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AUTOMATIC DOOR LITIGATOR

A Publication of the ATLA Automatic Door Litigation Group

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THE CHAIRMAN'S DOCKET

Introducing the Automatic Door Litigator

by Edson Howard Rafferty
Co-chairperson, ATLA Automatic Door Litigation Group

This is the first issue of the new quarterly publication of the ATLA Automatic Door Litigation Group. Its purpose is to provide a forum for members, technical experts and other interested parties to present, in written form, material and information that will potentially be of interest to other members of the Litigation Group. This publication is **NOT** for public dissemination and is intended strictly and solely for the use of personal injury attorneys in their representation of plaintiffs injured by automatic doors.

The ATLA Automatic Door Litigation Group was formed by your Litigation Group Chairman, Edson Howard Rafferty and his partner Philip S. Shaw, after a multi-year involvement in an automatic door case against Stanley Magic Door, Inc. of Farmington, Connecticut (installer and maintainer of the door), Stanley Magic Door Division of the Stanley Works of Farmington, Connecticut (the designer, manufacturer, assembler, tester and marketer of the door), The Stanley Works of New Britain, Connecticut (the holding company for the various Stanley subsidiaries and divisions) and Mount Au-

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FEATURE ARTICLE

Anatomy of a Door

by Warren F. Davis

What are the key components of an automatic pedestrian door, how are they interrelated, and how do accidents arise involving such doors?

In the context of this article, an automatic door is a commercially available power operated or power assisted door used to facilitate pedestrian traffic. Other types of doors, such as overhead garage doors, that are not used primarily for pedestrian traffic are not considered.

Automatic doors are used frequently in restricted areas not generally accessible to the public, such as to provide controlled access to the operating area of a hospital. Here,

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ANNOUNCEMENTS

The ATLA Automatic Door Litigation Group Annual Meeting will take place at 10:30 AM to 12:30 PM on Tuesday, August 2, 1993, at the ATLA Annual Convention and Meeting, San Francisco Hilton Hotel, Hilton Square, San Francisco, California. The exact location of the Litigation Group Meeting will be listed in the ATLA Program available at this ATLA Convention.

The following guest speakers will make presentations at the meeting:

Warren F. Davis, Ph.D. [Physics (MIT)] of Davis Associates, Inc., West Newton, Massachusetts, (617)-244-1450, and plaintiffs' expert in numerous automatic door cases, will talk on the fundamental system design flaws in automatic doors, the applicable ANSI A156.10 and UL 325 standards, and how they interrelate.

Richard W. McLay, Ph.D., of STARK Company, Shelburne, Vermont, (800)-338-6008, will present an automatic door computer simulation that he has prepared and will customize to each plaintiffs' individual case.

Drs. Davis and McLay are also available as experts to Group Members.

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doors of simplified design are customarily employed. Automatic opening triggered by sensors is dispensed with in favor of a simple paddle switch or a switch activated by a special identification card. This type of door is inherently safer than fully automatic doors because the user triggers the opening of the door by a deliberate act of some kind. The user fully anticipates and is prepared for the action of the door. Moreover, there can be no unanticipated behavior stemming from failure or improper adjustment of the door sensors since they do not exist. And, because authorized use of the door is restricted to employees and selected individuals known in advance, users can be trained on safe operation of the door, further decreasing the likelihood of an accident. For these reasons, this article focuses instead on the characteristics of automatic doors intended for public access.

Why automatic doors?

There are several characteristics of automatic doors that make them attractive to both building owners and pedestrians. Shoppers leaving supermarkets ladened with bundles or pushing shopping carts find it most convenient to have exit doors open automatically for them. Disabled individuals, especially those using wheelchairs, find building access greatly facilitated by such doors. Tenants and building owners in the colder regions realize significant heating fuel savings, with the result that automatic doors are cost effective to install. They are likewise so in the warmer regions where air conditioning costs are a consideration.

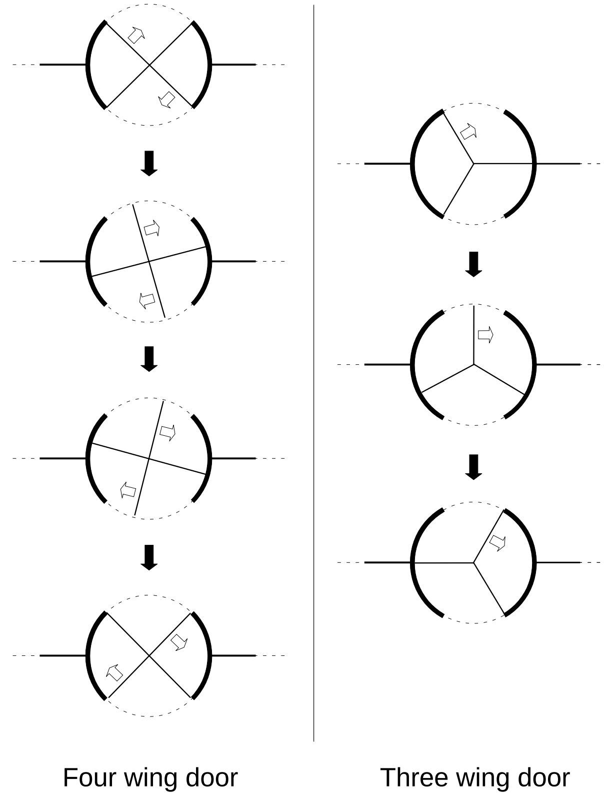
Unfortunately, these advantages are offset by significant shortcomings inherent in currently available designs. Automatic doors are, after all, machines designed to imitate the behavior of a human doorman or doorwoman. However, endowing machines with humanlike intelligence, even with respect to a task as simple as opening a door, is not a trivial undertaking. To come close, designs must incorporate a great many sophisticated features not yet envisioned by available systems. Subsequent articles in this series will elaborate on this point. This article deals rather with the typical components and configuration of currently available designs.

Basic door designs

There are broadly three types of automatic doors in current use – sliding doors, swinging doors and revolving doors. Each has its own advantages and disadvantages.

Sliding doors retract along their own dimensions when they open. This affords a safety advantage because no floor area is swept out by the action of the door. For the same reason, sliding doors can be used to handle both incoming and outgoing traffic.

Swinging doors can be used for one-way traffic only and have the potential for striking an inattentive individual in the sweep of the door on the side toward which they open.



Three and four wing revolving doors in plan view showing two points of contact throughout revolution.

Revolving doors can be used for two-way traffic but suffer several disadvantages. An individual may be struck in the sweep of the door, on either the in or out side, as it rotates. Because of the ganging of their wings, of which there are usually three or four, into a single rigid structure, the force of the blow could exceed that of a swinging door by a factor of three or four times. There is the potential for head and limbs to be caught in a shearing motion between the fixed and rotating members of the door. And, it is difficult to pass through a revolving door in a wheelchair, pushing a shopping cart, carrying large items, or in the company of children. Their primary advantage is that their rotating wings form a constant seal with the fixed cylindrical part of the door within which they rotate. That is, at any point in the rotation, the edges of two wings are always in contact, via a flexible seal, with the cylinder. See the figure above. At no point in the door's operation can air move freely into or out of the building. Consequently, revolving doors are considered to be the most cost effective of the three basic designs from the standpoint of energy conservation.

The majority of automatic doors employ microwave motion sensors working on the Doppler principle to sense the approach of pedestrians and to initiate the opening, or rotation, of the door. Such sensors broadcast a rather wide beam of microwave radiation, of a wavelength of about 3 cm, from a concealed microwave horn (antenna) centered on the door header and projected downward to illuminate the approach to the door. Reflections from objects moving within the beam are received by the same antenna and electronically compared with the outgoing reference signal. Slight variations of wavelength caused by reflection from moving objects generate a motion detection signal, which is used to trigger the opening of the door.

Microwave motion sensors are mounted on one or both sides of the automatic door, depending on whether traffic is to be mono- or bidirectional. Both options are available for sliding doors. The microwave sensor is installed only on the approach side of swinging doors. Revolving doors, being inherently bidirectional, are usually equipped with sensors on both sides, though this is not mandatory. Also, when motion sensors have been installed on both sides of a door, whether sliding or revolving, it may be possible to disable one sensor to discourage bidirectional traffic.

> ***"... ANSI A156.10 is a voluntary standard; manufacturers are not compelled to be in compliance."***

According to the ANSI (American National Standards Institute) standard A156.10, sponsored, produced and copyrighted by the BHMA (Builders Hardware Manufactures Association), microwave motion sensors should have a range of at least four feet perpendicular to the door opening. That is, the door should begin to open when a moving pedestrian reaches a distance of four feet from the door. The triggering distance can exceed four feet, but should never be less than that value. It should be noted that ANSI A156.10 is a voluntary standard; manufacturers are not compelled to be in compliance. ANSI A156.10 contains many other detailed recommendations with which attorneys should also be familiar.

Doors that do not employ microwave motion sensors usually use "control mats" to sense the approach of pedestrians. These consist of pressure activated electrical switches distributed throughout a mat that is placed upon, or in a recess within, the floor at the approach to the door. The purpose of the control mat, to sense approaching pedestrians and trigger door opening, is identical to that of the microwave sensor. There is, however, one significant difference. Current microwave sensor designs respond only to *motion* whereas control mats respond to *presence*, independent of motion. Because the pedestrian becomes "invisible" to the microwave sensor if he/she stops moving, the door can close even though the individual is standing (motionless) within the microwave sensor beam. The control mat will, on the other hand, hold the door open for as long as the individual is standing on the mat. Systems that employ control mats are, for this reason, inherently somewhat safer.

However, control mats suffer from two disadvantages that have created a trend toward replacement by microwave motion sensors. First, if the mat is placed *upon* the floor there is a potential for pedestrians to sustain injuries by tripping on the edges of the mat as they approach the door. On the other hand, installation costs increase substantially if the mat is mounted flush *within* the floor, especially if the floor is made of concrete or other difficult to work materials.

After triggering by the approach sensor, whether a microwave beam or control mat, the door is maintained in the open state for a time deemed long enough to permit a pedestrian to pass through and safely beyond the door opening. Special adjustable time delay circuits hold the door actuating signal in the on state well beyond the disappearance of the signal generated by the microwave sensor or control mat. ANSI A156.10 recommends that this time delay be set to 1.5 seconds *at a minimum*.

On doors with a microwave motion sensor, the beam must be adjusted so that it does not respond to the motion of the door itself, whether of the sliding, swinging or revolving type. Otherwise, if the door lies within or enters the sensor beam as the door closes, its motion will be detected, generating a new signal commanding the door to reopen. At the end of the adjustable hold delay, this process will repeat, causing the door operation to cycle endlessly. In practice, this adjustment is made by first tilting the microwave source on the door header downward until its beam intercepts the door, as judged by the induction of door cycling. Then, the source is tilted gradually upward until the cycling of the door ceases, indicating that the door is no longer within the active part of the sensor beam.

This adjustment creates perforce, for sliding and swinging doors, a region in the plane of the door itself that is not illuminated by the microwave motion sensor, or sensors if the door is set up for bidirectional traffic. Consequently, a person could stand on the threshold of the opened door and, after the expiration of the hold delay, be struck by the closing door. To circumvent this possibility, additional sensors, employing a variety of technologies such as light beam, sonar and infrared detectors, are commonly used to provide presence detection in the plane of the door. The signal from the presence detector is used to hold the door open even in the absence of the motion detector signal and expiration of its hold delay.

As is so often the case, the increased complexity required to solve one problem brings with it a fresh new problem. Generally, the presence detector can render a meaningful signal only when the door has fully retracted or has swung sufficiently open that it does not "see" the door. This means that as the door begins to close, the presence detector must be automatically disabled so that it will not respond to the shut door, thereby creating an interval within which a pedestrian could step into the door opening and be struck by the door as

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it closes.

This problem does not arise with the revolving design because the rotating door remains in place between the inner and outer areas covered by the motion detectors. A presence detector, if installed, would continually detect the presence of the door itself because the door simply rotates about a fixed axis. By assumption, however, a presence detector is not required because the rotating action of the door forces pedestrians through the door opening; they cannot stop in the way of the door.

How accidents occur

Most accidents involving automatic pedestrian doors result from the individual being struck by the door as it closes or revolves. ANSI A156.10 sets conservative standards for the amount of force with which a door can close, which, if adhered to, are not likely to cause injury. In the vast majority of cases, however, injury occurs not by being struck by the door itself but as a collateral result of being knocked to the ground. The victim is most often an elderly woman whose bones have become fragile due to osteoporosis and the most common injury sustained is a fractured or broken pelvis.

Many, though by no means all, accidents occur because one or more of the parameters, such as door closing speed, detector sensitivity, or holding time delay have been set deliberately to extreme values. Examination of the service records for the door often reveals that technicians were called shortly before the accident to increase closing speed or decrease the holding time delay because workers stationed near the door complained of the blast of cold air each time the door was opened. Thus, many accidents involve automatic doors that are otherwise in proper working order and which could have been avoided by maintaining conservative adjustments as recommended by the manufacturer and the ANSI A156.10 standard.

Of course, there are many other potential failure mechanisms involving such phenomena as outright failure or drifting of sensors, mechanical failure, failure of control circuitry, interference between sensors, and special circumstances that arise from the physics peculiar to a given sensor that lead to improbable, but not impossible, accidents. Future articles in this series will offer more insight into this latter complex class of mechanisms.

Warren F. Davis has a Ph.D. in theoretical physics from MIT and is president of Davis Associates, Inc., 43 Holden Road, West Newton, MA 02165, Tel. (617) 244-1450, FAX (617) 964-4917. He has extensive training and experience in RADAR and microwave radiation detection and analysis devices and systems. He has served and/or is serving as a technical expert for plaintiffs on numerous automatic door cases.

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burn Hospital of Cambridge, Massachusetts, the door owners, [*Catherine Hayes v. The Mount Auburn Hospital, Stanley Magic Door, Inc., The Stanley Works and Stanley Magic Door Division of the Stanley Works*, Civil Action No. 89-3122, Middlesex Superior Court, Commonwealth of Massachusetts] in which the various "Stanley Companies" used every possible tactic (both ethical and questionable) to restrict, inhibit, block, impede, delay and avoid the litigation, all phases of discovery and, ultimately, the trial itself.

The case involved an eighty year old woman who had her hip shattered by a Stanley Magic Door automatic sliding door that closed on her, knocking her down, as she entered Mount Auburn Hospital to see her doctor. The case settled on the eve of trial for $200,000.00. [A more in-depth discussion of the case, and the tactics employed by Stanley Magic Door Company, will be published in the August, 1993, issue of the *AUTOMATIC DOOR LITIGATOR*].

Neither the format, the content, nor the size of the *AUTOMATIC DOOR LITIGATOR* are set in stone and can — and most likely will — vary from time-to-time and from issue-to-issue. The purpose, as stated, is to provide a place, or forum, where any information and any issues of interest and/or importance to Group Members can be brought forth, presented and discussed. It is hoped that it will also serve to keep litigation group members updated on the status, problems, issues, results, settlements and/or judgements of other group members as they relate to automatic door cases.

Automatic Door Litigator is published quarterly by the ATLA Automatic Door Litigation Group.

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Membership is reserved exclusively for Regular, Sustaining or Life members of the Association of Trial Lawyers of America (ATLA) who exclusively represent plaintiffs in automatic door cases against the manufacturer, installer, servicer and/or owner of said doors.