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AVAILABILITY OF TECHNICAL INFORMATION
ON AIR COMPRESSORS FOR PLANT AIR APPLICATION

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INTRODUCTION

Until the late 1950's the lubricated reciprocating air compressor dominated the field. Technical information was ample and easily available. Occasionally, the lubricated sliding vane machine has been used. Only for special applications were non-lube reciprocator or liquid ring machines being deployed.

This fairly stable situation has changed radically in the last 15 years. Some well known but semi-dormant concepts have been revitalized and new concepts have been developed. As a result, by the mid 1970's the following machines have been added to the compressor family: centrifugals in the capacity range which makes them applicable for plant air service, oil-flooded twin screw, oil-flooded sliding vane, dry screw, single screw, conical screw, and more recently the power-slide type of the oil-flooded twin screw.

Within the same time frame, compressor components and accessories have become more diversified, more advanced, more complex, and quite frequently more prone to misapplication and malfunctioning.

This impressive variety of equipment on the market offers excellent opportunities to compressor users. However, in order to take advantage of these opportunities the need arose for an efficient flow of information between all sectors of the compressor community.

The availability and the character of the information which can be identified, will be discussed and analyzed in this presentation.

SEARCH FOR INFORMATION

A search has been conducted for information which could be of practical and readily applicable value to compressor users. Concurrently, the writer probed very scrupulously for any kind of feedback from the users of compressors. This feedback would be of paramount practical value to the compressor industry, to universities and to research establishments, by indicating to them the genuine interests and dilemmas of the users of compressors.

The search has covered the five year period, 1971

through 1975. Reviewed were general circulation technical magazines and two volumes of Purdue Compressor Technology Conference Proceedings, 1972 and 1974. The search did not cover textbooks, data books or manufacturers' bulletins.

For several years, this writer has scanned methodically twelve technical trade magazines for the information mentioned above. Associates in the engineering profession were asked to pass on to him all items of literature on air compressors noticed in the magazines and journals they receive. Contacts in the compressor industry were asked the same favor. Many complied with this request.

Additionally, the writer visited Republic Steel's Research Library and the Cleveland Public Library, searching methodically through some of the volumes and randomly checking many others.

No personal discretion was exercised in selecting the information for this study. All items found by this writer, his fellow engineers and his contacts in the compressor industry, were included in the bibliography.

SECTION I - SOURCES OF INFORMATION

The following sources of information have been identified:

- A. The publications which lead in coverage of air compressors are listed here in alphabetical order:
 1. Chemical Engineering
 2. Compressed Air Magazine
 3. Factory
 4. Hydraulics & Pneumatics
 5. Plant Engineering
 6. Power
 7. Purdue Compressor Technology Conference Proceedings
- B. The publications which occasionally include information on air compressors are as follows:
 1. Combustion
 2. Electric World
 3. Instrument Technology

4. Iron Age
5. Iron and Steel Engineer
6. Lubrication
7. Maintenance Engineering
8. Power Engineering

No attempt was made to indicate in the preceding lists the number of separate articles attributed to each of the publications. To do so, could be to some degree meaningless and unfair, and I suggest that caution be exercised in classifying the usefulness or the value of an information source solely on the basis of the number of articles published, recognizing that some articles are short and very general in nature, whereas others are very detailed and extensive.

Occasionally, a single article can represent a major offering to compressor users, for example the work of Charles W. Gibbs, a reprint from Compressed Air Magazine, ref. (11).

A case of a different nature which can serve as an example of a single entry representing a notable contribution to compressor literature can be seen in the comprehensive article authored by E.A. Baniak in Lubrication, ref. (23).

In still other cases, an article can be relatively short but very valuable to the scientific community and to the operators of compressed air systems, for example one can cite as such, the work of Prof. Vladimir Chlumsky of Makerere University, ref. (53). Prof. Chlumsky presented this paper at the 1972 Purdue Compressor Technology Conference.

On many occasions even a relatively brief item of information can be of a great practical value to many of the readers. An example: William O'Keefe's column in Power magazine concerning air compressor valve failures, ref. (39).

In total, sixty-one (61) articles on the subject of our current interest have been found. All of these are listed in the bibliography, and serve as the basis for the considerations which are shown in Sections II and III of this presentation.

Conclusions Stemming from Section I:

1. Insofar as the sources of information are concerned, these are ample, offer a wide variety of presentations and reflect diversified editing approaches. This balance seems to be in harmony with the needs of readers, and can be classified as sound and practical.
2. The emergence of the Purdue Compressor Technology Conferences, and the resulting proceedings represents a significant contribution to all sectors of the air compressor community. Purdue's program initiated in 1972, offers an excellent forum for presentations which are too specialized for general circulation press media.

SECTION II - AFFILIATION OF AUTHORS

It is highly desirable that all sectors of the compressor community contribute to the generation of

related information. It can be expected that the editors of technical magazines and those affiliated with compressor manufacturers will form the front line. However, it is equally important that other sectors of this community contribute their share of input.

The actual state of affairs is far short of these expectations.

Following is a breakdown of the bibliography, listed by the affiliation of the authors. An author is credited with one (1) article for each of his presentations irrespective of the subject or extent. A co-author is credited with one-half (0.5) of an article when different affiliations are evident. When the co-authors have a common affiliation, one (1) article is credited to all of them.

Affiliation of the Authors and the Number of Articles Credited to Each Group of Authors - Five Year Period, 1971 through 1975:

1. Editors	15.5
2. Compressor Manufacturing Companies	30
3. Universities	1.5
4. Research Establishments	1
5. Compressor Users, Industrial	1.5
6. Compressor Users, Utilities	0
7. Engineering and Construction Firms	3
8. Consultants	1.5
9. P.E.	1
10. Emeritus	1
11. Suppliers of Lubricants	2
12. Manufacturers of Instrumentation	2
13. Manufacturers of Air Filters	1
14. Manufacturers of Heat Exchangers	0
15. Manufacturers of Safety Valves	0

More Detailed Information with Reference to the Preceding Listing for the Same Five Year Period

1. Editors are represented by 15 authors and one co-author.
2. Those affiliated with compressor manufacturing companies, listed by company affiliation, contributed as follows:

Ingersoll-Rand Company	15 Articles
Joy Manufacturing	5
Allis-Chalmers Company	3
Worthington Corporation	3
Chicago Pneumatic	1
Davy Compressor Company	1
Elliott Company	1
Schramm, Incorporated	1
3. Contribution of Universities: Professor Vladimir Chlumsky, Makerere University, Kampala, Uganda, author, ref. (53), and Dr. V. H. Larson, Cleveland State University, Cleveland, Ohio, co-author, ref. (19).
4. Contribution of Research Establishments: Walter W. von Nimitz, Southwest Research Institute, San Antonio, Texas, ref. (59).
5. Contribution of Compressor Users, Industrial:

This writer, Republic Steel Corporation, Cleveland District, author, ref. (61), and Richard Ostrowski, Republic Steel Corporation, Chicago District, co-author, ref. (22).

6. Contribution of Compressor Users, Utilities: None.
7. Contribution of Engineering and Construction Firms: R. W. Abraham, The Badger Company, ref. (2), R. F. Neerken, The Ralph Parsons Company, ref. (4), and R. W. Foster, Commonwealth Assoc. Inc., ref. (5).

The contribution of the other affiliation groups is equally modest or none at all.

Conclusions Stemming from Section II:

1. The editors of technical magazines and the authors from a few compressor manufacturing companies were the only ones who contributed significantly to the generation of compressor literature.
2. All other sectors of the compressor community produced very modest contributions. The typical contribution of any of these sectors is shown by one (1) or two (2) papers in a five year period.

SECTION III - SUBJECT COVERAGE

Considering the very unbalanced situation which was observed with reference to the affiliation of authors, it should not be surprising to find the same state of affairs in the area of subject coverage.

In this section, each article is not necessarily rated as one entry; instead, when a presentation covered two or more subjects, or when it consisted of clearly defined distinct parts, each subject or part was rated as a separate entry.

The Listing of Subject Coverage, Five Year Period, 1971 through 1975

A. Air Compressors and Related Issues, Information of a General Character

- | | |
|--------------------|---|
| 1. Air Compressors | 4 |
| 2. Related Issues | 6 |

B. Air Compressors, More Specific Information

- | | |
|----------------------------------|---|
| 1. Compressors, Various Types | 7 |
| 2. Compressors, for Oil Free Air | 1 |
| 3. Compressors, Screw Type | 7 |
| 4. Compressors, Centrifugal | 5 |
| 5. Compressors, Reciprocating | 2 |
| 6. Compressors, Other Types | 0 |

C. Related Issues, More Specific Information

- | | |
|---|---|
| 1. Compressor Selection and Application | 3 |
| 2. Compressor Foundations | 1 |
| 3. Compressor Operation (Recips.) | 1 |
| 4. Compressor Maintenance (Recips.) | 1 |

- | | |
|---------------------------------------|---|
| 5. Compressor Lubrication | 3 |
| 6. Compressor Controls (Centrifugal) | 4 |
| 7. Instruments and Components | 3 |
| 8. Reciprocals, Air Valve Problems | 1 |
| 9. Operating Problems, Various Types | 1 |
| 10. Corrosion | 1 |
| 11. Protective Coatings | 1 |
| 12. Pulsations and Vibrations | 2 |
| 13. Oil Carryover | 1 |
| 14. Explosion Hazard | 1 |
| 15. Safety, General | 1 |
| 16. Air Receiver | 1 |
| 17. Air Filtering, Practice | 2 |
| 18. Noise, General | 3 |
| 19. Noise Abatement | 2 |
| 20. Costs, Recips. and/or Centrifugal | 2 |
| 21. Costs, Other Types | 1 |

D. Related Issues Lacking Coverage

1. Compressor Installation
2. Centrifugals, Operation and Maintenance
3. Condensate Removal, Oil Free Air
4. Intercoolers
5. Aftercoolers
6. Closed Loop Cooling Systems
7. Safety Valves
8. Check Valves for Centrifugal Air Compressors
9. Operational Dependability of Air Systems Based on Centrifugal Air Compressors

Conclusions Stemming from Section III:

1. The information of general character is more than ample. The information describing various types of air compressors is adequate. However, it is restricted to selected types of compressors and some of the machine types are not even mentioned.
2. Most vital to all sectors of the compressor community would be the information related to the specific issues. This information is very scarce and several very essential subject areas were not given any attention at all.

GENERAL CONCLUSIONS

On the basis of this study, the following general conclusions can be reached with reference to the scope of this undertaking as outlined at the beginning of the presentation:

1. At least seven (7) technical publications have an active interest in the subject area of air compressors. The input of the editors is noteworthy and the pages of these publications are open to prospective writers.
2. The input of some compressor manufacturing companies is very significant and valuable. Unfortunately, only a few of the companies contribute to this program. Others give only little contributions or none at all.
3. Very disappointing is the finding that only a meager input can be credited to the following:

Universities
Research Establishments
Compressor Users
Engineering Firms
Manufacturers of Components and Accessories

4. Subject coverage is very unbalanced and unsound. The availability of the most needed information is very limited. Many of the vital issues did not get any attention at all in the five year period which is covered by this study.
5. There are valid and obvious reasons why this information gap cannot be filled in by the editors of technical magazines or by compressor manufacturing companies. This program would be beyond their scope of activities.
6. Instead, the following are destined to generate the information which is most needed: Universities, Research Establishments, Compressor Users and Engineering Firms.

Will they?

SUPPLEMENTARY NOTE

Keeping up to date with the progress in compressor technology is one of the work assignments of this writer within his area of responsibilities in the Cleveland District of Republic Steel Corporation. So, the groundwork for this study has been performed largely within the area of the company's activities. On the other hand, the views expressed in this presentation and the conclusions reached, represent the personal opinions of this writer.

BIBLIOGRAPHY

CHEMICAL ENGINEERING

1. M. H. White, "Surge Control for Centrifugal Compressors", December 25, 1972.
2. Robert W. Abraham, "Reliability of Rotating Equipment", October 15, 1973.
3. Ronald P. Lapina, "Can You Rerate Your Centrifugal Compressor?", January 20, 1975.
4. Richard F. Neerken, "Compressor Selection for the Chemical Process Industries", January 20, 1975.

COMBUSTION

5. R. W. Foster, "Steam vs Air for Sootblowing", August, 1973.

COMPRESSED AIR

6. G. M. Diehl, "Think Quiet", reprint 1971.
7. Ward L. Luther, "The Ecology of an Air Compressor", August, 1972.
8. David E. Iocco, "Fundamental Principles for Designing Soil-Based Reciprocating Compressor Foundations", November, 1973.

9. "Synthetic Compressor Lubricants, September, 1974.
10. "Synergistic Coatings", April, 1975.
11. C. W. Gibbs, "Maintenance of Reciprocating Compressors", reprint 1975.

ELECTRICAL WORLD

12. "Utility Switches to Centrifugals for Station Air", March 1, 1971.

FACTORY

13. "Drop-in-Place Compressors Speed Startup", February, 1972.
14. B. B. Forristall, "Absolute Filtration Widens Plant Uses for Centrifugal Compressors", April, 1973.
15. Gary M. Rekstad, "Inroads for Oil-Free Air", February, 1975.
16. "Still Troubled by Air Compressor Noise?", December, 1975.

HYDRAULICS & PNEUMATICS

17. "Air System for Profit-Making Designs", April, 1971.
18. V. V. Jeste, "Are Your Compressors Overworked?", December, 1972.
19. N. R. Stull in consultation with V. H. Larson, "Air Compressors, Conditioning, Costs, and the Crunch", a series of articles which began in the June, 1975 issue.

INSTRUMENTATION TECHNOLOGY

20. W. S. Buzzard, "Controlling Centrifugal Compressors", November, 1973.

IRON AGE

21. "Assembly Operation Thrives with Computer Control", December 22, 1975.

IRON AND STEEL ENGINEER

22. Richard Ostrowski and G. J. Fink, "Compressed Air System Deficiencies and Maintenance", July, 1971.

LUBRICATION

23. E. A. Baniak, "Compressors-I, Principles and Types" and "Compressors-II, Applications and Lubrication", January-March, 1973 and April-June, 1973.

MAINTENANCE ENGINEERING

24. Fredrick E. Torala, "Filter Inspection and Maintenance", 1972.

PLANT ENGINEERING

25. "Packaged Air Compressors", November 26, 1971.
26. G. L. Taft, "Don't Overlook the Air Receiver", May 18, 1972.
27. Leonard Basaj, "How to Size an Air Compressor", June 15, 1972.
28. Gunter Weise, "Controlling Centrifugal Compressors", August 24, 1972.
29. Leonard Basaj, "Selecting Compressor System Components", September 21, 1972.
30. T. Caffrey, "Checking Actual Air Compressor Capacity", October 19, 1972.
31. T. J. Quinn, "Controlling Centrifugal Compressor Noise", April 4, 1974.
32. Richard L. Dunn, "Rotary Screw Air Compressors", May 16, 1974.
33. Richard G. Kent, "Monitoring Compressor Performance", October 31, 1974.
34. Ernest B. Cunningham, "Innovation in Air Compression", June 26, 1975.
35. James F. Hendricks, "Understanding Centrifugal Air Compressors", November 13, 1975.

POWER

36. William O'Keefe, "Air Systems: More Centrifugals, Dryer Air", November, 1971.
37. William O'Keefe, "Compressing Air for Industry and Utilities", April, 1972.
38. Lloyd M. Polentz, "Make Your Pressure Tests Safe, Effective", February, 1973.
39. William O'Keefe, "How Can We Prevent Air-Compressor Valve Failure?", March, 1974.
40. Henry Van Ormer, "Rotary-Screw Compressor Improvements are Continuing", October, 1974.
41. William H. Vedder, "Packaged Compressors Offer Savings", February, 1975.
42. William M. Kauffmann, "Audit Your Air System to Save Energy", May, 1975.
43. H. A. Van Ormer, "Right Selection and Installation Choices Improve Rotary-Screw-Compressor Results", July, 1975.
44. Don Lohse and Gordon Taft, "Putting Compressor Heat Energy to Work", August, 1975.
45. Alton P. Swett, "How Much Oil Is In Your Air System?", October, 1975.
46. David E. Iocco, "Simple Measures Prevent Resonance and Other Troubles in Reciprocating-

Compressor Piping, October, 1975.

47. W.O.K., "Sootblowing Systems Head the List", November, 1975.
48. John Johnson, "Fundamentals of Managing Air Systems in Industrial Plants", The 1975 Energy Management Guidebook.

POWER ENGINEERING

49. W. H. Vedder, "How to Select an Air Compressor Capacity Control System", December, 1974.

PURDUE COMPRESSOR TECHNOLOGY CONFERENCE - PROCEEDINGS

50. G. M. Diehl, "Compressor Noise Control", 1972, p. 60.
51. Arthur R. Woster, "Design of a New Reciprocating Compressor Line", 1972, p. 90.
52. Gordon L. Taft, "Selection and Application of the Industrial Screw Compressors", 1972, p. 306.
53. Prof. Vladimir Chlumsky, "Fire and Explosion Prevention in Compressed Air Plants", 1972, p. 442.
54. J. B. VanderKelen, F. King, M. L. Batch, "Compressor Lubrication", 1974, p. 95.
55. David E. Iocco, "Air Piping Design for Reciprocating Compressors", 1974, p. 140.
56. George M. Diehl, "Sound Power Measurements on Large Compressors Installed Indoors - Two-Surface Method", 1974, p. 230.
57. Dr. Ghanshyam C. Patel and Joseph Piersimoni, "Development Refinement of the High Performance Rotary Oil Flooded Compressors", 1974, p. 258.
58. Lon E. Rempfer, "100# Air...Centrifugal or Reciprocating?", 1974, p. 266.
59. Walter W. von Nimitz, "Reliability and Performance Assurance in the Design of Reciprocating Compressor Installations", 1974, Part I, p. 329; Part II, p. 337.
60. Dr. Arthur M. Seligman, "Full Automation of a Big Air Compressor Plant", 1974, p. 352.
61. Stan Nowacki, "Air Compressors for Plant-Air Application, Most Apparent Problems and Suggested Solutions", 1974, p. 360.