F. G. FEELEY.

SLITTING MACHINE.

APPLICATION FILED NOV. 9, 1912.

1,139,355.

Patented May 11, 1915.

2 SHEETS—SHEET 1.

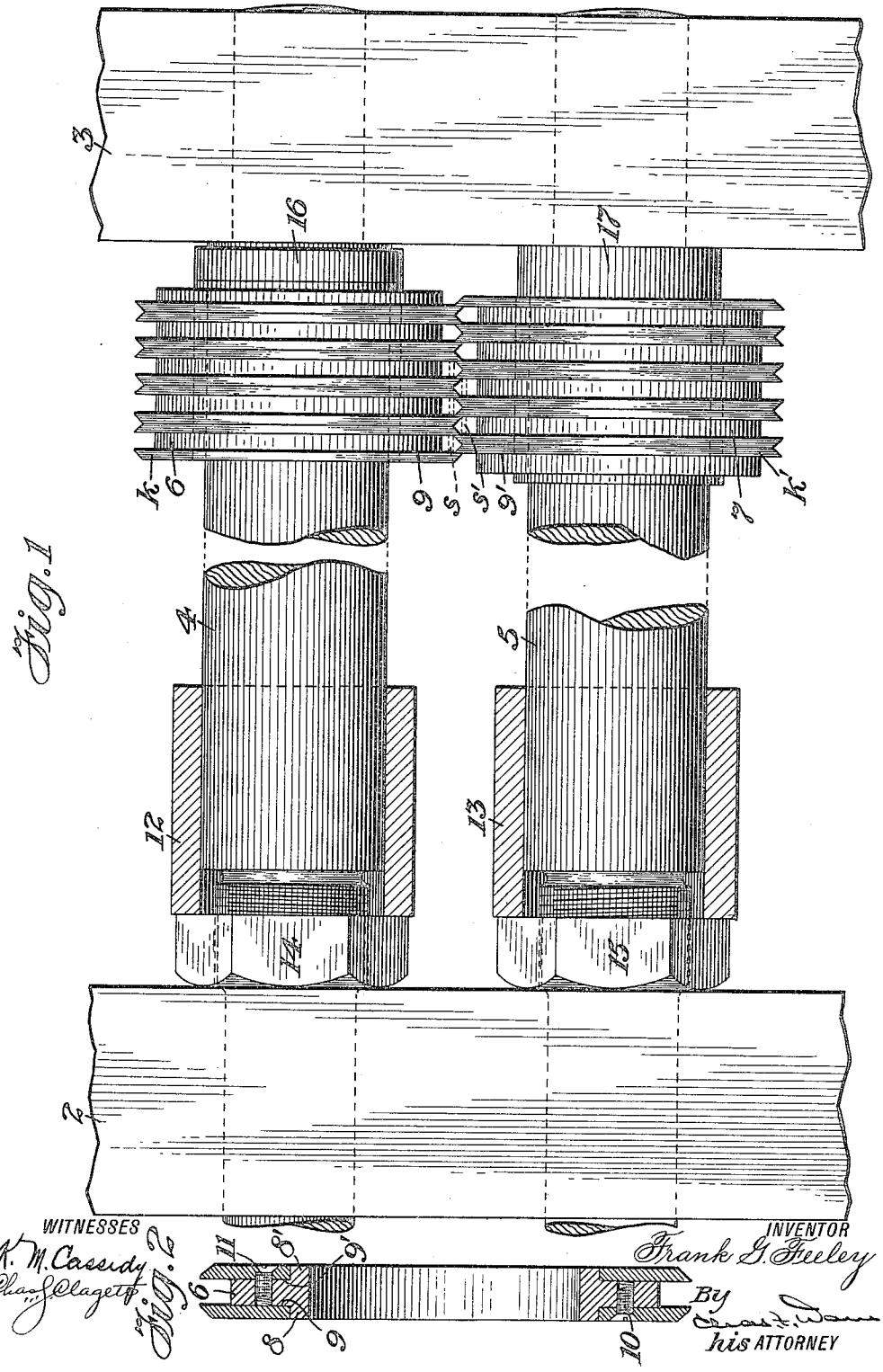

Fig. 1

Fig. 2

WITNESSES

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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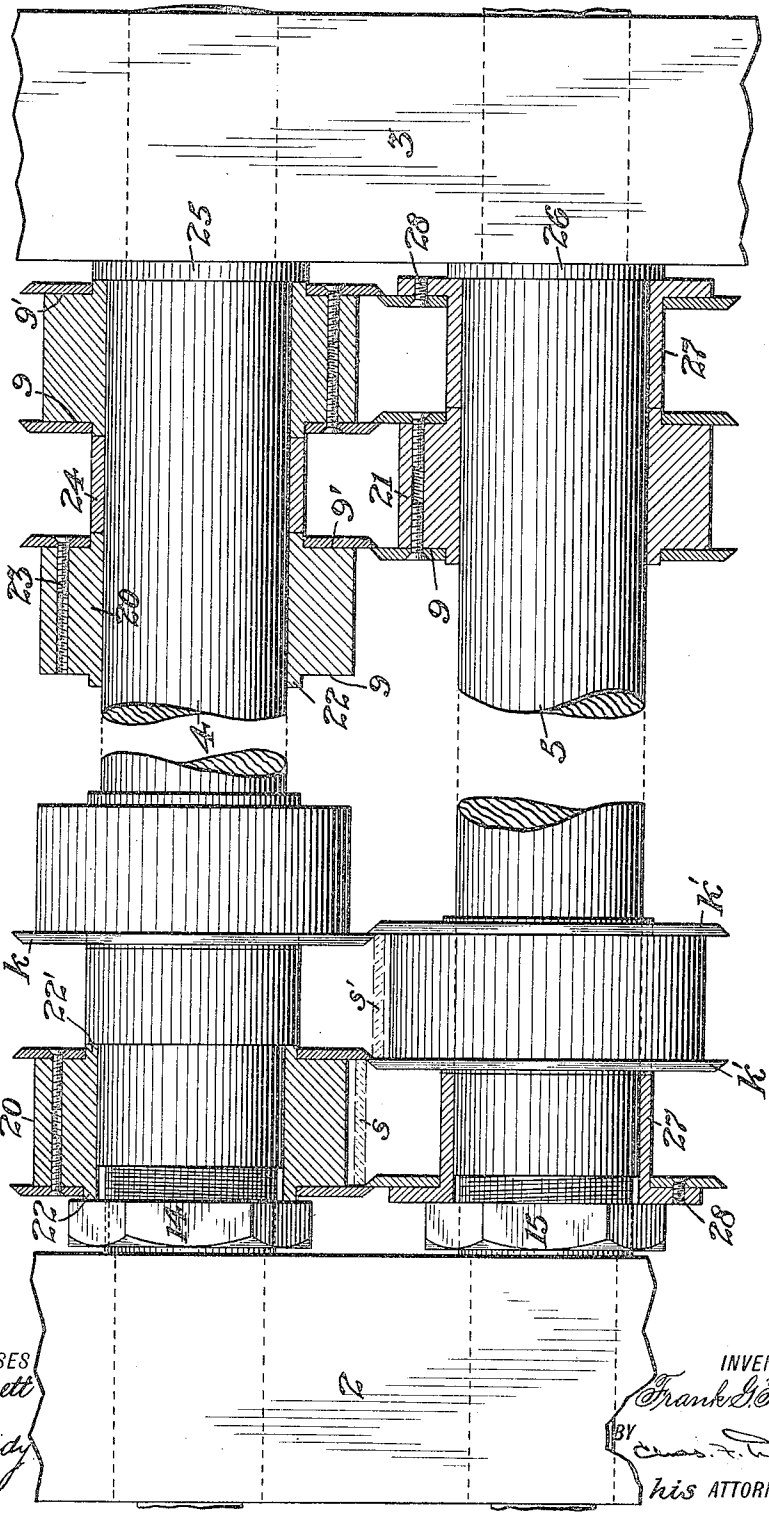

Fig. 3

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C

UNITED STATES PATENT OFFICE.

FRANK G. FEELEY, OF CHICAGO, ILLINOIS, ASSIGNOR TO M. D. KNOWLTON COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

SLITTING-MACHINE.

1,139,355. Specification of Letters Patent. Patented May 11, 1915.

Application filed November 9, 1912. Serial No. 730,345.

To all whom it may concern:

Be it known that I, FRANK G. FEELEY, citizen of the United States, and resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Slitting-Machines, of which the following is a specification.

This invention relates to improvements in slitting machines for slitting cardboard, paper, or other material in sheet form.

In machines of this class as heretofore constructed it has been customary to slit the material by passing it between co-acting rotary knives carried by parallel shafts with the knives of one shaft disposed in parallelism with those on the other shaft, but all placed in the same relation to the corresponding knives of the other shaft, that is, at the same side thereof. It has also been customary to secure these knives to collars carried by the respective shafts, with the parts so organized that the outer faces of each pair of coöperating knives, that is, those faces not in contact with the collars, are in engagement with each other. In such a construction as this, when the knives become worn to any substantial extent, such as would require grinding of the outer faces thereof, adjustment of the positions of the knives on the shafts is necessary before further use thereof. A further serious disadvantage in such a construction, especially when the material is to be cut into relatively narrow strips, is that with the knives on each shaft all arranged in the same relation to the knives on the other shaft, that is, at the same side thereof, the strips being cut do not maintain their parallelism with the axes of the shafts and the cutters thereon, but are tipped downward at corresponding sides thereof owing to the fact that one edge of each strip when cut rests on a cutter carried by one shaft while the other edge of said strip is pressed down below the edge of the next cutter on the same shaft, and the surface of such a strip crosswise thereof makes a more or less acute angle with the axis of the shaft carrying the knives on which the strip is supported.

The main object of this invention is to eliminate these objectionable features and produce a slitting machine in which no adjustment of any knife on its shaft is necessary after regrinding its face, this result being obtained by employing a construction in which the inner instead of the outer surfaces of the knives secured to the collars on the cutter shafts will coöperate with each other, which in turn permits repeated grinding of the knives on their cutting sides, as well as on their peripheries, until the knives are worn down and relatively thin, and to so organize the parts that each strip will be separated from the sheet to be slit by the conjoint action of a pair of knives carried by one shaft and located between and co-acting with a pair of knives on another shaft, this mode of organizing the parts resulting in keeping the strips being severed in parallelism with the axes of the shafts throughout the slitting operation.

Other features of the invention not hereinbefore referred to will be hereinafter described and claimed and are illustrated in the accompanying drawings, in which—

Figure 1 is an elevation and partial section of so much of a slitting machine as is necessary for the proper illustration of the present invention; Fig. 2 is an enlarged transverse section of one of the knife-collars and a pair of knives, constituting a cutting unit carried by a shaft, the section being taken in the line of one of the diameters, and Fig. 3 is a view similar to Fig. 1, but is a modification of the invention, illustrating means for cutting a sheet into wider strips than those cut by the mechanism of Fig. 1.

Similar reference characters designate like parts in all the figures of the drawings.

Referring first to Figs. 1 and 2, 2 and 3 designate portions of the frame-work of a slitting machine, preferably of standard construction, in which shafts for carrying the knives or cutters may be mounted in bearings for rotation, substantially in well-known manner. The usual shafts to which such cutters or knives are secured are shown at 4 and 5, one being located above the other, with their axes in parallelism and the adjacent sides of the shafts disposed at a proper distance apart to permit the necessary cutting action of the knives. The knives or cutters proper may be any suitable for the purpose, but are preferably annular knives having chisel edges. It is customary to secure these knives to collars mounted on shafts and the knives of the present machine are intended to be mounted in that manner. Knife-collars suitable for the purpose are illustrated at 6 and 7, the

collars 6 being those carried by the upper shaft and the collars 7 being those of the lower shaft. Preferably, and as shown herein, all of these collars are identical in construction and interchangeable with one another.

Each of the knife-collars illustrated comprises a central annular member, the circumference of which is of considerably larger diameter than the opening in it, and each also has a pair of hubs projecting from it sidewise, which hubs are shown as of the full width of the collar and are indicated in the collars 6 at 8 and 8′, the collars 7 of the lower shaft having hub portions identical in construction with those just described. The oppositely extending hubs 8 and 8′, being at their circumference of considerably small diameter than the central main portion of each knife-collar, leave, as will be clear, two parallel faces, such as 9 and 9′, for locating the faces of the two knives intended to be mounted on each collar. These knife-locating faces or cheeks are, as will be evident from the drawings, parallel with each other and are spaced at the same distance apart in all of the knife-collars.

The cutters or knives usually employed in connection with the collars just described, are annular knives, the openings in which have a diameter which is the same as that of the hub portions of the collars just described, in order to enable them to fit snugly in place on said hubs. This will be evident by referring to Fig. 2. In addition to this, the thickness of each knife preferably corresponds to the extent of projection of the hub on which it is mounted, so that when the knives are in place the collar and the pair of knives carried by it, when the knives are new, form a unit which is of the same thickness at all points, except at the chisel edges of the knives. Each knife ordinarily is of considerably greater diameter than the collar on which it is carried, in order that each knife may be reground a number of times before it is replaced by a new one. The manner in which the knives may be secured to the collars may be any suitable for the purpose of holding them securely in position, screws, such as 10 and 11, being shown for this purpose. It should be understood that the diameter of each knife is such that when the collars with the knives in place thereon are slid onto the shafts 4 and 5, and assembled in position for slitting the material, the cutting edges of the knives on one shaft will overlap those on the other shaft a considerable distance, which distance is sufficient to permit repeated regrinding of the cutting edges.

Each of the units, such as shown in Fig. 2, has a central opening of such size that the collar will fit snugly on the shaft, each unit being pushed into place on its shaft with the cheeks of the hubs in contact with one another, all of these units being preferably securely held in place by some suitable means. In the present construction sleeves are shown at 12 and 13 at the left-hand ends of the upper and lower shafts respectively, which sleeves are clamped up against the outer ends of the respective series of units or collars, by means of nuts, such as 14 and 15. At the opposite end of each shaft the collars are located against a suitable stop, which stops are indicated at 16 and 17. Thus by means of a single stop at one end of each shaft and a collar and adjusting nut at the other end it will be obvious that a whole series of collars on each shaft may be securely held in place without any other fastening means, and properly located in the relative positions which they occupy for slitting the material. It will be noticed that when the units are slid into place and properly located on each shaft and those shafts are brought into working relation with each other, the units on each shaft interlock with those on the other and every pair of knives on one shaft coöperates with a pair of knives located between them but carried by the other shaft. This mode of organizing the parts assures the cutting of strips from a sheet of material passing between the knives, which strips will lie parallel with the axes of the shafts at all times as they pass between the cutters, alternate strips, such as indicated at s and s', being thrown slightly upward and slightly downward respectively, as they are cut from the sheet. In this construction it will be seen also that as each collar is of the same width and each knife is secured at its inner side to a cheek of that collar, the position of which cheek never changes and is always in the plane of a corresponding cheek of the coöperating collar on the other shaft, the regrinding of the inner faces or sides of the annular knives does not disturb the cutting relation of the parts at all, no matter how many times the knives may be reground. In all cases the inner faces of coöperating knives will always move in a common plane, that is to say, with their cutting edges at the inner sides of the knives in contact with each other. Every unit of the machine is interchangeable with every other, and regrinding of the knives carried by it will not in any way change the spacing of the cutting edges of the knives, as is the case when collars and knives of the ordinary type are employed, in which the outer sides of the knives coöperate with each other instead of the inner sides. From this it will be clear that in the present slitting machine no adjustment is required to permit the use of reground knives, as the reduction of the thickness of the knives by grinding their bevel edges and

their inner sides, has no effect whatever upon the spacing of the cutting edges.

The general construction of the slitting knives and their mode of coöperation with the other parts has been described. The specific construction of each knife of the upper and lower set is preferably that illustrated, *k* and *k'* showing coacting knives carried respectively by the upper and lower shafts, each being an annulus having a chisel edge the beveled face of which is intended to be ground from time to time to sharpen the knife, as is the inner face of said knife, that is to say, the side thereof of largest diameter. Each knife *k* of the upper series coöperates with an oppositely disposed knife *k'* of the lower series to slit the material by a rotary cutting action of two knife edges rotating in overlapping paths, as will be evident from an inspection of the overlapping interlocking relation of the knives in the two series, which is clearly shown in Fig. 1.

In Fig. 3 there is illustrated a modification of the invention for the purpose of adapting the knives and their spacing means to the cutting of much wider strips than those cut by the knives of Fig. 1. In this view the supports, shafts, and other parts, which are substantially identical with those of Fig. 1, are indicated by corresponding reference characters, these parts being the frame members 2 and 3, the upper and lower shafts 4 and 5, the knives *k* and *k'*, the screws 10 and 11 for securing them in place, and the nuts 14 and 15 at corresponding ends of the shafts for holding the knives etc., in place. The knife-collars on which the knives *k* and *k'* are mounted are indicated at 20 and 21 and are considerably wider than those shown at 6 and 7. Each has hubs projecting from opposite ends thereof as in the case of the collars 6 and 7, these hubs being designated respectively by 22 and 22'. The knives *k* and *k'* are also shown in this case as held in place on the collars by screws, 23, as in the case of the construction first described. The knives themselves, are, or may be, identical with the knives of Figs. 1 and 2 and are disposed in the same manner, facing alternately in opposite directions. In this case, however, the cheeks of the hubs of the knife-collars are not in contact, but are held apart by suitable spacing devices, such as spacing collars, 24, these being employed in order to avoid the necessity of using collars having long, thin hubs. All of the collars 24 should of course be of the same width in order to space the knives properly, their width being determined by the width of the main portions of the knife-collars, the construction being such, as will be seen, as to permit a pair of knives on the lower shaft to be located between and in contact with the knives of a coacting pair on the upper shaft. In the construction shown in this view the two shafts 4 and 5 are filled with cutting units and spacing collars from end to end of each shaft, and are held in place against stops, 25 and 26, at one end of each shaft, by nuts, 14 and 15, at the opposite ends of these shafts, the sleeves 12 and 13 of Fig. 1 not being employed in this modification. It will be noticed that while both of the shafts 4 and 5 of Fig. 3 have series of similar cutting units and spacing collars, the lower shaft also carries at opposite ends thereof a knife-carrier and spacing device specifically different from anything previously described herein. The reason for this is that because of lack of space for the regular knife-collar 21 at the ends of the lower shaft, a special collar narrow enough to fill the space left at each end of the shaft is necessary. The two devices employed, indicated at 27, are preferably identical with each other and interchangeable. Each consists of a relatively wide hub, constituting a spacing device, and a collar proper with a single knife-locating cheek against which the inner side of the corresponding knife *k'* is located, the knife being secured to the hub by a short screw 28, substantially as before described in connection with the other parts. The inner cheek of the nut 15 comes up against the outer face of the device 27 at the left-hand end of the shaft, and by pressure against it serves to hold all of the devices on the lower shaft in place, substantially as in the case of the devices on the upper shaft.

It will of course be obvious that in both of the specific types of slitting machine illustrated, the knives on each shaft are spaced at regular predetermined distances apart, and so located as to interlock with one another; that all of the cutting units in each form of the machine are interchangeable with one another, with the exception of the two special units employed on the lower shaft in Fig. 3 and just described; and that whether the spacing of the knives at predetermined intervals is effected solely by the knife-collars, or by the knife-collars coöperating with spacing collars, all of the principal relations of the parts and their functions are the same in both types of machine. In each the knives when in action move in overlapping paths in such a manner as to make straight cuts through the material, that is cuts which are not distorted by tipping of the strips relatively to the axis of the lower shaft, and in each case the knives may be reground on their inner faces as well as on their beveled edges repeatedly without in any way affecting the locating of the cutting edge of such a reground knife when it is restored to its original position in the machine for reuse.

What I claim is:

1. In a machine of the class specified, a shaft, a plurality of collars mounted thereon having oppositely disposed knife seating surfaces, annular knives secured at their working faces to said seating surfaces, and said collars having oppositely disposed projecting portions adapted to coöperate with the corresponding projecting portion of an adjacent collar to thereby space the collars independently of the knives.

2. In a machine of the class specified, the combination with a pair of parallel shafts, of a plurality of knife collars carried by each of said shafts, said collars having oppositely disposed knife locating cheeks, annular knives secured at their working faces to said cheeks, and said collars having oppositely disposed projecting portions extending at least flush with the outer faces of the knives to coöperate with the corresponding projecting portion of an adjacent collar to thereby space the collars irrespective of the thickness of the knives, and the pairs of coöperating knives having their working faces in the same plane.

3. In a machine of the class specified, the combination with a shaft, of a knife-collar carried by said shaft and having a pair of parallel knife-locating cheeks from which project oppositely extending hubs of smaller diameter than the main portion of the collar, and a pair of knives secured to said collar with their working faces adjacent said cheeks.

4. In a machine of the class specified, the combination with a shaft, of a knife-collar carried by said shaft and having a pair of parallel knife-locating cheeks from which project oppositely extending hubs of smaller diameter than the main portion of the collar, and a pair of annular knives mounted on said hubs and having their working faces adjacent said cheeks.

5. In a machine of the class specified, a shaft, a plurality of collars mounted thereon each having a knife-seating surface, an annular knife secured to each collar with its working face adjacent said seating surface, and means to space the collars on the shaft independently of the knives, whereby the same spacing of the collars may be maintained regardless of the thickness of the knives and whereby the working faces of the knives may be maintained in the same plane with their respective seating surfaces, thereby preserving the spacing of the working faces of the knives.

6. In a machine of the class specified, a shaft, a plurality of collars mounted thereon, each having oppositely disposed knife seating surfaces, annular knives secured to said collars, one at each side of each collar with its working face adjacent its seating surface, and means to space the collars on the shaft independently of the knives, whereby the same spacing of the collars may be maintained regardless of the thickness of the knives and whereby the working faces of the knives may be maintained in the same plane with their respective seating surfaces, thereby preserving the spacing of the working faces of the knives.

7. In a machine of the class specified, the combination with a pair of parallel shafts, of a plurality of knife collars carried by each of said shafts, each of said collars having knife-locating cheeks and an annular knife secured to the collar at each of said cheeks, the working face of each knife lying adjacent the corresponding knife-locating cheek, and means to space the collars on the shafts independently of the knives, the collars on one shaft being so positioned with respect to those on the other shaft that the working faces of the knives of one shaft lie in the same planes with the working faces of the knives of the other shaft, substantially as described.

Signed at Chicago, in the county of Cook, and State of Illinois, this fourth day of November, A. D. 1912.

FRANK G. FEELEY.

Witnesses:

RALPH E. CUSHMAN,

R. C. GULLEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."