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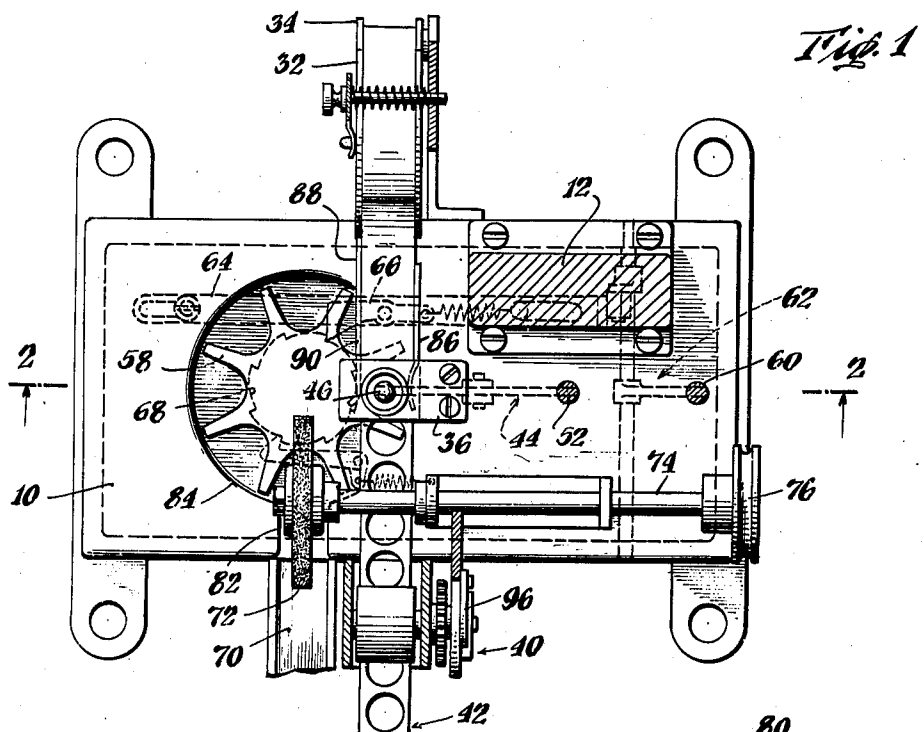
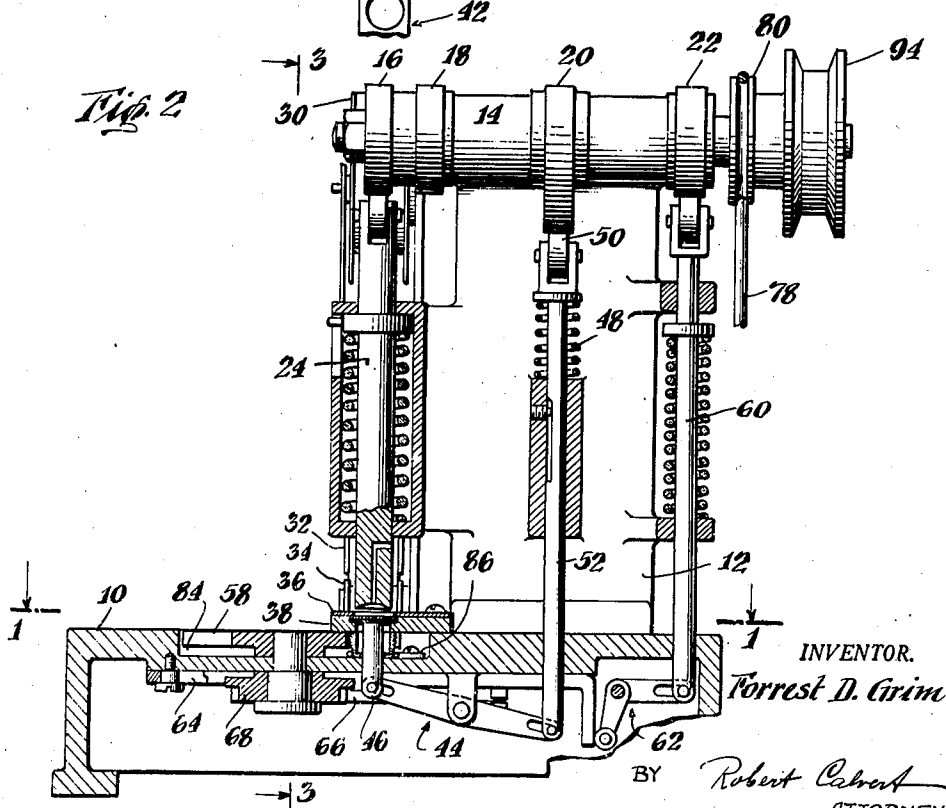
F. D. GRIM

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MACHINE FOR CUTTING AND PLACING SHEET MATERIAL

Filed Feb. 19, 1942

2 Sheets-Sheet 1



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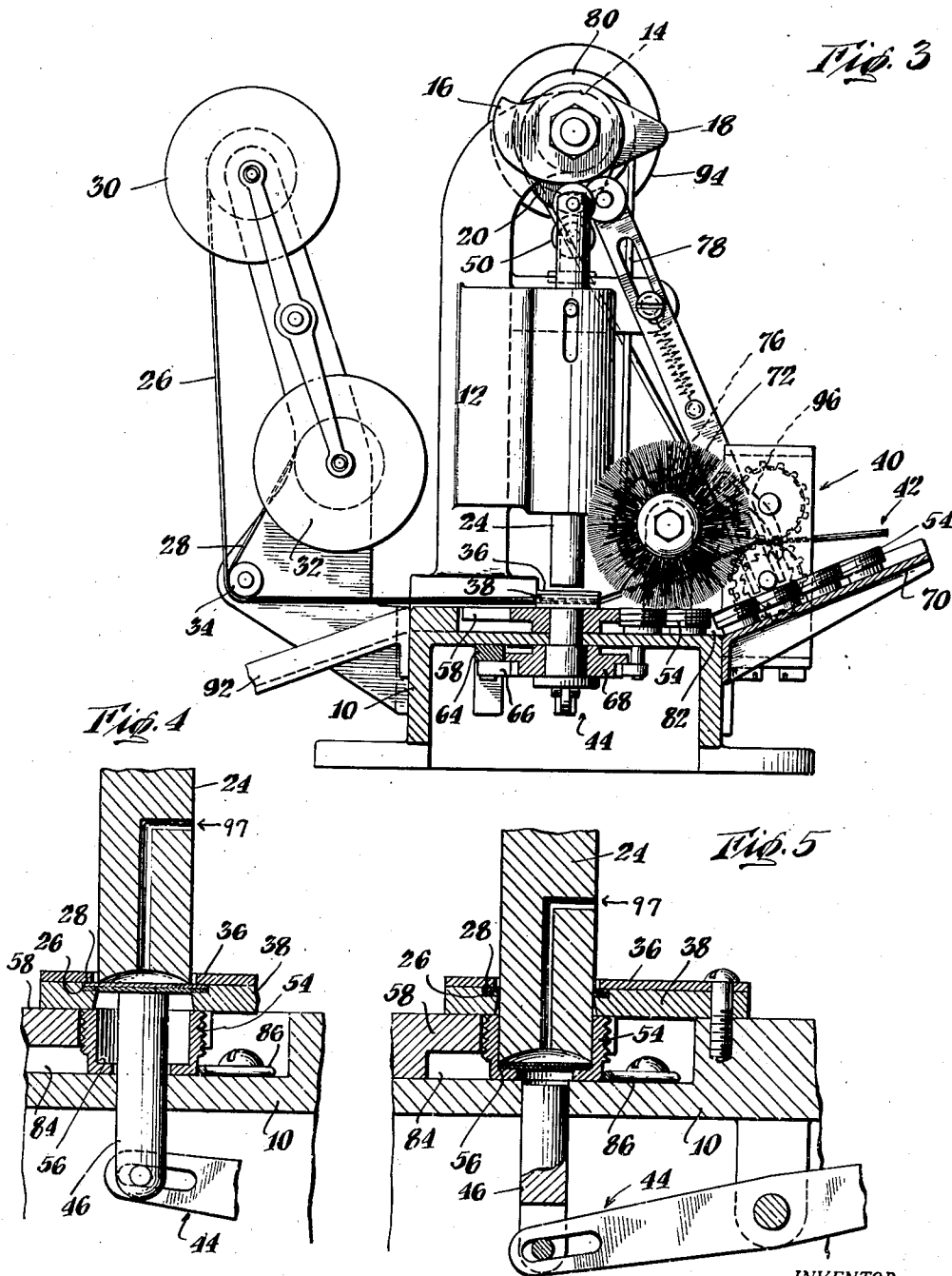
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MACHINE FOR CUTTING AND PLACING SHEET MATERIAL

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2 Sheets-Sheet 2



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MACHINE FOR CUTTING AND PLACING
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3 Claims. (Cl. 164—89)

This invention relates to a machine for cutting and placing sheet material and particularly to a machine for cutting thin paper and placing the cut out pieces over a hole in a receiving member.

The machine is particularly useful in forming and placing discs of thin paper over the opening in the base of the detonator magazine of Oerlikon antiaircraft shell. For this reason the invention will first be described in connection with such use.

The detonator magazine is a part of the nose piece of the shell. That magazine carries a booster charge that transmits, to the main explosive charge in the shell, the explosion initiated by a contact-sensitive cap disposed in the forward end of the nose and just in advance of the detonator magazine. The detonator magazine is cup shaped and is provided with a central hole through its base.

It has been found desirable to place a double thickness of thin paper suitably about 0.003 inch thick, inside the base of the detonator magazine so that the paper extends in double thickness across the said hole.

In cutting and introducing these double thicknesses of thin paper into the magazines at the rate of many thousands a day, a number of problems have been encountered. In the first place, there is an objectionable tendency for the one of the resulting discs that is adjacent to the cutting punch to cling to the punch, instead of falling away as the cutting punch is finally raised. Furthermore, there is the difficulty due to the tendency of the discs, as they are cut and allowed to fall away, to settle in an inclined position and not level in the detonator magazine, this tendency being aggravated by any incompleteness of shearing of the discs from the original sheet material at any point.

The present invention provides a machine which cuts the discs cleanly, eliminates objectionable adherence of any disc to the cutting punch as the latter is raised, and places the discs flatwise and regularly in the base of the detonator magazine or upon other receiving member.

Briefly stated, the invention comprises the herein described machine comprising the combination of means for cutting pieces of thin sheets of paper or the like, including a cutting punch, and means for holding the cut out pieces of paper flatwise and generally in a plane extending transversely with respect to the direction of movement of the cutting punch until the pieces are laid in position on the receiving member. In

the preferred embodiment, the means for accomplishing this latter purpose comprise a movable support or plunger disposed below the cutting die and extending through the hole in the base of the detonator magazine and a mechanism for raising the said plunger almost or approximately to the lower level of the paper being cut and then holding the cut out pieces of paper between the plunger and the punch as the pieces are lowered to the position of resting on the receiving member, the machine including other means to raise the cutting punch and lower the plunger, so that each of these parts may then be moved away from the receiving member, and other means for then discharging the receiving member to make room for another one that is to be supplied with the paper discs. The invention comprises also a cutting punch for thin paper or the like having a concave cutting end and provided with a vent for admitting air between the forward end of the punch and the sheet material cut by the punch.

In general the machine comprises the combination of parts for feeding one or more thicknesses of paper through a die, a cutting punch co-acting with the die for cutting discs or pieces of other shape from the said paper, a support for holding the detonator magazine or other receiving member below the position of cutting of the paper, and means for engaging the cut pieces of paper between the said punch and a movable plunger so that the cut pieces of paper may be maintained level between the said punch and plunger and, while in this position, deposited upon the said receiving member. The machine includes also means for then moving the punch and plunger in different directions and away from the level of the said receiving member, so that the cut pieces of paper are left in horizontal relationship on the said receiving member.

The invention will be illustrated in detail by description in connection with the drawings to which reference is made.

Fig. 1 is a horizontal cross section on line 1—1 of Fig. 2.

Fig. 2 is a vertical cross section on line 2—2 of Fig. 1.

Fig. 3 is a vertical view partly in section on line 3—3 of Fig. 2.

Fig. 4 is an enlarged detailed vertical section of the punch and die assembly showing the punch in cutting position.

Fig. 5 is a similar view showing the punch in position at the end of its down stroke where it

places the cut out paper over the hole in the base of the detonator magazine.

In these figures there are shown a rigid base member 10 constituting a support for the machine and a stand 12 secured in any suitable manner to the base and extending upwardly for supporting the main shaft 14.

This main shaft in turn carries cams 16, 18, 20, and 22.

Punch 24 has a face that is continuous from edge to edge, that is, solid except that it is provided with a small vent 97 to be described later.

Cam 16 operates the punch 24 for cutting pieces from the sheet material, that suitably is in the form of two tapes 26 and 28 of thin paper which are fed from rolls 30 and 32 respectively and pass over guide 34 and through suitable openings, to and through the die. The die consists of an upper part 36 and lower part 33 defining therebetween a space for the passage of the paper.

Cam 18 actuates a ratchet mechanism 40 of a conventional type with rubber rolls for drawing the sheets of paper through the die, the paper as it passes through the ratchet being in the form of strips 42 from which the desired cut out discs have been removed, as will be described later.

Cam 20 actuates mechanism 44 for raising upwardly a plunger 46 so that, at the end of the movement of the plunger upwardly, the plunger comes approximately to the lower level of the paper in the die. As the cam 20 rotates, the spring 48 maintains contact of the wheel 50 with the cam; the arm 52 and mechanism 44 are thus so moved that the mechanism 44 after completing the upward movement of the plunger 46 lowers the plunger until it is in position shown in Fig. 5. In this cycle, the plunger has first moved upwardly into the die and the hole in the base of the detonator magazine and then returned to its original position below the paper receiving space in the die.

At the time the plunger 46 is being lowered, the cam arrangement shown also forces the punch 24 downwardly through the die and into receiving member 54, in this case the detonator magazine, in which the cut out pieces of sheet material are deposited. The punch brings the cut out pieces down approximately to the wall 56 of the hole in the receiving member. The punch is then raised and the receiving member moved out of position by angular movement of the wheel 58.

As shown, the cam 20 is mounted near the center of the main shaft. It is fastened to the shaft by conventional means such as set screws (not shown). This cam through the roller 50 operates a push rod, the roller being held constantly against the face of the cam by the spring 48 disposed as shown and resting upon a part held at a fixed level with respect to the base 10. At its lower end the push rod is connected to the cross beam 44 supported on a pivot point near the middle of the cross beam and at the other end connected to the plunger 46.

The cam 16 which actuates the punch and the cam 20 at certain stages of rotation are out of phase with each other, as shown in Figs. 2 and 3, so that the plunger comes up from below against the sheets 26 and 28 that are to be cut and the punch 24 comes down upon the sheet and through the die from above. Then the plunger and punch move downward more or less in unison and hold between them the cut out discs of the sheet material. When these discs have been deposited in the

bottom of the receptacle 56 (see Fig. 4), then the mechanism causes the plunger to continue to move downward and the punch to move upward. This latter movement is caused by the springs 48 and 24 which move upwardly the rods 52 and the punch 24 as the main shaft 14 rotates and the pressure of the cams upon the rod 52 and punch 24 is released.

The feeding wheel 58 is rotated by cam 22 acting through arm 60 upon a bell crank arrangement 62 which moves a bar 64 carrying dog 66. This dog engages a sprocket wheel 68 carried on the same shaft as the star wheel 58 and secured in fixed relation to wheel 58. For each downward movement of the arm 60, the ratchet wheel is rotated counterclockwise through an angle corresponding to the width of one recess in the outer part of the star wheel.

The receiving members (detonator magazines) 54 which are to be provided with the cut out pieces of sheet material are supplied one each to recesses in the star wheel 58, through feeding chute 70. The receiving members slide down this inclined chute onto the base member 10 and are then fed into the recesses of the star wheel by means of a slowly rotated feeding brush 72 which at the position of contact with the receiving members is moving in the direction of the star wheel, so as to give a positive but mild pushing action upon the receiving members and force them one at a time into any recess available at the time. The brush is rotated by any suitable means such as shaft 74 with pulley 76 driven by the belt 78 engaging the pulley 80 on the main shaft 14. The brush operates continuously and pushes a detonator magazine forwardly into the feeding wheel whenever a recess in that wheel is in position and empty, for receiving a magazine.

The base 10 is suitably provided with a recess 82 for the passage of the said receiving members 54 to the feeding brush 72. Also the base plate is suitably recessed, as at 84, to receive the star wheel as shown particularly in Fig. 2.

In order to center the members 54 which are to receive the cut out pieces of sheet material, there is provided a wire spring 86 acting towards the center of the star wheel 58 so as to push each receiving member, as movement of the star wheel brings the member into contact with the spring, tightly against the inner portion of the recess in the star wheel, at the stage of rotation of the wheel at which the receiving member is to be provided with the cut out pieces of sheet material. In this manner, the receiving members are centered and lined up with the punch and plunger, the mechanism being so constructed that the plunger is adapted to be moved upwardly through the hole in member 54 and the punch down approximately to the upper level of the wall of the hole.

Another duct 88 is provided in the base member 10 for discharge of the receiving members after they have been provided with the cut out pieces of sheet material. A guide member 90 on the said base directs the receiving members, from the position at which they were supplied with the cut out pieces of sheet material, into the discharge duct 88. This duct leads to an inclined chute 92, through which the said members fall to suitable collecting means (not shown).

Features that are not shown or described in detail are conventional. Thus there are used a motor of usual type and belt acting upon the main drive pulley 94 and the shaft 14.

After the discs of paper are laid over the aperture in the base of the detonator magazine and the magazine so provided with the paper discs is discharged from the machine, then the detonator magazine is filled with explosive in usual manner.

The machine makes possible the placing of the paper discs quickly, regularly, and smoothly over the openings in the base of the detonator magazine, so that the explosive charge on its side adjacent to the base is protected somewhat by the paper, all in accordance with specifications for this type of shell.

In place of the detonator magazine for the Oerlikon shell there may be used other apertured receiving members upon which the pieces of thin cut out material are to be placed. Thus, there may be used a washer or a cup shaped member provided with a hole through the base of the said member. These alternative members for receiving the cut pieces of paper are not shown as they are conventional.

In place of the paper there may be used other thin sheet material, as for example, cheesecloth, silk, thin Cellophane, and the like, although paper is used in the detonator magazine because of the desired behavior of paper when the detonator charge is fired. Convenience and operating advantages of importance are obtained with the present machine whenever the material to be cut out and placed is thin and flexible, as distinguished from cardboard or the like stiff material.

Materials of construction of the machine of the present invention are those that are usual for constructing parts for cutting machines. Thus, the machine may be made of brass, bronze, steel, or stainless steel, except that the cutting punch and die should be of a material adapted to retain a cutting edge under the conditions of use and the brush, belts, motor, and other parts for which all metal construction is not satisfactory are of conventional materials and construction. Feeding rolls may be rubber or plastic faced.

Using a machine of the kind described it has been found possible to place the desired discs of thin paper in the detonator magazines of Oerlikon shells at the rate of approximately 2,000 or more an hour, the machine requiring only one or two operators. Furthermore, the machine makes possible the control of the operation so that two thicknesses, and only two thicknesses of paper, are introduced and arranged regularly so that they lie smoothly on the base of the detonator magazine. Because of the air vent 97 in the punch and the concave face of the punch, there is practically no difficulty from adherence of even the thinnest paper discs to the face of the punch as the punch is withdrawn from the position of placing the discs in the magazine. Because the vent 97 is in direct communication with the atmosphere, the air within the vent is maintained at all times at approximately normal pressure.

The whole machine is motor driven with a belt adapted to slip in case of overloading.

All parts of the machine are so synchronized that the operations are performed automatically in the desired sequence.

It will be understood that certain details given are for the purpose of illustration, not restriction.

of the invention, and that variations within the spirit of the invention are intended to be included within the scope of the appended claims.

What I claim is:

1. A machine for cutting pieces of thin sheet material and placing the said pieces upon a portion of a receiving member provided with an aperture extending through the said portion, the machine comprising the combination of a die, a vertical punch coacting with the die to do the cutting, means for delivering to the die the sheet material to be cut, means for holding the apertured receiving member below the die and in alignment therewith, a vertical plunger disposed normally below the position of holding of the receiving member and in line with the die and punch and having an upper part of smaller diameter than the aperture in the said member, and additional means for raising the plunger until its uppermost part extends through the said aperture and approximately to the underside of the sheet material in the die, for actuating the cutting punch causing the punch to move downwardly through the die and approximately to the upper level of the part of the receiving member that is to receive the cut out sheet material, meanwhile cutting the said material, for causing the said plunger to move downward just in advance of the punch and in proximity thereto, so that the cut out pieces of sheet material are maintained between the punch and plunger in generally horizontal position, and for then moving the said plunger downwardly and the punch upwardly and both away from the level of the receiving member, after the sheet material is brought approximately to the upper surface of the said part of the receiving member, so that the cut out pieces are deposited flatwise in desired position upon the receiving member and over the aperture therein, the said additional means including two cams and two rigid members operated by the cams and connected to said punch and plunger, respectively, the two cams being out of phase so as to cause the movements stated.

2. A machine as described in claim 1, the cutting punch being provided with a vent admitting air at atmospheric pressure between the face of the punch and the cut out piece of sheet material, so as to promote separation of the cut out piece from the punch as the punch is raised in the last step of the cycle of operations described.

3. A machine for cutting thin sheet material comprising a cutting punch and means for moving the punch to the cutting position and withdrawing the punch from said position, the punch having a forward cutting end that is continuous from edge to edge and is provided with a small air vent extending from an inner part of the cutting end, through the punch, and to the outside of the punch at a position behind the cutting end thereof and the vent being in direct communication with the atmosphere, so that air within the said vent is maintained at a normal pressure and so that there is eliminated suction by the punch upon the thin sheet material as the punch is withdrawn from the position of cutting of the said material.

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