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SHEET TRIMMING, SLITTING, AND SCORING MECHANISM

Filed Feb. 24, 1941

2 Sheets-Sheet 1

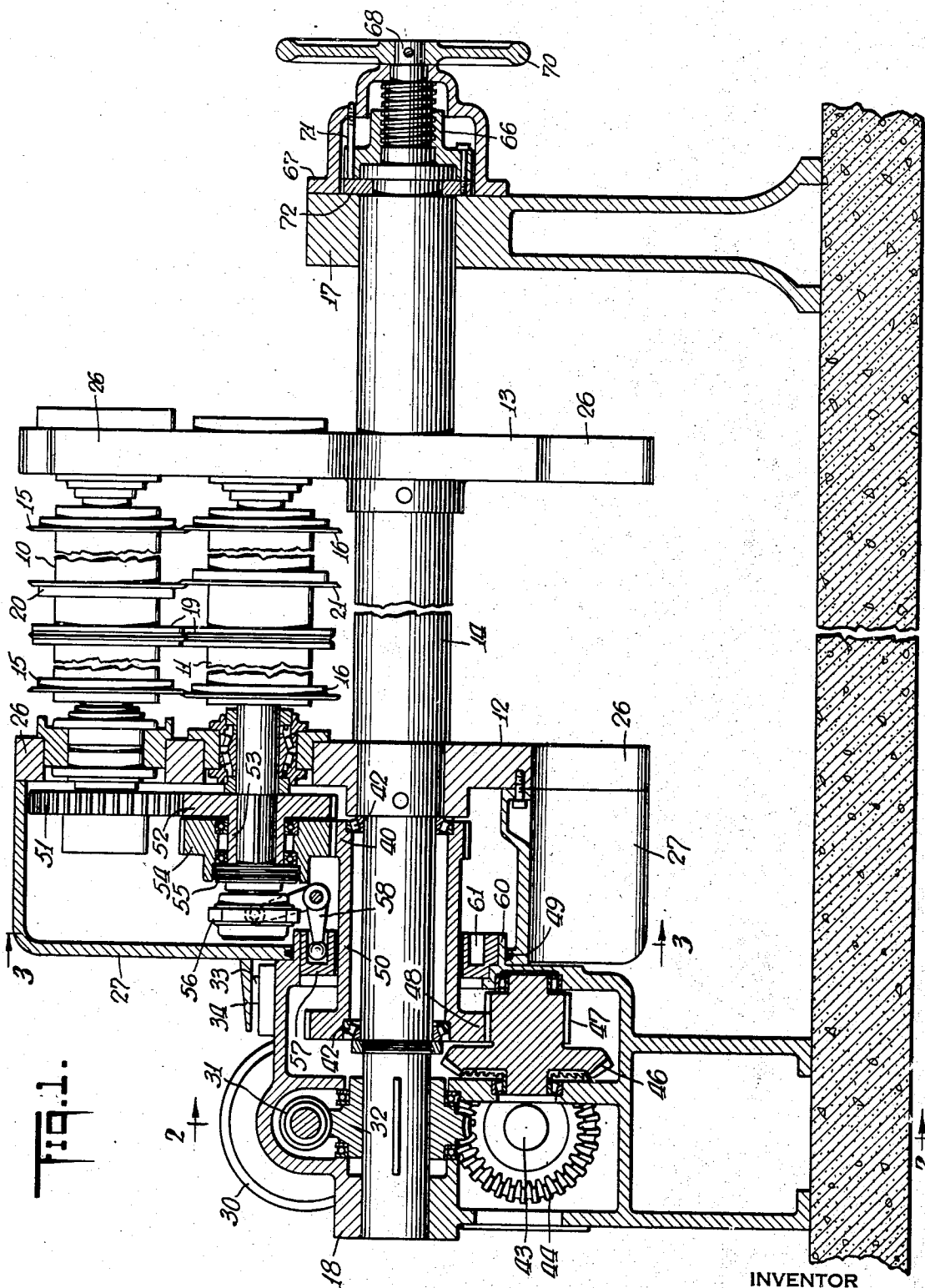


Fig. 1.

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Fig. 3.

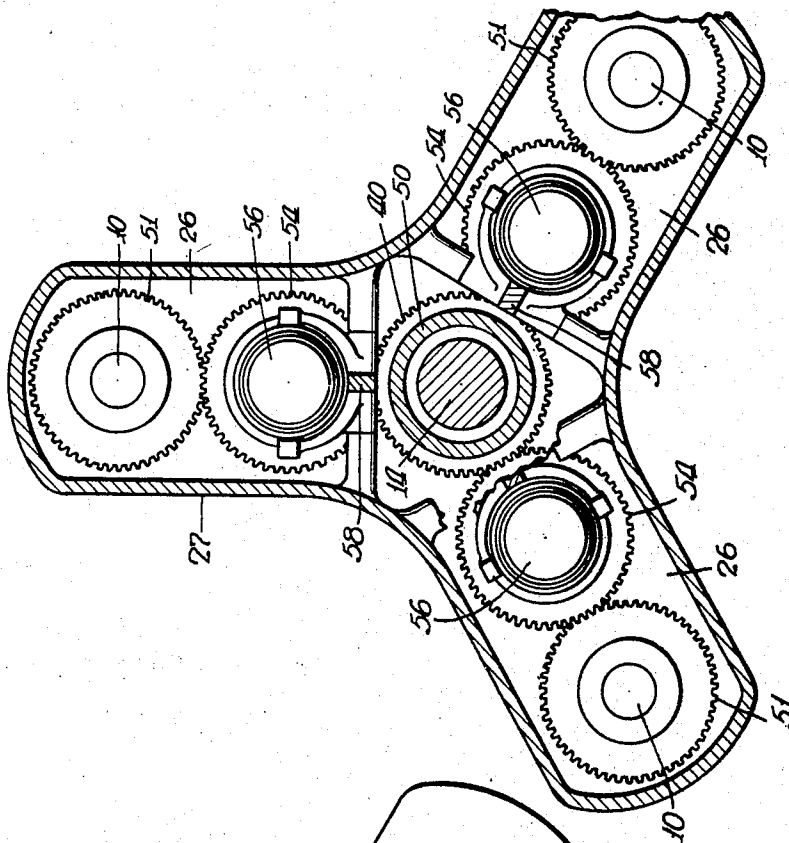
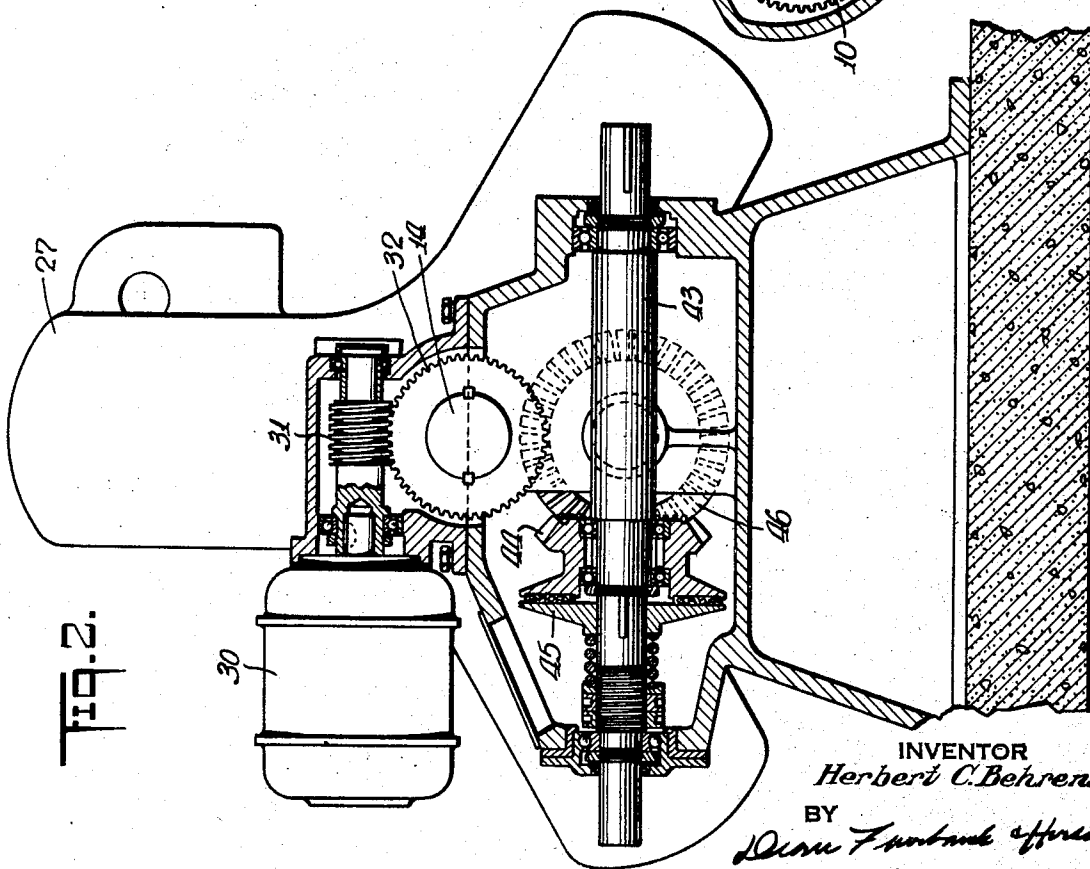


Fig. 2.



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SHEET TRIMMING, SLITTING, AND
SCORING MECHANISM

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The present invention relates to a machine for slitting and/or scoring sheet material, such as single or double faced corrugated paper board, to trim the sides of said sheet, to divide said sheet longitudinally into sections of desired width, and/or score said sheet preparatory to the formation of some product such as a box blank therefrom.

In a machine of this general type, the trimming, slitting or scoring mechanism includes a pair of shafts carrying pairs of opposed coacting slitting and/or scoring heads adjustable along said shafts in accordance with the desired width of the sections to be cut, and the desired position of the score lines. After one run has been completed, it is usually necessary to adjust one or more pairs of the rotary heads along their respective shafts, and sometimes necessary to change the number of these heads in preparation for the next run. To make such adjustments often requires considerable time, and so it has been customary to provide two or more of these mechanisms, each with its pair of shafts, and so mounted that while one mechanism is in operative position and being used, another mechanism is in inoperative position where the adjustments may be made at leisure preparatory to moving it into operative position to replace the other one at the end of a run.

My invention relates to this type in which two or more slitting, trimming or scoring mechanisms are mounted on a frame which is rotatable about a central axis to permit any one of the mechanisms to be swung into or out of operative position with respect to the path of movement of the advancing sheet.

One object of the present invention is to effect the automatic connecting and disconnecting of each mechanism to the driving means as the mechanism moves into and out of operative position, and without in any way disturbing or changing the meshing relationship of any of the power transmitting gears.

To secure this object there is provided a centrally located drive for all of the mechanisms which act on the sheet and clutch means for each mechanism which is so mounted, designed and operated that it will transmit power to the mechanism only when the latter is in or adjacent to its operating position. Thus I avoid the necessity of bringing any gears into or out of mesh when shifting the position of the mechanism.

As a further feature, the connecting and disconnecting of the drive to the mechanisms is effected automatically as said mechanisms are moved into or out of operative positions.

As another feature, means are provided for adjustably moving the mechanisms axially while

the machine is running to permit centering of the rotary heads with respect to the advancing sheet. This is particularly advantageous in centering the outside trimming heads with respect to the sheet, so that the amount trimmed from the opposite edges of the sheet can be made equal in case the sheet shifts laterally in either direction.

A further object is to provide power means for effecting the rotation of the frame in either direction, automatically stopping it in the proper operative position and locking it against movement while acting on the sheet.

Various other objects, features and advantages of the present invention will be apparent from the following particular description, and from an inspection of the accompanying drawings in which

Fig. 1 is a vertical section taken through a slitting and scoring machine embodying the present invention, and

Figs. 2 and 3 are sections taken on lines 2—2 and 3—3 respectively of Fig. 1.

In the form illustrated in the drawings, there are provided three duplicate pairs of parallel coacting shafts 10 and 11 all mounted on a rotatable frame having end sections 12, 13 secured to a normally stationary central shaft 14 journaled in bearing blocks or stationary frame parts 17 and 18, so that any one of said pairs can be brought directly above the axis of said frame in operative position upon rotation of central shaft 14 and said frame.

Each pair of shafts 10 and 11 have rigidly but adjustably secured thereto the desired number of members for acting on the sheet as it passes therebetween. These members may include two pairs of coacting slitting heads 15 and 16 trimming the margins of the advancing sheet to give it straight edges and the desired width, any desired number of pairs of coacting slitting heads 20 and 21 for subdividing the sheet longitudinally in sections of the desired width and number, and if desired, any required number of pairs of scoring heads 19 for creasing the sheet to provide fold lines. Each pair of heads is mounted for adjustment along the shafts 10 and 11 to properly locate longitudinally scores and slits in the advancing sheet.

The pair of end frame sections 12 and 13 which are affixed to the horizontal shaft 14 for rotation therewith may each have three radiating arms 26 spaced 120° apart for supporting the end bearings of the shafts 10 and 11.

The parts so far referred to may be of the conventional type heretofore employed.

For rotating the shaft 14 and the frame sections 12 and 13, there is provided a motor 30 operatively connected to the shaft 14 through a

reduction gearing comprising a worm 31 on the motor shaft, and a worm wheel 32 splined to said shaft 14 and meshing with said worm. The motor 30 is reversible so that the frame 12, 13 can be rotated selectively in either direction 120° to move either one of the lower pairs of shafts 10 and 11 and their slitting and scoring heads into upper operative position.

The worm 31 and worm wheel 32 form an irreversible drive which cannot rotate except through operation of the motor 30. This serves to automatically lock the frame 12, 13 against rotation when the motor is stopped with the frame in any one of its three angular operative positions.

For rotating the shafts 10 and 11 there is provided a central drive gear 40 and a gear transmission between said gear and each of said pairs. The gear 40 encircles the shaft 14 and is driven from any suitable means, as, for instance, from a drive shaft 43, coupled through a spring-pressed friction clutch 45 to a bevel gear 44 which meshes with a bevel gear 46, carrying a spur gear 47 meshing with a gear 48 encircling the shaft 14 and rigid or integral with the gear 40. A sleeve 50 encircling the shaft 14 is shown rigidly connecting the gears 40 and 48 and supported on the shaft 14 through bearings 42.

Each pair of shafts 10 and 11 has a pair of intermeshing gears 51 and 52, and as a feature of my invention, I provide clutch means for operatively connecting each gear 52 to the gear 40 when its driven parts are in operative position and without meshing or unmeshing any gears. In the form shown each radially inner gear 52 has a hub 53 on which a gear 54 is rotatably supported through suitable bearings. Each gear 54 meshes with the drive gear 40 and is disengageably coupled to the shaft 11 for rotation therewith by means of a clutch 55 which is shown as of the multiple disc friction type with alternate discs secured to the gear 54 for rotation therewith and axial movement therealong, and intervening discs splined to the shaft 11 to permit axial movement therealong.

Each set of transmission gears 51, 52 and 54, and associated clutch 55 is housed in a casing formed on the arm 26 by a cover 27 on the outer side of the frame plate 12, and sealed along an inner peripheral section on the other side by a packing ring 49 engaging a fixed frame part or housing 60 for the gears 44, 46, 47 and 48.

As a feature of the present invention, the clutch 55 is automatically operated during the rotation of the frame arm 26 associated therewith. For that purpose there is provided a collar 56, which is splined to the shaft 11, and moved axially along said shaft by means of a fixed cam 57 and a swinging follower in the form of a bell crank 58 between said cam and said collar. The cam 57 in the form of a ring encircles the sleeve 50 between the gears 40 and 48 and is secured to the fixed frame part 60 of the machine. An annular face groove 61 on the cam 57 receives one arm of the bell crank 58, while its other arm extends in an annular peripheral groove of the collar 56.

The cam groove 61 is not concentric with the shaft 14. The part of the groove which is directly above the shaft is spaced farther from said axis than are other parts of the groove. Thus when any one of the slitting and scoring mechanisms nearly reaches operative position in the rotation of the shaft 14 and frame 12, 13, the end of the bell crank lever in the cam groove

61 is pushed radially outwardly to engage the clutch, and as said mechanism leaves operating position, the end of the lever is pulled radially inwardly to disengage the clutch.

The gears 52 and 54 shown in Fig. 1 will therefore be coupled for rotation in unison, and the drive between the drive gear 40 and the shafts 10 and 11 which are uppermost is established. The two other clutches 55 associated with the two lower inoperative pairs of shafts 10 and 11 are always disengaged so that no driving of these shafts while in these positions can take place, and these shafts may be freely rotated if necessary in adjusting the heads thereon.

While the sheet is travelling between a pair of coacting shafts 10 and 11, it may shift slightly transversely so that it will not be properly centered with respect to the outside trimming knives 15 and 16. As a feature of the present invention means are provided for shifting the shafts 10 and 11 axially while the machine is running to effect the centering of these knives with respect to the advancing sheet. For that purpose one end of the shaft 14, for instance, that journaled in the bearing block 17, is engaged by a sleeve 66 which is axially movable therewith but which permits rotation of said shaft with respect thereto. A housing 67 for the sleeve 66 is fixed to the bearing block 17 and forms a bearing for a spindle 68 coaxial with the shaft 14. The inner end portion of this spindle is threaded in the sleeve 66, while the other end projects outwardly from the housing 67 and has an operating means shown as a hand wheel 70 affixed thereto. The sleeve 66 is held against rotation by a plurality of studs 71 fixed thereto and slidably passing through holes in the housing 67, and is held against axial movement in respect to the shaft by a flange 72 extending into an annular groove in the shaft 14. One of said studs 71 may be calibrated at its outer end to indicate by the extent of its outward projection beyond the housing 67 the axial position of the shaft 14.

In order to permit the axial movement of the shaft 14 without interrupting the drive to the operative shafts 10 and 11, the gear 47 is substantially wider than the gear 48 meshing therewith. Upon axial adjusting movement of the shaft 14, the frame 12, 13, the shafts 10 and 11 and the drives thereto including the gears 40 and 48 are moved axially therewith. The gear 48 remains in mesh with the gear 47 during this axial movement so that the drive to the upper operative shafts 10 and 11 is continued without interruption.

Preferably, means are provided for breaking the circuit of the motor 30 when any pair of shafts 10, 11 is brought to operative position and it is important that such circuit breaking means be so located that it is not affected by any axial adjustment of the shaft 14 and the part carried thereby. As shown, the bearing block and gear housing section 18 carry a motor stop switch 33 which is operated by a lug 34 projecting from each cover member 27 and in a direction parallel to the axis of the shaft 14 so that the lug may be moved endwise with the other parts carried by the shaft 14 without changing its operative relationship to the switch.

While the upper pair of shafts 10 and 11 with their associated trimming and scoring heads are operating on an advancing sheet, the operator may be axially adjusting the slitting and scoring heads on one of the lower inactive pairs of shafts

10 and 11. In this way the operator can be preparing the two lower pairs of shafts 10 and 11 for the next two succeeding runs. When the run through the upper shafts 10 and 11 has been completed, the operator operates the switch to start the motor 30 rotating in a direction to selectively move either one of the two lower pairs of shafts 120° into upper operative position. The movement of the shafts 10 and 11 into and out of operative position is attended without moving any of the gears of the drives to said shafts out of mesh. Reestablishment of the drives is effected simply and automatically by the clutches 55 without the necessity of moving spaced gears into intermesh. When any pair of shafts 10 and 11 is brought into operative position, the lug 34 throws the switch 33 to stop the motor. The irreversible gearing 31, 32 will hold the parts in the selected position.

As many changes could be made in the above apparatus, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A sheet trimming machine including a normally stationary shaft having a plurality of sets of trimming devices carried thereby, radially spaced therefrom, circumferentially spaced apart, and independently adjustable axially, a pair of gears on said shaft, one rigid with the shaft and one relatively rotatable thereon, a plurality of gear trains, each including a clutch and each connecting said second mentioned gear with a corresponding one of said sets of trimming devices, means meshing with said first gear for rotating said shaft to move the trimming devices into and out of operative position, and means meshing with said second gear for connecting any one of said sets of trimming devices through its corresponding clutch.

2. A sheet trimming machine including a normally stationary shaft having a plurality of sets of trimming devices carried thereby, radially spaced therefrom, circumferentially spaced apart, and independently adjustable axially, a pair of gears on said shaft, one keyed on the shaft and one relatively rotatable thereon, a plurality of gear trains, each including a clutch and each connecting said second mentioned gear with a corresponding one of said sets of trimming devices, means meshing with said first gear for rotating said shaft to move the trimming devices into and out of operative position, and means for engaging and disengaging each clutch as its corresponding set of trimming devices is brought into or out of operative position.

3. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a frame, a plurality of sets of coacting shafts supported on said frame and having means thereon for acting on the sheet, said frame being rotatable to bring any one of said shaft sets into operative position with respect to the sheet, a rotary drive member mounted coaxially of said frame, power transmitting means connected to said drive member and clutch means for independently connecting said power transmitting means to any one of said shaft sets.

4. A machine for slitting and/or scoring an

advancing sheet longitudinally comprising a plurality of sets of coacting shafts adapted to adjustably carry slitting and scoring heads, and bodily rotatable in unison about an axis to permit any one of said shaft sets to be moved into operative position with respect to the sheet, a drive, and a transmission from said drive to each of said shaft sets and including a disengageable clutch.

5. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a frame, a plurality of sets of coacting shafts supported on said frame and adapted to adjustably carry slitting and scoring heads, said frame being rotatable to bring any one of said shaft sets into operative position with respect to the sheet, a rotary drive member mounted coaxially of said frame, and a transmission from said drive member to each of said shaft sets, and including a disengageable clutch.

6. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a frame, a plurality of sets of coacting shafts supported on said frame and adapted to adjustably carry slitting and scoring heads, said frame being rotatable to bring any one of said shaft sets into operative position with respect to the sheet, a drive, a transmission from said drive to each of said shaft sets, and including a clutch, and means for automatically disengaging the clutch of the transmission of the shaft set disposed in operative position as said latter set is moved away from said position, and for automatically engaging the clutch of the transmission of another set as said latter set is moved into operative position.

7. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a plurality of sets of coacting shafts adapted to adjustably carry slitting and scoring heads, and bodily rotatable in unison about an axis to permit any one of said shaft sets to be moved into operative position with respect to the advancing sheet, a drive, a transmission from said drive to each of said shaft sets and including a disengageable clutch, and cam operated means for engaging said clutch when a corresponding shaft set is moved into operative position, and for disengaging said clutch when said shaft set is moved out of said position.

8. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a plurality of sets of coacting shafts adapted to adjustably carry slitting and scoring heads, and bodily rotatable in unison about an axis to permit any one of said shaft sets to be moved into operative position with respect to the sheet, a drive, and a transmission from said drive to each of said shaft sets and including a pair of coaxial gears and a disengageable clutch for coupling said gears for rotation in unison.

9. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a plurality of duplicate sets of coacting shafts adapted to adjustably carry slitting and scoring heads, and bodily rotatable in unison about an axis to permit any one of said shaft sets to be moved into operative position with respect to the sheet, a rotary drive member coaxial with said axis, a transmission from said drive member to each of said shaft sets and including a pair of coaxial gears, a multiple disc friction clutch between said gears for coupling said gears together for rotation in unison, a cam, and follower means between said cam and said clutch for disengaging

said clutch as the corresponding shaft set is moved out of operative position, and for engaging said clutch as said set moves into operative position.

10. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a plurality of sets of coating shafts adapted to adjustably carry slitting and scoring heads and bodily rotatable in unison about an axis to permit any one of said shaft sets to be moved into operative position with respect to the advancing sheet, a rotary drive member, a transmission from said drive member to each of said shaft sets and including a disengageable clutch, a cam presenting a cam surface eccentrically encircling said axis, and cam follower means between said cam surface and said clutch for engaging and disengaging said clutch according to the position of its corresponding shaft sets with respect to said axis.

11. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a rotatable frame, a plurality of sets of coating shafts supported on said frame equidistant from the axis thereof and adapted to carry axially adjustable slitting and scoring heads, a drive shaft therefor, a motor, a transmission between said motor and said frame for rotating said frame to move one of said sets out of operative position with respect to the sheet and another set into said operative position and including irreversible gearing locking said frame against rotation when said motor is not operating, and means for automatically establishing and interrupting driving connections between said drive shaft and each of said sets as it moves into and out of operative position.

12. A machine for slitting and/or scoring an advancing sheet longitudinally comprising a frame, a plurality of sets of coating shafts supported on said frame and carrying axially adjustable slitting and scoring heads, said frame being rotatable to bring any one of said shaft sets into operative position with respect to the sheet, a drive shaft, a motor for rotating said frame, limit means for stopping said motor automatically when said frame reaches its next successive operative position, and means for automatically establishing and interrupting driving connections between said drive shaft and each of said sets as it moves into and out of operative position.

13. A machine for longitudinally slitting and/or scoring an advancing sheet, comprising a normally stationary frame, a plurality of pairs of coating shafts supported on said frame, each pair having slitting and scoring elements secured to and longitudinally adjustable thereon, and each pair also having a pair of intermeshing gears, said frame being rotatable to bring any one of said pairs of shafts and their said elements into operative position with respect to the sheet, a drive gear rotatably mounted coaxially of said frame, and means movable in a direction parallel to the axis of said frame, for drivably connecting said drive gear and the gears of a pair of said shafts when the latter are in operative position with respect to the sheet.

14. A machine for longitudinally slitting and/or scoring an advancing sheet, comprising a normally stationary frame, a plurality of pairs

of coating shafts supported on said frame, each pair having slitting and scoring elements secured to and longitudinally adjustable thereon, and each pair also having a pair of intermeshing gears, said frame being rotatable to bring any one of said pairs of shafts and their said elements into operative position with respect to the sheet, a drive gear rotatably mounted coaxially of said frame, and a plurality of members carried by said frame, and one adjacent to each of said pairs of gears and movable axially of one of the gears, for drivably connecting said drive gear and the gears of a pair of said shafts when the latter are in operative position in respect to the sheet.

15. A machine for longitudinally slitting and/or scoring an advancing sheet, comprising a shaft, a frame supported on said shaft for rotation about the axis thereof, a plurality of sets of shafts supported on said frame equidistant from the axis thereof and carrying axially adjustable slitting and scoring heads, a drive gear coaxial with said first mentioned shaft, a plurality of gears carried by said frame and each coaxial with a corresponding shaft of said sets of shafts and normally rotatable idly on said shafts, and all meshing with said drive gear, and means for drivably connecting each of said plurality of idle gears to its coaxial shaft when the latter is moved to operative position in respect to the sheet.

16. A machine for slitting and/or scoring an advancing sheet of material, including a normally stationary frame, a plurality of pairs of shafts carried by said frame and disposed in spaced relationship around the axis of said frame, slitting elements longitudinally adjustable on said shafts, means for rotating said frame to bring any pair of shafts and its slitting elements into or out of operative position in respect to the path of movement of the sheet, a drive gear coaxial with said frame, a plurality of gears continuously meshing with said drive gear and each corresponding to a separate one of said sets of shafts and normally rotatable in respect to said shafts, and means automatically operable to drivably connect each of said plurality of last mentioned gears to its corresponding set of shafts as said set of shafts is moved into operative position in respect to the sheet, by the rotation of said frame.

17. A machine for slitting and/or scoring an advancing sheet of material, including a normally stationary frame, a plurality of pairs of shafts carried by said frame and disposed in spaced relationship around the axis of said frame, slitting elements longitudinally adjustable on said shafts, means for rotating said frame to bring any pair of shafts and its slitting elements into or out of operative position in respect to the path of movement of the sheet, a drive gear coaxial with said frame, a pair of meshing gears on each pair of shafts, all of said last mentioned gears and said drive gear having their axes in fixed relative positions, and means controlled by the rotation of said frame for automatically establishing power transmitting connections between said drive gear and each of said sets of shafts.

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