United States Patent [19]

Trikilis

[11] **3,781,661**

[45] ***Dec. 25, 1973**

[54] **MAGNETIC MATERIAL AND METHOD OF PRODUCING SAME**

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[*] Notice: The portion of the term of this patent subsequent to Dec. 13, 1983, has been disclaimed.

[22] Filed: **Jan. 4, 1972**

[21] Appl. No.: **215,385**

Related U.S. Application Data

[60] Continuation of Ser. No. 733,163, May 29, 1968, abandoned, which is a division of Ser. No. 531,253, March 2, 1966, Pat. No. 3,418,613.

[52] **U.S. Cl.** **324/34,** 340/280

[51] **Int. Cl.** **G01r 33/00**

[58] **Field of Search** 324/34, 41, 45; 317/134, 157.5; 340/258, 280; 335/284, 302, 303

[56] **References Cited**

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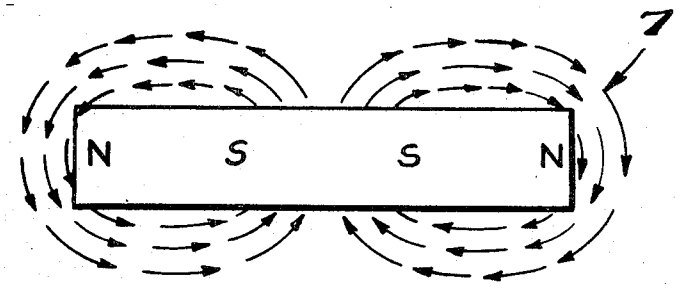
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[57] **ABSTRACT**

A pilferage prevention system is disclosed in which articles to be protected are provided with plural magnetic fields in different directions, each of which is detected such that neutralization of the plural fields for the purpose of preventing detection is precluded.

10 Claims, 17 Drawing Figures



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SHEET 1 OF 4

Fig. 1A.

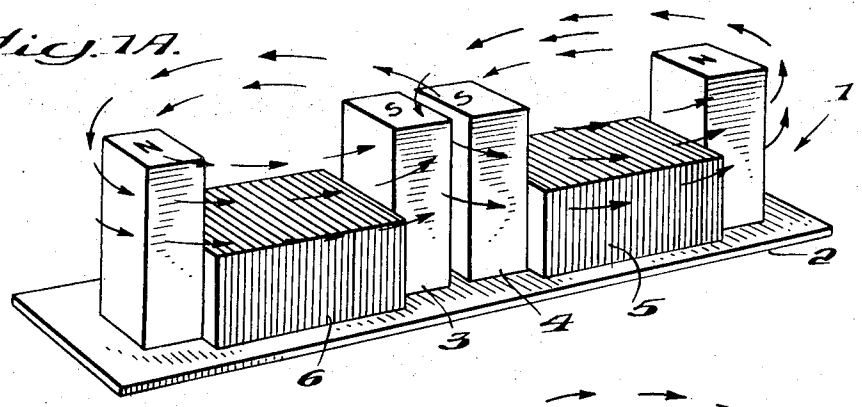


Fig. 2A.

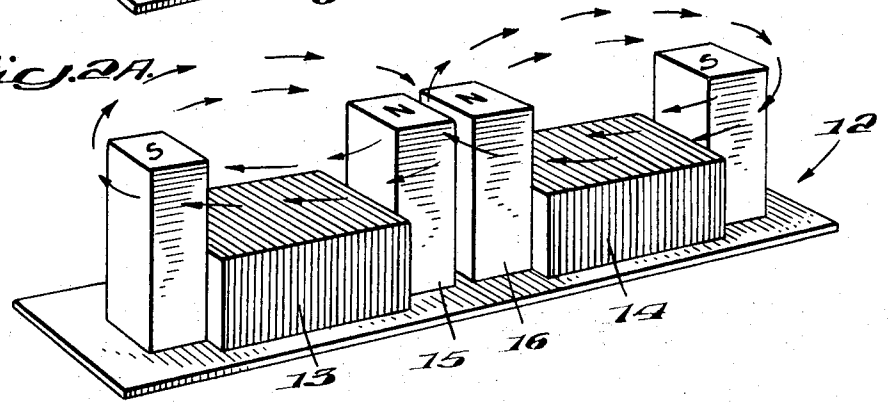
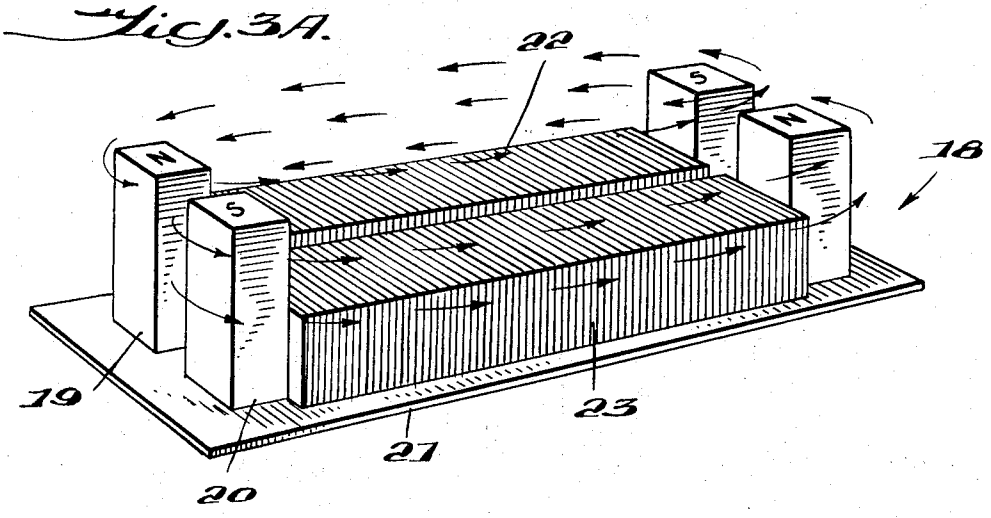


Fig. 3A.



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Fig. 1B

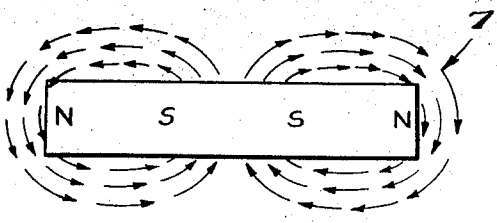


Fig. 2B.

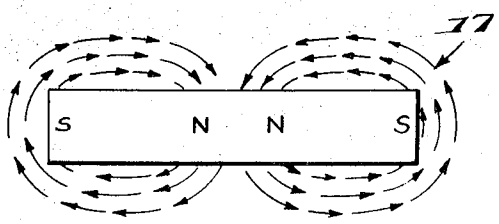


Fig. 1C.

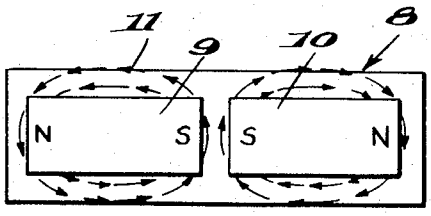


Fig. 4A.

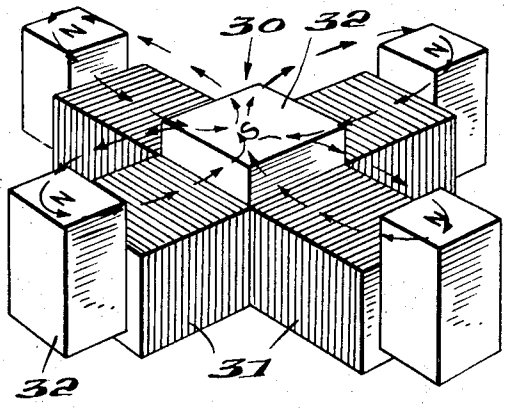


Fig. 5A.

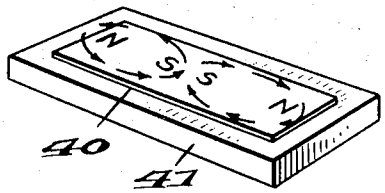


Fig. 4B.

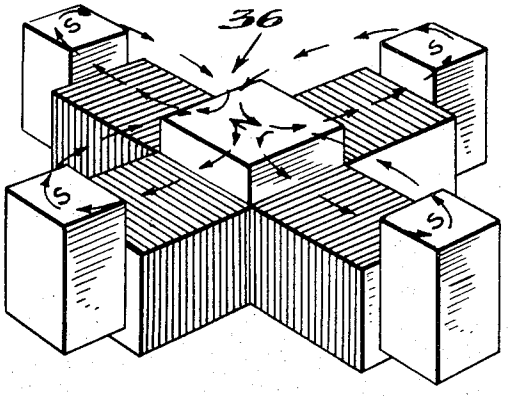


Fig. 5B.

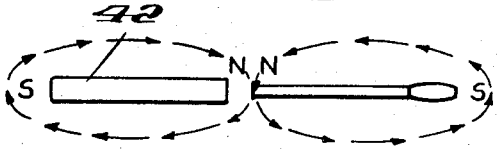
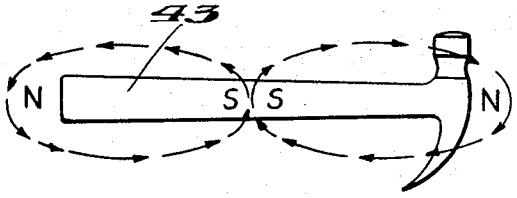


Fig. 5C.



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Fig. 3B.

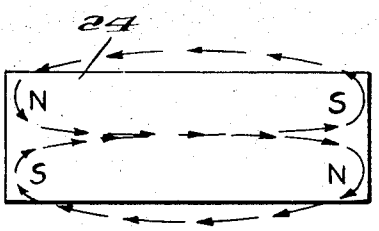


Fig. 3C.

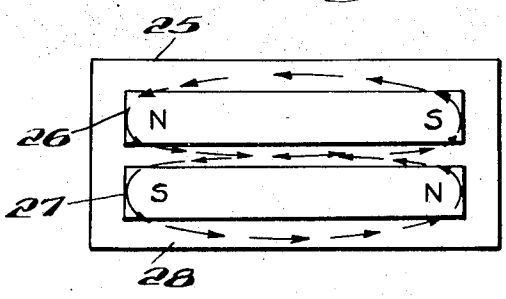


Fig. 4C.

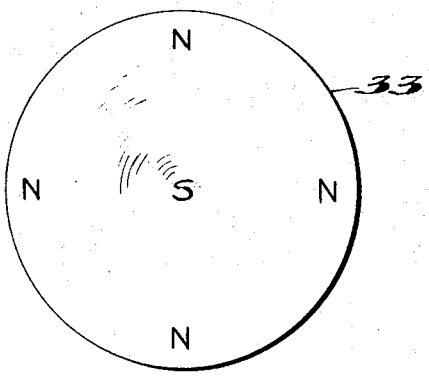


Fig. 4D.

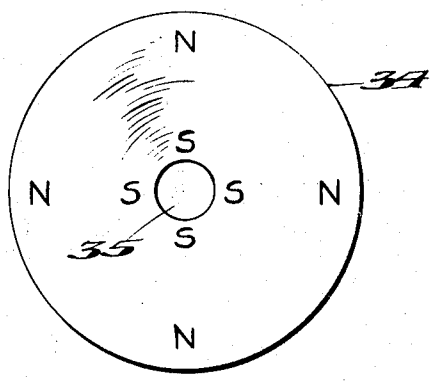
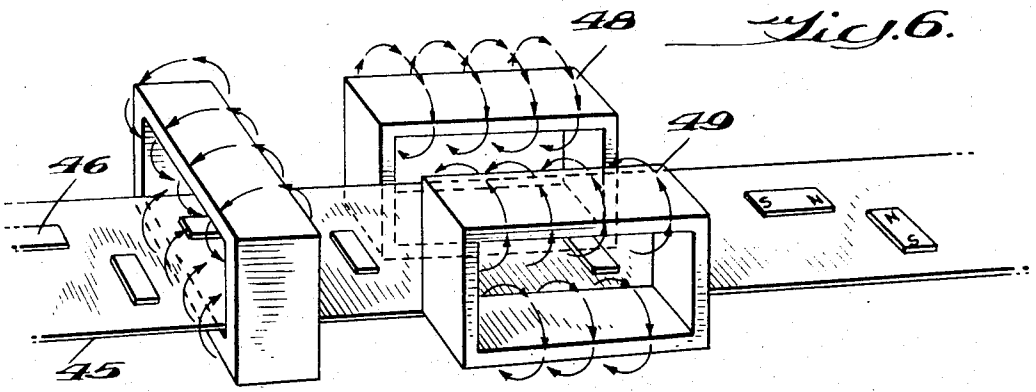


Fig. 6.



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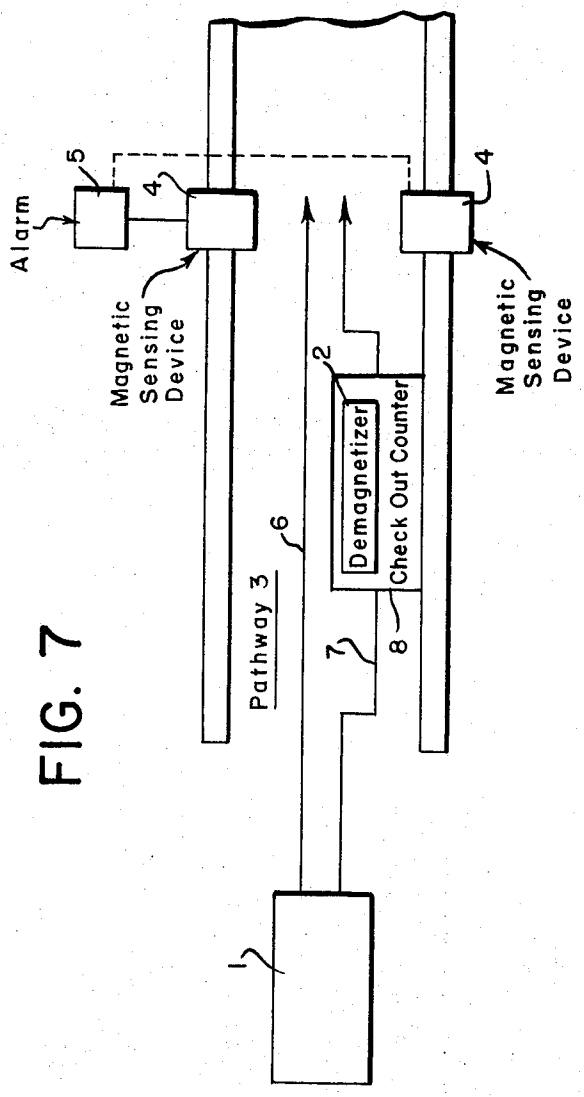


FIG. 7

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MAGNETIC MATERIAL AND METHOD OF PRODUCING SAME

REFERENCES TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 733,163 filed May 29, 1968, now abandoned, which in turn was a division of application Ser. No. 531,253, filed Mar. 2, 1966, now U.S. Pat. No. 3,418,613.

This invention relates to magnetic devices and more particularly to magnetized articles for use in systems to prevent pilferage. This invention further relates to a method of magnetizing such articles.

The problem of pilferage by customers, employees, borrowers and others has reached an alarming level. Various radioactive and electronic systems have been designed to protect articles from unauthorized removal. However, each has attendant disadvantages. The radioactive systems present problems in handling and the electronic systems are costly to install and maintain. In my copending application, Ser. No. 412,893, for SYSTEM AND METHOD FOR PREVENTING PILFERAGE BY DETECTION OF MAGNETIC FIELDS, filed Nov. 23, 1964, a system was described in which articles such as goods or commodities, easily accessible to the public, are protected by being given a detectable magnetic field which must be demagnetized by authorized personnel before it may be removed from a security area. A magnetic sensing device is placed at the exit or doorway to detect any articles which have not been exposed to the demagnetizer. The security area includes or terminates in a pathway, which is defined to mean any area, route or line of travel where the system is established to detect pilferers. Various possible routes may exist through such pathway, each such route constituting a way in which a person might pass through the pathway. For example, one such route may include picking up a protected article within the security area or pathway and exiting therefrom without having such goods demagnetized. In another such route, the protected goods picked up may be demagnetized prior to leaving. A more complete explanation of the pilferage system is contained in U.S. Pat. No. 3,292,080.

FIG. 7 illustrates goods 1 which are to be protected from theft by giving them a detectable magnetic field. A pathway 3 is privided within which the system is arranged. It is contemplated that 'pathway' be used herein to mean any area, route or line of travel where the system is established to detect pilferers. This 'pathway' may be situated in a library, department store, plant or anywhere else where goods are to be protected.

A demagnetizer 2 is provided in a portion of pathway 3,. The demagnetizer 2 is usually situated at a check-out counter 8 or the like near the exit of the pathway. One type of demagnetizer that may be used is a common current carrying coil which, when energized, produces a magnetic field within the coil.

A magnetic sensing device 4 is positioned at the exit of the pathway. This magnetic sensing device 4 is designed to detect the magnetic field of any goods 1 which are to be protected and have not been demagnitized. It is preset to sense only magnetic fields having predetermined values of B and H_c. In this manner, foreign items which display a magnetic field different than these pre-determined values will not detected (sic) when passing by the magnetic sensing device 4.

The sensing device 4 may be selected from any well-known instruments, such as a magnetomer, gradiometer, fluxmeter, gaussmeter and permeameter. These instruments are usually protected from disturbances by outside magnetic fields by means of high permeable shielding.

An alarm 5 will be actuated by the magnetic sensing device 4 when a magnetic field, emanating from the protected goods is detected. The alarm may be a visible or an audible warning device. The magnetic sensing device 4 could also be used to actuate and lock a door or a turnstile, positioned at the exit to the pathway, and thus prevent the thief from leaving the security area.

There are two possible routes the goods 1 may follow through the system. If the goods follow the normal and proper channel (line 7 of FIG. 7) they are taken to a check-out counter 8 where the goods are deactivated by the demagnetizer 2. The demagnetized goods are then exposed to the magnetic sensing device 4. The sensing device 4 will not, however, actuate the alarm 5 since no magnetic field will be present to be detected. Thus, the goods will be permitted to leave the security area. The alternate route that the goods 1 may follow is illustrated by line 6 of FIG. 7. The goods 1 are carried directly through the pathway without passing in contact with the demagnetizer 2. When the goods 1 reach the magnetic sensing device 4, the magnetic field of the goods will be detected. The magnetic sensing device 4 will in turn actuate alarm 5 and the pilferer will be exposed.

The system operates satisfactorily with any article having a detectable magnetic field. Therefore, the article need only have a single detectable magnetic field to operate satisfactorily with the pilferage prevention system described above.

However, one disadvantage of using only a single detectable magnetic field is that the system may be defeated by neutralizing the single magnetic field of the protected article by an external magnetic source. This may be accomplished by placing another device of the same magnetic strength having an opposed polarity immediately adjacent to the protected and magnetized article. One magnetic field then acts to neutralize the other in the same manner as that occurs when two bar magnets are placed side by side with poles directly opposite. Thus, it can be seen that if such were to occur, the removal of the articles by an unauthorized person in the aforementioned system would not be detected.

The present invention relates to magnetized articles suitable for use in pilferage prevention systems and to a method of magnetizing the articles to be used in said systems.

The magnetized articles are not limited to any particular shape and may be rectangular, circular or have any three dimensional configuration, as long as they are capable of retaining a detectable magnetic field. The magnetized articles may be the goods to be protected themselves where they are capable of retaining a detectable magnetic field or they may take a form so as to be readily attachable to the goods or products to be protected.

One feature of the present invention is that the articles to be protected are capable of retaining a plurality of magnetic fields so as not to be subject to neutralization by an external magnetic source. This is accomplished by individually magnetizing these articles themselves to provide at least two separate detectable fields where they are in the form of goods or commodities, or by attaching to the goods an article in the form of a magnetic flat component having at least two separate magnetic fields. Whether the articles are in the form of magnetized commodities or are in the form of the flat magnetized components, no matter what type of external neutralizing sources are used, only one of the two magnetic fields will be neutralized since each article has two oppositely disposed magnetic fields.

A further feature of this invention is the method of magnetizing the articles. The article may be magnetized individually so a plurality of north-south magnetic fields may be produced as described above, or the articles may be magnetized in bulk, wherein only a single magnetic field is applied to the individual article.

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1*a* illustrates one embodiment of a magnetizer used in the invention;

FIGS. 1*b* and 1*c* illustrate two rectangular magnetized components having a magnetic field produced by the magnetizer of FIG. 1*a;*

FIG. 2*a* illustrates a second embodiment of a magnetizer used in the invention;

FIG. 2*b* illustrates a magnetized article made with the magnetizer of FIG. 2*a;*

FIG. 3*a* shows a third embodiment of a magnetizer used in the invention;

FIGS. 3*b* and 3*c* show magnetized articles made with the magnetizer of FIG. 3*a;*

FIGS. 4*a* and 4*b* illustrate two additional types of magnetizers;

FIGS. 4*c* and 4*d* illustrate the magnetized articles made with the type of magnetizers of FIGS. 4*a* and 4*b;*

FIG. 5*a* is a commodity protected with an article of the present invention;

FIGS. 5*b* and 5*c* show magnetized commodities;

FIG. 6 shows apparatus used in the method of magnetizing materials in bulk;

FIG. 7 is a schematic illustration of a pilferage prevention system as shown in U. S. Pat. No. 3,292,080.

Various embodiments of the magnetized article to be used are shown in the drawings. There is no limitation on the size or shape of the article, and it need only have the property of residual magnetic induction, that is, it must be capable of retaining a detectable magnetic field. An example of such material is one with ferromagnetic properties. As indicated in my copending application, Ser. No. 412,893, for SYSTEM AND METHOD FOR PREVENTING PILFERAGE BY DETECTION OF MAGNETIC FIELDS, filed Nov. 23, 1964, the magnetized article may be the protected goods themselves where they are capable of retaining a magnetic field, for example, an iron hammer or screwdriver, or the article may take the form of a flat component that is physically attached to the goods to be protected such as a flat metallic strip as shown in FIGS. 5*a*, 5*b* and 5*c*. To facilitate the description, the articles shown in the drawings are flat strip and circular components of the type that could be easily attached to goods or commodities to be protected.

FIG. 1*a* discloses a double-headed magnetizer **1** designed to produce the magnetic articles of the present invention. The double-headed magnetizer **1** is provided with a base **2** whereon two conventional C-shaped yokes **3** and **4** are mounted in a longitudinal arrangement, the open ends facing upwardly. Around the base of each yoke **3** and **4** is wound a coil **5** and **6** designed to carry the magnetic current. The coils **5** and **6** are wound in such a manner that magnetic fields of opposite polarity are produced when current is passed through them. In this embodiment the south poles are shown adjacent each other while their respective north poles are on the opposite end of the magnetizer unit **1.**

It will be understood by those skilled in the art that an article capable of retaining a residual magnetic induction may be magnetized by placing it directly over the open ends of the yoke pieces **3** and **4** and energizing the coils **5** and **6.** The energized coils **5** and **6** produce magnetic flux fields between the two north and south poles which act to reorient the molecular structure of the magnetizable article. The article, such as the flat strip component **7** shown in FIG. 1*b*, is provided with a pair of north-south magnetic fields, with the two south poles at its respective center and north poles at its ends. A non-magnetic material may be placed at the center of the article **7** between the two magnetic fields in any convenient manner to act as a means for definitely separating the two fields.

Alternately, a strip component **8** may be formed by two pieces of magnetized material **9** and **10** set in a non-magnetic material **11** such as plastic or cardboard to form a composite structure. This strip component **8** may be formed by first separately magnetizing the individual pieces of material and then setting them in the plastic or cardboard, or by setting the individual pieces in the plastic or cardboard and utilizing the magnetizer **1** as above.

With this arrangement of double magnetic fields in the component, the problem of neutralizing the magnetized component is almost totally eliminated, since a neutralizing magnet having one magnetic field cannot be placed over both the magnetic fields of the article and one or the other will remain detectable.

FIG. 2*a* shows a double-headed magnetizer **12** similar to the magnetizer **1,** except the coils **13** and **14** wound around the yokes **15** and **16** produce an opposite polarity to the magnetizer **1.** In this way, the north poles are adjacent to each other while the south poles are on the opposite end of the magnetizer unit **12.** The strip component **17** shown in FIG. 2*b* formed by this double-headed magnetizer **12** thus has a polarity opposite to the strip component **7** of the first embodiment.

A non-magnetic material may also be placed between the two magnetic fields. Also, a strip component may be formed by two pieces of magnetized material set in non-magnetic material, to form a composite structure in the same manner as component **8** of the first embodiment.

FIG. 3*a* shows a third type of double-headed magnetizer **18** wherein two C-shaped yokes **19** and **20** are placed on a base **21** facing upwardly in a parallel, side-by-side relationship rather than in a longitudinal line as illustrated in FIG. 1*a* and FIG. 2*a*. The coils **22** and **23**

are wound around the bases of their respective yokes **19** and **20** in such a way so as to produce magnetic fields of opposite polarity when the current is passed through the coils. That is, one yoke of the magnetizer **18** has a north-south polarity while the other yoke immediately adjacent thereto has a south-north polarity.

FIG. 3*b* illustrates a magnetized strip component **24** produced by the magnetizer **18.** In this figure the two detectable magnetic fields are arranged in parallel, side-by-side relationship to form the double polarity magnetized strip component **24.**

As in the first two embodiments, the strip component **24** may be provided with a strip of non-magnetic material between the two fields. Alternately, a strip component article **25** may be formed using two pieces of magnetized material **26** and **27** of opposite setting on a non-magnetic base **28.**

A variety of magnetizers and components are contemplated by this invention, the only limitation being that the magnetizer carry at least two magnetic yokes of opposite polarity to provide the component with two magnetic fields in order that both fields will not be subject to neutralization from an external magnetic source.

FIG. 4*a* shows a cross-shaped magnetizer **30** capable of producing four magnetic fields. The coils **31** are so wound on the yoke section **32** so as to produce a south polarity at the center of the magnetizer **30** and north polarities at the end of the magnetizer yokes. Thus, by placing any article to be magnetized above or in juxtaposition with the magnetizer **30,** it will receive four magnetic fields extending radially outwardly from the center of the magnetizer.

This type magnetizer **30** is particularly convenient for use in producing circular magnetized components **33** and **34** as shown in FIGS. 4*c* and 4*d*. The same principle applies to the circular components **33** and **34** as to the longitudinal strip components described above. The opposite polarity arrangement of the detectable magnetic fields precludes neutralization by an external magnetic source. To facilitate handling, a circular component **34** may be provided with a hole **35** in its center.

It is understood that this type magnetizer may have its coils wound in such a manner so the current flows in the opposite direction in order that the center of the magnetizer forms a north pole and the opposite ends form south poles. This type of magnetizer **36** is shown in FIG. 4*b*. The operation is the same as the described above, with merely a change in polarity. The article to be detected is given a plurality of radially spaced magnetic fields which are not subject to neutralization from an external source.

As indicated above the article to be magnetized is not limited to any particular size or configuration. FIG. 5*a* illustrates a magnetized component type article **40** which is shown attached to the goods or commodity **41** such as a library book or the like. It is understood this attachment may be made in any convenient manner such as by using glue or pressure-sensitive tape. Also, any goods or commodities which are to be protected, and are capable of retaining a detectable magnetic field, may be directly magnetized with a plurality of magnetic fields. For example, metallic tools or appliances could be given a plurality of detectable magnetic fields. FIG. 5*b* illustrates a screwdriver **42** and FIG. 5*c* illustrates a hammer **43** both of which have been magnetized according to this invention. Such goods could be magnetized by a longitudinal magnetizer **1, 12** or **18.** Differently shaped commodities, such as a frying pan, not shown, could be magnetized by a cross-shaped magnetizer **30** or **36.** The type of magnetizer used depends upon which is the more convenient to use.

Where an article to be protected is made in great quantity, it may not be economically feasible to individually magnetize each article in order to provide it with a plurality of magnetic fields.

The detection system of my copending application, Ser. No. 412,893, for SYSTEM AND METHOD FOR PREVENTING PILFERAGE BY DETECTION OF MAGNETIC FIELDS, filed Nov. 23, 1964, operates in the same manner whether the articles or goods to be protected have a single or a plurality of magnetic fields. Thus, it may be economically preferable to magnetize the articles in bulk thereby giving them only a single detectable field. In order that the pilferage prevention system operates more efficiently, the articles or goods to be protected need be magnetized along their longitudinal axis, which produces a stronger magnetic field. A method of bulk magnetizing the articles in such a manner is described below.

FIG. 6 shows an apparatus for magnetizing such articles in bulk. A conveyor **45** carries the articles **46,** which are to be magnetized, arranged in random position on the belt **45.** A magnetizer **47** is constructed so as to allow the article to pass through its center and it is wound in to produce a magnetizing force field parallel to the direction of movement of the articles. Two other magnetizers **48** and **49** are placed adjacent to the conveyor **45** and are wound to produce a magnetic force field perpendicular to the direction of movement of the articles **46** on the conveyor **45.**

To facilitate detection, it is desirable that the articles **46** be magnetized along their longitudinal axis. When the article to be magnetized passes the magnetizer units **47, 48** and **49,** it will be substantially parallel to either the magnetic force field produced by magnetizer unit **47** or the field produced by the magnetizer units **48** and **49.** It has been found there is little magnetic strength in any field produced across the width of the magnetized articles **46.** Thus, an article which is magnetized by passing through a parallel force field is not neutralized by passing through a second magnetic force field perpendicular to it since only the width is exposed to this second field. If the articles **46** are to be magnetized in the form of the goods or commodities to be protected, they will be normally packaged in such a way so as to be perpendicular to the magnetizer unit **47** or perpendicular to the units **48** and **49.** If the article is not packaged but is lying loosely on the conveyor, the magnetic field produced by the magnetizer units will have a tendency to align the articles **46** passing by. In both cases the articles **46** are magnetized along their longitudinal axes.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

I claim:

1. In a system for the prevention of pilfering of articles passing through a pathway wherein there are plural distinct routes, said system having a means for demagnetizing said articles passing only through one route and sensing means situated at the exit of said pathway

for sensing the magnetic field of all articles passing through all routes, the combination with a plurality of detectable magnetic fields carried by each article wherein at least two of the magnetic fields are disposed in a different direction such that both cannot be neutralized at the same time by a single external source.

2. The system of claim 1 wherein said articles have a strip component of magnetized material, said component having two detectable magnetic fields of opposite polarity wherein poles of similar polarity of said magnetic fields are positioned immediately adjacent each other and the other poles of similar polarity are placed in the opposite ends of said strip component.

3. The system of claim 2 wherein said component strip has two detectable magnetic fields thereon arranged in a parallel, side-by-side relationship, the polarity of one of said magnetic fields being opposite in direction to the polarity of said second magnetic field.

4. The system of claim 1 wherein said articles have a circular component of magnetized material, said circular component having similar poles of one polarity located at the center of said circular component, and similar poles of the opposite polarity located at the radial extremities of said circular component.

5. In a system for the prevention of pilfering of articles from a security area, said security area having an entrance and exit pathway, said system having a sensing means situated at the exit of said pathway for sensing the magnetic field of all articles passing through the exit, the combination with a plurality of detectable magnetic fields carried by each article wherein at least two of the magnetic fields are disposed in a different direction.

6. In the process for preventing the pilfering of articles passing through a pathway, said pathway having plural distinct routes, comprising supplying said articles with a detectable magnetic field, placing a demagnetizing field in only one route, demagnetizing only the articles passing through said field, positioning a magnetic sensing device at the exit of said pathway and sensing the magnetic field of all said articles passing through any one of said routes for detecting any articles which have not been demagnetized, the combination with the step of actively supplying each of said articles with a plurality of magnetic fields wherein at least two magnetic fields are disposed in a different direction.

7. In the process of claim 6 including the step of actively supplying each article with a strip component having two detectable magnetic fields of opposite polarity wherein poles of similar polarity of said magnetic fields are positioned immediately adjacent each other and the other poles of similar polarity are placed in the opposite ends of said strip component.

8. In the process of claim 6 including the step of supplying each article with a strip component having two detectable magnetic fields thereon arranged in a parrellel, side-by-side relationship, the polarity of one of said magnetic fields being opposite in direction to the polarity of said second magnetic field.

9. In the process of claim 6 including the step of actively supplying each article with a circular component of magnetized material, said circular component having similar poles of one polarity located at the center of said circular component, and similar poles of the opposite polarity located at the radial extremities of said circular component.

10. In a process for preventing the pilfering of articles comprising providing a security area in which goods are to remain, said security area having an entrance and exit pathway, actively supplying said articles located in the security area with a detectable magnetic field, positioning a magnetic sensing means at said exit pathway, sensing the magnetic field of said articles which pass into said exit pathway and preventing the removal of said articles from the security area, the combination with the step of actively supplying each of said articles with a plurality of magnetic fields wherein at least two magnetic fields are disposed in a different direction.

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