March 6, 1956 R. A. HARRIS ET AL 2,737,387

FEEDING OF WRAPPING MATERIALS TO WRAPPING MACHINES AND THE LIKE

Filed Aug. 26, 1952 4 Sheets-Sheet 1

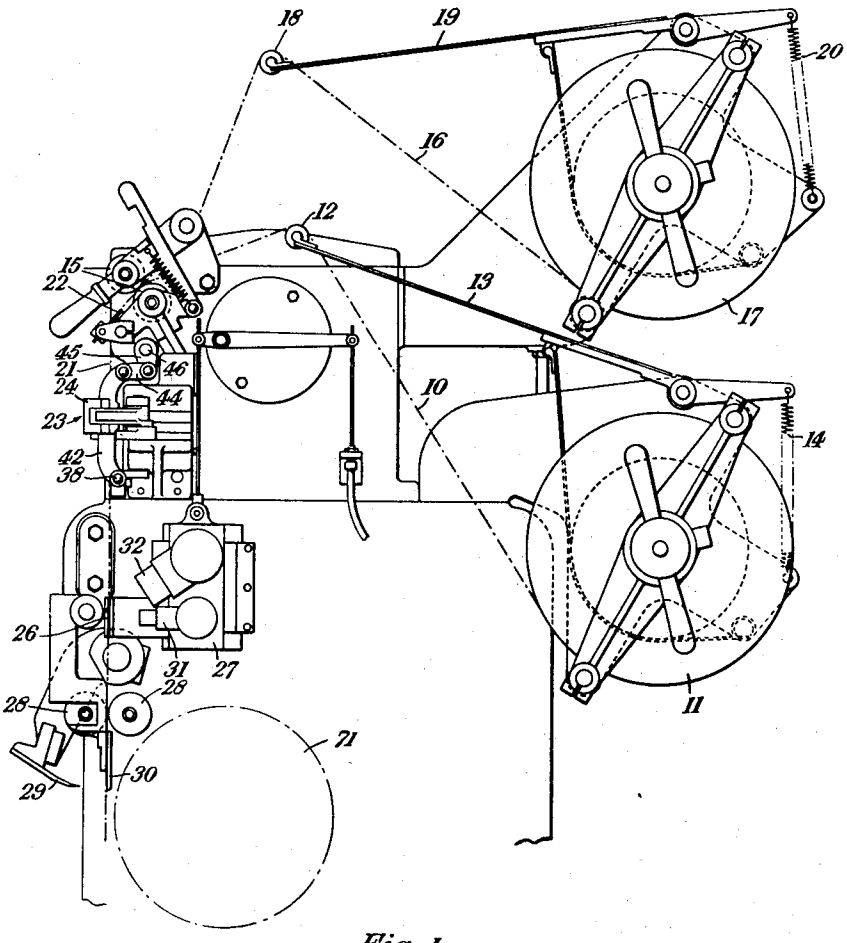


Fig. 1.

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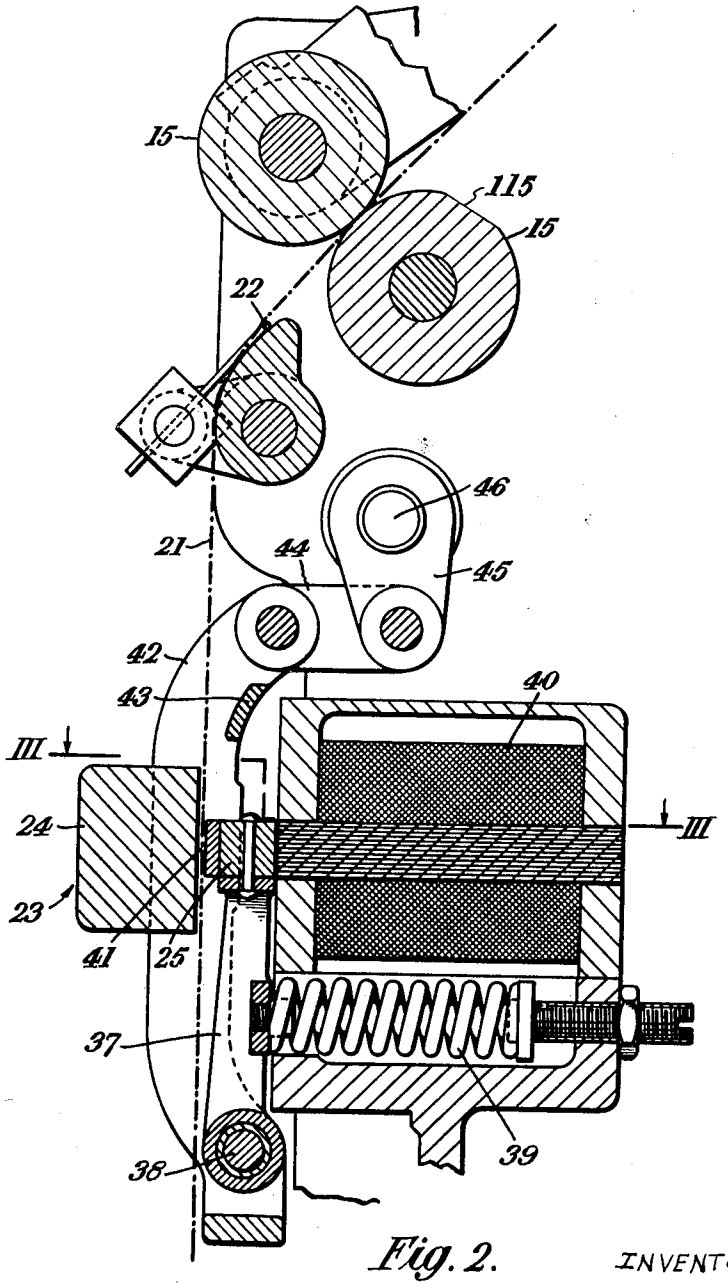


Fig. 2.

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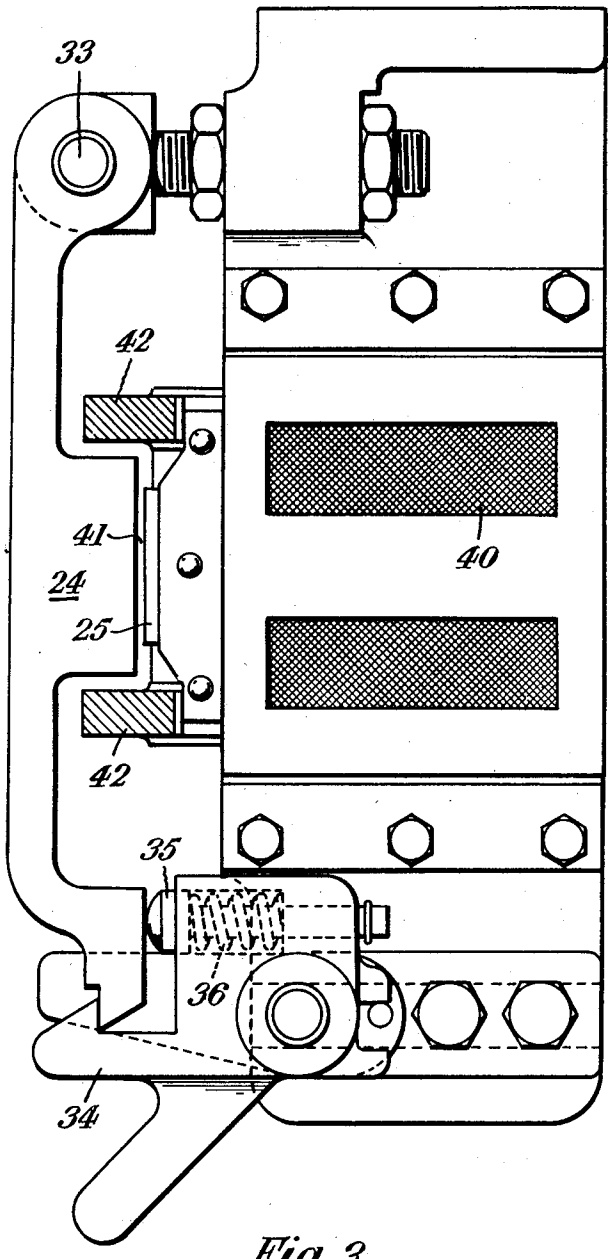


Fig. 3.

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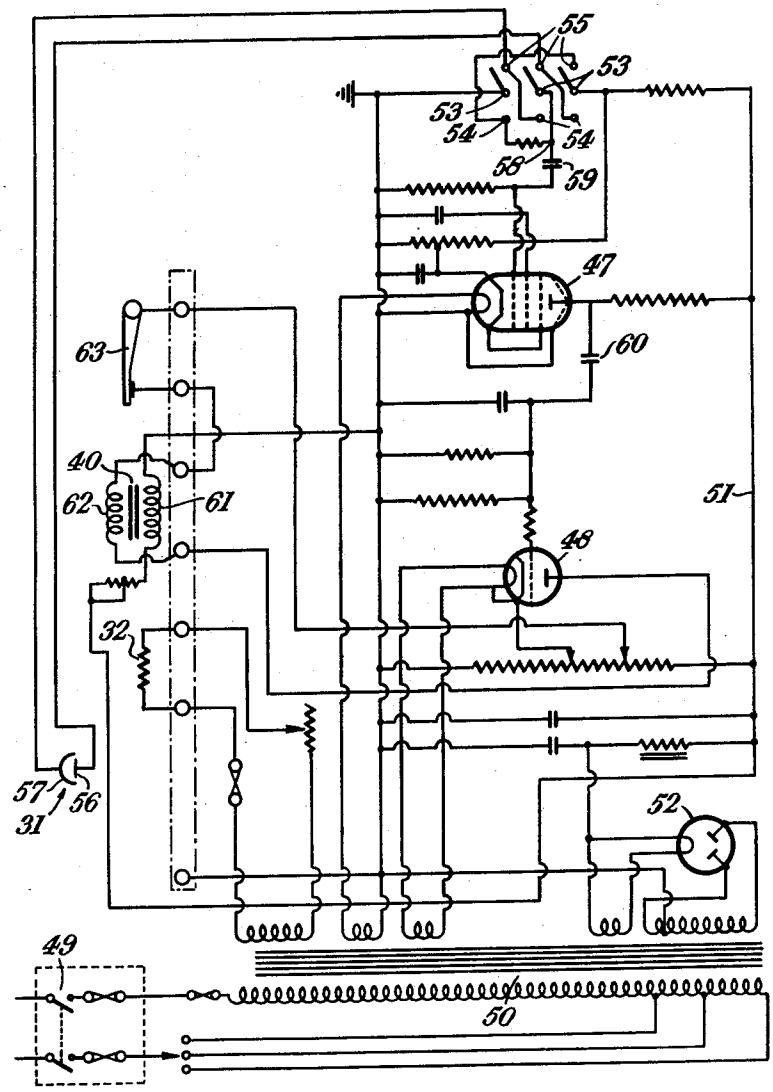


Fig. 4.

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United States Patent Office 2,737,387 Patented Mar. 6, 1956

2,737,387

FEEDING OF WRAPPING MATERIALS TO WRAPPING MACHINES AND THE LIKE

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Application August 26, 1952, Serial No. 306,334

Claims priority, application Great Britain September 13, 1951

2 Claims. (Cl. 271—2.6)

This invention is concerned with wrapping, bag-forming and filling and like machines using wrapping material bearing at spaced substantially equidistant points printed or embossed letterpress or the like. In such machines it is necessary that the wrapping material should be registered accurately with respect to its arrival at a predetermined stage in its path through the machine in order to ensure that the printed matter thereon shall as far as possible occupy a uniform position on every article. Amongst known methods of obtaining such registration may be mentioned (*a*) the "peg" method, in which pegs serve to engage perforations in the wrapping material, but which is unsatisfactory on account of the high cost of perforation of the material and the difficulty in some cases of ensuring perforation at accurately spaced points, (*b*) the method wherein overfeed or underfeed of the material is caused periodically to bring about an appropriate change of speed, by the accumulation, under control of a photo-electric detector, of an electrical condenser charge over a number of machine cycles, a method which is only satisfactory in cases where slight inaccuracies occurring between periodic corrections are unimportant, and (*c*) the "direct control" method exemplified by the apparatus disclosed by British patent specification No. 262,588, which again depends upon the use of a perforated wrapping material cooperating with an electrical feeler mechanism which, when it senses a perforation in the web of wrapping material, operates a clamp to arrest the feed of the web.

The object of this invention is to provide, primarily (though not necessarily) for use in conjunction with a high speed wrapping machine, improved means for registering the web of wrapping material at each machine cycle with a higher degree of accuracy than has been attained by the methods hereinbefore referred to and without requiring the use of perforated wrapping material.

The invention accordingly provides, in a wrapping, bag-forming and filling or like machine, the combination of mechanism for feeding past a registration station an imperforate web of wrapping material bearing signal-exciting marks, printed or otherwise applied thereto at regularly repeated intervals, a detector at the registration station, a normally inoperative electro-magnetically controlled clamp and means responsive to detection of a mark by the detector for actuating the clamp and thereby arresting the feed of the web.

For slow speed machines we may, for example, employ a photo-electric cell and associated amplifier activated by printed spots on the web and arranged to actuate a pull-on electro-magnet to apply the clamp whenever a spot is detected. Thus the amplifier may include a relay valve which is energised, by the response of the cell to arrival of a spot at the registration station, to operate a relay and thereby complete a circuit to energise the electro-magnet, a cam-operated armature-return switch being utilised to cut off the current to the electro-

magnet prior to commencement of the next cycle of feed of the web.

This method is not, however, suitable for high speed machines, in which a complete machine cycle may be performed in less than $\frac{1}{10}$ second, because even with a well designed electro-magnet the time for build-up of the magnetic field and acceleration of the armature may be too great, possibly delaying application of the clamp to the web until after the end of the feeding operation.

Considerable economy in operating time may be achieved, according to the invention, by providing a spring or the equivalent (e. g. the pressure of compressed air or pivot reaction from a pendulum under forced vibration) tending to force the clamp onto the web, the spring being restrained by electro-magnetic action until required to act and afterwards being restored to magnetic restraint by means of a suitable returning device.

With this arrangement the time taken to apply the clamp is considerably reduced for the following reasons: as the maximum magnetic force is available when the magnetic circuit is closed, the spring which the magnet is retaining can be of relatively great strength, in fact so strong that it is only just safely being overcome by the magnet.

If current from an amplifier associated with the detector is fed at the appropriate moment to the energising circuit of the electro-magnet in such a way as to reduce the magnetic field, the result is the almost instantaneous release of the spring which, due to its considerable strength, can produce a very high acceleration of the clamp, which moves $\frac{1}{32}$" or so to the web in a small fraction of a machine cycle. Rapid action of the clamp is also facilitated because there is no wait for the build-up of a magnetic field, and any opposition by the magnetic field to the movement of the clamp by the spring falls off very rapidly due to the inverse square law of magnetic attraction.

One embodiment of the invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of the wrapper feed mechanism,

Fig. 2 is a section, on a larger scale, through the feed rollers and the clamp,

Fig. 3 is a section on the line III—III in Fig. 2, and Fig. 4 is a circuit diagram.

Like reference numerals designate like parts throughout the figures.

In the machine illustrated, two wrappers are applied to each article. A web **10** (Fig. 1) of outer wrapper is drawn, from a reel **11**, over a jockey pulley **12** on a pivoted arm **13**, loaded by a spring **14**, by a pair of continuously rotating feed rollers **15**. A web **16** of inner wrapper is similarly drawn by the rollers **15** from a reel **17**, over a jockey pulley **18** on a pivoted arm **19**, loaded by a spring **20**. The two superposed webs, which are indicated by the reference numeral **21**, pass from the rollers **15** over a wire loop **22** (Fig. 2), which is spring loaded so as to tension the web, and then through a clamp **23**, comprising a pressure bar **24** and a cooperating armature **25**. Beyond the clamp **23**, the web passes between guides **26** (Fig. 1) at a registration station, the guides being mounted on a bracket **27**, to intermittently rotating feed rollers **28**. At each cycle, a composite wrapper is severed from the leading end of the web **21** by a moving knife **29** which coacts with a fixed knife **30**. The composite wrapper is then introduced, with an article to be wrapper, in conventional fashion into a pocket wheel indicated at **71** in Fig. 1.

The outer web **10** of wrapping material carries a printed or embossed design which needs to be registered

correctly with respect to the wrapped articles. It accordingly bears a regularly repeated pattern of printed spots, spaced by the length of a wrapper, which are detected by a photo-electric cell **31** at the registration station. The photo-electric cell **31** is supported by the bracket **27**, which also carries a lamp **32** for illuminating the web.

The pressure bar **24**, see Fig. 3, is pivoted at **33** and normally retained in position by a catch **34** as shown. A plunger **35**, actuated by a spring **36**, serves to hold the bar **24** in engagement with the catch **34**. The armature **25** is carried on an arm **37** (Fig. 2) pivoted on a spindle **38** and a strong spring **39** urges the armature **25** into position to clamp the web **21**. A normally energised electro-magnet **40** however normally holds the armature **25** attracted, as shown in Figs. 2 and 3, leaving a narrow gap **41**, about 1/32" wide, for the passage of the web **21**.

When the web has been fed to a position about 1/8" from its correct position in relation to the wrapping mechanism, one of the spots thereon moves into the path of the beam from the lamp **32**. This causes the photo-electric cell to transmit, as later described, an impulse to cause the electro-magnet **40** almost instantaneously to free the armature **25**. The powerful spring **39** immediately presses the armature **25** onto the pressure bar **24**, closing the gap **41** through which the web **21** was feeding, and stopping further movement of the web by the intermittent feed rollers **28**, which slip on the web during their remaining small amount of rotation.

The continuous feed rollers **15** feed rather more than the correct length of web, and the surplus is allowed to pull back at each machine cycle by the provision of a flat **115**, Fig. 2, on one roller **15**, which releases the web at the time when the clamp **23** is holding it in its correct position. The spring jockey arms **13** and **19** pull the surplus wrapping material back, and the web **21** is therefore taut when the roller flat has passed and paper feeding by the continuous feed rollers **15** is resumed.

Until the intermittent feed rollers **28** begin to feed again, a surplus of wrapping material builds up between them and the continuous rollers **15** when the latter resume feeding. This surplus is taken up by the lightly-sprung wire loop **22**.

Before the intermittent feed rollers **28** resume feeding, the armature **25** is returned to the position shown in the drawings by the following mechanism. A pair of armature-return arms **42** (Fig. 2 and 3), joined by a cross piece **43**, are pivoted on the spindle **38** and abut against the ends of the armature **25** as shown in Fig. 3. One of the arms **42** is coupled by a link **44** to an arm **45** fixed to a shaft **46**. At an appropriate time in the machine cycle a cam (not shown) rocks the shaft **46** clockwise, thereby moving the arms **42** in an anticlockwise direction to free the arm **37** so that it may apply the clamp when released by the electromagnet. At an appropriate later time in the machine cycle, the cam rocks the shaft **46** counter-clockwise, imparting clockwise movement to the arms **42** and so recompressing the spring **39** and returning the armature **25** to position to be re-attracted by the electro-magnet, the field of which has now been restored.

The amplifier circuit controlled by the photo-electric cell **31** will now be described with reference to Fig. 4. It comprises a normally conducting valve **47** and a normally non-conducting gas-filled relay valve **48**. Current is supplied from the mains, via a mains switch **49** to the primary winding of a transformer **50**. The secondary winding of the transformer provides heating current for the filaments of the valves **47, 48** and current for lighting the lamp **32**. High tension is supplied to the line **51** via a rectifier **52**.

The photo-electric cell **31** is connected in circuit by means of a three pole change-over switch **53** which is shown in the off position. The switch **53** is moved to make with the contacts **54** when it is desired that the photo-electric cell should operate by "fall of light," i. e. by sensing dark spots on a light background. The anode **56** of the cell is then connected to the line **51** while the cathode **57** of the cell is connected to the point **58** and is also earthed. When the cell senses a dark spot, the current through it decreases, and the resulting fall in potential of its cathode **57** impresses, via a condenser **59**, a negative pulse on the grid of the valve **47**. The current through the valve **47** is thus reduced and the resulting rise in potential of its anode impresses, via a condenser **60**, a positive pulse on the grid of the relay valve **48**, causing the relay valve to fire.

When it is desired that the photo-electric cell should operate by "rise of light," i. e. by sensing light spots on a dark background, the switch **53** is moved to make with the contacts **55**. The anode **56** of the cell is then connected to the line **51** and to the point **58**, while the cathode **57** of the cell is earthed. When a spot is sensed, the current through the cell increases, and the resulting fall in potential of the anode **56** is impressed, as a negative pulse, on the grid of the valve **47**, reducing conduction in the valve **47** and causing the relay valve **48** to fire as before.

The electro-magnet **40** has a holding coil **61** which is connected between the line **51** and earth and therefore normally energised to retain the armature attracted. It also has a release coil **62**, wound in the opposite sense to the holding coil **61** and connected in circuit between the line **51** and the anode of the relay valve **48**. Until a spot is sensed, there is no current through the relay valve **48** and the coil **62** is de-energised. As soon, however, as a spot is sensed the relay valve **48** fires and the resultant flow of current through the release coil **62** causes the electro-magnet to release the armature and so apply the clamp.

A quenching switch **63** is opened momentarily, by a cam not shown, prior to restoration of the armature **25** by the arms **42** (Fig. 2). This deprives the relay valve **48** of anode potential, so causing it to cease to conduct and deprive the release coil **62** of current. When therefore the armature is restored, the current through the holding coil **61** will be effective to hold it against the push of the spring **39** until such time as the release coil **62** is again energised.

As an alternative to the arrangement shown in Fig. 4, the circuit can be so arranged that the relay valve **48** conducts only momentarily in response to the signal derived from the photo-electric cell, thereafter returning automatically to its non-conducting condition. This renders the provision of the quenching switch unnecessary and also has the advantage that the current through the release coil, being momentary only, can be relatively heavy without harming the relay valve, so offering the possibility of a quicker reduction in magnetic attraction on the armature.

As a still further alternative, the electro-magnet may be provided with a holding coil only, the relay valve being so adjusted that it normally conducts to supply current through the holding coil but is arranged to cease conducting momentarily, on receipt of a pulse from the photo-electric cell, thereby de-energising the holding coil. In this arrangement also no quenching switch will be needed.

What we claim as our invention and desire to secure by Letters Patent is:

1. In mechanism for feeding and registering a web of imperforate sheet material bearing thereon a pattern of regularly repeated marks, the combination of a detector for said marks, a clamp for the web comprising a pressure bar, an armature disposed closely adjacent to said pressure bar, a spindle, and an arm supporting said armature and pivoted on said spindle, a spring urging said armature to position to clamp the web against the pressure bar, an electro-magnet normally energized and having a pole normally restraining said armature from movement by said spring to clamping position, means responsive to detection of a mark by the detector for temporarily weakening the field of said electro-magnet to permit of rapid movement by said spring of said armature to clamping position, and a cam-operated lever also pivoted on said spindle for

thereafter returning said armature into contact with the pole of said electro-magnet.

2. A combination as claimed in claim 1, wherein said pressure bar is mounted at one end on a pivot and comprising a catch for preventing pivotal movement of the pressure bar in a direction away from said armature and a spring holding said pressure bar in engagement with said catch.

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