Feb. 24, 1931. E. R. KAST 1,793,553

SHEET COLLATING APPARATUS

Filed July 16, 1929 3 Sheets-Sheet 1

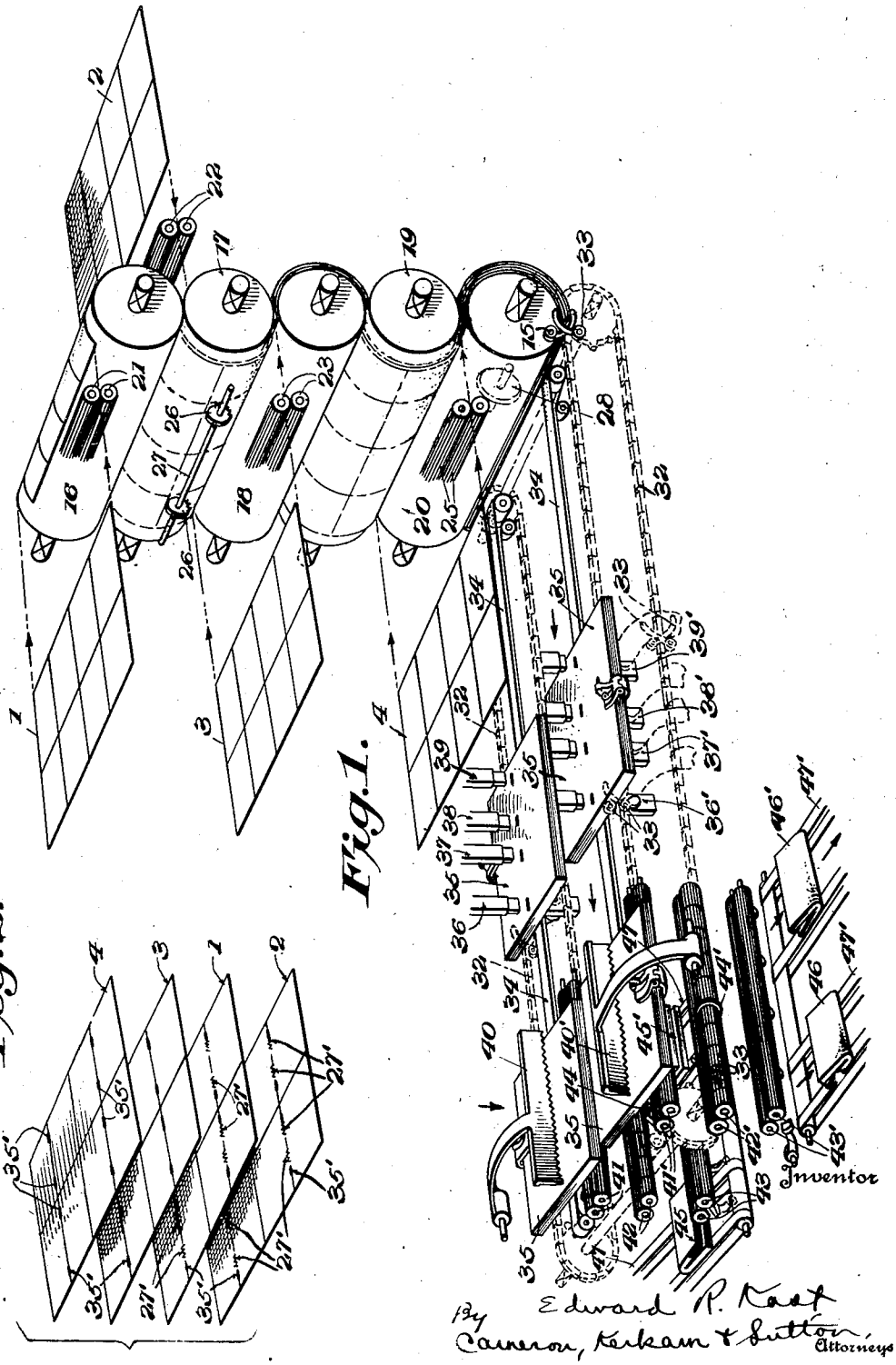


Fig. 1.

Fig. 2.

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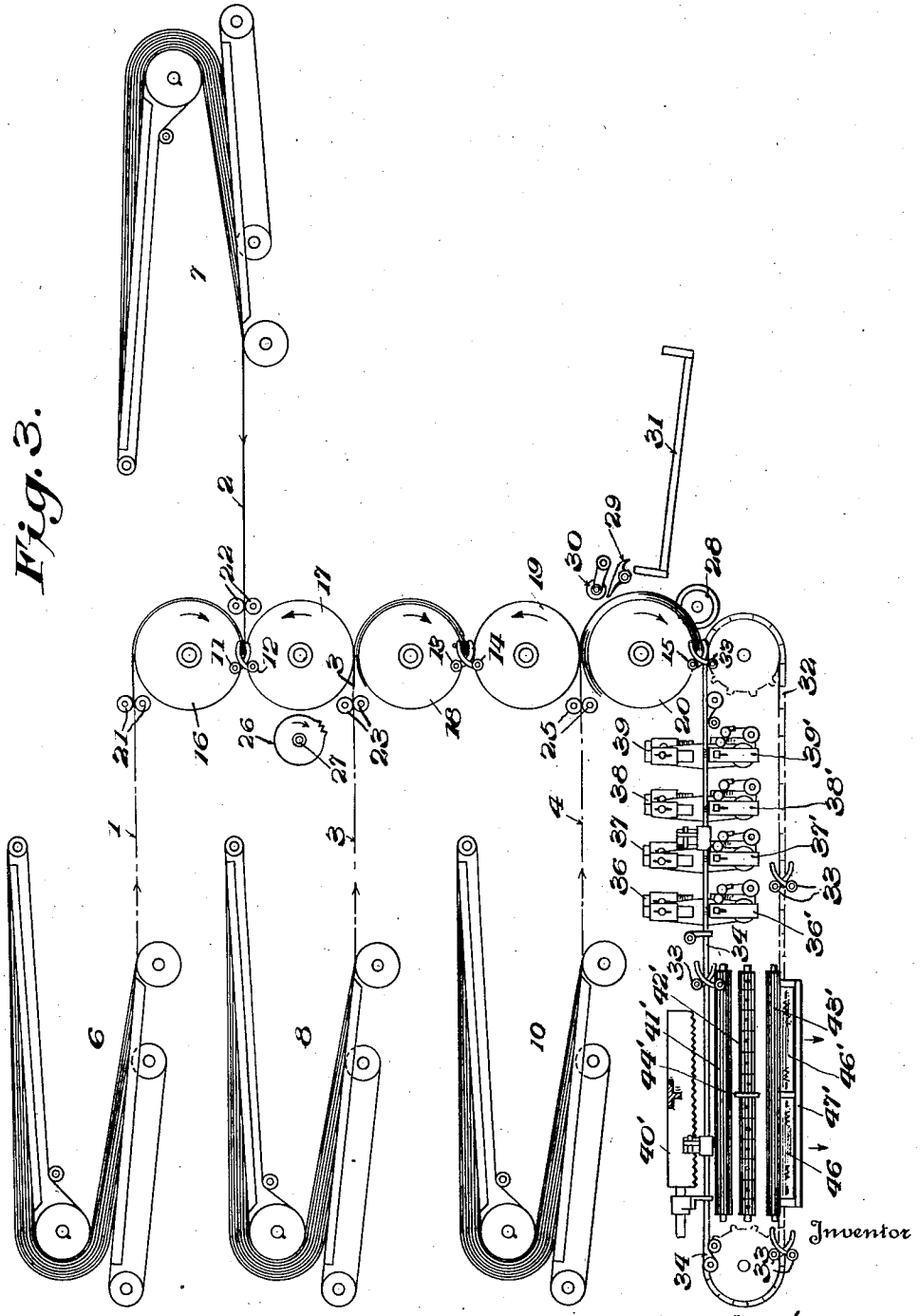
Attorneys

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SHEET COLLATING APPARATUS

Filed July 16, 1929 3 Sheets-Sheet 2

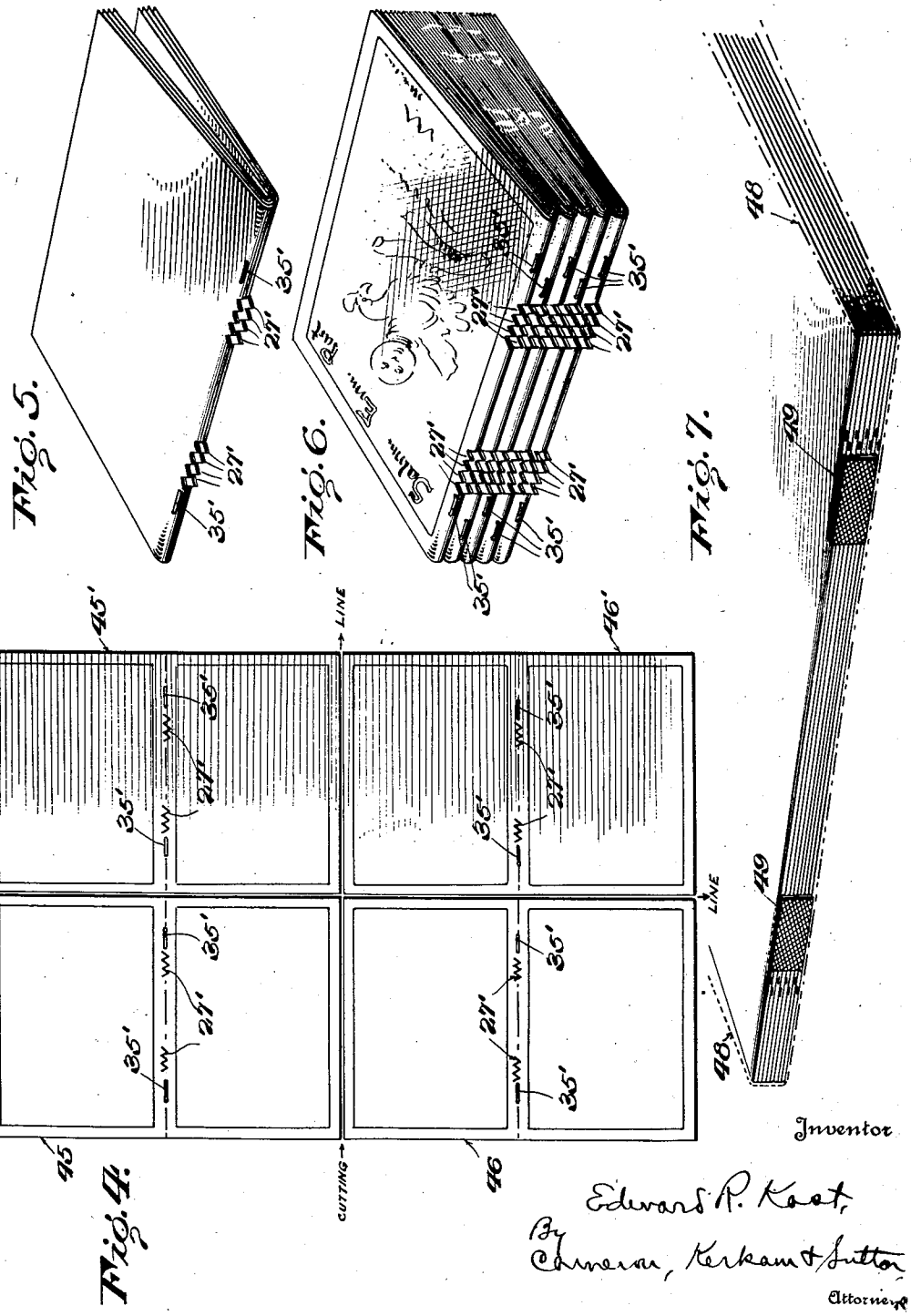
Fig. 3.



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SHEET COLLATING APPARATUS

Filed July 16, 1929 3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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SHEET-COLLATING APPARATUS

Original application filed July 5, 1926, Serial No. 120,791. Divided and this application filed July 16, 1929. Serial No. 378,712.

This invention relates to sheet collating apparatus, and while capable of general use, is particularly adapted for association with signature making machines, book making mechanism, or other analogous instrumentalities.

The present application is a division of my copending application Serial No. 120,791, filed July 5, 1926, and the invention has for its principal objects the provision of a sheet collating apparatus which produces binding serrations on one or more sheets collated with one or more imperforate sheets; which collates the serrated and imperforate sheets so that when they are subsequently folded to form signatures, the imperforate sheet or sheets will be disposed within the serrated sheet or sheets; which embodies a plurality of collating cylinders and a plurality of sheet feeders all arranged to occupy minimum space in the place of installation; and which is a relatively inexpensive, highly efficient and extremely expeditious apparatus for collating sheets in the making of signatures or books.

In order to more clearly understand this invention, reference may be had to the accompanying drawings which illustrate one embodiment of the inventive idea, and wherein—

Fig. 1 is a detail perspective view of the apparatus, parts of which are omitted for purposes of clearer illustration;

Fig. 2 is a detail perspective view of superposed sheets spaced apart in order to show the disposition of serrated sheets with respect to imperforate sheets collated therewith;

Fig. 3 is a side elevation of the apparatus illustrated in Fig. 1, showing the arrangement of sheet feeders for delivering sheets to the collating cylinders;

Fig. 4 is a bottom plan view of collated imperforate and serrated sheets stapled together and cut to provide a plurality of multiple sheet signatures;

Fig. 5 is a detail perspective view of a folded signature;

Fig. 6 is a view similar to Fig. 5 showing a plurality of signatures grouped together for binding by the alined serrations thereof; and

Fig. 7 is a detail perspective view of a bound book comprised by signatures such as shown in Figs. 5 and 6.

Referring to the drawings, wherein like reference characters designate like parts throughout the several views, the embodiment of the invention shown therein is, for example, illustrated in association with a mechanism for making signatures. The signatures may be formed, for example, from four sheets 1, 2, 3, 4, of sixteen pages each, which are collated together and cut as hereinafter disclosed, to produce four sixteen-page signatures. It is to be expressly understood, however, that the signatures may be formed from any desired number of sheets in accordance with the number of pages desired for each signature. In the preferred embodiment of the invention, herein shown, the sheets are delivered by a plurality of suitable feeders 6, 7, 8, 10 (Fig. 3), to the grippers 11, 12, 13, 14, 15, of a plurality or series of cylinders 16, 17, 18, 19, 20, which collate the sheets and have axes of rotation all located in a straight line or in the same plane so that said cylinders are all radially alined or arranged in radial alinement. Before being seized by said grippers, the sheets pass through rollers 21, 21, 22, 22, 23, 23, 25, 25 and are registered by the usual or any suitable devices for this purpose (not shown.) The collating cylinders 16, 17, 18, 19, 20 are preferably disposed vertically one above the other in superposed relation and are spaced successively in increasing amounts from the top of the series to the bottom thereof, in order to accommodate the increasing thickness of the sheets as they are successively collated by said cylinders.

In accordance with the present invention concomitantly acting collating cylinders are employed, to one of which a sheet is fed, this sheet being carried around the cylinder to the point of juxtaposition thereof with another cylinder where a second sheet is fed and collated with the first sheet. The first and second sheets are then carried around the second cylinder to the point of juxtaposition thereof with a third cylinder where a third sheet is

fed and collated with the first two sheets, and so on if it is desired to collate sheets fed to each point of juxtaposition of the collating cylinders. As herein shown, however, the aforesaid three sheets are carried around by the third cylinder to a fourth cylinder which, in turn, carries said sheets around to the point of juxtaposition of said fourth cylinder with a fifth cylinder where a fourth sheet is fed and collated with the three previously mentioned sheets for delivery from the last mentioned cylinder to mechanisms hereinafter described.

The construction and operation of the sheet feeders, such as shown at 6, 7, 8, 10, as well as the construction and operation of collating cylinders, such as shown at 16, 17, 18, 19, 20, are well known and understood in the art and a detail description of these instrumentalities per se is therefore necessary. It will be noted, however, that as herein disclosed, the sheet feeders 6, 8, and 10 are arranged at one side of the collating cylinders in spaced superposed relation so as to deliver sheets 1, 3 and 4 to cylinders 16, 18, and 20, while the sheet feeder 7 is arranged at the opposite side of the collating cylinders so as to deliver sheet 2 to cylinder 17. In other words, the feeders 6, 7, 8, are disposed in staggered relation on opposite sides of the series of cylinders, and the feeders 7 and 10 are also disposed in staggered relation at opposite sides of the series of collating cylinders. As clearly shown in Fig. 3, the feeder 6 delivers sheets to cylinder 16 preferably above the axis thereof, the feeders 8 and 10 deliver sheets to the points of juxtaposition of the cylinders 17, 18 and 19, 20 respectively, and the feeder 7 delivers sheets to the points of juxtaposition of the cylinders 16 and 17.

In describing the collation of sheets by the present apparatus, the successive operations will be set forth as respects a single assembly of the four sheets above referred to. It is to be expressly understood, however, that this invention is not limited to the feeding of the specific number of sheets indicated, and that the number of collating cylinders, together with the number of sheet feeding mechanisms may be increased or descreased as desired in accordance with the number of sheets to be collated in a group thereof.

As clearly shown in Figs. 1 and 2, the sheet 1 is first registered and fed to the grippers of the uppermost collating cylinder 16. The sheet 1 is then carried around the cylinder 16 to a point where a sheet 2 being fed to the cylinder 17 is in proper position with respect to cylinder 17 and to the sheet 1 about to be transferred from cylinder 16 to cylinder 17. Sheet 2 is then registered and fed in registered relation to sheet 1, at which time sheets 1 and 2 are gripped by the grippers of cylinder 17 and carried around the latter past a pair of rotary segmental saws or serrators 26, 26 disposed in spaced relation on a driven shaft 27 so as to punch or cut spaced groups of serrations 27′, 27′ in the two collated sheets on substantially parallel lines equidistant from each other and from the opposed ends of said sheets. After passing the rotary segmental saws or serrators 26, 26, the serrated sheets 1 and 2 travel with the cylinder 17 to a point where they are collated with an imperforate sheet 3 being fed to the cylinder 18 by the sheet feeder 8. Sheets 1 and 2 are then transferred to cylinder 18 where they are associated with the previously registered sheet 3 and cylinder 18 then takes the three collated sheets and carries them around to cylinder 19. The grippers of cylinder 19 then seize the three collated sheets and carry them around to a point where they are collated with a previously registered imperforate sheet 4 being delivered to cylinder 20 by sheet feeder 10. The grippers of cylinder 20 then take the four collated and perfectly registered sheets and carry them around to a conveyor which will be presently described. The collating cylinders preferably are rotated successively in opposite directions, as indicated by the arrows in Fig. 3. It will thus appear that by rotating the adjacent cylinders in opposite directions and associating the feeders therewith as above described, said cylinders operate to associate the serrated and imperforate sheets so that the serrated sheet or sheets will be disposed on the cylinders exteriorly of the imperforate sheet or sheets carried thereby.

During travel of the four collated sheets on cylinder 20, they are preferably severed between the ends thereof on a line intermediate the lines of serration and substantially parallel therewith. Cutting of the sheets in this manner may be performed, for example, by a rotary cutter 28 located adjacent the lowermost cylinder 20 and driven by any suitable means. A switch 29, roller 30 cooperating therewith, and a receiver 31 may be employed, if desired, for switching out defective collated groups of sheets, a detecting mechanism (not shown) being preferably associated with each cylinder to trip the switch in the event that a sheet was absent.

In the embodiment of the invention illustrated by the drawings appended hereto, the collating apparatus is shown in association with signature making instrumentalities comprised by a conveyor, staplers or stitchers, folders, and delivery mechanism.

The conveyor, which receives the collated sheets from the cylinder 20, may be of a well known type comprising endless chains 32, 32 having a plurality of sets of grippers 33, 33 and belts 34, 34 which support the collated sheets during their travel on the conveyor. The cut and collated sheets on the cylinder 20, after being seized by one of the sets of conveyor grippers, are carried to the stitcher

mechanism where the two piles of sheets 35, 35 after being registered, are stapled together at 35′, 35′ on the lines of the serrations. As herein shown, eight stitchers 36, 37, 38, 39 and 36′, 37′, 38′, 39′ are employed, the latter preferably being disposed in staggered relation with respect to the former, so that the stapling presented on the backs of signatures grouped as shown in Fig. 6 to form books will be staggered to eliminate bulging of the books.

After the piles 35, 35 have been stapled, they are moved by the conveyor and registered under folding means including blades 40, 40′ which engage the stapled piles of sheets on their lines of stapling and force them between sets of rollers 41, 42, 43 and 41′, 42′, 43′. The sets of rollers 42 and 42′ are provided with cutters 44, 44′ arranged to cut the stapled and folded piles 35, 35 into equal parts on a line extending transversely of the lines of serration and stapling and substantially equidistant from, and parallel with, the opposed sides of the sheet. The completed signatures 45, 45′ and 46, 46′ are then delivered from the sets of rollers 43, 43′ onto conveyors 47, 47, 47′, 47′ which carry said signatures away from the folding means for distribution in the boxes or holders of a gathering machine or the like. Thereafter, books or the like such as shown in Fig. 7 may be formed from the signatures in the manner disclosed in my co-pending application above referred to or any other desired way. Said books are preferably provided with a cover 48 and may, if desired, have strips 49, 49 of gauze or the like applied to the backs of the books over the binding serrations 27′, 27′ thereof and beneath the cover 48.

It will appear from the foregoing that by the present invention sheets may be collated, serrated and cut to provide signatures, the serrations of which project from the backs of the signatures when they are folded and serve as means to bind a plurality of said signatures together to form books or the like. It will further appear that signatures produced in this manner may be formed into books that open perfectly flat, and have as many "double spreads" as there are signatures employed, which constitutes a great advantage in that more of this desirable space is available to advertisers.

While one illustrative embodiment of the inventive idea has been described in detail, the scope of the invention is not limited to such embodiment, or otherwise than by the terms of the appended claims.

What is claimed is:

1. In a sheet collating apparatus, a series of concomitantly acting juxtaposed collating cylinders arranged in radial alinement, means for feeding a sheet to one of said cylinders, and means for feeding a sheet to each of a plurality of points of juxtaposition of the collating cylinders so as to be collated with said first named sheet.

2. In a sheet collating apparatus, a plurality of radially alined juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders, and means for feeding successive sheets in opposite directions to a plurality of points of juxtaposition of the collating cylinders so as to be successively collated with each other and with aid first named sheet.

3. In a sheet collating apparatus, a series of superposed collating cylinders, means for feeding a sheet to the uppermost cylinder, and means for feeding successive sheets in opposite directions to a plurality of points of juxtaposition of the collating cylinders so as to be collated thereby with each other and with the first named sheet.

4. In a sheet collating apparatus, a series of radially alined concomitantly acting juxtaposed collating cylinders, a feeder for delivering a sheet to one of said cylinders, and means for feeding a sheet to each of a plurality of points of juxtaposition of the collating cylinders so as to be collated thereby with each other and with the first named sheet, said means being arranged on both sides of the series of cylinders.

5. In a sheet collating apparatus, a series of radially alined juxtaposed collating cylinders, and sheet feeding means on both sides of said series of collating cylinders and including a plurality of sheet feeding devices arranged in staggered relation and adapted to feed sheets to different cylinders of said series respectively.

6. In a sheet collating apparatus, a series of radially alined collating cylinders, and sheet feeding means on both sides of the series of collating cylinders and including a plurality of sheet feeding mechanisms successively adapted to feed sheets in opposite directions to different cylinders of said series respectively.

7. In a sheet collating apparatus, a series of superposed concomitantly acting collating cylinders, and sheet feeding means on both sides of the series of collating cylinders and including a plurality of independent feeders arranged in staggered relation and adapted to feed sheets in opposite directions to successive cylinders of said series respectively.

8. In a sheet collating apparatus, a plurality of concomitantly acting juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders, mechanism for feeding a sheet to each of a plurality of points of juxtaposition of the collating cylinders so as to be collated with each other and with the first named sheet, and a device for serrating one or more of the sheets being collated with the other sheet or sheets.

9. In a sheet collating apparatus, a series of concomitantly acting radially alined col-

lating cylinders, means for feeding sheets to one or more of said cylinders, means for forming spaced serrations in said sheets on a line or lines intermediate opposed extremities thereof, and means for feeding imperforate sheets to a remaining cylinder or cylinders so as to be collated with the serrated sheets.

10. In a sheet collating apparatus, a series of superposed collating cylinders, means for feeding sheets to one or more of the uppermost cylinders, means for forming spaced serrations in said sheets, and means for feeding imperforate sheets to a remaining cylinder or cylinders so as to be collated with the serrated sheets.

11. In a sheet collating apparatus, a series of radially alined collating cylinders, and means for feeding sheets to be collated thereby, said means including a pair of feeders one on each side of the cylinders and each adapted to feed sheets to one of said cylinders, the sheet feeder on one side of the cylinders being arranged in staggered relation with the cylinder fed by the sheet feeder on the opposite side of the cylinders.

12. In a sheet collating apparatus, a series of superposed radially alined collating cylinders, a device for feeding sheets to the uppermost cylinder, and means for feeding sheets to other cylinders of the series and including a plurality of devices arranged at different levels on opposite sides of the series of cylinders and successively adapted to feed sheets in opposite directions to the points of juxtaposition of successive cylinders.

13. In a sheet collating apparatus, a series of radially alined collating cylinders, means for feeding sheets to the cylinders to be collated thereby and including a pair of feeders one on each side of the cylinders and each adapted to feed sheets to one of said cylinders, the feeder on one side of the cylinders being arranged in staggered relation with the cylinder fed by the feeder on the opposite side of the cylinders, and means for cutting the collated sheets into a plurality of piles.

14. In a sheet collating apparatus, a series of superposed radially alined cylinders adapted to collate sheets fed thereto, a device for feeding sheets to the uppermost cylinder, sheet feeding means on both sides of the series of cylinders and including a plurality of devices arranged at different levels and successively adapted to feed sheets in opposite directions to a plurality of said cylinders at points of juxtaposition thereof, and a rotary cutter cooperating with one of the cylinders and adapted to cut the collated sheets into a plurality of piles.

15. In a sheet collating apparatus, a series of radially alined cylinders adapted to collate sheets fed thereto, means for feeding sheets to one or more of the cylinders, means for forming serrations in said sheets on a line or lines between opposed extremities thereof, means for feeding imperforate sheets to another cylinder or cylinders so as to be collated with the serrated sheets, and means adapted to cut the collated sheets between the line or lines of serrations and thereby form a plurality of piles therefrom.

16. In combination, a plurality of juxtaposed cylinders adapted to associate sheets so that a serrated sheet or sheets will be disposed exteriorly of an imperforate sheet or sheets, means for feeding one or more sheets to one or more of the cylinders respectively, means for serrating the sheet or sheets so fed, and means adapted to feed one or more imperforate sheets to one or more of the other cylinders respectively for collation with said serrated sheet or sheets as aforesaid.

17. Mechanism of the character described including a rotating sheet receiving cylinder, means for feeding a sheet thereto, means for serrating said sheet, means for feeding an imperforate sheet, and a cylinder operating to collate the serrated sheet with the imperforate sheet so that the former is disposed exteriorly of the latter on said last named cylinder.

18. Mechanism of the character described including a plurality of sheet feeders arranged in opposed staggered relation, means for serrating a sheet fed by one of said feeders, and sheet collating means interposed between said feeders receiving the sheets therefrom and associating them so that the serrated sheet is disposed on said means exteriorly of the imperforate sheet or sheets thereon.

19. In combination, mechanism adapted to collate serrated and imperforate sheets so that the imperforate sheet or sheets will be disposed on said mechanism interiorly of the serrated sheet or sheets thereon, means for folding the collated sheets to form a signature with serrations projecting from the back thereof, and means for delivering the collated sheets to said folding means from said collating mechanism.

20. In combination, mechanism adapted to collate serrated and imperforate sheets so that the serrated sheet or sheets will be disposed on said mechanism exteriorly of the imperforate sheet or sheets thereon, means for stapling said sheets together on the line of serrations, means for folding the stapled sheets to form a signature with serrations projecting from the back thereof, and means for feeding the collated sheets from the collating mechanism past said stapling means to said folding means.

21. In a sheet collating apparatus, a series of radially alined juxtaposed cylinders adapted to collate sheets fed thereto, means for feeding a sheet to one of said cylinders, means for feeding another sheet or sheets to another cylinder or cylinders to be collated

with the first named sheet, and a device for serrating one or more of the sheets collated with the other sheet or sheets.

22. In a sheet collating aparatus, a plurality of concomitantly acting radially alined cylinders adapted to collate sheets fed thereto, means for feeding a sheet to one of said cylinders, means for forming serrations in said sheet on a line between opposed extremities thereof, and means for feeding an imperforate sheet to another of said cylinders so as to be collated with the serrated sheet.

23. In a sheet collating apparatus, a plurality of superposed cylinders adapted to collate sheets fed thereto, means for feeding a sheet to one of the uppermost cylinders, means for forming serrations in said sheet on a line between opposed extremities thereof, and means for feeding an imperforate sheet to one of the cylinders below said uppermost cylinder so as to be collated with the serrated sheet.

24. In a sheet collating apparatus, a series of superposed radially alined cylinders adapted to collate sheets fed thereto, means for feeding a sheet to one cylinder of the series to be collated with sheets fed to other cylinders thereof, and means on both sides of the series adapted to feed sheets to said last named cylinders.

25. In a sheet collating apparatus, a series of radially alined cylinders adapted to collate sheets fed thereto, and means for feeding said sheets in opposite directions from both sides of said series of cylinders and including a plurality of feeders arranged in staggered relation.

26. In a sheet collating apparatus, sheet collating means including three radially alined juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders, and means for feeding a sheet to each point of juxtaposition of said collating cylinders so as to be collated with each other and with said first named sheet.

27. In a sheet collating apparatus, sheet collating means including three radially alined juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders, and means for feeding sheets in opposite directions from both sides of the three cylinders for delivery thereto at the points of juxtaposition thereof.

28. In a sheet collating apparatus, a series of radially alined juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders, and means on both sides of the series of cylinders for feeding sheets to points of juxtaposition thereof.

29. In a sheet collating apparatus, a series of radially alined juxtaposed collating cylinders, means for feeding a sheet to one of said cylinders to be carried to a point of juxtaposition thereof with another cylinder, means for feeding a sheet in one direction to said point to be collated with the first named sheet by the second cylinder, and means for feeding a sheet in the opposite direction to the point of juxtaposition of the second cylinder with a third cylinder, whereby the three sheets may be collated together on the last named cylinder.

30. In a sheet collating apparatus, a series of radially alined juxtaposed cylinders for collating sheets fed thereto, means on both sides of the series of cylinders for feeding said sheets, and means cooperating with one of the cylinders for cutting the collated sheets into a plurality of piles.

31. In a sheet collating apparatus, a series of radially alined cylinders for collating sheets fed thereto, means on both sides of said series of cylinders for feeding said sheets and including a plurality of feeders arranged in staggered relation, and means for cutting the collated sheets into a plurality of piles.

32. In combination, a series of radially alined cylinders for collating sheets fed thereto, means on both sides of the series of cylinders for feeding said sheets, stitcher mechanism, and means for delivering the collated sheets from one of said cylinders to said stitcher mechanism.

33. In combination, a series of radially alined juxtaposed cylinders for collating sheets fed thereto, means on both sides of the series of cylinders for feeding said sheets, folding mechanism, and means for delivering the collated sheets from one of said cylinders to said folding mechanism to be folded thereby.

34. In combination, a series of radially alined juxtaposed cylinders for collating sheets fed thereto, means on both sides of the series of cylinders for feeding said sheets, a folding device, stitcher mechanism interposed between the series of cylinders and the folding device, and means for delivering the collated sheets from one of said cylinders to the stitcher mechanism and folding device to be stitched and folded thereby, respectively.

35. In combination, a series of superposed radially alined cylinders for collating sheets fed thereto, means on both sides of the series of cylinders for feeding said sheets, means for cutting the collated sheets into a plurality of piles, stitching and folding mechanisms, and means for delivering the piles of collated sheets from one of said cylinders to the stitching and folding mechanisms to be stitched and folded thereby, respectively.

In testimony whereof I have signed this specification.

EDWARD R. KAST.