

July 4, 1967

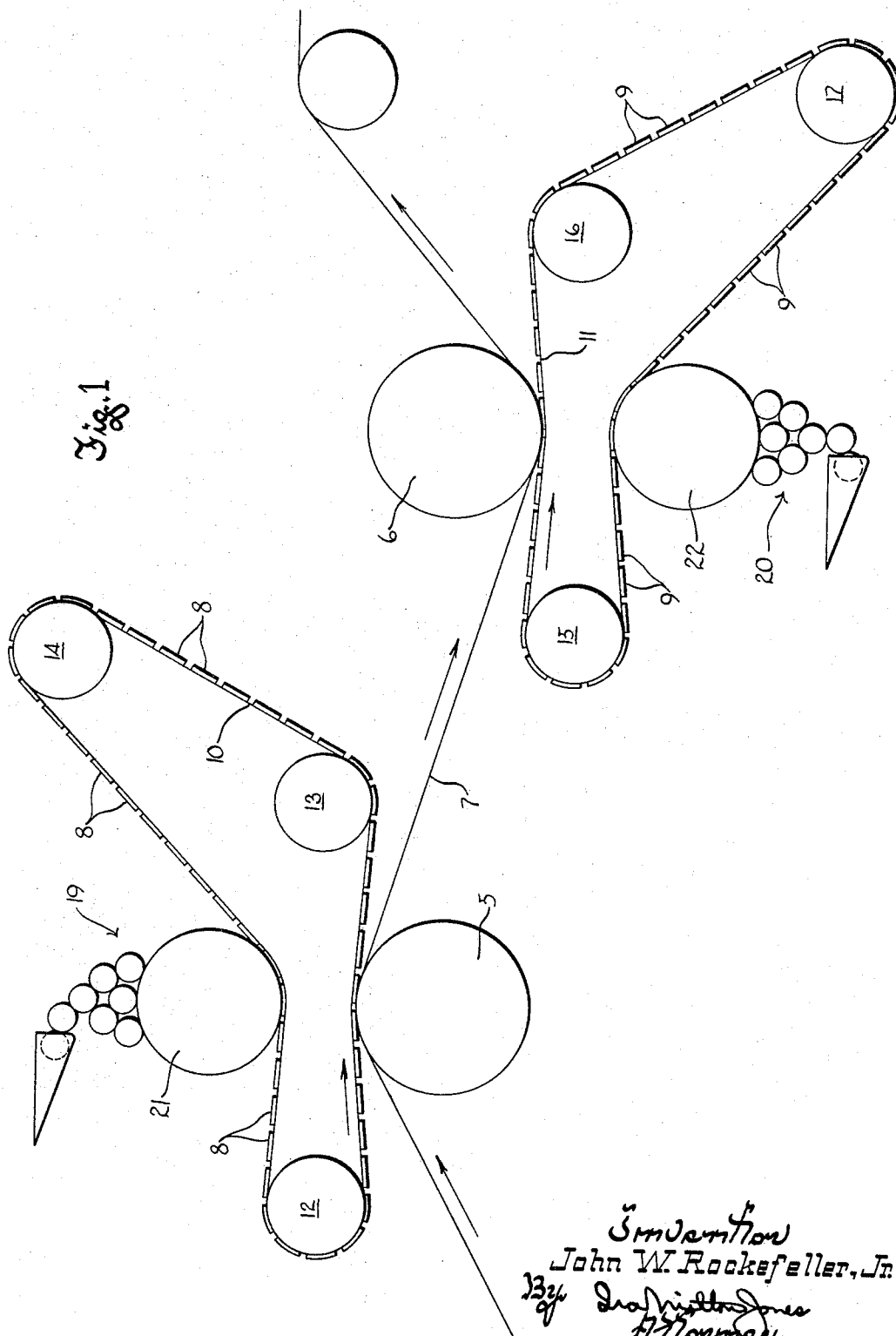
J. W. ROCKEFELLER, JR

3,329,088

PRINTING METHOD AND APPARATUS

Filed Dec. 31, 1962

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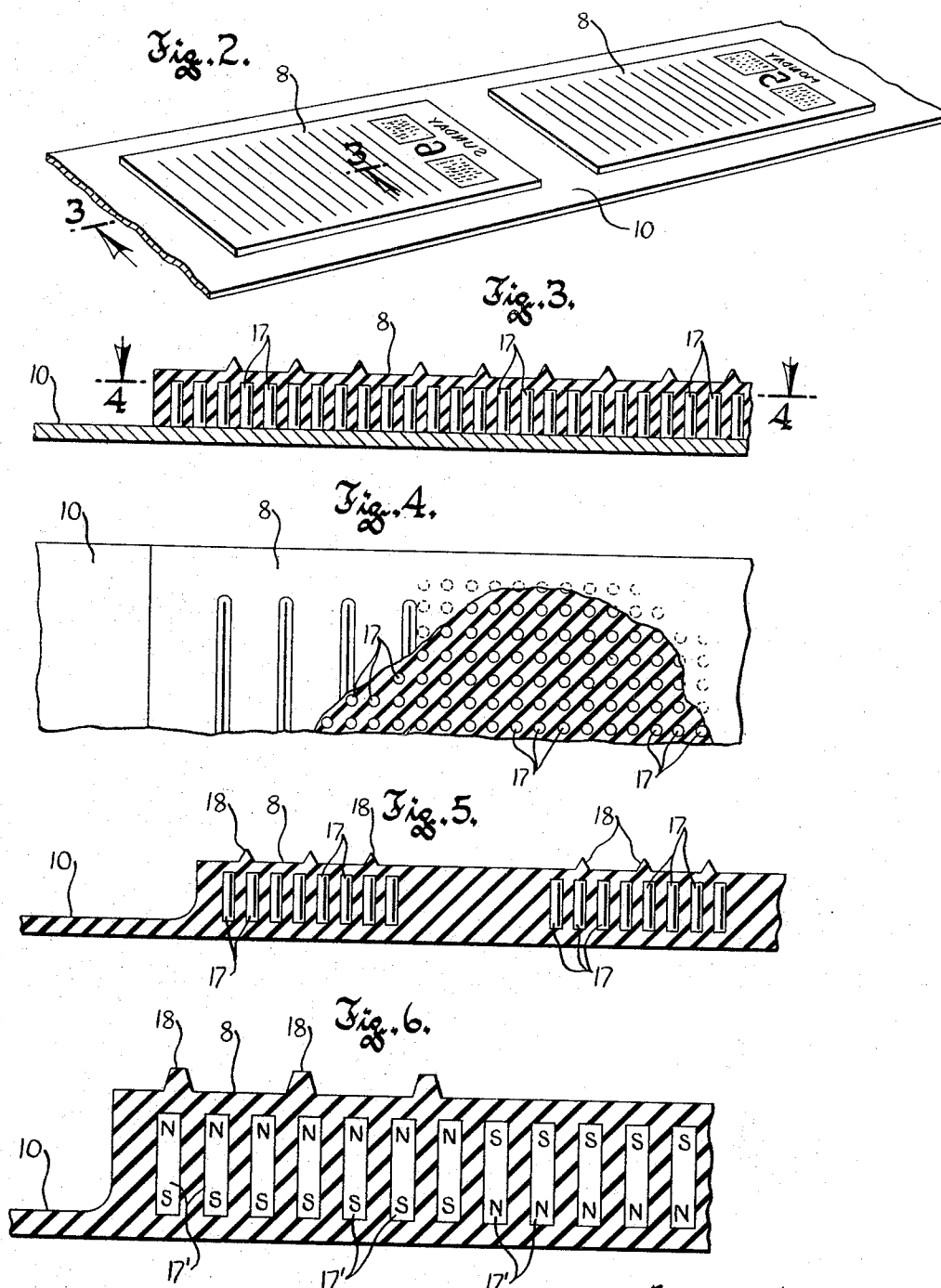
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PRINTING METHOD AND APPARATUS

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4 Sheets-Sheet 2



Invention
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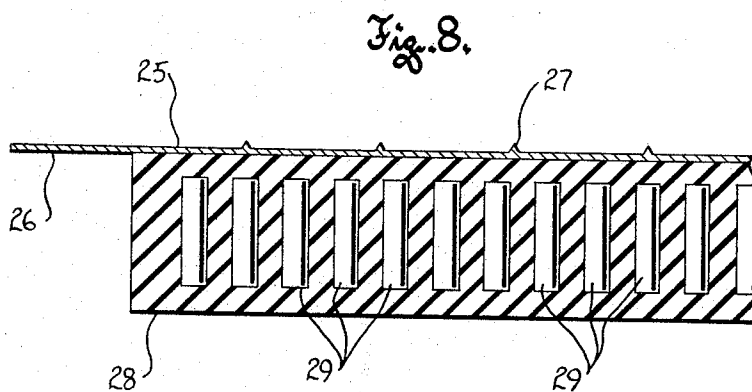
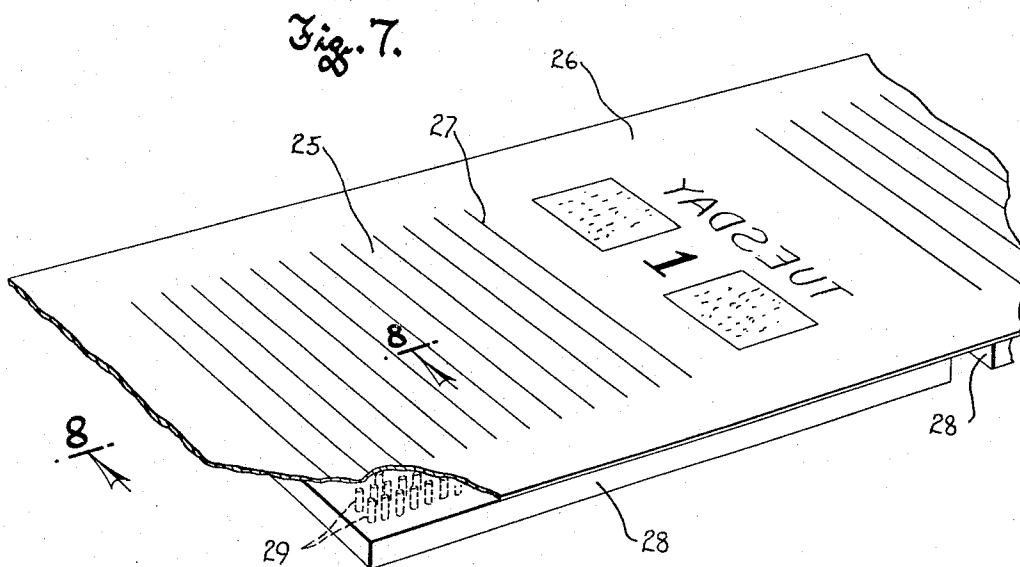
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J. W. ROCKEFELLER, JR
PRINTING METHOD AND APPARATUS

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4 Sheets-Sheet 3



Invention
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July 4, 1967

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PRINTING METHOD AND APPARATUS

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4 Sheets-Sheet 4

Fig. 9.

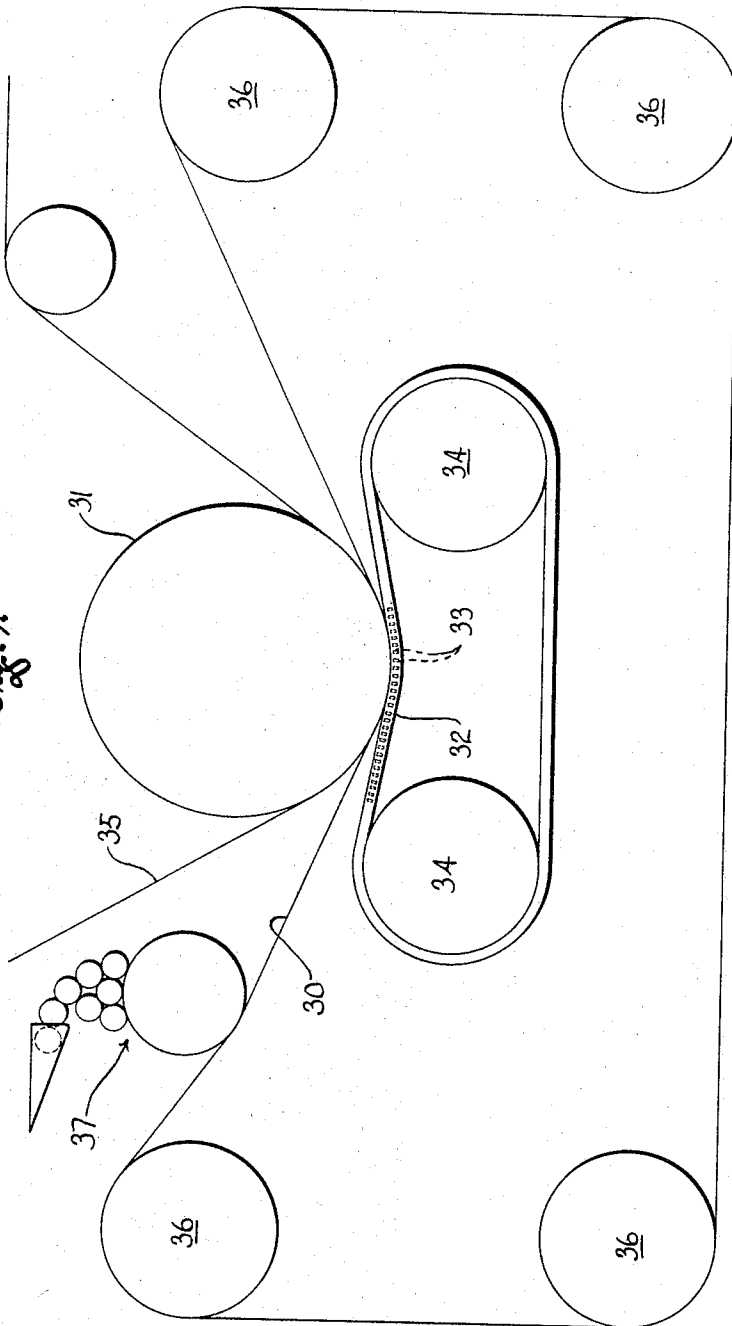
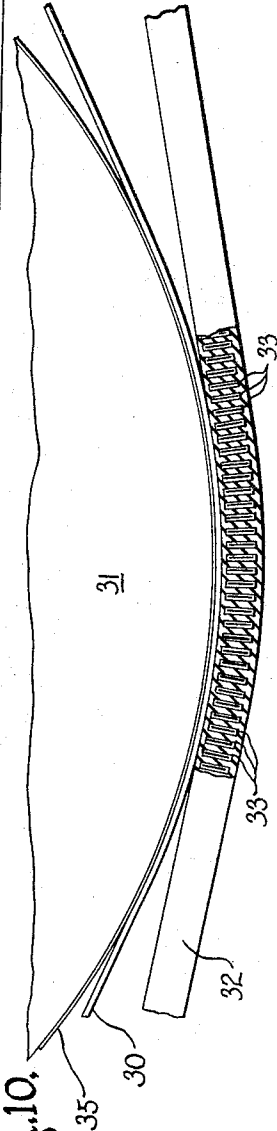


Fig. 10.



Invention
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This invention relates to the art of printing and, like that of the pending application of John W. Rockefeller, Jr., Ser. No. 94,918, filed Mar. 10, 1961, now abandoned, of which this application is a continuation-in-part, has as its purpose to provide an improved method and apparatus for printing by which the objections inherent in so-called letter press printing are eliminated, without however sacrificing any of its desirable attributes.

The invention is applicable to sheet-by-sheet printing as well as web printing, though perhaps it finds its greatest utility in web printing. In any event, it should be understood that unless otherwise specified, where the term "sheet" is used herein—both in the specification and the claims—it encompasses a web as well as a sheet.

In conventional letter press printing, a predetermined fixed pressure is maintained between the printing form or plate and the surface of the sheet or web being imprinted while the latter is supported by the impression cylinder in the case of a rotary press, or by the platen in the case of the flat bed or job press. Since the printing surface of the form or plate obviously and of necessity varies in height, a backing layer or tympan of some kind is used to more or less resiliently support the sheet or web as it is being imprinted. Thus, in the case of the rotary press, the impression cylinder always has a tympan wrapped around it, usually consisting of a sheet of rather heavy paper and numerous paper shims or packing therebeneath, so placed as to achieve the desired printing pressure over the entire area being printed. Building up the height or thickness of the tympan by means of shims or packing is known as "make-ready," and to do it properly requires considerable skill. Only an experienced pressman can be entrusted with the job.

The cost in time and money which this make-ready entails is one of several reasons why letter press printing has been on the decline in recent years and has been all but superseded by offset printing.

The present invention does away with costly time-consuming make-ready and still achieves proper printing pressure.

The invention is exceptionally well adapted to the printing of books, calendar pads and the like, wherein a large number of successively different indicia or intelligence must be imprinted on a continuously advancing web. In such variable repeat printing, the different printing forms or plates are carried by an endless flexible belt, to be successively brought into operative coaction with an impression cylinder over which the web to be imprinted runs. The patent to De Florez No. 2,600,215, and the earlier patent to Keller No. 2,066,179, are examples of printing methods and presses used for such variable repeat printing.

Since the printing forms or plates for this type of printing must be flexible, they are generally made of rubber or the like. However, with the conventional letter press printing methods, high quality printing could not be achieved with such yieldable forms or plates. Because of the yieldability or surface softness of these forms or plates, small local high spots or areas thereof spread out and return to normal size as they are transiently subjected to the printing pressure characteristic of conventional letter press printing. Lack of sharp definition was thus inevitable, but with this invention, the same forms or plates produce exceptionally fine printing.

With the above and other objects in view, this invention resides in the novel method and apparatus devised

for the practice thereof, as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise method and apparatus herein disclosed may be made as come within the scope of the claims.

As will hereinafter more fully be described, the invention resides principally in producing the required contact between the printing form and the sheet being imprinted, by means of magnetic attraction between the elements of the printing couple, i.e. the supporting surface—either platen or cylinder—and the printing form or plate; and to assure that every portion of the form or plate which is to do the printing will engage the sheet with the proper printing pressure as that portion is brought into printing position, at least one element of the printing couple is flexible. Preferably, it is the printing form or plate which is flexible, and the description to follow will proceed upon that premise.

With a flexible printing form or plate and an unyielding pressure cylinder or platen, the printing pressure acting on each localized area of the form or plate as a result of the magnetic attraction between the two elements of the printing couple, is thus independent of the amount of printing pressure upon all other localized areas thereof.

Except for its disclosure in the aforesaid copending application, the use of magnetic attraction between the supporting surface and the printing plate to achieve correct printing pressure is unprecedented in the art. To obtain the desired magnetic attraction between the supporting surface (impression cylinder or platen) and the printing form or plate, the latter must be rendered magnetically attractable and the supporting member must be magnetized or vice versa. Of course, the objective sought will be also attained if both the printing form and the supporting surface are magnetized and the polarity is such that they are mutually attracted.

For a more complete description of this invention, reference is now made to the accompanying drawings which illustrate several embodiments of the invention according to the best modes so far devised, and in which:

FIGURE 1 is a diagrammatic view illustrating the adaptation of this invention to a perfecting-type belt plate press for printing both sides of a web with a succession of different indicia—as, for instance, the daily sheets of a calendar pad;

FIGURE 2 is a fragmentary perspective view of a portion of one of the plate carrying belts of the press illustrated in FIGURE 1;

FIGURE 3 is a detail sectional view through FIGURE 2 on the plane of the line 3—3, but drawn to an enlarged scale;

FIGURE 4 is a top plan view of a portion of the plate belt, with a part thereof broken away and in section;

FIGURE 5 is a cross sectional view similar to FIGURE 3, but illustrating a slightly modified embodiment of this invention;

FIGURE 6 is a cross sectional view also similar to FIGURE 3, illustrating another modified embodiment of the invention;

FIGURE 7 is a perspective view similar to FIGURE 2, showing the invention in still another form;

FIGURE 8 is a detail sectional view through FIGURE 7 on the plane of the line 8—8, but on an enlarged scale;

FIGURE 9 diagrammatically illustrates a portion of a press similar to that shown in FIGURE 1, showing how the invention may be employed with a thin metal etched plate belt; and

FIGURE 10 is a fragmentary detail view of a portion of the printing couple of the press shown in FIGURE 9, with parts broken away and in section.

Referring now to the accompanying drawings and particularly to FIGURE 1, the numerals 5 and 6 designate

the two impression cylinders of a rotary perfecting press, over and under which a web 7 to be imprinted runs. As is customary, the web is drawn from a reel (not shown) and, after being imprinted, moves on to a cutting and folding machine, also not shown.

Each impression cylinder constitutes one unit of a printing couple. The other unit thereof is any one of a series of printing forms or plates 8 and 9, the former coating with the cylinder 5 and the latter with the cylinder 6. These printing forms or plates are made of flexible material, such as rubber or a rubber-like material, and are either integral parts of or simply mounted on and carried by belts 10 and 11, respectively.

The belts 10 and 11 respectively run over sets of cylinders or rolls 12, 13 and 14, and 15, 16 and 17. At least one of the cylinders or rolls of each set is power driven to move the belts 10-11 at a linear speed identical to that of the web 7.

The cylinders or rolls 12 and 13 are so placed with respect to the impression cylinder 5 that the stretch of the belt 10 therebetween is under a degree of tension sufficient to, of itself, establish contact between the successive plates 8 and the outer surface of the web 7 as it travels over the cylinder 5. In like manner, the rolls or cylinders 15 and 16 are so positioned with respect to the impression cylinder 6 that the stretch of the belt 11 therebetween is under tension and held against the opposite side of the web 7 as it passes under the impression cylinder 6.

However, the tension of the belts is not relied upon to produce the printing pressure between the forms or plates 8-9 and the web 7. This is done by magnetic attraction between the impression cylinders and the printing forms or plates as they pass in cooperative relation with the cylinders. To this end, the cylinders 5 and 6 are magnetized in any suitable way. The manner in which this is done forms no part of the invention. Moreover, magnetized cylinders are well-known, being used in magnetic separators wherein a belt trained about the cylinder carries material from which ferrous metal objects are to be separated.

The printing forms or plates 8 and 9 are made of rubber, or similar flexible material, and are either adhered, or otherwise secured, to the belts 10 and 11, as in FIGURES 2, 3 and 4; or formed integrally with the belts, as in FIGURES 5 and 6. In the latter case, the belt, like the printing forms or plates would of course be formed of rubber or whatever other flexible material is used for the forms or plates. Where the belts are separate from the plates they may be of any suitable flexible material, such as fabric, or even metal provided it is sufficiently flexible.

The significant characteristic of the plate belt is the manner in which its plates are rendered magnetically attractable. In all cases, this is done by embedding or otherwise fixing a multiplicity of discrete small bodies of magnetically attractable material, preferably short mild steel pins 17, in or to the printing forms or plates. Where pins are used they can be cut from wire, and they should be arranged with their axes perpendicular to the opposite faces of the plates, so that the pins are all parallel to one another. So disposed, the pins are substantially radial to the magnetized impression cylinders as the plates travel thereover.

Preferably the opposite ends of the pins 17 are spaced inwardly of the adjacent surfaces of the plates. They may be equispaced throughout the entire area of the printing plates or, as shown in FIGURE 5, they may be located only in those portions of the plates which have raised printing characters or delineations 18, so that only these areas of the plates are attracted to the magnetized impression cylinder. In this manner, good assurance is had that only those portions of the printing plates which are actually to do the printing will come in contact with the sheet being imprinted.

As indicated, the pins 17 may be of mild steel, but

obviously they could be formed of any other magnetically attractable material. Also, if desired, they may be magnetized so that each has a "north" and a "south" pole, as are the pins 17' in FIGURE 6. In this case the pins located in those areas of the plate which are to do the printing are oriented differently from the pins in the portions of the plates which are not to print. In other words, the polarity of the pins of the two groups is reversed.

With the pins magnetized and oriented as shown in FIGURE 6, it follows that as a plate travels over a magnetized impression cylinder, those parts thereof which are to do the printing can be magnetically attracted toward the impression cylinder, while those portions of the plate which are not to come in contact with the surface of the sheet being imprinted, can be repelled from the magnetized impression cylinder. This simply requires establishing the correct polarity relationship between the magnetized impression cylinder and the magnetized pins.

A very significant advantage of this invention is that it gives the printing forms or plates the desired magnetic characteristic, i.e. it makes them magnetically attractable to a magnetized impression cylinder without, however, detracting from the necessary and desirable flexibility of the forms or plates.

Although the size of the individual pins is not critical, for purposes of illustration they may be one-quarter of an inch ($\frac{1}{4}$ ") long and one-sixteenth of an inch ($\frac{1}{16}$ ") in diameter, arranged in very close proximity to one another. It should be understood, however, that the size and spacing of the pins may be varied as required to achieve the desired printing pressure.

As shown in FIGURE 1, in addition to utilizing magnetic attraction to achieve desired printing pressure at the printing couple, the same force may be employed to improve the transfer of ink to the printing form. Thus, the inking mechanism, indicated generally by the numerals 19 and 20, in each instance includes a magnetized inking roller 21-22 over which the succession of printing forms or plates travels to have their active surfaces inked. Those areas of the forms or plates which are not to do any printing should be repelled from the inking roller through proper polarity control if they are not held spaced from the roller by the stiffness of the forms or plates themselves.

Obviously, by simply increasing or decreasing the length of the endless belts 10 and 11, the total number of printing forms required for any particular job can be accommodated. This entails simply removing one belt and substituting another and, of course, increasing or decreasing the spacing between the pulleys or cylinders over which the belt travels, as by adjusting the location of the rolls 14 and 19.

In the embodiments of the invention thus far described, the pins or discrete bodies of magnetically attractable material are embedded directly in the flexible printing forms or plates. The invention, however, also contemplates having the pins or other particulated bodies of magnetically attractable material embedded in pad-like elements, or even in a continuous belt which is not actually a part of the printing forms or plates. Hence, the invention is admirably suited to use with thin metal plate belts, in which case—as shown in FIGURES 7 and 8, for example—the "plates" 25 may be simply successive portions of an endless flexible belt 26 of zinc, aluminum, manganese, copper or other suitable sheet metal, on the order of fifteen to thirty thousandths of an inch (.015" to .030") thick, having its printing surface etched to form the desired printing indicia, as at 27.

The opposite surface of the belt 26 has a series of flexible pads 28 suitably adhered or fixed thereto. These pads are formed of rubber or the like and provide a matrix for a multiplicity of discrete bodies or pins 29 of magnetic metal, which are embedded therein to make the pads magnetically attractable towards a magnetized impression cylinder, without destroying their flexibility or

5

interfering with the freedom of the plate belt to conform to the impression cylinder. Hence, as the plate belt passes over a magnetized impression cylinder such as the cylinder 5 in FIGURE 1, with a sheet to be imprinted therebetween, the etched printing surface of the belt—suitably inked—will be pressed against the sheet by the magnetic attraction between the impression cylinder and the magnetically attractable pins or bodies embedded in the pads.

In another adaptation of this form of the invention, illustrated in FIGURES 9 and 10, the flexible magnetically attractable part of the printing couple is entirely independent of the plate belt. Thus, the plates which are successive portions of a thin flexible endless belt 30 of suitable metal, having the printing indicia etched on one surface thereof, travel between an impression cylinder 31 and a stretch of an endless flexible band 32 of rubber or the like having mild steel pins 33 or other suitable discrete bodies of magnetically attractable metal embedded therein. The band 32 is trained over rollers 34, one of which is driven to give the band the same lineal speed as the belt 30 and the sheets or web 35 being imprinted. The plate belt is trained over a plurality of rollers 36, at least one of which is driven, and a conventional inking mechanism 37 inks the etched printing surface of the belt as it approaches the printing couple.

From the foregoing description taken with the accompanying drawings, it will be seen that all embodiments of the invention illustrated herein have one important feature in common. In every case the pins are embedded in rubber or similar flexible material. This permits the pins to move longitudinally relative to one another as needed to provide the proper printing pressure. It will also be readily apparent to those skilled in this art that this invention constitutes a significant improvement in the printing art, and that it should go far towards perpetuating letter press printing.

What is claimed as my invention is:

1. A printing form comprising: a flexible non-magnetic plate-like member having a printing image on one face thereof; and a multiplicity of discrete magnetically attractable bodies embedded in said plate-like member, and so distributed therein that those portions of the form which are to do the printing have said bodies embedded therein, while those portions of the printing form which are not to do the printing are devoid of said bodies.

2. A printing form comprising: a flexible non-magnetic plate-like member having a printing image on one face thereof; and a multiplicity of polarized magnetic bodies embedded in said member, the polarity of the portions of said bodies which lie beneath those areas of said printing face that are to do printing being of one sign and the portions of said bodies which lie beneath those areas of said face which are not to do printing being of the opposite sign, so that upon placement of the printing form in printing coaction with a magnetized impression surface, those areas of the form which are to print may be attracted toward the impression surface while those areas which are not to effect printing may be repelled from said surface.

3. The printing form of claim 2, wherein said polarized magnetic bodies are in the form of magnetized pins, each having a north and a south pole.

4. In the art of printing, the improvement which comprises: rendering only those portions or areas of a flexible printing form which are to print, magnetically attractable; and bringing the flexible printing form into proximity to a surface of a sheet to be imprinted while said sheet overlies the surface of a solid magnetized sheet-supporting member.

5. A printing couple comprising:

- (A) a magnetized impression member having a surface to support a sheet to be imprinted;
- (B) flexible plate means having printing indicia on one face thereof;
- (C) a pad member of flexible material having a

6

multiplicity of magnetically attractable pins embedded therein with their axes parallel; and

(D) means mounting the flexible plate means and the flexible pad member in juxtaposition to the impression member with the printing surface of the plate means contiguous to the sheet supporting surface of the impression member and the pad member overlying the plate means with the pins perpendicular to said face of the flexible plate means so that

(1) the magnetic attraction between the magnetized impression member and the magnetically attractable pins in the flexible pad member provides printing pressure to press the printing surface of the plate means against a sheet supported by the impression member.

6. The printing couple of claim 5, wherein the plate means and the pad member are one unitary piece of material having the flexibility of rubber.

7. The printing couple of claim 5, wherein the plate means is a piece of thin sheet metal with the printing indicia etched on one side thereof.

8. The printing couple of claim 7, wherein the pad member is a piece of material having the flexibility of rubber; and wherein the pad member is attached to the side of the thin sheet metal plate means opposite the side thereof on which the printing indicia is etched.

9. The printing couple of claim 5, wherein the pad member is an endless band of flexible material; and wherein the plate means is an endless belt of thin flexible sheet metal having the printing indicia etched on one side thereof, and having one stretch thereof interposed between the sheet supporting surface of the impression member and one stretch of the endless band which provides the pad member.

10. A printing couple comprising:

- (A) a magnetized impression cylinder;
- (B) a flexible plate having printing indicia on one face thereof;

(C) means mounting the flexible plate for movement over the impression cylinder with a sheet to be imprinted interposed between the impression cylinder and the face of the plate which has the printing indicia thereon; and

(D) means to provide printing pressure between the flexible plate and the impression cylinder comprising

(1) a multiplicity of parallel magnetically attractable pins embedded in a matrix of flexible non-magnetic material, and

(2) means for holding said matrix against the printing plate with the axes of the pins perpendicular to said face of the printing plate.

11. A printing couple comprising:

(A) an impression member to support a sheet while the same is being imprinted, said impression member having a magnetized surface;

(B) a printing member of flexible non-magnetic material having opposite faces, one of which provides a printing surface;

(C) means mounting said members in cooperative relationship with their said surfaces contiguous so that a sheet received therebetween may receive the imprint of said printing surface; and

(D) a multiplicity of pins of magnetically attractable material carried by said printing member and disposed in force transmitting relation thereto, with their axes substantially perpendicular to its printing surface, so that the printing member will be attracted towards the magnetized surface of the impression member to press the printing surface against the sheet to be imprinted without deleteriously affecting the ability of the flexible printing member to conform to the shape of the magnetized surface of the impression member and the sheet thereon.

12. In the part of printing, the improvement which comprises:

- (A) providing a magnetized solid sheet-supporting surface of one polarity;
- (B) providing a flexible printing form having a printing image on one face thereof;
- (C) arranging polarized magnetically attractable discrete bodies in force-transmitting relation to said flexible printing form, but spaced from its said face, with those of said bodies that are opposite the portions or areas of the flexible printing form which are to do the printing so disposed polarity-wise as to be attracted towards the magnetized sheet-supporting surface when in juxtaposition thereto,
- and those of said bodies that are opposite the remaining portions or areas of the flexible printing form, so disposed polarity-wise as to be repelled from the magnetized sheet-supporting surface when in juxtaposition thereto; and
- (D) bringing the flexible printing form into proximity to a sheet to be imprinted while said sheet overlies the magnetized supporting surface, with the surface of the form which has the printing image thereon contiguous to the sheet,
- so that those portions or areas of the flexible printing form which are to print are drawn against the sheet, while those portions or areas of the printing form which are not to print are held spaced from the sheet.

13. A printing couple comprising:
cooperating members having surfaces between which a sheet may be received and gripped,
said surface of one of said members providing the printing form,
the surface portion at least of one of said members being yieldably flexible, and
the surface of one of said members being magnetized and that of the other member being magnetically attractable, so that said members are magnetically attracted to one another when in printing coaction, to provide printing pressure.

14. The printing couple of claim 13, wherein it is the yieldably flexible surface portion which is magnetically attractable to the other, and
wherein said surface portion which is magnetized is non-yielding.

15. The printing couple of claim 14, wherein the magnetically attractable property of the yieldably flexible surface portion is provided by a multiplicity of magnetically attractable pins embedded in a portion thereof with their axes parallel, and so oriented as to be perpendicular to said magnetized surface portion when in juxtaposition thereto.

16. A printing couple comprising:

- (A) an impression cylinder member to support on its surface a sheet to be imprinted; and
- (B) a flexible printing form member to have printing engagement with a sheet on the surface of the impression cylinder member,
one of said members being magnetized and the other being magnetically attractable, so that during operation the members of the couple are magnetically drawn together to provide printing pressure.

17. In the art of printing, the improvement which comprises:

- (A) means providing a printing couple consisting of cooperating relatively movable members between which a sheet may be passed to be imprinted,
one of said members being a rotatable cylinder and one of said members having the printing form on a surface thereof;
- (B) means to provide printing pressure between the printing form and a sheet as it passes through the printing couple, said last named means comprising
 - (1) a magnetic couple consisting of said cylinder and
 - (2) a cooperating member that is movable with the sheet,
said cylinder being magnetized and said cooperating member being yieldably flexible and having a multiplicity of magnetically attractable pins in a portion thereof with their axes parallel and so oriented as to be endwise attracted towards the cylinder when in juxtaposition thereto,
so that said cooperating member is magnetically attractable towards the cylinder to effect printing pressure between the printing form and the sheet.

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