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March 29, 1999

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1999 APR 12 P 2:57

CPSC/OFFICE OF THE SECRETARY

Chairperson Ann Brown
U.S. Consumer Product Safety Commission
Washington, D.C. 20207

Re: Electricians Steel Fish Tape

Dear Chairperson Brown:

I recently represented the family of a consumer who was electrocuted in his own home while utilizing an electrician's steel fish tape. In our case, the fish tape was manufactured by Thomas & Betts Corporation out of Memphis, Tennessee.

The purpose of this letter is to request that the Consumer Product Safety Commission undertake an investigation into this product because the evidence that was uncovered during the course of this litigation disclosed that this tool is indeed a very dangerous product. According to the testimony of the defendant manufacturer, the demand for the tool has expanded greatly due to an expansion of the do-it-yourself market brought on by the advertising and marketing of such retailers as Home Depot, Costco, Orchard Supply Hardware and others.

The facts of our case indicated that the consumer was a 36 year old attorney who on Memorial Day weekend, 1995, wished to string stereo speakers through the attic of his home. He had with him a steel fish tape manufactured by Thomas & Betts Corporation through its subsidiary Holub Company. While attempting to fish the stereo wires through a wall, he came into contact with a live circuit and because the fish tape was the only grounding device in the attic, he was electrocuted resulting in his death. I represented the widow and four children as a result of that tragic death.

During the course of our investigation, Thomas & Betts Corporation denied that they had any knowledge of any prior litigation involving their product. Yet, contained on the product was a warning to the consumer indicating that the product should not be used around any live circuits. (See Exhibit #1 attached.)

In attempting to obtain the information which lead to the placement of this warning on the product, I was met with claimed ignorance and lack of knowledge relating to prior electrocutions or prior hazardous encounters with the tool.

Chairperson Ann Brown
March 29, 1999
Page 2

Our search through the database of the CPSC rendered no evidence indicating any information relating to these steel fish tapes. Therefore, we turned to the Federal Occupational Safety & Health Administration. Our search through that database indicated that in the last ten years or so there have been approximately 14 electrocutions involving many fatalities.

I enclose as Exhibit #2 the computer run from the Occupational Safety & Health Administration reflecting the case histories.

In addition to the Federal data, we attempted to contact California OSHA and they were not willing to release the information to us, but on my own I was able to find two other cases, both involving steel fish tape. The first was entitled Cotton vs. Holiday Inn which was recently settled in San Francisco Superior Court and the second case out of Odessa, Texas, entitled Jacobs vs. Kline Tools involving use of the steel fish tape and a young man who was badly burned.

In this litigation, it was our contention was that this was a dangerous tool and should not have been placed in the hands of ordinary consumers. The Marketing Director from Thomas & Betts Corporation, Mr. Andrew Paliszewski, testified in his deposition that it was not their intention to put these products in the hands of ordinary consumers. However, the marketing practices of the local hardware stores and do-it-yourself outlets would contradict that testimony.

In addition, my research through the common handyman journals showed that the fish tape is a common item being advertised for use by the consumer and in the case of a New York Times article with virtually no warnings attached to its use. (See Exhibit #3)

During the course of our litigation, I retained Mr. Fred Holmes who has spent 40 years with Pacific Gas and Electric Company which is the utility supplier in Northern California. I have enclosed his Declaration which was part of the proceedings in our case. His testimony I think should be valued highly in light of his experience and his testimony is that the utilities banned the use of these steel fish tapes over 15 years ago. (See Exhibit #4)

I have also enclosed the Declaration of Dr. David Thompson who taught Industrial Engineering at Stanford University for over 30 years and is an expert in the field of warnings. He testified that because professional electricians are supposed to be aware of the lockout procedures whenever using steel fish tape that the only way to communicate the lockout procedures to the ordinary consumer is through the use of a warning which, according to Dr. Thompson, is recommended by the American National Standards Institute in their Specification Z35.4. (See Exhibit #5)

I would sincerely request that the Consumer Product Safety Commission undertake an investigation of this product with a view to banning it from consumer use, or, in the alternative,

Chairperson Ann Brown
March 29, 1999
Page 3

imposing strict regulations with regard to warnings and strict instructions with regard to its potential use.

If you have any questions I would be happy to document further this complaint with deposition testimony referred to or any other information that you may wish.

Feel free to contact me at my office during standard business hours and I would be happy to provide any further information you may need.

Yours very truly,

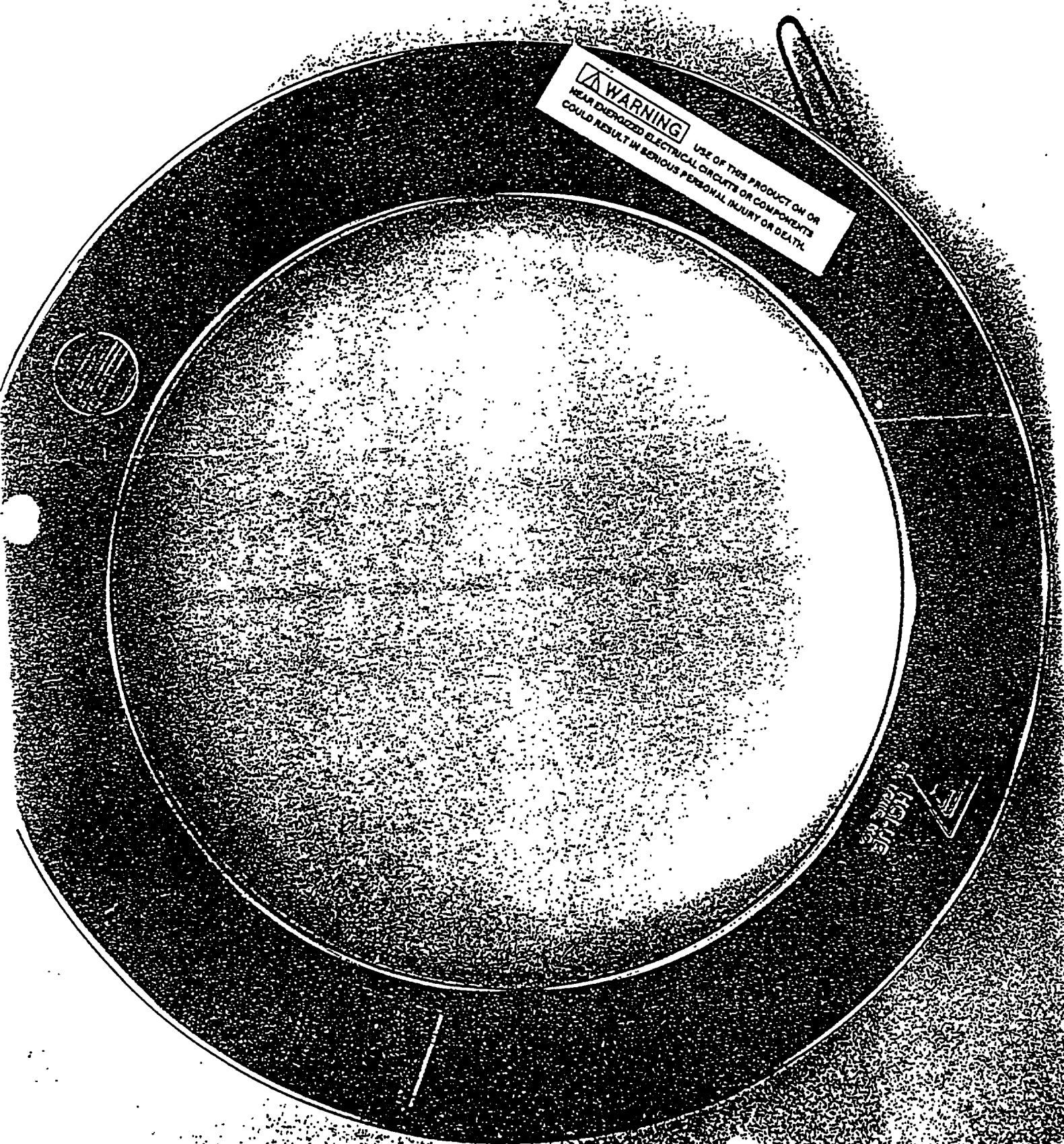
THE BOCCARDO LAW FIRM LLP

By 

JOHN C. STEIN

JCS:lo
Encls.

⚠ WARNING USE OF THIS PRODUCT ON OR
NEAR ENERGIZED ELECTRICAL CIRCUITS OR COMPONENTS
COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH.



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8 ATTORNEYS FOR PLAINTIFF

9 SUPERIOR COURT OF THE STATE OF CALIFORNIA

10 FOR THE COUNTY OF SANTA CLARA

11 MARY CATHERINE BERNAL, et al.,) CASE NUMBER: CV758248

12 Plaintiffs,)

13 vs.)

14 ORCHARD SUPPLY HARDWARE. a)
15 corporation, et al.,)

16 Defendants.)

) DECLARATION OF DAVID A.
) THOMPSON, PH.D. IN
) OPPOSITION TO MOTION FOR
) SUMMARY JUDGMENT BY
) THOMAS & BETTS
) CORPORATION

) DATE: September 23, 1997

) TIME: 9:00 A.M.

) DEPT: 22

) COMPLAINT FILED: 5-23-96

) TRIAL DATE: NONE

18
19 I, DAVID A. THOMPSON, PH.D., declare as follows: My Resume
20 is attached.

21 Warning Inadequate

22 The warning and photo attached hereto as Exhibit 4 (shown
23 herein enlarged: actual label 1.5" long with orange background)
24 is not adequate for several reasons.

25 The potential threat of "serious personal injury or death" is
26 correctly stated, and merits a much more substantial warning than

1 this. It should meet the American National Standards Institute
2 standard for warning labels, ANSI Z535, and it does not. That
3 standard, developed in the 1970's, was promulgated most recently
4 as ANSI Z535.4, Product Safety Signs and Labels. Such labels
5 "should (1) alert persons to a specific hazard, (2) the degree or
6 level of hazard seriousness, (3) the probable consequences of
7 involvement with the hazard, and (4) how the hazard can be
8 avoided."

9 The warning on the Holub tape does not specify (1) a specific
10 hazard, in this case Electrical shock or Electrocution. It does
11 define (2) the degree or level of the hazard seriousness, "serious
12 personal injury or death," but not in a manner appropriate to the
13 dangers involved. The likelihood of "serious personal injury
14 or death" warrant a DANGER (in red) signal word, not WARNING (in
15 black), according to the ANSI Standard. The Holub label does
16 define the probable consequences of involvement with the hazard,
17 but does so verbally, not graphically as required by the ANSI
18 Standard. It is well known that a picture communicates far more
19 rapidly and effectively than does text. In this case, a typically-
20 used graphic of a bolt of lightning striking the hand or body, for
21 example, would proclaim critical information clearly, regardless
22 of language skills. In the ANSI Standard label format, this
23 graphic is directly below or adjacent to the DANGER trigger word.

24 In addition, the Holub label is completely silent on item
25 (4), how to avoid the hazard. This is a serious omission, since
26 this required action statement tells the user how to remain safe--

1 what they can and must do to avoid the hazard. Only when the user
2 has a means of avoiding the hazard, expressed in a clear,
3 understandable manner, is there any opportunity for the product to
4 be used safely. In the present case, an appropriate action
5 statement, used on other fish tapes, is: "Turn off all electrical
6 power to work area." In a multi-person operation, such as a
7 factory' this would require "Lock Out-Tag Out" to assure that
8 someone else would not accidentally re-energize the relevant
9 circuits while the fish tape was in use.

10 Design Defective

11 However, not only is the warning label on the Holub
12 inadequate, its basic design is defective. Because it is
13 foreseeable that electrical shock may well result from the use of
14 the fish tape in pulling wires through conduits, the tape should
15 be designed to prevent electrical shock by being made non-
16 conductive. Comparable products that meet these needs are the
17 IDEAL S-Class[®] Non-Conductive Fish Tape and the FLEXMASTER[™] and
18 SUPERFLEX[®] non-conductive fish tapes made by defendant's
19 subsidiary.

20 From an engineering design viewpoint, it is important to
21 design the product to be safe under all foreseeable conditions of
22 use, if reasonably feasible to do so. In this case it is feasible,
23 using high tensile strength plastics, and other fish tape products
24 do so. Manufacturing a product with a known or foreseeable hazard
25 built in, and then adding a warning label, is, in my opinion,
26 inappropriate and irresponsible. Even if the warning label were

1 properly designed, which it was not in this case, the approach of
2 making the user responsible for noticing it and understanding it,
3 thereby avoiding hazards that could have been eliminated in design
4 and manufacture, should not be followed.

5 Summary

6 For the reasons listed and described above, this product in
7 its present form is defective and foreseeably hazardous to use. It
8 should not be made available for sale to the public.

9 I declare under penalty of perjury that the foregoing is true
10 and correct.

11 Executed this September 8, 1997, at San Jose, CA.

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14 DAVID A. THOMPSON, PH.D.

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David A. Thompson

Professor of Industrial Engineering and Engineering Management
Stanford University, Stanford, California, 94305

President, Portola Associates, Inc.
920 Incline Way, Suite F, Incline Village, Nevada 89451

Telephone: (702) 833-3304

Fax: (702) 833-3305

Areas of Specialization:

Human Factors Engineering
Ergonomics
Job Analysis and Evaluation
Biomechanics
Forensic Accident Reconstruction

Education:

1951: B.S. Mechanical Engineering, University of Virginia
1955: B.S. Industrial Engineering, University of Florida
1956: M.S. Engineering, University of Florida
1961: Ph.D. Industrial Engineering, Stanford University

Professional Registration:

- Registered Professional Industrial Engineer in California (No. 1 0084).
- Certified Professional Ergonomist (No. 048).
- Member, Industrial Engineering Applicant Review Committee of the California State Board of Registration for Civil and Professional Engineers, 1967.

Honors:

Graduated with High Honors, University of Florida
Elected to *Phi Kappa Phi* Honor Society
Elected to *Sigma Xi* Honorary Society (Scientific)

Listed in *Who's Who in the West*, *Who's Who in America*, *Who's Who in the World*, *Who's Who in Science and Engineering*, *Who's Who in the Safety Profession*, *Who's Who in Society*, *Personalities of the Americas*, *International Who's Who*, *American Men and Women of Science*, *Men of*

1965 Svenska Cellulosa AB, Sundsvall, Sweden. Analyze and recommend changes in the management control system and plant organization of the Ostrand Pulp Mill. (Consulting as a representative of Stanford Research Institute).

1965 College of San Mateo, Evening Division, San Mateo, CA. Teach classes in Work Simplification to elementary school cafeteria workers.

1966 Electrolux AB, London, England. Make production engineering analysis of plant performance.

1966-67 Almana Svenska Elektriska Aktiebolaget, Vasteras, Sweden. Teach a course in various aspects of production line conversion and consult with company engineers during conversion.

1966-67 United Air Lines, San Francisco, CA. Assist in the formulation of various wage programs.

1967 Pacific Telephone and Telegraph, San Francisco, CA. Make a multiple regression analysis of the cost-output relationship of a principal supplier, Western Electric, to determine the effect of their size on their prices to Pacific Telephone. Testify as an expert witness concerning the study findings before the California Public Utilities Commission, Application 49142.

1967 Alfa Laval Bergedorfer Eisenwerk, Hamburg, Germany. Perform general manufacturing systems audit, concentrating on manufacturing methods, productivity and plant layout. Work with plant engineers in planning programs to increase profitability.

1967 Electronic Associates, Incorporated, Palo Alto, CA. Evaluate the work-in-process and finished goods inventory as a function of manufacturing's contribution to project value added.

1967 ARINC Research, Incorporated, Santa Ana, Ca. Teach a short-course in Human Factors Design for Project and Design Engineers at the Naval Weapons Center, China Lake, CA.

1968 Plantronics, Incorporated, Santa Cruz, CA. Evaluate the use of a new design of headset, running a balanced experimental design in a medium-sized TWA reservation office to obtain quantitative and qualitative data.

1969 Willis & Associates, San Francisco, CA. Develop a program for manufacturing low-income housing for presentation to the U.S. Department of Housing and Urban Development.

1969 Stanford Research Institute, Menlo Park, Ca. Develop manpower planning ratios for selected manufacturing facilities in the U.S. and Scandinavia.

1970 Mipro Corporation, South San Francisco, CA. Analyze manufacturing methods and systems, recommend changes and assist in implementation.

1970 Western Union, San Francisco, CA. Design and supervise a sampling study of manpower requirements for message handling within California.

1970-72 Veterans Hospital, Palo Alto, CA. Design and manage a sampling study to analyze staff activities on two psychiatric wards.

1971 Cia Vale do Rio Doce, Rio de Janeiro, Brazil. Teach a training course in Methods Engineering and Man-Machine Systems.

1972-75 Stanford Research Institute, Menlo Park, CA. Develop and implement handling methods and costs.

- 1981-82 Envirotech Operating Systems, San Mateo, CA. Perform manpower analysis of wastewater treatment plants.
- 1982 Air Products and Chemical Company, Allentown, PA. Prepare ergonomic evaluation of office environment with emphasis on visual display terminals.
- 1982 Chevron, U.S.A., Concord, CA. Prepare ergonomic analysis of video display terminals and workplace for data entry operators.
- 1983 International Brotherhood of Teamsters, Local 396, Modesto, CA. Perform analysis of physical effort and endurance in handling bags of powdered milk. Recommend number of workers needed for a particular facility.
- 1983-86 San Francisco Municipal Railway, San Francisco, CA. Design a test and administration procedures to measure strength of cable car operators. Review ergonomic aspects of driver's workspace in new bus designs at the manufacturer's facilities prior to commencement of manufacturing busses destined for San Francisco.
- 1983-84 Inet Corporation, Sunnyvale, CA. Prepare ergonomic evaluation of nuclear material inspectors for the U.S. Arms Control & Disarmament Agency, for submission to the United Nations International Atomic Energy Agency.
- 1983-84 Pacific Gas & Electric Company, San Francisco, CA; International Brotherhood of Electrical Workers, Walnut Creek, CA. Analyze physical stress in an office automation environment; redesign the workspace and working environment to reduce physical tension and fatigue, and to increase productivity.
- 1983-85 International Brotherhood of Teamsters, Local 490, Vallejo, CA. Prepare analysis of physical work difficulty and stress in materials handling in a large grocery chain warehouse.
- 1984 United Furniture Workers of America, San Rafael, CA. Conduct work measurement studies to evaluate new incentive pay plan at a furniture manufacturer in Sacramento. (Consulting).
- 1984-85 Pacific Gas & Electric, San Francisco, Ca. Evaluate physical evidence of human performance activity related to product liability litigation.
- 1984-86 Pacific Bell, San Francisco, CA. Review drafts of VDT Guidelines for office supervisors and comment. Evaluate the design and layout of a data entry office using VDTs extensively.
- 1984-87 Stanford University Libraries, Stanford, CA. Assist in the design layout of VDT workstations and the selection of hardware in the Cataloging, Acquisitions, and Serials sections.
- 1985 Mouse Systems Corporation, Santa Clara, CA. Design research experiment protocol for testing new mice designs.
- 1986 United Furniture Workers of America, San Leandro, CA. Function: Analysis of production procedures and measurement of performance times at a large mattress manufacturing plant.
- 1986-90 PepsiCo, Incorporated, Dallas, TX. (Includes Frito-Lay and Franchise Services, Incorporated). Study physical requirements of truck drivers and warehouse personnel; suggest safety measures; and design alternative, modified jobs for light-duty assignments to injured personnel.

- 1990- Krames Communications, San Mateo, CA. Consulting and editorial assistance in the content and format of training material related to materials handling, repetitive motion injuries, industrial ergonomics, and VDTs. Attend shooting of VDT video, coach actors.
- 1991 Varian Associates, Fremont, CA. Ergonomic analysis of clean room laboratory.
- 1991 San Francisco Newspaper Agency, San Francisco, CA. Ergonomic audit of newspaper agency offices, the print room, the garage, and the mail room.
- 1991 Continental Engineering, Los Angeles, CA. Consult for furniture manufacturer producing specialty equipment for VDT operators, emphasizing equipment ergonomics.
- 1991 Apple Computer Company, Cupertino, CA. Consulting on a new product testing laboratory; ergonomic evaluation of new Macintosh Notebook computer prior to public release.
- 1991- Rucker Fuller, San Francisco, CA. Ergonomic evaluation of workstation design and office layout of San Francisco headquarters; assist in training program design.
- 1991 PAL Consultants, San Jose, CA. Analyze NRC Human Factors Research Center.
- 1991 Santa Cruz County, California. Ergonomic analysis and redesign of workstations.
- 1991-92 Vision Service Plan, Sacramento, CA. Consulting on the design and layout of computer workstations in large medical facility.
- 1991-92 Sun Microsystems, Mountain View, CA. Type 5 Keyboard and Mouse Ergonomic Verification Study.
- 1992 Sun Microsystems, Mountain View, CA. Ergonomic evaluation of proposed portable computer.
- 1992 Personal Health Designs, Loudonville, NY. Review script for VDT brochure on office ergonomics.
- 1992-93 Safeway, Oakland, CA. Ergonomic analysis of new checkstand designs; review script for ergonomics video.
- 1993 Genentech, Inc., South San Francisco, CA. Ergonomic analysis of production and packaging facility.
- 1993-94 New United Motors Manufacturing Company, Fremont, CA. Ergonomic analysis of cumulative trauma during new model start-up (jointly with Cal/OSHA).
- 1994 Safeway, Oakland, CA. Analysis of cumulative trauma injuries at Tempe, Arizona Distribution Center and report to Arizona Department of Occupational Safety and Health.
- 1995 Santa Clara Valley Water District, San Jose, CA. Ergonomic critique of computer graphics workstations used by engineering draftsmen, and VDT workstations used by desktop publishers.
- 1996 Acer Peripherals, Inc., Taiwan, R.O.C. Assist in the design of a new ergonomic keyboard.
- 1996 Microsoft, Redmond, WA. Analysis of selected keyboard ergonomic characteristics.
- 1997 Sun Microsystems, Mountain View, CA. Research and consulting in the design of new ergonomic keyboard.

1987-88 - Consultant, San Francisco General Medical Center, San Francisco, CA. Function: Study and advise on the job design characteristics and testing equipment for patients in the Division of Occupational Medicine.

1990-91 Consultant, San Francisco General Medical Center, San Francisco, CA. Function: design and assemble hardware and software system to measure typists' EMG activity, and reduce the data to charts and graphs. Assist in conducting research study of a variable geometry computer keyboard using this data analysis system. Run pilot study and publish results.

1993- Principle investigator, in-house study at Portola Associates. Function: analysis of computer keyboard tactile feedback.

Publications:

"Rapid Amortization of Emergency Facilities", Engineering Economist, Summer 1957.

Solutions to Problems, Principles of Engineering Economy (Grant Ireson), Ronald Press, New York 1960.

(With M. Acker) "Development of the Prevocational Unit: Standard Rehabilitation Service", Archives of Physical Medicine, Vol. 14, May 1960, p. 195.

(With M. Acker) "A Detailed Physiological Difficulty Analysis of Manual Work", Journal of Methods Time Measurement, Sept.-Oct. 1960, p. 1-6.

"Time Study Sample Size - The Effect of Effort Rating Variation", Journal of Industrial Engineering, March-April 1961, p. 122.

On the Evaluation of Human Ability to Perform Industrial Work, unpublished doctoral dissertation, Stanford University, Stanford, CA, June 1961.

"The Development of a Quantified Difficulty Measure for Precision Work", The Journal of Methods Time Management, July-August 1963, pp. 8-16.

"A Mathematical Correction for Time Study Pace Estimates", Time and Motion Study, August 1963, pp. 29-32.

"Development of an Elemental Motion Analysis for Man-Work Matching in Vocational Rehabilitation and Placement", Archives of Physical Medicine and Rehabilitation, October 1963, pp. 545-548.

"Calibrating Observer Bias in Time Study Pace Estimation", Journal of Industrial Engineering, Technical Notes, November-December 1963, p. 345.

(With P. Applewhite and G. Pauhle) "Frequency Distribution Shape and Work Output", Perceptual and Motor Skills, Vol. 20, 1965, pp. 407-408.

(With P. Applewhite and G. Pauhle) "Prediction of Drive State and Output from Frequency Distribution Shape", Perceptual and Motor Skills, Vol. 21, 1965, pp. 505-506.

"Time Studies", Pacific Factory, February 1965, p. 8, 31.

An Industrial Engineering Analysis of the Ostrand Sulfate Pulp and Chloride Mills, prepared for Svenska Cellulosa AB, Sundsvall, Sweden, Stanford Research Institute Report I-5559, October 1965.

(With P. Kirschner) "Decision Tree Display Parameters for Interactive Graphics Computers", International Conference in Interactive Techniques in Computer-Aided Design Proceedings, Bologna, Italy, September 21-23, 1978.

Human Factors Issues in Proposed Aircraft Caution and Warning System Experimentation, NASA Contract Report, Contract NCA2-DR 745-710, Ames Research Center, Moffett Field, CA, May 1979.

"Commercial Air Crew Detection of System Failures: State of the Art and Future Trends", NATO Symposium on Human Detection and Diagnosis of System Failures Proceedings, Roskilde, Denmark, August 4-8, 1980. Also in Rasmussen, J. and W. B. Rouse, eds., Human Detection and Diagnosis of System Failures, Plenum Press, New York, 1981.

(With S. Douglas and M. Junge) "Information-Decision-Action Charts: A Tool for the Ergonomics Analysis of Computerized Control and Information Systems", Joint IEA/NES International Conference on Ergonomics in Action Proceedings, Oslo, Norway, August 20-22, 1980.

"Staffing Recommendations, Fairfield-Suisun Subregional Wastewater Treatment Plant", submitted to Solano County for Envirotech Operation Services, San Mateo, CA, February 26, 1982.

"Ergonomic Analysis of Key Data Entry Facility", submitted to Chevron U.S.A., Concord, CA, March 5, 1982.

"Computerized Wastebaskets and Electronic Bookcases: New VDT Interfaces", Human Factors Society Bulletin, Vol. 26 No. 4, April 1983.

"Unrest in the Data Entry Department: Time Running Out?", Computer Decisions, Vol. 15 No. 5, p. 164, May 1983 (Interview).

(With Thomas Sheas of INET Corporation) Human Factors Affecting IAEA Inspector Performance, prepared for the U.S. Arms Control and Disarmament Agency, September 1983, 83 pages.

(With C. Lupi, L. Morse, J. Ladou, and V. Emster) "Carpal Tunnel Syndrome and Occupation: A Matched Case Control Study", Clinical Research, 32, #1, 40a, 1984.

An Analysis of Work Methods and Potential Health Hazards at the PG&E Payment Processing Center submitted jointly to PG&E, San Francisco, CA, and IBEW Local 1245, Walnut Creek, CA, January 6, 1984 (revised).

(With T. Meites, M. Herbert and T. Mc Laughlin) A Program to Design and Develop an Unbiased New Hire Screening Process for Entry Level Jobs at Libbey-Owens-Ford, for the U.S. Equal Employment Opportunity Commission, Chicago District Office, July 1, 1985.

Ergonomic Analysis of Selected Repetitive Motions Jobs in Central Mail Remittance at Pacific Bell, a report to Cal/OSHA, San Francisco, CA, June 1, 1986.

(With D.C. McEvers and C.A. Olson) "Case Study in Data Entry System Design", Human Factors Society 30th Annual Conference Proceedings, Dayton, OH, September 1986.

"Comparison of Stress Levels and Musculoskeletal Discomfort Among VDT and Other Machine Operators", International Ergonomics Association 10th International Congress Proceedings, Sydney, Australia, August 1-5, 1988.

"Fault Logic Analysis of Product Safety", Proceedings of the Human Factors Society, Anaheim, California, October 24-28, 1988, pp. 527-531.

Bay Area Hospital Management Engineers, Palo Alto,

g for an HMO", 9th Annual Symposium on Health Care
CA, November 20-21, 1975.

ed Assembly", NATO International Symposium on Human
ny, March 8-12, 1976.

obot Programming", Forschungsinstitut Fur Anthroptech-
of Germany, March 15, 1976.

s Handling", Peninsula Manufacturers Association Sympo-
A, March 31, 1976.

ed Automation Systems", Collins Radio (Rockwell Intern-
posium, Newport Beach, CA., April 22, 1976.

3-of-Constraint Robot Performance Evaluation Test", Thir-
annual Control, Cambridge, MA, June 17, 1977.

uation of Remote Teleoperator Robot Manipulation", Seventh
on Industrial Robots, Tokyo, Japan, October 21, 1977.

ars for Interactive Graphics Computer", International Confer-
in Computer-Aided Design, Bologna, Itay, September 22,

r Power Industry", Lawrence Livermore Laboratory, Livermore,

Design", National Fire Prevention Association, Hilton Hotel, San
co, CA, February 22, 1979.

oid It in Software Systems", Software Underground, San Francisco,

Industrial Engineer in Title VII Litigation", 6th Annual Employment
posium, USF Law School, San Francisco, CA, January 11, 1980.

or safety engineers and managers, for Peninsula Industrial Medi-
ege, Sunnyvale, CA, February 1980.

and Industrial Engineering Can Learn From Each Other", Key-
Occupational Medicine Seminar, SRI International, Menlo Park,

Occupational Medicine, University of California San Francisco,
o, CA, March 27, May 15 and June 19, 1980.

Mateo County Medical Society, San Mateo, CA, April 30, 1981.

urance", American Society for Quality Control Annual Confer-
CA, May 26, 1981.

ality", ASQC Stanford Conference, Luncheon banquet speech,
1.

Occupational Medicine, University of California San Francisco,
1982.

n Regional Conference of the
A, January 22, 1964.

Human Factors Society, Bay Area

ance Measurements", Human
ber 20, 1964.

Industrial Engineers, Peninsula
55.

Industrial Engineers, Peninsula Chap-

ck Delay", Human Factors Soci-

y for Quality Control, San Jose

ck Delay", Human Factors Soci-

artment of Industrial and Sys-
March 1, 1967.

val Ordinance Test Center,

merican Documentation Insti-

Seminar, Shell Development

ctual Activities", Interna-
September 9, 1968.

Time Through a Data
20, Columbia, OH, Octo-

Industrial Engineers'
, 1968.

an Institute of Industrial
1968.

y Control Society, Penin-

Human Factors Society, Bay

, 1969.

for Information Display,

- "Systems Dynamics in Hospital Analysis", Bay Area Hospital Management Engineers, Palo Alto, CA, October 3, 1975.
- "Systems Dynamics in Financial Planning for an HMO", 9th Annual Symposium on Health Care Delivery Systems, Carmel-by-the-Sea, CA, November 20-21, 1975.
- "The Man-Robot Interface in Automated Assembly", NATO International Symposium on Human Factors, Berchtesgaden, West Germany, March 8-12, 1976.
- "Man-Machine Systems Analysis of Robot Programming", Forschungsinstitut Fur Anthropotechnik, Mechenhelm, Federal Republic of Germany, March 15, 1976.
- "Application of Robotics to Materials Handling", Peninsula Manufacturers Association Symposium on Back Injuries, San Mateo, CA, March 31, 1976.
- "Programmable Robotics in Advanced Automation Systems", Collins Radio (Rockwell International) Production Managers Symposium, Newport Beach, CA., April 22, 1976.
- "The Development of a Six Degree-of-Constraint Robot Performance Evaluation Test", Thirteenth Annual Conference on Manual Control, Cambridge, MA, June 17, 1977.
- "Comparative Performance Evaluation of Remote Teleoperator Robot Manipulation", Seventh Annual International Symposium on Industrial Robots, Tokyo, Japan, October 21, 1977.
- "Decision Tree Display Parameters for Interactive Graphics Computer", International Conference in Interactive Techniques in Computer-Aided Design, Bologna, Italy, September 22, 1978.
- "Human Factors in the Nuclear Power Industry", Lawrence Livermore Laboratory, Livermore, CA, September 29, 1978.
- "Command-Control Console Design", National Fire Prevention Association, Hilton Hotel, San Francisco Airport, San Francisco, CA, February 22, 1979.
- "Human Error and How to Avoid It in Software Systems", Software Underground, San Francisco, CA, November 16, 1979.
- "The Function and Role of an Industrial Engineer in Title VII Litigation", 6th Annual Employment Discrimination Litigation Symposium, USF Law School, San Francisco, CA, January 11, 1980.
- "Job Design", a short course for safety engineers and managers, for Peninnsula Industrial Medical Clinic, Mission Valley College, Sunnyvale, CA, February 1980.
- "What Occupational Medicine and Industrial Engineering Can Learn From Each Other", Key-note Address, Second Annual Occupational Medicine Seminar, SRI International, Menlo Park, CA, April 18, 1980.
- "Ergonomics", Miniresidency in Occupational Medicine, University of California San Francisco, Medical School, San Francisco, CA, March 27, May 15 and June 19, 1980.
- "Ergonomics Principles", San Mateo County Medical Society, San Mateo, CA, April 30, 1981.
- "Human Factors in Quality Assurance", American Society for Quality Control Annual Conference, Tutorial, San Francisco, CA, May 26, 1981.
- "Controlling Organization Quality", ASQC Stanford Conference, Luncheon banquet speech, Palo Alto, CA, October 3, 1981.
- "Ergonomics", Miniresidency in Occupational Medicine, University of California San Francisco, Medical School, San Francisco, CA, February 4 and 25, 1982.

"Safety Ergonomics", American Society of Safety Engineers, Sunnyvale, CA, October 14, 1986.

"The Role of Ergonomics in Safety Engineering", American Back Society Fall Symposium, San Francisco, CA, December 4-6, 1986.

"VDT Office Ergonomics for Librarians", San Francisco State University, San Francisco, CA, May 28, 1987.

"Ergonomics Postgraduate Seminar", Annual Conference on Occupational Health, American Academy of Occupational Medicine, San Francisco, CA, October 19, 1987.

"A Look at the Working Environment", Stress Management in the Transit Industry, University of Wisconsin, Milwaukee, WI, October 28, 1987.

"Introduction and Overview of Basic Occupational Engineering", Ergonomics: Human Factors in the Industrial Environment, Northern California Occupational Health Center, University of California, Berkeley, CA, March 22-23, 1988.

"Comparison of Stress Levels and Musculoskeletal Discomfort Among VDT and Other Office Machine Operators", Proceedings of the International Ergonomics Association, Sydney, Australia, August 1-5, 1988.

"Work Modification and Workplace Re-design: Biomechanical Applications of Ergonomic Principles", Industrial Clinic Series, American Back Society Fall Symposium on Back Pain, San Francisco, CA, December 3, 1988.

"Cal/OSHA VDT Advisory Committee Report", Pacific Coast Electrical Association, San Jose, CA, April 13, 1989.

"Ergonomics for Health Care Workers", Occupational Safety and Health Institute, University of California, Santa Cruz, August 16, 1989.

"The Worker-Machine Interface", Institute of Industrial Engineers, Peninsula Chapter, Mountain View, CA, February 13, 1990.

"Seating Ergonomics", Occupational Medicine Conference, Valley Health Center, San Jose, CA, February 28, 1990.

"VDT Workplace Ergonomics", Hewlett-Packard Corporation, Palo Alto, CA, March 25-26, 1990.

"Repetitive Strain Injury", AT&T Joint Workcenter Planning Conference, St. Louis, MO, June 19-20, 1990.

"Cumulative Repetitive Motion Trauma", Occupational Health Nurse Symposium, O'Connor Hospital, Sunnyvale, CA, July 11, 1990.

"New and Changing Roles of Human Factors in the 1990's", Bay Area Chapter Human Factors Society, Sunnyvale, CA, September 26, 1990.

"Repetitive Strain Injury", San Francisco State University, San Francisco, CA, October 2, 1990.

"Ergonomics for VDT Users", Association of Hospital Employee Health Professionals, San Francisco, CA, October 11-13, 1990.

"VDT Workstations: Ergonomics, Health, Safety, and Productivity" Data Entry Management Association 14th Annual Conference and Exposition, Las Vegas, NV, October 16, 1990.

"Office Ergonomics Standards", TUV Rheinland of North America, Inc., Orlando, Florida, Nov. 1-2, 1990.

"VDT Ergonomics: Problems/Policies", American Society of Public Administration, San Francisco, CA, May 7, 1992.

"Terminal Disease: Are VDT's a Problem?", Technology and Society Committee, Mountain View, CA, May 12, 1992.

"Cumulative Trauma Disorders", University of Southern California Human Factors in Safety Management, Sunnyvale, CA, May 21, 1992.

"VDT Ergonomics and Safety", American Library Association, San Francisco, CA, June 29, 1992.

"Job Analysis", University of California Labor and Occupational Health Program, Burlingame, CA, August 13, 1992.

Panel: "Warnings", Human Factors Society, Tandem Computer Corporation, Cupertino, CA, November 18, 1992.

"Ergonomics", University of California Occupational and Environmental Medicine - Intensive Residency, San Francisco, CA, January 28, 1993.

"VDT Workplaces in a Global Market", TUV Rheinland, San Diego, CA, February 24-25, 1993.

"Keyboard Research Methodology", San Jose State University, San Jose, CA, April 27, 1993.

"Ergonomics in the Workplace", Eighth Annual Conference of the Society for Industrial and Organizational Psychology, San Francisco, CA, May 1, 1993.

"The Current State of Safety and Health in Eastern Europe", American Society of Safety Engineers, Greater San Jose Chapter, Sunnyvale, CA, May 11, 1993.

"Keyboard Research", Bay Area Ergonomic Study Group, Saint Francis Hospital, San Francisco, CA, January 11, 1994.

"Computer Keyboard Ergonomics", Mills Peninsula Hospital, Burlingame, CA, March 3, 1994.

Silicon Valley Ergonomics Conference and Exposition, San Jose, CA, May 21-24, 1995:

- Panel: *Human Factors in Litigation* "Use of Computer Programs & Graphics in Accident Reconstruction"
- Panel: *Ergonomically Designed Keyboards* "RSI in the Office"
- Session Chair: *Ergonomics in Computerized Offices*.

National Ergonomics Exposition and Conference, San Jose, CA, October 17-19, 1995:

- Talk: Computer Ergonomics: How to Choose the Right Keyboard
- Panel Participant: Ergonomic Pearls of Wisdom: 60 Ideas in 60 Minutes
- Panel Moderator: Employee Involvement: A New United Motor Manufacturing Ergonomics Case Study

"Industrial Ergonomics", speech to occupational physicians from Thailand for University of California Medical Residency Program, Miyako Hotel, San Francisco, CA, January 30, 1996.

"The Product Warning Expert: When is a warning not a warning?", Bar Association of San Francisco, sponsored by Bar Association of San Francisco, October 29, 1996.

"An Economic Evaluation of Ergonomics", Golden Empire Safety Society, at Stockdale Country Club, Bakersfield, CA, January 28, 1997.

compressor motor was overlooked. After disconnecting the energized conductor from the compressor motor and taping the ends with electrical tape, the victim pushed a fish tape through the conduit till its end protruded. He then attached the conductor to the fish tape, pulling it back through until the energized wire protruded from the conduit. He then removed the electrical tape. The victim was holding the fish tape, grounded against the conduit, when he contacted energized wire and collapsed, breaking contact. Cardiopulmonary resuscitation (CPR) was begun in about 5 minutes by emergency medical services but was unsuccessful. It is recommended that adequate identification be provided at control panel boxes for disconnecting means and circuits, that standard operating procedures for circuit testing be reinforced, and that training in CPR be offered to employers and employees.

NOT CLEAR IF
HOLDING HOUSING
OR FISH TAPE.

DESCRIPTORS: NIOSH Publication; NIOSH Author; Region 3; FACE 87 63;
Electrical workers; Electrical hazards; Accident analysis; Accident prevention; Safety practices

4/9/12 (Item 12 from file: 161)
DIALOG(R)File 161:Occ.Saf.& Hth.
(c) Format only 1998 The Dialog Corp. All rts. reserv.
0131899 NIOSH-00170038

FACE Report: Electrician Dies in Ohio
Anonymous

Division of Safety Research, NIOSH, U.S. Department of Health and Human Services, Morgantown, West Virginia, Report Number FACE-86-52, 6 pages
September 17, 1986

An electrician employed by an electrical contractor died of injuries from an electrical discharge or electrical explosion which occurred while he was trying to wire around a circuit breaker with blown fuses. Branch circuit conductors were to be installed to an existing 20 amp 277 volt (V) circuit breaker in a 480V/277V electrical panelbox. The electrician tried to pass a copper wire into the top of the panelbox; the fishtape used to guide the wire accidentally entered the rear of a meter base, damaging the meter base and creating a dead short. Three fuses in a current limiting circuit breaker in the adjacent electrical panel opened. The electrician connected jumper wire to each of these terminals in an attempt to bypass the circuit breaker. He connected the first jumper on Phase-A to one of the energized buss terminals on the 480V circuit breaker. Phase-A was energized from meter socket to fuse terminals, and due to the dead short in the meter socket, Phase-B was also energized back to the fuse terminal and jumper. The electrician touched the energized tip of Phase-B to the energized buss connection and the 480V breaker arced. The electrician received electrical burns on 95 percent of his body, and 15 other people were injured. Recommendations arising from this accident included: never bypassing electrical safety devices; deenergizing electrical systems prior to any work being performed on them; and proper training of employees in the use

NOT RELATED
TO FISH TAPE
HOUSING.

of electrical testing devices.

DESCRIPTORS: NIOSH Publication; NIOSH Author; Region 5; FACE 86 52;
Electrical workers; Safety practices; Safety research; Electrical

Set S4, browsing format:

4/8/1 (Item 1 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

09318336 SUPPLIER NUMBER: 19166946 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Tools.(Electrical Products Yearbook)

WORD COUNT: 3426 LINE COUNT: 00270

SPECIAL FEATURES: illustration; photograph

INDUSTRY CODES/NAMES: ELEC Electronics; BUSN Any type of business

DESCRIPTORS: Electricians--Equipment and supplies; Tools--Evaluation

PRODUCT/INDUSTRY NAMES: 3423000 (Hand & Edge Tools); 3546000 (Power
Driven Hand Tools)

SIC CODES: 3423 Hand and edge tools, not elsewhere classified; 3546
Power-driven handtools

FILE SEGMENT: TI File 148

4/8/2 (Item 2 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

09137547 SUPPLIER NUMBER: 18899327 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Getting the most from your transformer installation.(Cover Story)

WORD COUNT: 5308 LINE COUNT: 00416

SPECIAL FEATURES: illustration; chart

INDUSTRY CODES/NAMES: ELEC Electronics; BUSN Any type of business

DESCRIPTORS: Electric transformers--Management

PRODUCT/INDUSTRY NAMES: 3612000 (Transformers)

SIC CODES: 3612 Transformers, except electronic

FILE SEGMENT: TI File 148

4/8/3 (Item 3 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

08777454 SUPPLIER NUMBER: 18378510 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Suppliers. (part 3, from Graef, Anhalt, Schloemer & Assoc. through Miracle
Recreation Eqpt. Co.)(1996 Municipal Index Special Issue)

WORD COUNT: 20471 LINE COUNT: 01749

INDUSTRY CODES/NAMES: REG Business, Regional

DESCRIPTORS: Municipal services--Equipment and supplies; Industrial
suppliers--Directories

FILE SEGMENT: MI File 47

4/8/4 (Item 4 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

08777451 SUPPLIER NUMBER: 18378507 (USE FORMAT 7 OR 9 FOR FULL TEXT)

**Products and services. (part 10, from Water Meters, Residential through
Miscellaneous)(1996 Municipal Index Special issue)(Directory)**

WORD COUNT: 10068 LINE COUNT: 00893

INDUSTRY CODES/NAMES: REG Business, Regional

DESCRIPTORS: Local government--Purchasing; Municipal services--Equipment
and supplies; Public works equipment--Directories

PRODUCT/INDUSTRY NAMES: 4941100 (Water Treatment); 3569200 (Water & Waste
Treatment Equip); 3824231 (Water Meters); 2879600 (Herbicides); 1389110
(Well Pumping Services)

SIC CODES: 4941 Water supply; 3589 Service industry machinery, not
elsewhere classified; 3824 Fluid meters and counting devices; 2879
Agricultural chemicals, not elsewhere classified; 1389 Oil and gas field
services, not elsewhere classified

FILE SEGMENT: MI File 47

4/8/5 (Item 5 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

07806388 SUPPLIER NUMBER: 17001036 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Versatile mobile mount. (MCA 2000 NMO mobile antenna mount) (Evaluation)

WORD COUNT: 771 LINE COUNT: 00059

SPECIAL FEATURES: illustration; photograph

INDUSTRY CODES/NAMES: ADV Advertising, Marketing and Public Relations;
TELC Telecommunications

DESCRIPTORS: Radio equipment--Evaluation

PRODUCT/INDUSTRY NAMES: 3662182 (Citizens Band Equipment)

SIC CODES: 3663 Radio & TV communications equipment

TRADE NAMES: MCA 2000 NMO (Radio equipment)--Evaluation

FILE SEGMENT: TI File 148

4/8/6 (Item 6 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

07566767 SUPPLIER NUMBER: 16308638 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Maintenance tips and tricks.

WORD COUNT: 8194 LINE COUNT: 00646

SPECIAL FEATURES: illustration; chart; photograph

INDUSTRY CODES/NAMES: ENG Engineering and Manufacturing

DESCRIPTORS: Plant maintenance--Technique

FILE SEGMENT: TI File 148

4/8/7 (Item 7 from file: 148)
DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.
07215647 SUPPLIER NUMBER: 14889744 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Almost a Scorpio. (installation of network server and wiring)
WORD COUNT: 3005 LINE COUNT: 00212
INDUSTRY CODES/NAMES: LIB Library and Information Science
DESCRIPTORS: Computer networks--Installation
PRODUCT/INDUSTRY NAMES: 3661205 (Local Area Network Equip)
SIC CODES: 3661 Telephone and telegraph apparatus
FILE SEGMENT: TI File 148

4/8/8 (Item 8 from file: 148)
DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.
06199223 SUPPLIER NUMBER: 13619887 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Hand tools. (Directory)
WORD COUNT: 933 LINE COUNT: 00068
SPECIAL FEATURES: illustration; photograph
INDUSTRY CODES/NAMES: TRAN Transportation, Distribution and Purchasing
DESCRIPTORS: Tools--Directories; Tool industry--Products
SIC CODES: 3423 Hand and edge tools, not elsewhere classified; 3546
Power-driven handtools
FILE SEGMENT: TI File 148

4/8/10 (Item 10 from file: 148)
DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.
04901244 SUPPLIER NUMBER: 09131996 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Your chance to shine. (marketing electrical products) (includes related article on power generators)
WORD COUNT: 1407 LINE COUNT: 00104
SPECIAL FEATURES: illustration; table; photograph
INDUSTRY CODES/NAMES: CNST Construction and Materials
DESCRIPTORS: Electrical equipment and supplies--Marketing; Merchandising
--Economic aspects; Hardware stores--Marketing; Electric generators--
Marketing; Home center stores--Marketing
SIC CODES: 5251 Hardware stores
FILE SEGMENT: TI File 148

Set S6, browsing format:

6/8/1 (Item 1 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

05941966 SUPPLIER NUMBER: 12583074

Tapeworm infection - the long and the short of it. (Editorial)

INDUSTRY CODES/NAMES: HLTH Healthcare

DESCRIPTORS: Cestode diseases--Diagnosis; Cysticercosis, Cerebrospinal--
Diagnosis

FILE SEGMENT: MI File 47

6/8/2 (Item 2 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

05928093 SUPPLIER NUMBER: 11839958 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Can this marriage be saved? (a Honeywell Chronotherm II thermostat may
solve furnace-thermostat incompatibility) (Perfect Climate News)

WORD COUNT: 746 LINE COUNT: 00060

SPECIAL FEATURES: illustration; photograph

INDUSTRY CODES/NAMES: CNST Construction and Materials

DESCRIPTORS: Heating--Control; Thermostat--Evaluation; Furnaces--
Equipment and supplies; Heating and ventilation industry--Equipment and supplies

SIC CODES: 1711 Plumbing, heating, air-conditioning; 3585 Refrigeration
and heating equipment

FILE SEGMENT: TI File 148

6/8/3 (Item 3 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

05559327 SUPPLIER NUMBER: 11704535 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Tools. (1991-92 Electrical Products Yearbook Issue)

WORD COUNT: 2463 LINE COUNT: 00191

SPECIAL FEATURES: illustration; photograph

COMPANY NAMES: Greenlee Tool Co.--History; Ideal Industries Inc.
(Sycamore, Illinois)--History; Klein Tools Inc.--History

INDUSTRY CODES/NAMES: ELEC Electronics

DESCRIPTORS: Power tool industry--History; Tool industry--History

SIC CODES: 3678 Electronic connectors; 3644 Noncurrent-carrying wiring
devices; 3423 Hand and edge tools, not elsewhere classified; 3546

Power-driven handtools; 3544 Special dies, tools, jigs & fixtures

FILE SEGMENT: TI File 148

6/8/4 (Item 4 from file: 148)

DIALOG(R)File 148:(c) 1998 Info Access Co. All rts. reserv.

02179549 SUPPLIER NUMBER: 03544192 (USE FORMAT 7 OR 9 FOR FULL TEXT)

Product directory. (the who-makes-it directory of merchandise sold and used by the pleasure boating industry)

WORD COUNT: 139565 LINE COUNT: 12122

SPECIAL FEATURES: illustration; photograph

INDUSTRY CODES/NAMES: SPRT Sports, Sporting Goods and Toys

DESCRIPTORS: boating industry--Directories; Boats and boating--Equipment and supplies

SIC CODES: 3732 Boat building and repairing; 3731 Ship building and repairing; 5551 Boat dealers

FILE SEGMENT: TI File 148

6/8/5 (Item 1 from file: 155)

DIALOG(R)File 155:(c) format only 1998 Dialog Corporation. All rts. reserv.

06914559 92132472

Intrinsic factor secretion and cobalamin absorption. Physiology and pathophysiology in the gastrointestinal tract.

Tags: Human

Descriptors: *Intestinal Absorption; *Intrinsic Factor--Secretion--SE;

*Vitamin B 12--Metabolism--ME; Intestinal Absorption--Physiology--PH;

Vitamin B 12--Physiology--PH; Vitamin B 12 Deficiency--Etiology--ET;

Vitamin B 12 Deficiency--Physiopathology--PP

CAS Registry No.: 68-19-9 (Vitamin B 12); 9008-12-2 (Intrinsic Factor)

6/8/6 (Item 2 from file: 155)

DIALOG(R)File 155:(c) format only 1998 Dialog Corporation. All rts. reserv.

02417392 77168679

A case of fish tape-worm infection treated with paromomycin and an observation on its mode of action. II. With special reference to aminosidine (author's transl)]

Tags: Case Report; Female; Human

Descriptors: *Cestode Infections--Drug Therapy--DT; *Paromomycin

--Therapeutic Use--TU; Middle Age; Paromomycin--Administration and Dosage

--AD; Paromomycin--Metabolism--ME

Establishment Search Inspection Detail

Definitions

Inspection 100702364 - Dean Electric, Inc.

Inspection Information					
Nr: 100702364	Report ID: 0626300	Open: 1987-06-15			
Dean Electric, Inc.		Nr Employees: 25			
1300 Honor Drive		Nr Controlled: 25			
Desoto , TX 75115		Union Status: NonUnion			
SIC: 1731/Electrical Work		LWDI Rate:			
Mailing: 1038c South Cedar Hill Road , Cedar Hill , TX 75104					
Inspection Type: Fat Cat		Employees Covered: 2			
Scope: Partial		Advance Notice: Y			
Ownership: Private		Hours Spent: 50.0			
Safety/Health: Safety		Close Conference: 1987-06-18			
Opt Report Nr: 094		Close Case: 1987-11-30			
Optional Information:		Type	ID	Value	
		A	01	291-7153	
Related Activity:	Type	ID	Date	Safety	Health
	Accident	360137855	1987-06-10		

Violation Summary						
	Serious	Willful	Repeat	Other	Unclass	Total
Nr Violations	1					1
Penalty Amount	420.00					420.00
FTA Amount						

Violation Items								
	ID	Type	Standard	Issuance	Abate	Curr\$	Init\$	Fta\$
1	01001A	Serious	19260021 B02	1987-07-15	1987-07-22	420.00	420.00	
2	01001B	Serious	19260416 A03	1987-07-15	1987-07-22			
3	01001C	Serious	19260417 A	1987-07-15	1987-07-22			

Accident Investigation Summary

Summary Nr: 014466502 Event: 1987-06-10 Electrocutation

Two electricians were working on two overhead lights at the base of the steel poles. pole #1 contained a conductors for both sets of lights in its base. pole #2 which was not working was fed from pole #1 thru underground conduct. the two employees had removed the old conductors from the conduct feeding pole turned the circuit breaker off and tested conductors in pole #1 to ensure de-enerization. they inserted a in the empty conduct between the two poles leading from pole #1 to pole #2. it began raining so they w when they returned it was still raining so they decided to remove the fish tape and leave the site. one e the fish tape while standing on concrete, took two steps backwards into the grass and the fish tape was electrocuted him.

	Inspection	Age	Sex	Degree	Nature	O
1	100702364	39	M	Fatality	Electric Shock	

Payment and Administrative Actions

Administrative Actions

1	Area Office Interest	1987-10-20	4.90
1	Area Office Letter	1987-10-20	12.00

Payments

163 Nr	Type	Date	Penalty	FTA	Origi
292002276	Payment	1987-11-02	436.90		

Establishment Search Inspection Detail

Definitions

Inspection 018860536 - Ennis Electrico Co, Inc.

Inspection Information	
Nr: 018860536 Report ID: 0352440 Open: 1987-07-30 CSHO: O0899/C	
Ennis Electrico Co, Inc.	Nr Employees: 2
Building #41, N I H	Nr Controlled: 38
Bethesda, MD 20814	Union Status: NonUnion
SIC: 1731/Electrical Work	LWDI Rate:
Mailing: 10406 Balls Ford Rd, Manassas, VA 22110	
Inspection Type: Fat Cat	Employees Covered: 2
Scope: Partial	Advance Notice: N
Ownership: Private	Hours Spent: 51.4
Safety/Health: Safety	Close Conference: 1987-09-08
Planning Guide: Safety-Construction	Close Case: 1987-09-21
Opt Report Nr: 004-88	
Related Activity: Type	ID Date Safety Health
Accident 360751960 1987-07-29	

Accident Investigation Summary

Summary Nr: 000823260 Event: 1987-07-29 Electrical Shock

The victim and his apprentice had just installed new conduit leading to a co2 tank. mr. newman was hooking a metal fish tape that was in the conduit to 480v, 3 phase #8 ang conductors that were energized. when the conductors came in contact with the fish tape mr. newman was electrocuted. mr newman and a building engineer thought they had turned the power off at the breaker but due to poor labeling in pencil. only one of the two breakers powering the co2 unit was turned and tagged out. the 15 amp breaker was turned off but the 50 amp breaker was never located and thus was not turned off. mr.newman apparently did not follow the company's safety policy of always checking the wiring for current to assure that disconnecting means is not faulty. mr. newman is a va.state licensed journeyman.

Inspection	Age	Sex	Degree	Nature	Occupation
1 018860536	30	M	Fatality	Electric Shock	Supervisors; Electricians & Power Transm. Install.

Establishment Search Inspection Detail

Definitions

Inspection 107778862 - Dymanyk Electric, Inc.

Inspection Information	
Nr: 107778862 Report ID: 0552700 Open: 1988-03-09 CSHO: T1051/C	
Dymanyk Electric, Inc. 800 S. 5th St. Hopkins , MN 55343 SIC: 1741/Masonry Other Stone Work Mailing: 1915 Ne. Broadway St. , Minneapolis , MN 55413	Nr Employees: 8 Nr Controlled: 40 Union Status: Union LWDI Rate:
Inspection Type: Fat Cat Scope: Partial Ownership: Private Safety/Health: Safety Opt Report Nr: 06788	Employees Covered: 1 Advance Notice: N Hours Spent: 14.0 Close Conference: 1988-03-09 Close Case: 1988-04-05
Optional Information: Type ID Value S 04 14.0	
Related Activity: Type ID Date Safety Health Accident 360316418 1988-03-08	

Violation Summary						
	Serious	Willful	Repeat	Other	Unclass	Total
Nr Violations	1					1
Penalty Amount	175.00					175.00
FTA Amount						

Violation Items									
ID	Type	Standard	Issuance	Abate	Curr\$	Init\$	Fta\$	Contest	Evt
1 01001	Serious	19260403 102 1	1988-03-25	1988-03-28	175.00	175.00			

Accident Investigation Summary

Summary Nr: 000998211 Event: 1988-03-08 Electric Shock Burn - Direct Contact With Live Parts

An electrician was pulling fish tape through an electrical conduit. he was pulling from the top of a cabinet installed for this purpose. as the employee was attaching the tape to a rope, he accidentally contacted exposed energized circuit parts. an electric arc resulted, burning the employee's hands, wrists, one elbow, and face. the employee was hospitalized for the second and third degree burns to his wrists.

Review: X Keywords: electrical,electric shock,burn,electrical work,lockout,elec protect equip,electrical cabinet,clothing,e c

Inspection	Age	Sex	Degree	Nature	Occupation
1	107778862	46	M	Hospitalized Burn/Scald(Heat)	Electricians

Payment and Administrative Actions

Payments					
163 Nr	Type	Date	Penalty	FTA Origin	Balance
312003080	Payment	1988-04-05	175.00		

1 THE BOCCARDO LAW FIRM LLP

2 ATTORNEYS AT LAW

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4 P.O. BOX 15001

5 SAN JOSE, CALIFORNIA 95115-0001

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8 ATTORNEYS FOR PLAINTIFF

9 SUPERIOR COURT OF THE STATE OF CALIFORNIA

10 FOR THE COUNTY OF SANTA CLARA

11	MARY CATHERINE BERNAL, et al.,)	CASE NUMBER: CV758248
12	Plaintiffs,)	
13	vs.)	DECLARATION OF FRED C.
14	ORCHARD SUPPLY HARDWARE. a)	HOLMES IN OPPOSITION TO
15	corporation, et al.,)	MOTION FOR SUMMARY
16	Defendants.)	JUDGMENT BY THOMAS &
)	BETTS CORPORATION
)	DATE: Sept. 23, 1997
)	TIME: 9:00 a.m.
)	DEPT: 22

17 I, FRED C. HOLMES, declare as follows:

18 1. I have been engaged in electrical work since 1950 and
19 this work has included design, construction of electrical
20 distribution facilities as well as house wiring. Resume attached.

21 2. On or about January 24, 1997, I inspected the Bernal home
22 located at 15164 Stratford, Monte Sereno, CA, with Cathy Bernal,
23 John Loyd and Rich Medefesser. During this inspection, I
24 inspected the incident junction box, the metallic fish tape, the
25 portable lamps and the general vicinity of the accident site in
26 the attic in the Bernal home.

1 3. The metallic fish tape showed definite signs of
2 electrical contact by Mr. Bernal. The shiny side of the fish tape
3 actually showed signs of flesh as well as an imprint of where Mr.
4 Bernal's body was laying against the fish tape.

5 4. In my opinion, the metallic fish tape played a major roll
6 in the electrocution of Mr. Bernal. It was the metallic fish tape
7 that was grounded and created a path for the electricity to flow
8 from the incident junction box through Mr. Bernal and into the
9 metallic fish tape to the ground that caused Mr. Bernal's
10 unfortunate accident.

11 5. I inspected the incident junction box and indeed found
12 that a black (energized) wire had been forced into the junction
13 box and was making contact with the box which caused the incident
14 junction box to become energized with electricity. This energized
15 junction box, as well as the contact by Mr. Bernal from this
16 junction box to the grounded fish tape, caused Mr. Bernal's
17 electrocution.

18 6. In response to Mr. Andrew Paliszewski's Declaration, I
19 state the following:

20 (a) There are fishing tools on the market and have been
21 for many years that-are not made out of steel but are made out of
22 nylon and/or polyethylene that are non-conductive materials as
23 noted in\defendant's own Exhibit "C".

24 (b) It is my experience and it has been the industry's
25 experience that these fishing tools work very well and, of course,
26 have the additional advantage of not being conductors of

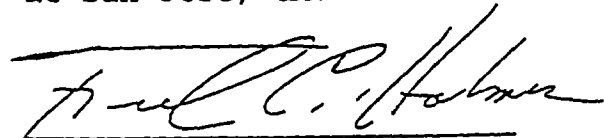
1 electricity.

2 (c) It is my opinion based upon my years of experience
3 in this field that when professional electricians are working on
4 non-energized locations they may use a steel fish tape, but when
5 they are working in the area of energized materials, they will
6 utilize the nylon or polyethylene fish tapes because they are not
7 conductors of electricity.

8 (d) It is my opinion that if a manufacturer is selling
9 these fish tapes to members of the public, he should advise
10 members of the public that a non-conductive tape is available if
11 it is necessary to be working around an energized circuit.

12 I declare under penalty of perjury under the laws of the
13 State of California that the foregoing is true and correct.

14 Executed this July 11, 1997, at San Jose, CA.

15 

16 FRED C. HOLMES
17
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23
24
25
26

Fred C. Holmes

Consulting Services

Electric Transmission and Distribution Systems, Failure Analysis and Investigations

EDUCATION: HEALDS ENGINEERING COLLEGE1954 - 1955
BRIGHAM YOUNG UNIVERSITY1957 - 1959
UNIVERSITY OF SAN FRANCISCO1960 - 1962
UNIVERSITY OF CALIFORNIA1967

WORK EXPERIENCE: CONSULTING ENGINEER 1987 - 1995

GAS & ELECTRIC OPERATIONS MANAGER 1986 - 1987
Pacific Gas & Electric Company
San Francisco, California

Managed the gas and electric distribution system within the City and County of San Francisco.

PROJECT SUPERINTENDENT 1984 - 1986
Pacific Gas & Electric Company
San Francisco, California

Managed PCB transformer replacement project in the downtown metropolitan area of San Francisco.

SUPERINTENDENT ELECTRIC OPERATIONS 1979 - 1984
Pacific Gas & Electric Company - San Francisco

Managed San Francisco Division Substations, Communications, Operating and Metering departments.

DISTRICT ELECTRIC SUPERINTENDENT 1976 - 1979
Pacific Gas & Electric Company - Ukiah California

Managed and directed the Electric Department activities in the Ukiah District of North Bay Division.

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WORK EXPERIENCE:

SENIOR DISTRIBUTION ENGINEER 1969 - 1976
Pacific Gas & Electric Company
Corporate Headquarters - San Francisco

Preparation of engineering and operating standards, review of engineering estimates submitted by the various operating divisions throughout the PG&E system.

ENGINEER (various positions) 1961 - 1969
Pacific Gas & Electric Company - San Francisco

Design and estimate preparation for the installation and/or reconstruction of electric facilities within the City and County of San Francisco and a portion of San Mateo County.

HELPER 1959 - 1961
Pacific Gas & Electric Company - San Francisco

Assist in the maintenance and repair of transformers and other underground distribution facilities.

TECHNICIAN 1955 - 1956
Pacific Telephone & Telegraph Company

Toll Test Technician

ELECTRICIAN 1950 - 1953
United States Navy

Electrician aboard the USS Perkins (DDR 877).

"Ergonomics and Safety Engineering", Workshop at the Spring Symposium on Back Pain, Anaheim, CA, May 28, 1987; Repeated At Fall Symposium on Back Pain, December 1987.

"VDT Workstations: Ergonomics, Health, Safety and Productivity", sponsored by the University Consortium for Continuing Education, San Francisco: Jan. 1987; Washington, DC and other locations: June and July 1987; Washington, DC: Feb. and Sept. 1991, Sept. 1992; Palo Alto, CA: Sept. 1988, Sept. 1989, Jan. and Aug. 1990, Jan. and Aug. 1991; Jan. and Aug. 1992, Feb. and Aug. 1993; Monterey, CA: Mar. and Aug. 1994; Mar. and Aug. 1995.

American Back Society Fall Symposium on Back Pain, San Francisco, CA: Dec. 1-2, 1988 (with Tom Signore) "Ergonomics and Safety Engineering: Practical Applications to the Work Place"; Nov. 30-Dec. 1, 1989; Dec. 6, 1990; Dec. 12, 1991; Dec. 10-11, 1992 (with Tom Signore) "Lifting Technology"; Dec. 4, 1993 (with Tom Signore) "Ergonomic Design of Materials Handling Jobs"; Dec. 2, 1994 "Practical solutions for workplace redesign".

"Warnings and Automobile Safety", Forensics Professional Technical Group, Human Factors Society Annual Convention, Orlando, FL, October 10, 1990.

"VDT Ergonomics and the San Francisco VDT Ordinance", Rucker Fuller, San Francisco, CA, February 15, March 1, 21 and 27, April 26, June 6, September 12, 1991, October 1, 1992.

Ergonomics Seminars, Lindsay's Furniture Systems, Fremont, CA, March 22 & 24, 1994.

Health and Safety Ergonomics Workshops, Boise Cascade, Menlo Park, CA, May 12, 1994.

Professional Societies:

American Institute of Industrial Engineers:

- Member of the Board of Directors, Peninsula Chapter, 1961-62, 1962-63.
- Chairman, Management Controls Conference, Palo Alto, CA, March 1961.
- Chairman, Annual Industrial Engineering Spring Conference, Palo Alto, CA, April, 1962.
- Co-chairman, 3rd Annual Industrial Engineering Spring Conference, Palo Alto, CA, Mar., 1963.
- Co-chairman, Annual Industrial Engineering Spring Conference, Palo Alto, CA, March, 1974.
- Committee Member, National Task Force on Industrial Engineering Definitions, 1962-63.
- Faculty Advisor to the Student Chapter, Stanford, 1957-58, 1959-60, 1961-62, and 1968-71.
- Director, Western Region Student Chapters, 1964-65.
- President, Bay Area Chapter, 1980.

Human Factors and Ergonomics Society:

- Director, Bay Area Chapter, 1966.
- Vice President, Bay Area Chapter, 1966.
- Publicity Chairman, 1967-68.
- National Conference Co-chairman and Program Chairman, Annual Conference, San Francisco, CA, 1977.
- President, Bay Area Chapter, 1980.
- Director, Bay Area Chapter, 1981, 1992.
- Forensic Professional Technical Group Program Chairman, 1990.
- General Chair, Annual Convention, San Francisco, CA, September, 1991.
- Interorganizational Liaison for ASTM 34.85, Ergonomics, 1993-
- Member, ANSI/HFES-100 Revision Committee; Secretary, Subcommittee on Input Devices and Keyboards, 1992-

Television Interviews:

1984:KTVU, Channel 11, San Jose, CA; Subject: Office Ergonomics.

1987:KCBS, Channel 5, San Francisco, CA; Subject: Carpal Tunnel Syndrome.

1989:KTVU, Channel 20, San Francisco, CA. Subject: VDI Advisory Committee Report to Cal-OSHA.

1989:CNN, San Francisco, CA. "Sonya Live in L.A." Subject: VDTs and Your Health.

1990:KNBC, San Francisco, CA. Subject: Analyzing Repetitive Strain Injury Among VDI Operators.

Films:

"Rapid Answers for Rapid Transit", (Directed and assisted with script and editing), Urban Mass Transit Administration, released March 1974.

"Office Ergonomics Training Program" (Narrated and appeared in), U.S. West, Seattle, Washington, November, 1990.

"Principles of Ergonomics in the Computer Classroom", Produced by Frank B. Hall for the Colorado School Districts Self Insurance Pool, 1991.

"Keeping Your Back in Action", Krames Communications, San Bruno, CA, 1991.

Editorial:

- Member, Editorial Advisory Board, Computers and Graphics, Pergamon Press.
- Editorial Reviewer for International Journal of Occupational and Environmental Health, University of California, San Francisco.
- Associate Editor, "Ergonomic Issues and Trends" Health Works, Gannett USA TODAY.
- Paper referee for annual conference of Human Factors and Ergonomics Society.
- Member, Organizational Board, HCI International '97, San Francisco, CA, August, 1997.

DIALOG DATABASES:

File 161:Occ.Saf.& Hth. 1973-1997/Q4
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(c) 1998 The HW Wilson Co.
File 155:MEDLINE(R) 1966-1998/Apr W1
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INQUIRIES:

**Consumer Product Safety Commission
Office of Public Affairs 301-504-0580**

I was transferred to the Data Department and spoke with Ida Harper about statistics or warnings the CPSC may have on fish tape, after describing to her what it is and how it is used. Ida said that the statistics they have for electrical products are all grouped under one code number, and therefore, she could not supply injury data for fish tape, specifically. However, she will search their database (which goes back to 1980) by keyword, and she will send me any accident reports or warnings they might have issued. If the resulting output is fewer than 12 pages, Ida will fax it to me by tomorrow; if the output is more than 12 pages, she will send it by FedEx for Thursday delivery.

*****ONLINE SEARCH RESULTS*****

SYSTEM:OS - DIALOG OneSearch

File 161:Occ.Saf.& Hth. 1973-1997/Q4

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File 148:IAC Trade & Industry Database 1976-1998/Feb 17

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File 8:EI Compendex(R) 1970-1998/Mar W3

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File 99:Wilson Appl. Sci & Tech Abs 1983-1998/Jan

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File 155:MEDLINE(R) 1966-1998/Apr W1

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*File 155: Due to technical problems, 1998 MEDLINE has been
restored to the 1997 version.

Set	Items	Description
S1	18	FISHTAPE? OR FISH()TAPE? ?
S2	12	S1 AND (INJUR? OR HAZARD? OR FATAL? OR DEATH? OR DIED OR A- CCIDENT?)
S3	12	RD S2 (unique items)
S4	12	Sort 3/ALL/PY,D
S5	6	1 NOT 3
S6	6	RD S5 (unique items)

Set S4, items 9,11,12, full format:

4/9/9 (Item 9 from file: 148)

DIALOG(R)File 148:IAC Trade & Industry Database

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05806531 SUPPLIER NUMBER: 11865460 (THIS IS THE FULL TEXT)

On guard. (an updated review of skills needed to install air conditioners)

Mullin, Ray

Refrigeration Service & Contracting, v60, n2, p14(6)

Feb, 1992

ISSN: 0148-382X LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT

WORD COUNT: 3198 LINE COUNT: 00254

TEXT:

A good knowledge of electrical requirements for hooking up a typical system helps keep compressors running and motors humming. Here's an updated review of the skills needed.

Are you sure that you are making the electrical connections to hvac equipment according to the requirements of the National Electrical Code? You might be in for a few surprises. Some of the things that were done in

the past are no longer permitted by the NEC.

Knowledge of air-conditioning, heating, and refrigeration technology is not enough. Knowledge of electrical systems is also very important. Imperative to meeting code when installing the electrical supply to such equipment is to carefully read and comply with the requirements found in the installation instructions (manuals) furnished with the equipment, and to the data found on the nameplate on the equipment.

This article will touch upon some of the basics of electrical code requirements found in the latest edition of the NEC, and in the current Underwriters Laboratories standards.

NATIONAL ELECTRICAL CODE

Let's take a look at the NEC. The first sentence in the NEC is:

Section 90-1. Purpose.

(a). Practical Safeguarding. The purpose of this code is the practical safeguarding of persons and property from hazards arising from the use of electricity.

Section 110-3(b) Installation and Use. Listed or labeled equipment shall be used or installed in accordance with any instructions included in the listing or labeling.

The NEC covers the special electrical code requirements for air conditioning and refrigeration equipment in Article 440. Circuits supplying hermetic refrigerant motor compressors are treated differently than standard motors. Where hvac equipment does not incorporate hermetic refrigerant motor-compressors, then we would refer to Article 422 (Appliances), Article 424 (Fixed Electric Space Heating), and Article 430 (Motor Circuits and Controllers). Much of what is covered in Article 440 also pertains to electric heat pumps and similar hvac equipment.

It is important to note that the requirements found in Article 440 are in addition to other articles of the NEC. For example, basic motor information is found in Article 430.....wire ampacity is found in Article 310.....conduit sizing is found in the tables in Chapter 9.....grounding is found in Article 250. To make an electrical installation that is in compliance with the NEC, you need to understand the requirements found in Article 440 for hvac equipment, and also understand some of the other sections and chapters of the NEC.

In looking at a typical nameplate of a central air conditioning unit (Fig. A), MINIMUM CIRCUIT AMPACITY means that the supply conductors, disconnect switch, and any other associated electrical equipment must be rated not less than the minimum circuit ampacity requirements. Underwriters Laboratories standards require that this data be included on the nameplate of the equipment.

Minimum circuit ampacity values are given in amperes.

The manufacturer of the equipment takes into consideration the current draw of the compressor(s), fan(s), crank case heater(s), solenoid(s), relay(s), heating elements(s), and any other electrical loads contained within the equipment. The manufacturer then applies the necessary

"multipliers" to these loads as required by the UL standards.

The installer does not have to do any more calculating. The manufacturer of the equipment has done it all.

Another important term is AMPACITY. The definition of this unique electrical term is found in the NEC. It means: The current in amperes a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

POWER SUPPLY CONDUCTORS: Some equipment manufacturers specify the minimum size and type of conductors required for the power supply. Other manufacturers put the burden on the electrician or hvac installer to select the size and type of conductors.

For example, on the nameplate (Fig. A), we find the words **MINIMUM CIRCUIT AMPACITY 37**. This means that the supply conductors must have a current rating of not less than 37 amperes. Next, refer to Table 310-16 of the NEC (Fig. B) to find a conductor rated 37 amperes or more. [Tabular Data Omitted]

In our example, find in the 60 degree C column of Table 310-16 that a No. 10 AWG copper conductor has an ampacity of 30 amperes.....and that a No. 8 AWG copper conductor has an ampacity of 40 amperes. Since the minimum circuit ampacity is 37 amperes, we would select the No. 8 AWG copper, 40 ampere conductor.

TERMINATIONS: According to the UL standards, unless the electrical terminals are otherwise marked, they are for use only with copper conductors.

Also, unless otherwise marked, the current-carrying ability of these terminals is based on the use of 60 degree C insulated conductors in circuits rated 100 amperes or less.....and on the use of 75 degree C insulated conductors in circuits rated over 100 amperes.

Some equipment, such as electric furnaces, boilers, and ovens, might be marked to require the use of 90 degree C wires, such as Type THHN. This could be needed because of the high temperatures associated with this equipment. But because of the way terminals and lugs are rated by UL, the ampacity for the conductors must still be based on the 60 degree C column of Table 310-16 for circuits rated 100 amperes or less.....and on the 75 degree C column for circuits rated over 100 amperes. Watch out for this common code violation when installing branch-circuit supply conductors to the equipment.

VOLTAGE DROP: If the supply conductors are long, some electricians multiply the minimum circuit ampacity by 1.25 in order to compensate for the long branch-circuit run. In our example above, where the minimum size conductor was determined to be No. 8 AWG copper, larger No. 6-AWG copper conductors could be installed so as to not have too much voltage drop over the branch-circuit conductors. One major manufacturer's nameplate indicates that its 230 volt unit has an operating voltage range of 197 volts minimum.....253 volts maximum.

Again, read the instructions to see if the manufacturer has recommendations regarding long branch-circuit runs. (Voltage drop

calculations are discussed in detail in the Bussmann Electrical Protection Handbook).

BRANCH-CIRCUIT OVERCURRENT PROTECTION: Today, branch-circuit overcurrent protection comes in the form of fuses or circuit breakers. Here again, we find many serious electrical installation violations of the NEC.....not always intentional, but because of failure to read the nameplate and the instructions furnished with the equipment, and more importantly, following these instructions.

Note on the sample label (Fig. A) the words **MAXIMUM FUSE SIZE AMPS**. This means that the unit must be protected only by fuses. It would be a violation of Section 110-3(b) of the NEC to protect this unit with a circuit breaker.

If the nameplate had indicated **MAXIMUM FUSE SIZE OR HACR BREAKER**, then properly sized fuses - or a circuit breaker that is marked Listed Type HACR would be permitted by the NEC for the unit's branch-circuit overcurrent protection. (The term HACR means Heating, Air Conditioning, Refrigeration.) Since all circuit breakers are not marked HACR, it is important to check this out before assuming that the circuit breaker you intend to use is okay to use as the overcurrent protection for the equipment's branch-circuit.

MINIMUM FUSE OR HACR BREAKER: Occasionally, a manufacture nameplate might indicate **MINIMUM FUSE OR HACR BREAKER**. Do not install anything smaller as it could result in nuisance opening of the branch-circuit fuse or HACR breaker.

Circuit breakers that are marked "Listed Type HACR" have been submitted to and tested by UL using a special test panel that examines the performance of a breaker connected ahead of a compressor motor contactor, a fan motor relay, capacitors for the fan and compressor motor, and various lengths of No. 16 and 18 AWG wire. The test panel is then subjected to a series of short circuit tests to determine if the level of protection is essentially equal to the level of protection provided by fuses.

HACR circuit breakers are rated 60 amperes or less.

The branch-circuit protection for large commercial and industrial hvac equipment rated above 60 amperes will invariably specify that fuses be used for the branch-circuit overcurrent protection. In some cases, the manufacturer will have provided the fuses internal to the equipment in order to meet the requirements of the NEC and the UL standards for HACR equipment.

Smaller, residential type equipment in the range of 5 ton or less in many instances indicate that it is suitable for protection by either fuses or HACR breakers. Again, read the nameplate data.

CAUTION: The advent of HACR breakers is rather recentthe last 15 years or so. Therefore, when replacing hvac equipment that is fed from an existing circuit breaker panel where the breakers are not marked HACR type, the equipment must be protected with fuses. Even if the replacement hvac equipment is marked **MAXIMUM SIZE FUSE OR HACR BREAKER**, since the existing circuit breakers are not marked HACR, fuses must be inserted ahead of the

hvac equipment. There is no exception to this rule. Older circuit breakers operated much slower than some of the newer types. There can be serious damage to the equipment and more seriously, injury to people as a result of possible fire or electrocution caused by a short-circuit or ground fault inside of the equipment.

Fuses would be installed in a disconnect switch near the hvac equipment. Pull-out type disconnects are commonly installed for this purpose. They are available in both fused and non-fused types. The fusible pull-out "heads" in this type of disconnect makes it easy for the installer to "meet code" relative to the fuse/breaker issue discussed above.

The nameplate might also read MAXIMUM OVERCURRENT PROTECTIVE DEVICE, in which case fuses, HACR breakers, or standard breakers would "meet code" (Fig. C). [Tabular Data Omitted]

The reasoning behind this tough code requirement for hvac equipment is that the branch-circuit overcurrent device is called upon to provide short-circuit protection for the large compressor motor, its contactor, and its associated large conductors....PLUS.... it must also protect the small fan motor, its relay, and its associated smaller conductors.

Checking the internal wiring of hvac equipment, it is not uncommon to find large conductors rated 50 amperes or more, and small control wires rated 8 amperes or less. Yet, the branch-circuit overcurrent protection must provide short-circuit protection for these small conductors and other small components inside the equipment.

When the manufacturer finds that ordinary circuit breakers cannot open fast enough during the short-circuit test to protect the small electrical components within the equipment, fuses or HACR circuit breakers will be required to protect the equipment.

To meet UL requirements, many times the smaller control circuit wiring is protected by small dimension fuses (1 1/2 x 13/32") termed Class CC fuses. The letters "CC" refer to the words "Control Circuit". These fuses will be an integral part of the equipment, properly sized and furnished by the manufacturer of the equipment.

Hvac equipment must meet the stringent special testing requirements found in the Underwriters Laboratories Standards, such as:

UL 303 Refrigeration and Air Conditioning Condensing and Compressor Units

UL 465 Central Cooling Air Conditioners

UL 559 Heat Pumps

UL 883 Fan-Coil Units and Room-Fan Heater Units

UL 1096 Electric Central Air-Heating Equipment

These standards will be phased out as the new UL Standard 1995 is phased in between now and January 2, 1993. UL 1995 is one of the first standards to combine (harmonize) the Underwriters Laboratories and Canadian Standards Association standards into one common document.

Other important electrical code requirements

DISCONNECTING MEANS:

- The disconnecting means for an individual hermetic motor/compressor must not be less than 115% of the rated load current, or the branch-circuit selection current, whichever is greater.

- The disconnecting means for an individual hermetic motor/compressor shall have a horsepower rating equivalent to the horsepower ratings that are shown in Table 430-151 of the NEC. This is a conversion table to cross locked-rotor current to horsepower.

- The disconnecting means must be within sight of and readily accessible from the equipment. The definition of "in sight" according to the NEC is "to be visible and not more than 50 feet distant".

- The disconnecting means may be mounted inside the equipment, or it may be mounted on or adjacent to the equipment. Mounting the disconnect switch on the side of the equipment, such as on a residential condensing unit is not good practice, because should the equipment need to be replaced, the service technician would need to get involved with the electrical wiring. Just another issue to make the job more involved than necessary. Running flexible conduit to the unit from a disconnect switch mounted on the wall near the equipment appears to be the most common method for making up the electrical connections.

- Don't mount the disconnect switch behind the unit, where access to it means crawling behind or over the equipment. This could present an electrical shock hazard. Section 110-16 of the NEC states: "Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment."

GROUNDING

Equipment grounding requirements are found in Article 250 of the NEC. Sometimes the equipment is properly grounded through the metal raceway that contains the electrical circuit to the unit. In other instances, a separate equipment grounding conductor is installed, in which case the minimum equipment grounding conductor is sized according to the Table 250-95 of the NEC.

The termination for the equipment grounding conductor is marked "G", "GR", "GRD", "GRND", or similar identification.

In the code, Table 250-95 shows the minimum size of equipment grounding conductor. There are certain conditions where equipment grounding conductors will be required to be larger than the sizes as shown in Table 250-95. These conditions are:

1.) where the branch-circuit conductors are increased in size to compensate for voltage drop, then the equipment grounding conductor must be increased in size proportionately according to the circular-mil area, and

2.) where the available short-circuit current is so high that if a severe ground fault occurs, the equipment grounding conductor might actually burn off..... leaving the equipment "HOT"a real electrical shock hazard.

SEPARATE BRANCH CIRCUIT

In most instances, hvac equipment should be supplied by a separate



circuit. This improves the continuity of service should power outages occur on other circuits in the building. The NEC in Section 422-7 requires that central heating equipment must be supplied by a separate circuit. Auxiliary equipment such as humidifiers, electrostatic air filters, or similar auxiliary equipment is permitted to be connected to the same branch-circuit as the central heating equipment.

LOW VOLTAGE WIRING

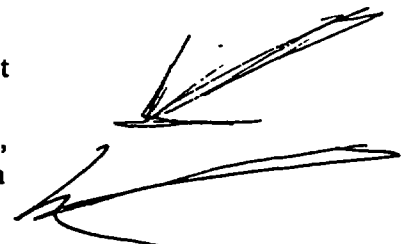
Most thermostat wiring is low voltage, defined in the NEC as Class 2 circuits. Section 725-38(a)(2) of the NEC prohibits the installing of Class 2 wiring in the same raceway or junction box along with light and power circuits. That is why the manufacturer of the equipment provides separate knock-outs for the low-voltage and line-voltage wiring. Power wiring and low-voltage thermostat wiring must be kept separate.

The only exception to this is where the Class 2 circuits and power circuits come together in the equipment to make up the electrical connections. The manufacturer will have provided the necessary clearances and barriers where the low-voltage and line-voltage circuits come together. How many times do we find the low-voltage wiring pulled into the same conduit as the power supply to an air-conditioning unit? Even if the electrician were to use standard 600 volt insulated conductors for the low-voltage Class 2 circuitry, it is a serious violation that could result in a lawsuit should personal injury or fire occur.

Always follow the manufacturers wire sizing recommendations for the field wiring of the low-voltage circuitry.

AVAILABLE SHORT-CIRCUIT CURRENTS

When installing equipment, particularly commercial and industrial units, be aware that the short-circuit tests performed by the testing laboratories are done at very low levels of short-circuit current. Where you think that the available short-circuit currents might exceed the values shown in the table (Fig. D), you will want to perform a "short-circuit study", and probably install current-limiting, time-delay fuses in the disconnect ahead of the equipment in order to reduce the fault current. It is not uncommon to find available short-circuit currents on the line side of the hvac disconnecting means to be 10,000 amperes, 15,000 amperes, 20,000 amperes, or more. An inadvertent slip of a screwdriver or fish tape will bear this out. This can be a real hazard if not properly addressed. [Tabular Data Omitted]



There are several proposals before the NEC making panels that would require equipment to be marked with its short-circuit withstand rating to further assist the installer in making a safe installation by selecting the proper size and type of overcurrent protective device for the branch-circuit supplying the equipment. This would be very helpful addition to the nameplate data.

This discussion on available fault current is almost always overlooked.....or ignored. Violent electrical explosions can result when a short-circuit occurs in equipment when the short-circuit currents exceeds