March 22, 1955 B. M. HALDEMAN 2,704,577

MACHINE HAVING ORBITALLY MOVING DIES FOR PERFORMING CONTACT OPERATIONS ON MOVING SHEET MATERIAL

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FIG. 1

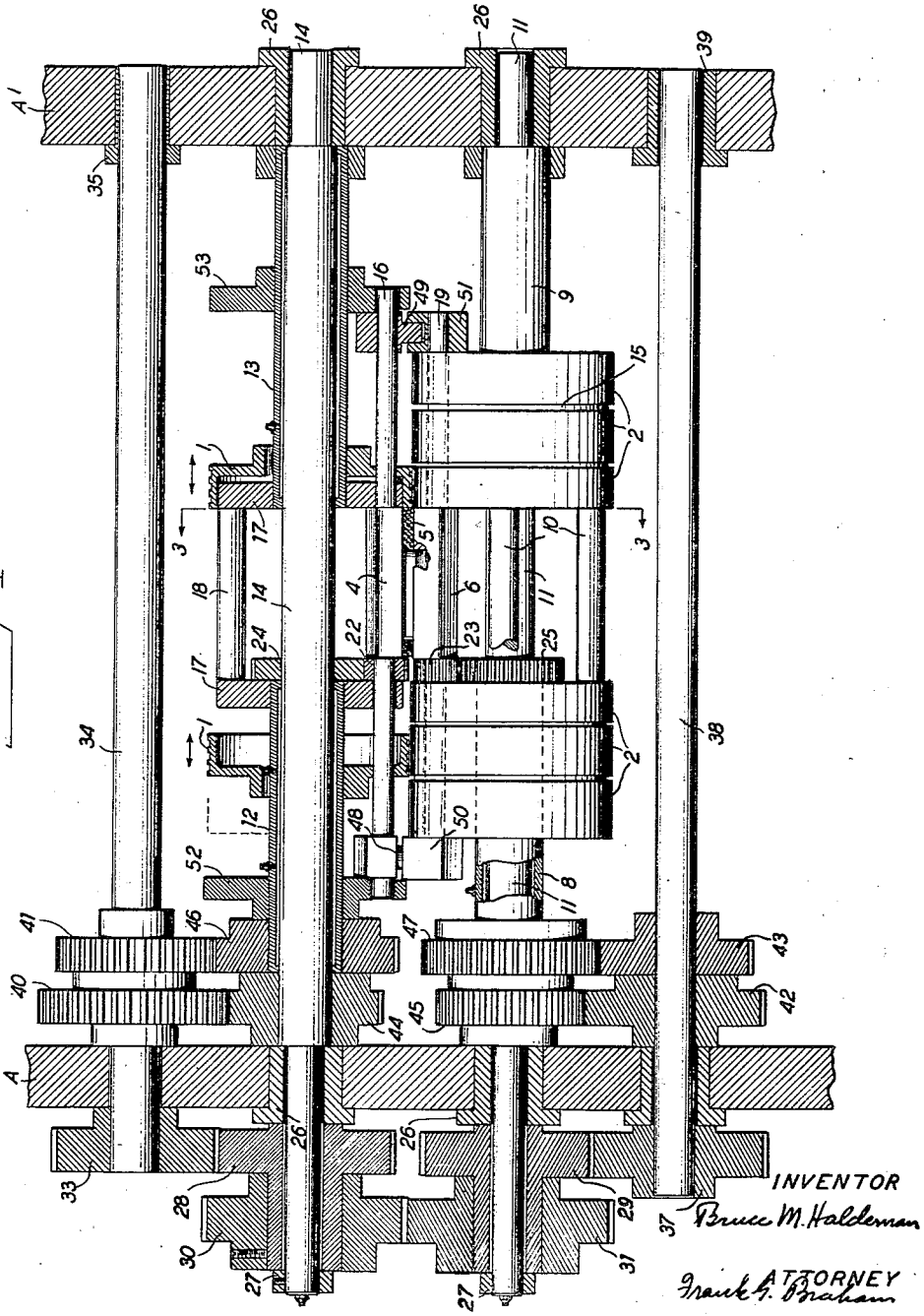

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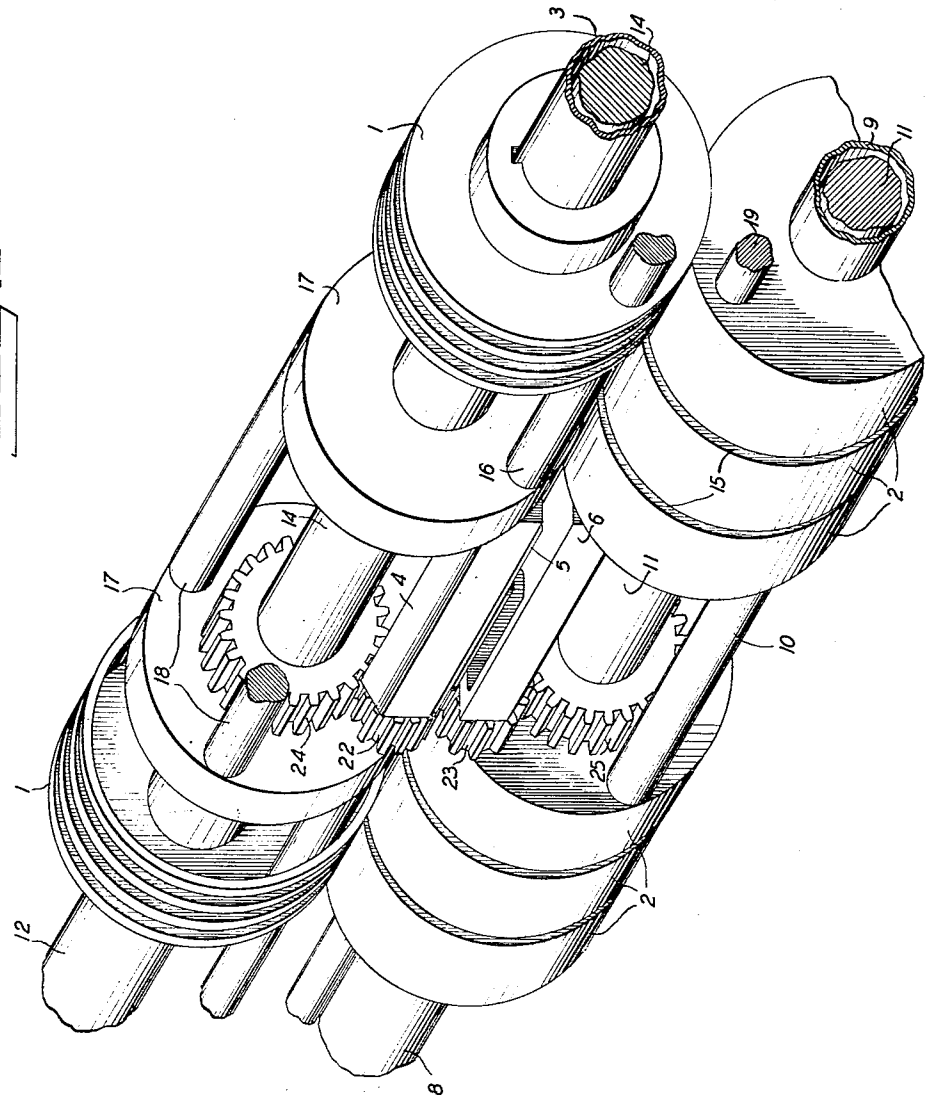
Fig. 2



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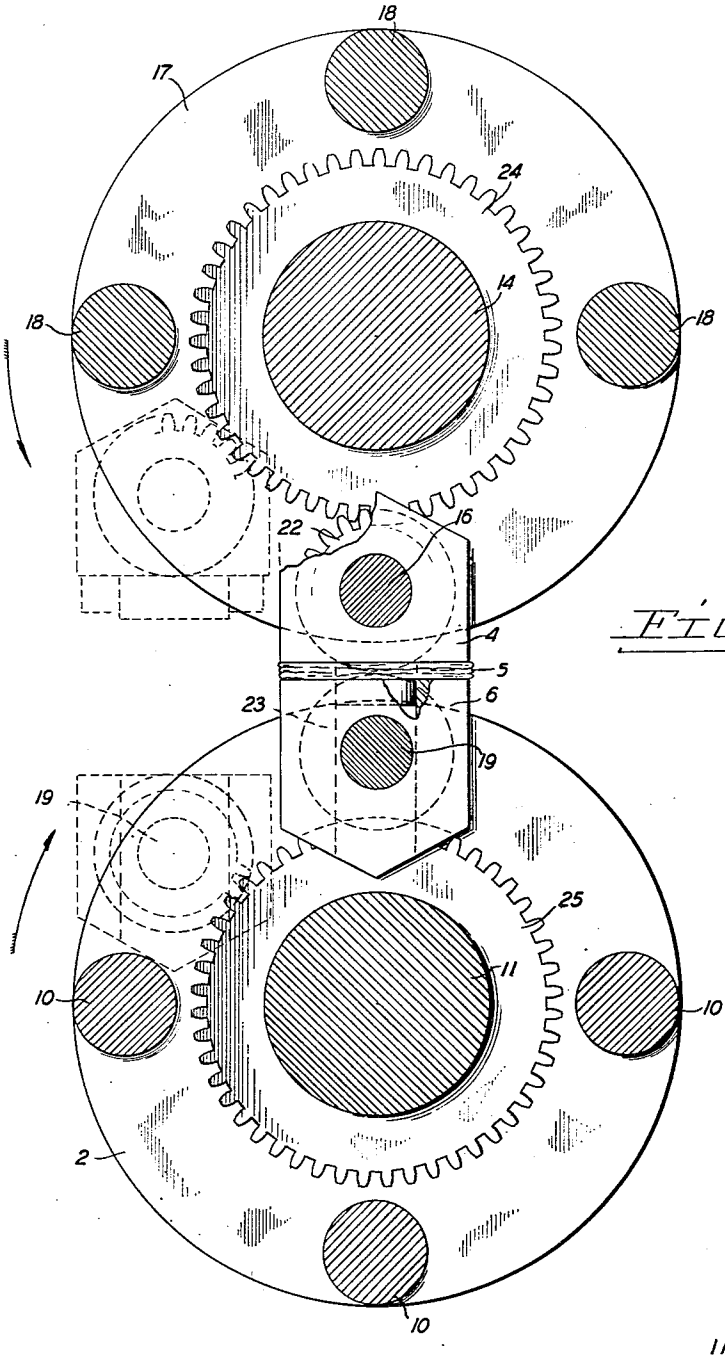

Fig. 3

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MACHINE HAVING ORBITALLY MOVING DIES FOR PERFORMING CONTACT OPERATIONS ON MOVING SHEET MATERIAL

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Application February 9, 1952, Serial No. 270,875

3 Claims. (Cl. 164—99)

This invention relates to machines such as punch presses and the like which are adapted to periodically perform contact operations on sheet material which is fed therethrough.

The primary object of the invention is to provide a machine of this sort which insures that the contact operations take place without any tearing or buckling of the material, yet enables the material to be fed through the machine at a constant speed and without interruption in its advance during the contact operations.

In accordance with the present invention, the above as well as other objects are attained by rotating the sheet contacting members in orbital paths and about their own axes to periodically carry them progressively and simultaneously into and out of engagement with opposite sides of the material and in such fashion that as they are so brought into contact with the material they are moving laterally in substantially the same direction and at the same speed as the material.

For a more complete description of the invention reference may be made to the accompanying drawings and the detailed descriptions which follow:

Referring to the drawings—

Fig. 1 is a front elevation, partly in cross section, of the present machine;

Fig. 2 is a perspective view of the punch and die members and the driving mechanisms therefor; and

Fig. 3 is a view taken along line 3—3 of Fig. 1.

As shown in the drawings, the machine is provided with two sets of feed rollers **1**, **2** adapted and arranged to feed a sheet or web of material to be operated upon between a pair of sheet contacting members **4**, **6** which in the present embodiment of the invention are shown as being a male and a female die.

The lower set of feed rollers **2** are fixedly mounted on a pair of spaced sleeve members **8**, **9** and they are mechanically coupled together by a plurality of spacer bars **10**. The sleeve members **8**, **9**, in turn, are rotatably mounted on a main drive shaft **11** of the machine. Each roller of the lower set **2** is provided with a plurality of annular grooves **15**, which receive the usual skids (not shown) that serve to support the material in its travel between the two sets of rollers.

The upper set of feed rollers **1** are also mounted on a pair of sleeve members **12**, **13**, which in turn, are rotatably mounted on a second main drive shaft **14** of the machine. The upper set of feed rollers **1**, however, are keyed to the sleeve members **12**, **13** so that while they rotate in unison therewith they may be adjusted to accord with the width of the sheet or web of material being fed between the dies **4**, **6**.

In operation, the rollers of the upper set **1** are positioned along the upper sleeve members **12**, **13** so that they overlie the two sections of the lower set of rollers **2** that accord with the width of the sheet or web of material being fed between the dies **4**, **6**.

As the sheet or web of material is fed between the oppositely disposed dies **4**, **6** by the two sets of feed rollers **1**, **2**, the dies are rotated in orbital paths and about their own axes to periodically bring them into and out of engagement with one another and in a direction substantially the same as the direction in which the sheet or web of material is fed therebetween at the point of their engagement. As the dies **4**, **6** are so brought into and out of engagement with one another, the desired blanks are punched out of the sheet

or web passing therebetween. Here it may be noted that the upper male die **4** is provided with a resilient backing **5** to prevent the adherence of the blanks thereto during the punching operations. To the ends that the dies may be so rotated in orbital paths and about their own axes, the upper die **4** is carried by a shaft **16** rotatably mounted in a pair of disks **17** which are fixedly secured on adjacent ends of the upper pair of sleeve members **12**, **13** and which are mechanically coupled together by a plurality of spacer bars **18**. The lower die **6**, on the other hand, is carried by a shaft **19** rotatably mounted in the lower set of feed rollers **2** which as stated heretofore are mounted on the lower set of sleeve members **8**, **9**.

The upper die carrying shaft **16** is provided with a gear **22** and the lower die carrying shaft **19** is provided with a like gear **23**. Gear **22** on the upper die carrying shaft **16** meshes with a gear **24** fixedly mounted on the upper main drive shaft **14** and in like manner gear **23** on the lower die carrying shaft **19** meshes with a gear **25** fixedly mounted on lower main drive shaft **11**.

The two main drive shafts **11**, **14** are rotatably mounted in bushings **26** carried by two vertically disposed side frames A, A' of the machine. Each of the two shafts project outwardly beyond its leftmost bearing as viewed in the drawings and its leftmost end is provided with a retaining collar **27**. Intermediate its collar and the adjacent bearing, the upper main drive shaft **14** is provided with a hub gear **28** which is rotatably mounted thereon. In like manner the lower main drive shaft **11** is provided with a similar gear **29**. The hub gear **28** mounted on the upper main drive shaft **14** carries a gear **30** which is fixedly mounted on the hub portion thereof, and this gear **30** meshes with a like gear **31** which is fixedly mounted on the hub portion of the gear **29** carried by the lower main drive shaft **11**. Also, the hub gear **28** which is rotatably mounted on the upper main drive shaft **14** meshes with a gear **33** fixedly mounted on an extended portion of an auxiliary drive shaft **34** journaled in bearings **35** and carried in the two upstanding side frame members A, A' of the machine. In like manner the hub gear **29** which is rotatably mounted on the lower main drive shaft **11** meshes with a gear **37** fixedly mounted on an extended portion of a second auxiliary drive shaft **38** which is also journaled in bearings **39** and carried by the two upstanding side frame members A, A' of the machine.

The upper and lower auxiliary drive shafts **34**, **38** are each provided with two gears **40**, **41** and **42**, **43** respectively. The large gears **40**, **42** on the auxiliary shafts **34**, **38** mesh with small gears **44**, **45** respectively. The small gears **41**, **43** on the auxiliary shafts **34**, **38**, however, mesh with large gears **46**, **47** respectively which are fixedly mounted on the upper and lower sleeve members **12**, **8** respectively. Under these conditions when power is supplied to either of the two hub gears **28**, **29**, the two main drive shafts **11**, **14** are driven in synchronism and at the same speed. Also, the sleeve members **8**, **12** are driven in synchronism and at the same speed. Due, however, to the difference in size between the gears which drive the main drive shafts **11**, **14** from those that drive the sleeves **8**, **12**, the main drive shafts are driven at a speed which is more than the speed of rotation of the sleeves.

As the upper sleeve **12** rotates, it drives the disk members **17**, in which the upper die carrying shaft **16** is mounted, with the result that the upper die **4** is rotated in an orbital path about the main shaft **14**. As the lower sleeve **8** rotates, it drives the lower set of feed rollers **2** in which the lower die carrying shaft **19** is mounted, with the result that the lower die **6** is rotated in a like path, and the arrangement is such that the two dies **4** and **6** are periodically carried into and out of engagement with one another.

As the two main drive shafts **11**, **14** rotate, the gears **24**, **25** mounted thereon also rotate and since these gears mesh with the gears **22**, **23**, respectively, which are mounted on the die carrying shafts **16**, **19**, respectively, these latter shafts and the dies mounted thereon rotate about their own axes as they travel through their orbital

paths. Preferably, the ratio of the intermeshing gears is such that in effect each die makes one complete turn about its own axis each time it is rotated about its orbital axis. Under these conditions, the dies remain parallel with one another as they travel through their orbital paths with the result that the dies **4**, **6** are moving laterally in substantially the same direction when they engage one another. In consequence, by feeding the sheet or strip of material between the dies in the same direction as this lateral movement and at substantially the same speed, the punching operation is effected without any substantial wear on the dies and without any tearing or buckling of the material.

Inasmuch, however, as the above described movement of the dies **4**, **6** is effected through a planetary gearing arrangement, it is deemed advisable to bring them into alignment just prior to their engagement with one another in order to prevent the possibility of back-lash from interfering with the smooth and easy entrance and exit of one into and out of the other which, if permitted, would tear the sheet or web and cause undue wear on the dies. To this end, the die carrying shafts **16** and **19** extend outwardly at either end through and beyond the respective feed rollers **1**, **2**. Since, in many instances, the over-all length of the upper pair of feed rollers **1** may be less than the over-all length of the lower pair of feed rollers **2**, it is deemed desirable to give the outer extremities of the upper die carrying shaft **16** additional support by journaling these portions of the shaft in disks **52**, **53**. Mounted on the upper die supporting shaft **16** are locating pins **48**, **49** which are adapted to engage female locating blocks **50**, **51** carried at the extremities of the lower die carrying shaft **19**. Inasmuch as the locating pins **48**, **49** and the locating blocks **50**, **51** are carried by the die carrying shafts **16**, **19** they too are maintained parallel with respect to one another as the dies **4**, **6** travel through their orbital paths with the result that they too are carried into and out of engagement with one another each time the dies **4**, **6** are rotated about their orbital axes.

The length of the pins **48**, **49** and the depth of the openings in the blocks **50**, **51**, however, is greater than the height of the dies **4**, **6** respectively, this being desirable to insure that the pins engage the locating blocks in advance of the engagement of the dies with one another. Also, the size and shape of the openings in the blocks **50**, **51** bear such a relation to the size and shape of the pins **48**, **49** as to insure that when the pins fully enter the openings in the blocks any back-lash will be taken up and the dies **4**, **6** will be brought into alignment prior to their engagement with one another.

The invention has been shown and described in preferred form, but obviously many variations and modifications may be made therein and in its mode of application which will be comprised within its spirit. One such variation which readily suggests itself is the provision of a multiplicity of pairs of dies, in which case several contact operations could be performed during each machine cycle of operation instead of the single operation obtainable in the present embodiment of the invention. Also, while the invention has been described in connection with a pair of dies, it is to be understood that these dies may be replaced by various other sheet contacting members such as sheet cutting knives, embossing members, paper bag folding and tucking bars, heat sealing units, printing members, scoring blades, and other like members. It is to be understood, therefore, that the invention is not to be limited to any specific form or embodiment, except insofar as such limitations are specified in the appended claims.

Having thus described my invention, I claim:

1. A machine for performing contact operations on sheet material continuously fed therethrough comprising a pair of dies mounted on parallel shafts and between which said material is fed, a pair of main drive shafts, a sleeve member rotatably mounted on each of said drive shafts, means for rotating said drive shafts in synchronism and at a fixed rate of speed, means for rotating said sleeve members in synchronism and at a speed different from that at which said drive shafts are rotated, means responsive to the rotation of said sleeve members for rotating said parallel shafts in orbital paths to periodically carry the dies mounted thereon into and out of engagement with one another, and means responsive to the rotation of said drive shafts for rotating said parallel shafts about their own axes as they travel through said paths to maintain the oppositely disposed faces of said dies parallel with one another as said dies are brought into and out of engagement with one another.

2. A machine for performing contact operations on sheet material continuously fed therethrough comprising a pair of dies mounted on parallel shafts and between which said material is fed, a pair of main drive shafts, a sleeve member rotatably mounted on each of said drive shafts, means for rotating said drive shafts in synchronism and at a fixed rate of speed, means for rotating said sleeve members in synchronism and at a speed different from that at which said drive shafts are rotated, means responsive to the rotation of said sleeve members for rotating said parallel shafts in orbital paths to periodically carry the dies mounted thereon into and out of engagement with one another, and a gearing mechanism responsive to the rotation of each of said main drive shafts for rotating said parallel shafts about their own axes as they travel through said paths to maintain the oppositely disposed faces of said dies parallel with one another as said dies are brought into and out of engagement with one another.

3. A machine for performing contact operations on sheet material continuously fed therethrough comprising a pair of dies mounted on parallel shafts and between which said material is fed, a pair of main drive shafts, a sleeve member rotatably mounted on each of said drive shafts, rollers mounted on each of said sleeve members adapted to feed said material between said dies, means for rotating said drive shafts in synchronism and at a fixed rate of speed, means for rotating said sleeve members and the rollers carried thereby in synchronism and at a speed different from that at which said drive shafts are rotated, means responsive to the rotation of said sleeve members for rotating said parallel shafts in orbital paths to periodically carry said die members into and out of engagement with one another, and a gearing arrangement responsive to the operation of each of said drive shafts for rotating said parallel shafts about their own axes as they travel through said paths to maintain the oppositely disposed faces of said dies parallel with one another as said dies are brought into and out of engagement with one another.

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