

The M-1 toss-bombing system is flexible. The pilot aligns the target with his visual gunsight and then pulls up as he likes after initiating computation at the "pickle point." The computer will release the bomb when the proper conditions are reached, i.e., at any of the alternative release points shown in the diagram.

AEROBATIC DELIVERY

Two Low-altitude Bombing Systems for U.S.A.F. and U.S.N.

LOFT, toss and over-the-shoulder bombing have now become familiar turns in the fighter/bomber repertoire, and even the bigger "birds," such as the B-47, are getting in on the act. The general principles are well known. An attacking aircraft approaches a target below radar coverage and, by pulling up into a roll-off-the-top and releasing at the critical moment, can lob its bomb on to the target without exposing itself to view or defensive fire. A general description of the process appeared in *Flight* for October 19, 1956. It need hardly be added that the prime purpose of loft bombing is the effective delivery of tactical—and possibly also larger—atomic weapons.

The first U.S.A.F. loft bombing system was developed by Minneapolis Honeywell and given the military designation LABS (Low Altitude Bombing System). The R.A.F. is also to use this and production in England is getting under way. Canberra B(I).8s in Germany are practising the necessary manoeuvre, as related in *Flight* for December 27, and the equipment should by now have been fitted.

The U.S. Navy have now also adopted the technique and applied it first to the FJ-4B Fury. Their own system was developed by Lear, Inc., after preliminary tests at the Naval Ordnance Test Station, China Lake, and has been called the AJB-3. It is a relatively inflexible system in that the run-up to the target must be planned in detail, accurately flown and followed by a manoeuvre executed precisely up to the point of releasing the bomb. To do this, the pilot follows the indications of a combined attitude and course indicator operated by the Lear remote gyro platform and of a command and indicator g-meter placed alongside it. Though this is not mentioned in descriptions so far published, it is presumed that autopilot coupling could be provided to make the manoeuvre at least partly automatic in execution.

The U.S.A.F. now has a later toss-bombing system under test. It is much more flexible in that it makes the bomb-release calculations semi-automatically during the attack and allows the pilot to approach the target at almost any angle of dive and pull up more or less as he likes. It will compute the relative positions of aircraft and target and release the bomb automatically when the right conditions obtain. Based originally on a bombing computer developed by the Swedish Saab Company, this system is now designated M-1 and is produced in America by the Mergenthaler Linotype Company.

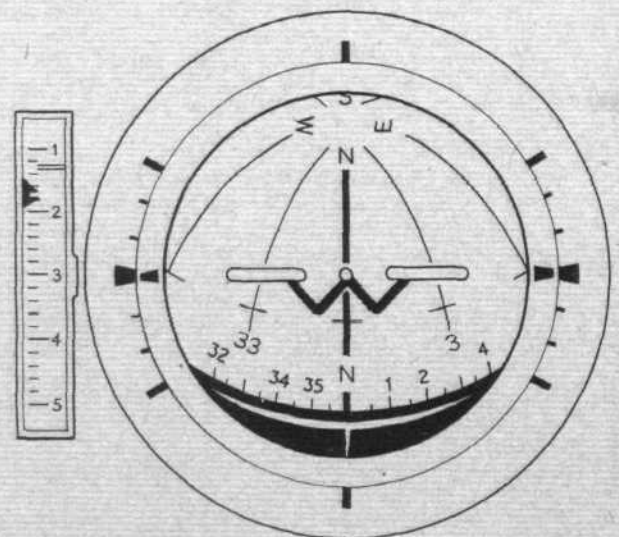
When using the Lear AJB-3 system, the pilot chooses a landmark somewhere short of the target as an initial point. He then determines, according to the characteristics of the bomb and his aircraft loading and speed, the proper climb angle for release and the time it will take him to reach that angle from level flight. He then further calculates the time from passing the initial point to beginning the pull-up and sets this data on the relevant control panels. An intervalometer takes care of the timing and the command g-meter is regulated by his setting of the release angle. On making his run, the pilot presses a button as he passes over the initial point so as to start the whole sequence going. This is colloquially known as "pickling" and the button and the point on

the ground are usually referred to, respectively, as the pickle button and the pickle point.

At the right moment during the level run-up, a red light and an aural tone tell the pilot to start pulling up, following the instructions of the programmed g-meter; then at the correct angle the bomb is automatically released and the pilot is free to continue over the top and return to base.

The AJB-3 weighs under 60 lb and consists of the Lear two-gyro stable platform, a related amplifier, compass adapter, rate-gyro erection-cut-off and flight-director instrument with integral g-programmer and g-meter and intervalometer. Data are preset on three control panels. The purpose of the rate-gyro erection cut-off is to stop the electrolytic levelling switches from monitoring the gyro platform to gravity whenever a rate of turn of more than 15 deg/min is reached. All but one of the amplifiers in the platform are transistorized; and several pick-offs are fitted to serve other aircraft systems besides the AJB-3. Compass slaving is also cut off during turns sharper than 15 deg/min and can be eliminated altogether when flying at high latitudes. The drift rate of the heading element of the platform is 2 deg/hr, though this is expected to be improved in future models.

The gyro platform can give accurate attitude and direction indications in all aircraft attitudes; and the director instrument is accordingly designed to indicate accurately under these conditions. It consists of a servo-driven ball, divided at the equator



The combined attitude and heading indicator for the Lear AJB-3 bombing computer shown indicating a straight and nearly vertical climb on a compass heading. Alongside, the two pointers show the actual and required g-loading during the pull-up for bomb-release.