United States Patent [19]

Carbine

[11] **3,756,589**

[45] **Sept. 4, 1973**

[54] **SHEET FEEDING APPARATUS**

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[73] Assignee: **Burroughs Corporation,** Detroit, Mich.

[22] Filed: **July 6, 1971**

[21] Appl. No.: **159,874**

[52] **U.S. Cl.** **271/51**

[51] **Int. Cl.** **B65h 5/06**

[58] **Field of Search** 271/51, 52, 19, 22, 271/39

[56] **References Cited**

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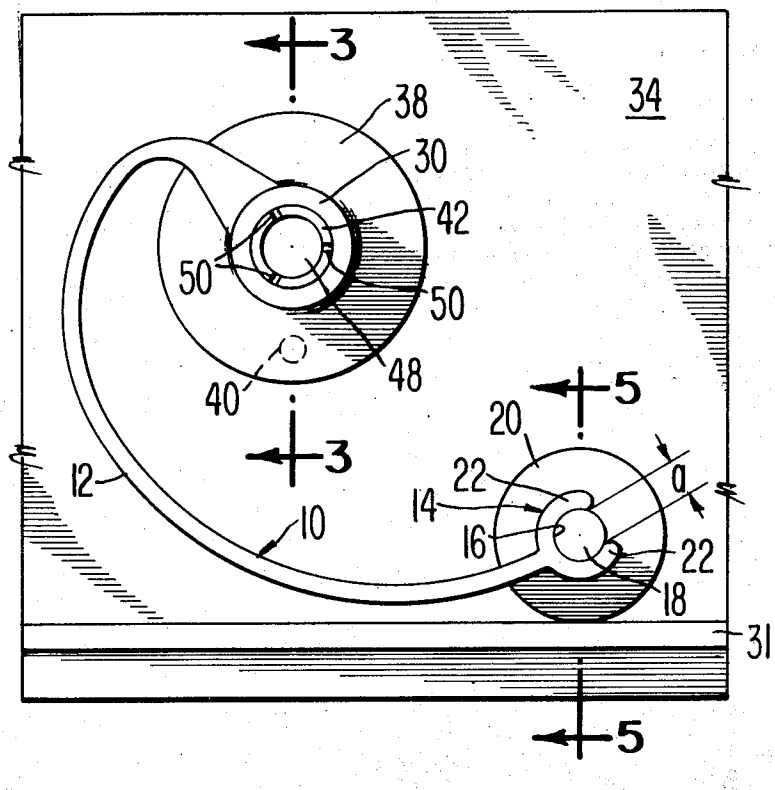
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Primary Examiner—Evon C. Blunk
Assistant Examiner—Johnny D. Cherry
Attorney—Paul W. Fish et al.

[57] **ABSTRACT**

Apparatus for adjustably supporting a pressure roller in a sheet feeding machine. The apparatus comprises a spring member which supports the pressure roller, and a hub member which supports the spring member. The hub and spring members may be constructed separately or as a molded unit. The force exerted by the pressure roller may be varied rapidly manually, without the aid of any tools. The spring member may be provided with an auxiliary spring, and may be shaped to facilitate flexing for feeding sheets whose thickness varies.

16 Claims, 17 Drawing Figures



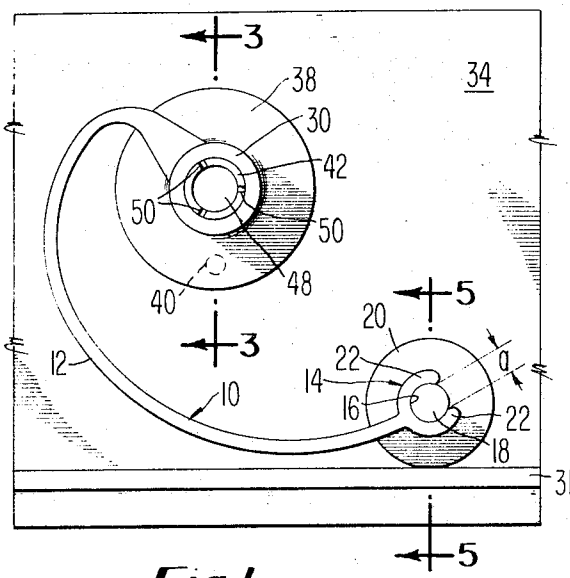


Fig.1

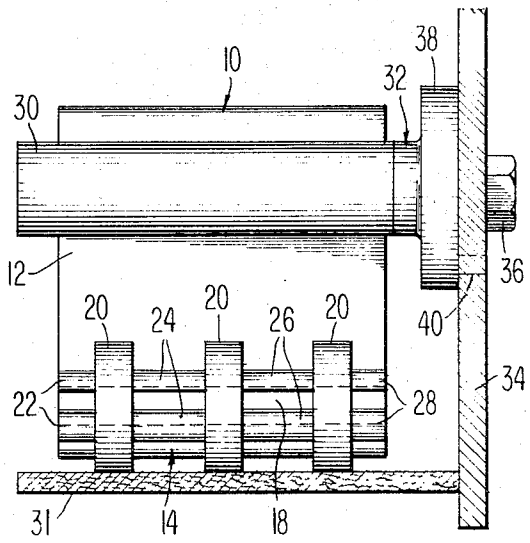


Fig.2

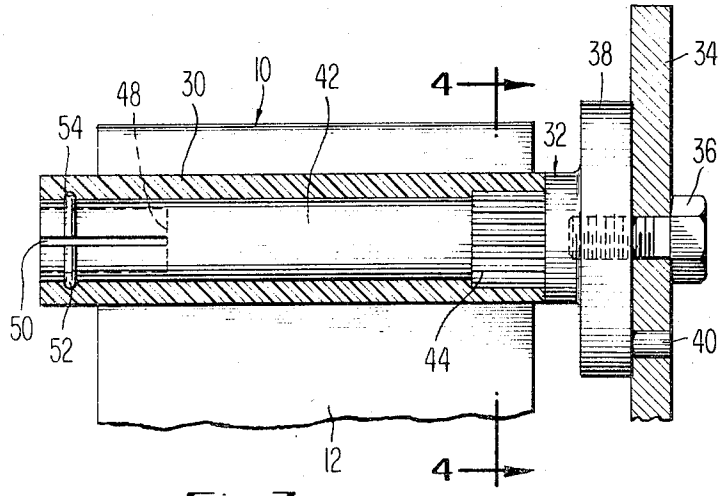


Fig.3

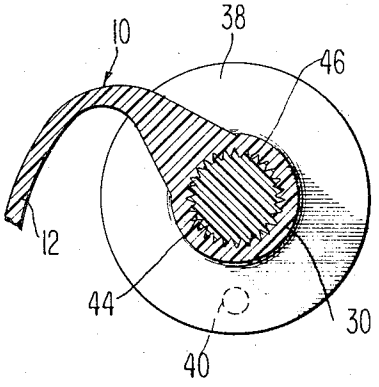


Fig.4

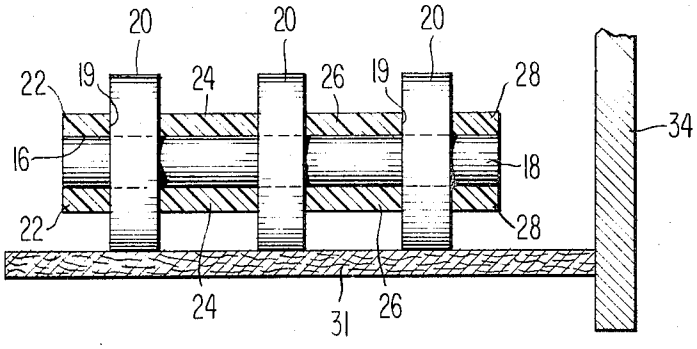


Fig.5

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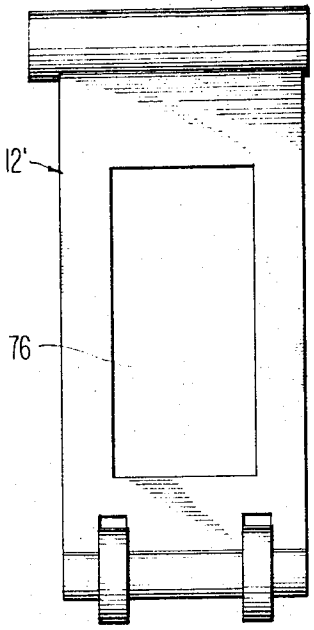


Fig.9

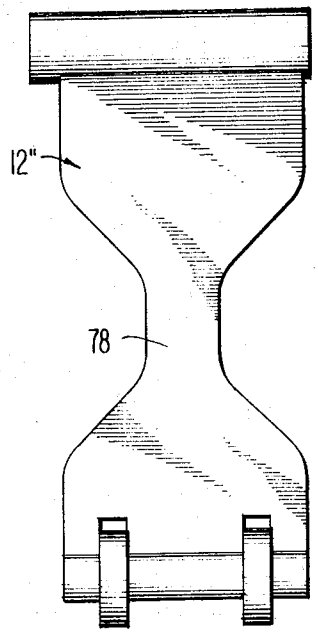


Fig.10

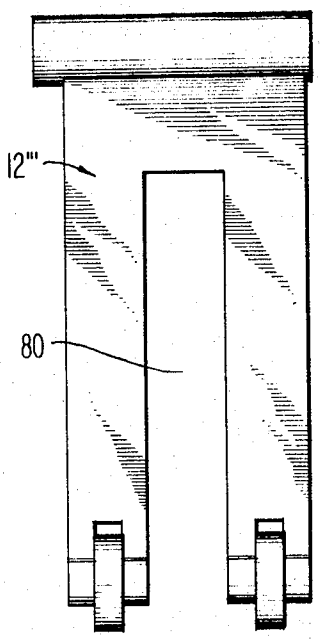


Fig.11

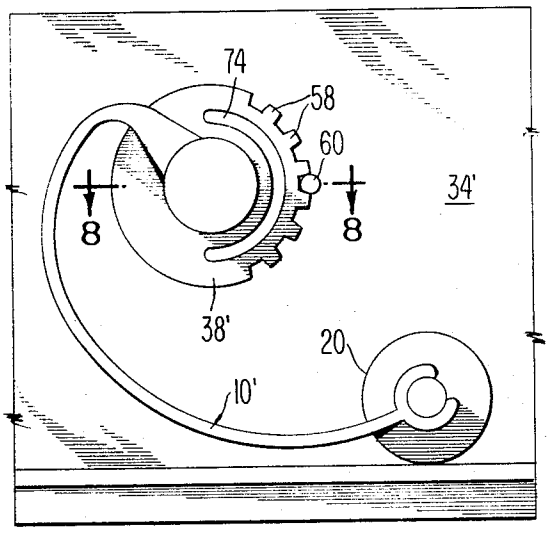
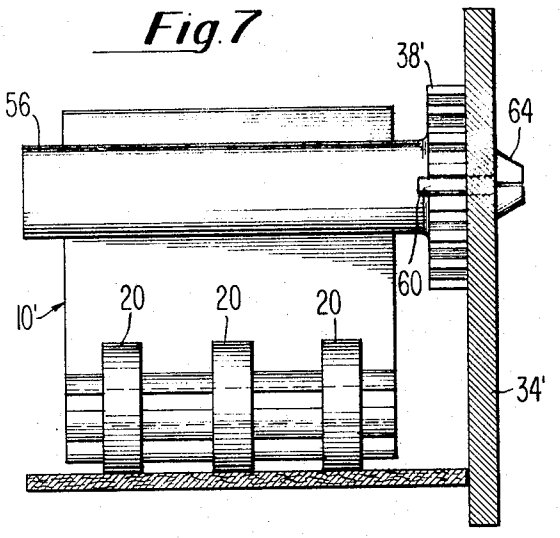


Fig.6

Fig.7



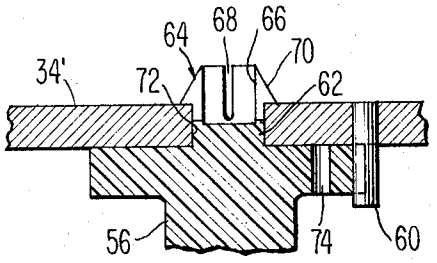


Fig.8

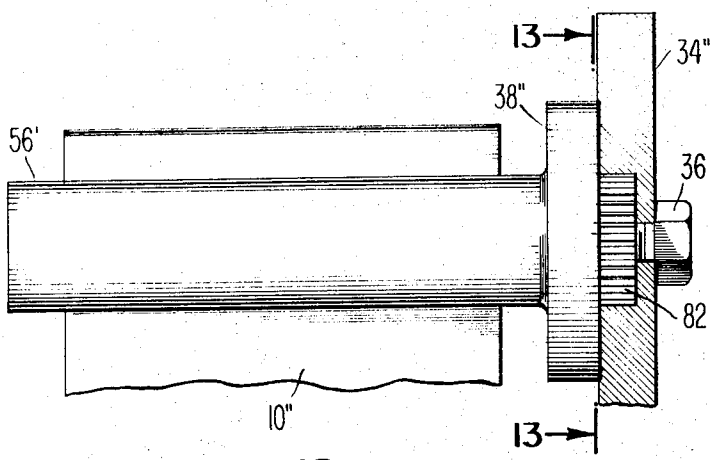


Fig. 12

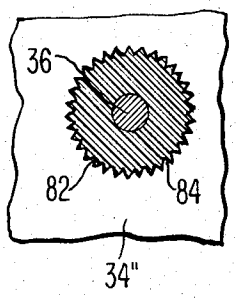


Fig. 13

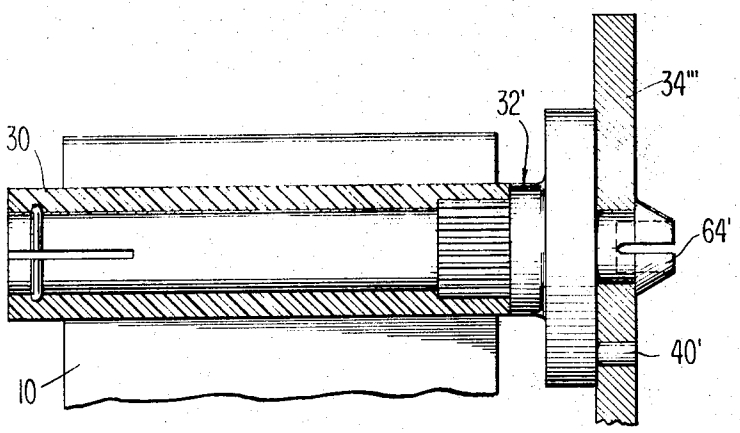


Fig. 14

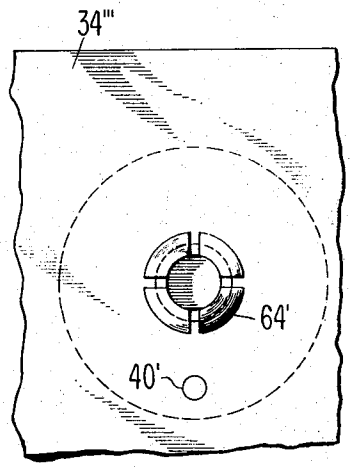


Fig. 15

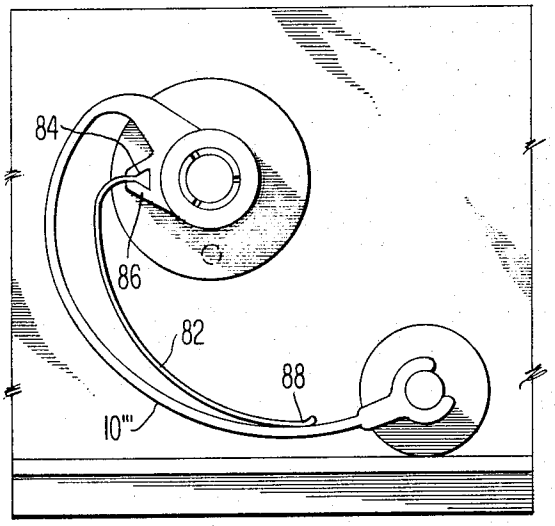


Fig. 16

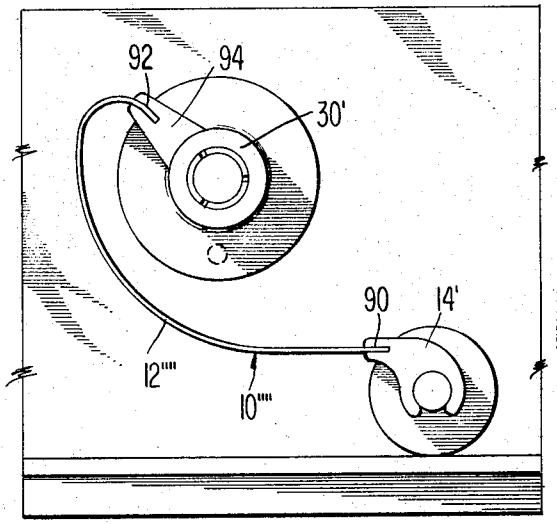


Fig. 17

SHEET FEEDING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates generally to sheet feeding devices and particularly to sheet feeding apparatus for supporting a pressure roller in position for keeping sheets against a drive member, such as a belt or pulley.

In many cases, sheet feeding machines are required to operate at high speed, but the design of their sheet feeding elements has not achieved the most desirable low-mass, low-inertia construction for high-speed operation. Also, the shafts, levers, springs, etc., of the pressure roller apparatus do not afford maximum speed and efficiency for relieving sheet jams, since in many cases such parts cannot be sufficiently manipulated or removed from the jammed area. Furthermore, known designs of apparatus for supporting pressure rollers in sheet feeding machines involve the use of several parts, which makes the assembly of the apparatus more time-consuming and complex, and results in relatively higher production costs. Additionally, adjustment of the pressure of the pressure rollers generally requires the use of auxiliary hand tools.

SUMMARY OF THE INVENTION

An object of the invention is to provide improvements in apparatus for supporting pressure rollers in sheet feeding machines.

Another object of the invention is to provide apparatus having relatively few parts and low inertia for adjustably supporting a pressure roller in sheet feeding operations.

A further object of the invention is to provide an apparatus for supporting a pressure roller and which facilitates the removal of sheets in relieving sheet jams.

Still another object of the invention is to provide an apparatus for supporting a pressure roller and which affords simple and rapid adjustment of the pressure of the roller.

Another object of the invention is to provide such an apparatus which is easy to assemble, simple to use and inexpensive to manufacture.

In accordance with the above objects and considered first in one of its broader aspects, a sheet feeding apparatus according to the invention may comprise an elongate spring and an elongate hub. The spring may comprise an elongate medial portion and a shaft-supporting portion connected to one end of the medial portion and shaped to securely support a roller shaft. The hub is connected to the other end of the medial portion with its axis normal to the longitudinal axis of the medial portion, and is provided with a series of serrations on one end arranged concentrically about the hub axis. A mounting means adjustably locates the hub on a member of a sheet feeding machine and includes detenting means carried by the member for detenting the hub serrations.

The invention will be more clearly understood when the following detailed description of the preferred embodiments thereof is read in conjunction with the accompanying drawing which is described below.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary front view of apparatus embodying the invention.

FIG. 2 is a right side view of the apparatus of FIG. 1.

FIG. 3 is a fragmentary enlarged sectional view taken along line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3.

FIG. 5 is an enlarged fragmentary sectional view taken along line 5—5 of FIG. 1.

FIG. 6 illustrates another embodiment of the invention.

FIG. 7 is a right side view of the embodiment shown in FIG. 6.

FIG. 8 is an enlarged fragmentary sectional view taken along line 8—8 of FIG. 6.

FIGS. 9–11 illustrate further embodiments of the invention.

FIG. 12 is a fragmentary sectional view of another embodiment of the invention.

FIG. 13 is a sectional view taken along line 13—13 of FIG. 12.

FIG. 14 is a fragmentary sectional view of another embodiment of the invention.

FIG. 15 is a fragmentary right side view of the apparatus of FIG. 14.

FIGS. 16 and 17 show further embodiments of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One embodiment of the invention is illustrated in FIGS. 1–5 and comprises an elastic elongate spring 10, preferably constructed of an acetal resin plastic and having an elongate medial portion 12 and a shaft-supporting portion 14 connected at one end to the medial portion 12. The shaft-supporting portion 14 is provided with an elongate bore 16 for nesting a roller shaft 18. The shaft-supporting end of the medial portion 12 is suitably slotted as at 19 (FIG. 5) for freely receiving one or more idler pressure rollers 20. The shaft-supporting portion 14 is provided with pairs of elastic jaws 22, 24, 26 and 28. The distance a (FIG. 1) between the jaws of each pair of jaws 22, 24, 26 and 28 is less than the diameter of the shaft 18 so as to permit the shaft 18 to be snapped into and retained in the bore 16. The rollers 20 may be caused to press with a desired degree of force against a drive member, such as a belt 31, for example, of an associated sheet feeding machine, not shown, by suitably loading the spring 10 in a manner which will be described shortly.

The other end of the spring medial portion 12 is connected to an elongate sleeve 30 which forms part of the spring 10 and is adjustably mounted on a hub 32 which is secured to a member 34 of the associated sheet feeding machine, as by means of a bolt 36. The hub 32 comprises a flange 38 which may be rotationally locked to the member 34, as by means of a dowel pin 40 which extends into the flange 38.

The hub 32 further comprises an elongate shaft portion 42 having a series of external circumferential serrations 44 which mate with a similar series of internal serrations 46 in one end of the sleeve 30. The other end of the hub shaft 42 is counterbored at 48 and provided with slots 50 to form it into a split collet. The collet end of the hub shaft 42 is provided with an external circular bead 52 which is contained in an internal circular recess 54 of substantially the same diameter in the sleeve 30.

The apparatus is used in a sheet feeding machine for feeding sheet material between the idler rollers 20 and

a drive member such as the belt **31**. The force with which the rollers **20** bear against the drive member **31** may be readily varied to suit conditions by varying the stress on the spring **10**. This is accomplished manually in a rapid and simple manner by merely pulling the sleeve **30** off the hub **32** to an extent sufficient to disengage the serrations **44** and **46**, rotating the sleeve **30** either clockwise or counter-clock wise, as required, and then pushing the sleeve back onto the hub **32** until the serrations **44** and **46** are again fully engaged and the bead **52** snaps back into the recess **54**, to thereby lock the sleeve **30** axially and rotationally on the hub **32**.

In the embodiment shown in FIGS. **6–8**, the sleeve and hub are formed as a single composite hub **56** so that the spring **10'** includes the composite hub **56** and is of unitary construction. In this embodiment, the serrations **58** are formed on the composite hub flange **38'** and are detented by a pin **60** press-fitted or otherwise secured in the member **34'**. A reduced-diameter shaft portion **62** (FIG. **8**) of the composite hub **56** extends through the member **34'** and terminates in a split collet **64** on the opposite side of the member **34'**. The split collet **64** is formed with a counterbore **66** and slots **68** to facilitate spring action of the split collet **64**.

The split collet **64** is provided with a chamfer or conical surface **70** to facilitate inserting it into the collet opening **72** in the member **34'**. As the split collet **64** emerges at the opposite side of the member **34'** in the process of inserting it into the member **34'**, it springs outwardly to lock the composite hub **56** axially to the member **34'**, however, the composite hub **56** can still be rotated in the collet opening **72**. Accordingly, to vary the pressure of the rollers **20** against the belt **30** in the embodiment shown in FIGS. **6–8**, it is only necessary to manually rotate the composite hub **56** in the appropriate direction until it is detented in the desired position by the pin **60**. An arcuate slot **74** formed in the flange **38'** facilitates flexing of the serrations **58** during manual adjustment.

The embodiments illustrated in FIGS. **9–11** are variations of the embodiment illustrated in FIGS. **1–5**. The elongate medial portion **12** of the spring **10** (FIGS. **1–5**) has a reduced area in the embodiments of FIGS. **9–11** to facilitate flexing of the medial portion. Also, only two idler rollers are shown in FIGS. **9–11**, however, the number of idler rollers is merely illustrative in all embodiments and is not limiting. Thus, in FIG. **9**, the elongate medial portion **12'** has its area reduced by means of a rectangular opening **76**. In FIG. **10**, the elongate medial portion **12''** has a reduced area **78**. In FIG. **11**, the elongate medial portion **12'''** is bifurcated to reduce its area by means of an elongate slot **80**. The reduced-area embodiments shown in FIGS. **9–11** permit the spring to flex more readily when feeding odd-shaped sheets, such as those, for example, which have thick and thin portions.

FIGS. **12** and **13** illustrate a modification of the embodiment shown in FIGS. **6–8**. In the embodiment shown in FIG. **12**, the flange **38''** is solid and the serrations are formed on a short extension **82** of the composite hub **56'** and mate with an internal set of serrations **84** formed in a counterbore in the member **34''**. Also, the composite hub **56'** is secured to the member **34''** by means of a bolt **36**. The roller pressure may be adjusted in the embodiment shown in FIG. **12** by loosening the bolt **36** to an extent sufficient to permit withdrawal of the composite hub **56'** from the serrations **84**, rotating the composite hub **56'**, as desired, and then reinserting the composite hub **56'** into the serrations of the member **34''** and securing the composite hub **56'** by tightening the bolt **36**.

FIGS. **14** and **15** illustrate a variation of the embodiment shown in FIGS. **1–5**. In the embodiment shown in FIGS. **14** and **15**, the bolt **36** is omitted and the end of the hub **32'** formed with a conical split collet end portion **64'**, similar to the split collet **64** of FIG. **8**. The embodiment in FIG. **14** permits rapid snap-action assembly of the hub **32'** to the member **34'''**. Adjustment of the spring **10** to vary the pressure of the rollers **20** is similar to that described for the embodiment shown in FIGS. **1–5**.

FIG. **16** illustrates a variation of the embodiment shown in FIGS. **1–5** in the provision of an auxiliary spring **82**, which may also be constructed of a plastic, such as acetal resin, similar to the spring **10'''**. The auxiliary spring **82** has one of its ends secured to the spring **10'''** in any suitable manner, as by having its end portion **84** shaped in the form of a dovetail and snapped into a mating dovetail opening in a protrusion **86** of the spring **10'''**. The other end **88** of the auxiliary spring **82** is biased against the spring **10'''**. The embodiment shown in FIG. **16** is particularly useful for feeding thick sheets or documents such as letter mail, or filled envelopes, for example.

FIG. **17** is a modification of the embodiment shown in FIGS. **1–5**. in this case, the spring **10''''** is constructed of three parts: (1) a sleeve **30'** and (2) a shaft-supporting portion **14'** both made of a plastic, such as acetal resin, for example, and (3) an elastic metal elongate medial portion **12''''** having its ends **90** and **92** press-fitted or otherwise secured in a protrusion **94** of the sleeve **30'** and in the shaft-supporting portion **14'**, respectively. The embodiment of FIG. **17** permits the feeding of sheets under high preload and for prolonged periods.

What is claimed is:

1. Sheet feeding apparatus comprising an elongate spring, said spring comprising an elongate medial portion, a shaft-supporting portion connected to one end of said medial portion and shaped to securely support a pressure roller shaft, an elongate hub connected to the other end of said medial portion and having its axis parallel to the axis of said roller shaft held by said shaft supporting portion, mounting means for locating said hub on a member of a sheet feeding machine, and adjusting means for adjustably locating said hub on said mounting means for varying the pressure on said roller shaft said adjusting means including a first series of serrations on one end of said hub arranged concentrically about the hub axis.

2. Apparatus of claim **1** wherein said mounting means includes detenting means for locking said hub in a fixed position from rotational movement.

3. Apparatus according to claim **2** wherein said detenting means is a pin mounted on said member.

4. Apparatus according to claim **3** wherein said hub is adjustable rotationally about its axis, said hub and serrations are elastic, said pin is fixed on said member and in mesh with said serrations, and said hub is provided with a first opening to facilitate flexing of said serrations whenever the hub is rotated.

5. Apparatus according to claim **4** wherein said member is provided with a second opening, and said mounting means includes a spring collet connected coaxially

with said hub and lockingly inserted into said second opening so as to rotatably fasten said hub to said member axially.

6. Apparatus according to claim **5** wherein said medial portion has a section of reduced area to facilitate flexing of said medial portion.

7. Apparatus according to claim **5** wherein said medial portion and shaft-supporting portion are bifurcated to facilitate flexing of said medial portion.

8. Apparatus according to claim **7** characterized further by the provision of an auxiliary elongate spring anchored at one end of said hub and with its free end biased against said one end of said medial portion.

9. Apparatus according to claim **2** wherein said detenting means is a second series of serrations on said member.

10. Sheet feeding apparatus comprising an elongate circular hub, means for securing said hub to a supporting member of a sheet feeding machine, a spring comprising an elongate medial portion, a shaft-supporting portion connected to one end of said medial portion and provided with pairs of jaws for yieldably securely supporting a roller shaft, and an elongate sleeve connected to the other end of said medial portion and having its axis normal to the longitudinal axis of said medial portion and slidably mountable on said hub, one of said hub and sleeve members provided with a first series of serrations and the other of said hub and sleeve members provided with detenting means engaged in said serrations when the sleeve is mounted on the hub, said hub having a split collet at one end and a circular bead on the outside of the hub encircling said split collet and having a larger diameter than the inside diameter of said sleeve, said sleeve having an internal circular recess of substantially the same diameter as the bead which contains the bead to lock the sleeve axially on the hub when the sleeve is mounted on the hub.

11. Apparatus according to claim **10** wherein said spring is made of an acetal resin.

12. Apparatus according to claim **11** wherein said shaft-supporting portion is provided with an elongate bore for nesting a roller shaft and pairs of elastic jaws extending normal to the axis of said bore, the distance between the jaws of each pair of jaws being less than the diameter of said shaft so as to permit said shaft to be snapped into and retained in said bore.

13. Apparatus according to claim **10** wherein said detenting means is a second series of serrations.

14. Apparatus according to claim **15** wherein said medial portion has a section of reduced area to facilitate flexing of said medial portion.

15. Apparatus according to claim **14** wherein said medial portion and shaft-supporting portion are bifurcated to facilitate flexing of said medial portion.

16. Apparatus according to claim **15** characterized further by the provision of an auxiliary elongate spring anchored at one end to said sleeve with its free end biased against said one end of said medial portion.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,756,589 Dated September 4, 1973

Inventor(s) Joseph C. Carbine

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 33, "30" should read --31--.

Signed and sealed this 9th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents