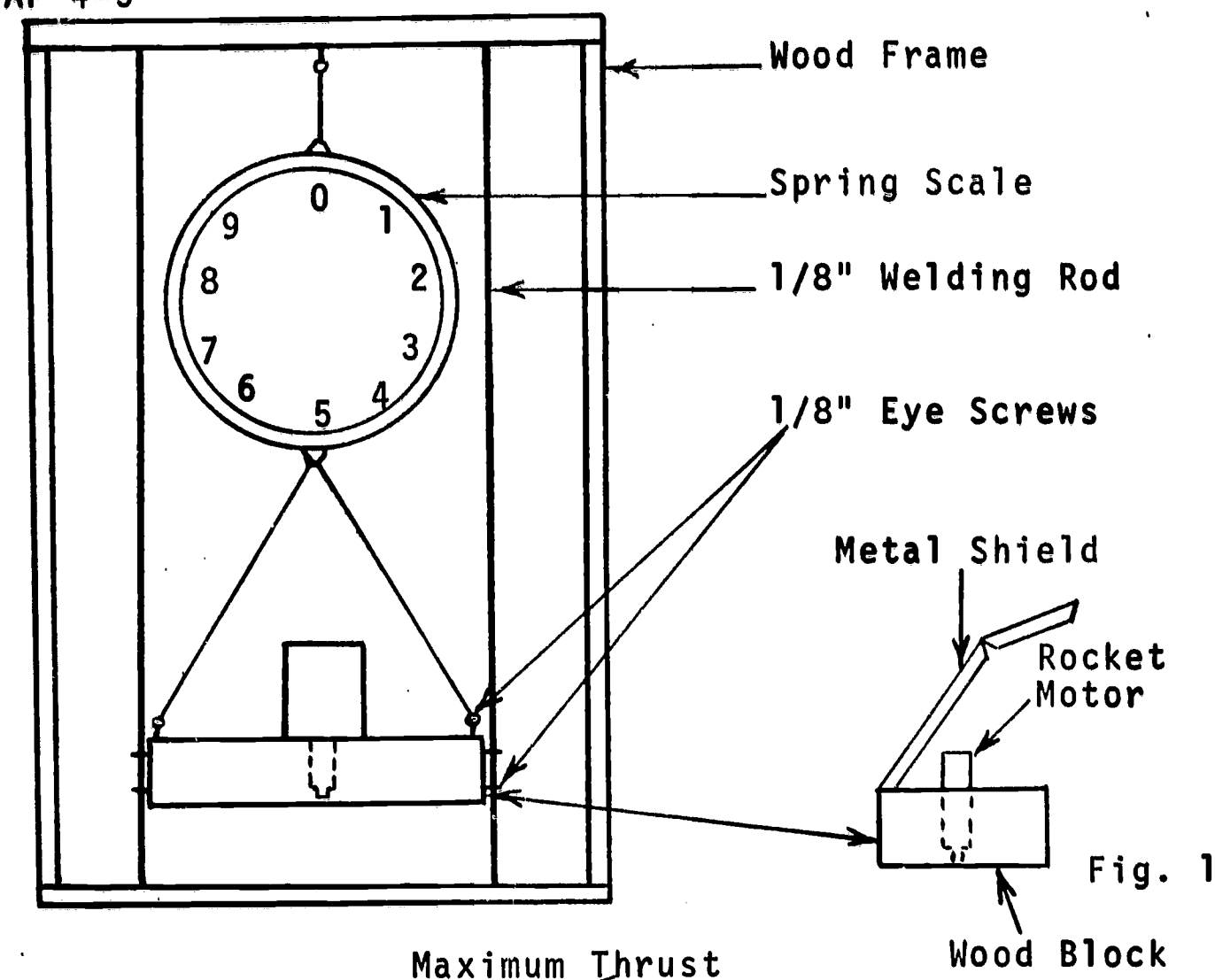

Wood Frame
Spring Scale
1/8" Welding Rod
1/8" Eye Screws
Metal Shield
Rocket Motor
Wood Block
0
1
2
3
4
5
6
7
8
9

Fig. 1

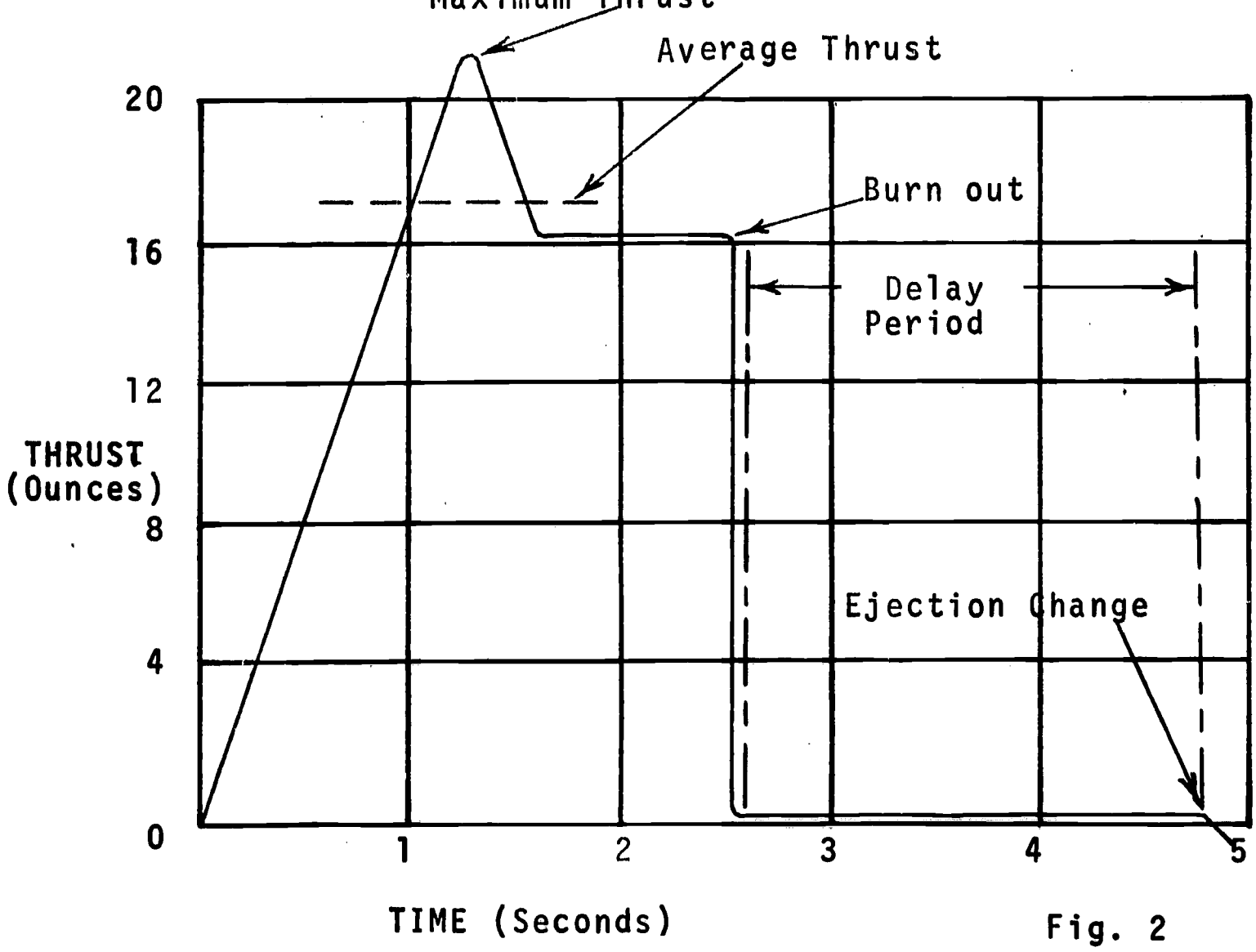

Maximum Thrust
Average Thrust
Burn out
Delay Period
Ejection Change
THRUST (Ounces)
20
16
12
8
4
0
1
2
3
4
5
TIME (Seconds)

Fig. 2

PHYSICAL PLANT MAINTENANCE FOR A SCHOOL INDUSTRIAL LABORATORY

Physical plant maintenance can be well learned in an activity such as the one described below. Not only do the students learn to assume responsibility but they also understand that maintenance is a vital part to any area where men and machines work together.

1. Select a plant engineer
   a. by election
   b. by teacher interviewing applicants

2. Select a safety engineer using one of the above procedures.

3. Select a maintenance supervisor using one of the above procedures.

4. The plant engineer and maintenance supervisor should appoint a custodial service head, and divide the rest of the class as either custodians or maintenance workers. (the number of each will depend on the size of the class, the size of the room, and the number of machines to be serviced)

5. The plant engineer and safety engineer should get together and make a set of policies for the department.

6. The custodial service head should get together with his workers to make work schedules and give each worker his duties.

7. The maintenance supervisor should get together with the rest of his men and assign machines to each worker. The workers should study the machines, find out how and where to lubricate for preventative maintenance. Any time a problem arises with the machine, they should pass the information up the line to the maintenance supervisor.

8. Meet back in the classroom to discuss the machines and their operation.